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29 November 2018

Legislative Council Secretariat
No. 1 Legislative Council Road
Legislative Council Complex

(Attn.: Ms Doris LO, Chief Council Secretary (1)2
Clerk to Subcommittee)

Dear Ms LO,

Subcommittee on
Land (Miscellaneous Provisions) (Amendment) Regulation 2018
List of follow-up actions arising from the meeting on 20 November 2018

I refer to your email of 20 November 2018. The Administration's response to the follow up actions arising from the Subcommittee meeting on 20 November 2018 is as follows:

Question (a) **the reports of (i) the review conducted by the Hong Kong University of Science and Technology on the standard permit period assessment ("PPA") templates for utility trench works, which was completed in 2012; and (ii) the follow up review conducted by the Hong Kong Polytechnic University on the PPA templates for excavation works other than utility trench works, which was completed in 2013;**

Answer (a) A copy of the two reports on review of PPA by the Hong Kong University of Science and Technology and the Hong Kong Polytechnic University are in Annex A and Annex B respectively (English version only);

Question (b) **a full list of the existing locations where trial common utility tunnels (CUTs) are implemented.;**

Answer (b) The Government adopts a positive attitude on any proposed use of CUTs in new development areas where it is reasonably cost-effective to do so. Two existing trial CUTs are located at Yan Cheung Road in Yau Ma Tei and at Horizon Drive in Chung Hom Kok. The effectiveness of the two trial CUTs is being reviewed by the HyD's consultant under the feasibility study on CUTs currently in progress. In addition, the Government is currently studying the feasibility of implementing CUTs in the Lok Ma Chau Loop and Tung Chung New Town Extension projects.

Yours faithfully,

(Vitus NG)
for Secretary for Development

c.c.
Director of Highways (Attn.: Mr. YK HO, AD/Tech)
Director of Lands (Attn.: Mr. Alan KL LO, AD/Specialist 2)

中文回答

回答(a) 香港科技大學及香港理工大學就檢討釐定掘路准許證的工期的兩份報告副本分別載於附件 A 及附件 B（只有英文版本）；

回答(b) 政府對於在新發展地區建造具合理成本效益的公用設施共同溝持積極態度。兩條現有屬於試驗性質的公用設施共同溝，分別位於油麻地欣翔道和春坎角海天徑。路政署顧問會於現正進行的共同溝可行性研究中就上述兩條試驗性質共同溝的成效作出檢討。此外，政府亦正研究在落馬洲河套地區及東涌新市鎮擴展項目中實施公用設施共同溝的可行性。

Annex A

Study of Permit Period Assessment Method For Utility Trench Works

Final Report

2012-02-28

香港科技大學
THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

Department of Civil and Environmental Engineering
The Hong Kong University of Science and Technology

路政署
HIGHWAYS DEPARTMENT

Highways Department
The Government of Hong Kong Special Administrative Region

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Chapter 1: International Utility Management Practices

1.1 Introduction

There is a large amount of utility services beneath the 2,040 km road network in Hong Kong. On average, there are 47 km of underground utility services laid under each kilometer of road, and the density can be much greater in the urban areas. Road openings are frequently required by utility undertakers (UUs) to install new services and/or maintain existing ones. These utility works are necessary to ensure the provision of essential utility services. However, they may also cause significant delay and disruption to the road network and frustration to road users. Highways Department (HyD), as the road maintenance authority in Hong Kong, is responsible for working in collaboration with UUs and ensuring that road openings are carried out with minimal disturbances to the public.

Currently, if a UU wants to lay its utility services in streets maintained by HyD, it needs to apply for an excavation permit (XP) from HyD for its utility trench work. The UU needs to submit a duly completed Permit Period Assessment (PPA) template to HyD for assessment and substantiation of the XP period to be applied for. PPA templates were developed by HyD in consultation with UUs after the amendments of the Land (Miscellaneous Provisions) Ordinance (LMPO) came into effect on April 1, 2004. These templates have been in use for different utility trench works for more than six years. It is time to conduct a thorough review of PPA templates by drawing upon the past experience and lessons and to enlarge their coverage of standard works in order to reduce the contingency between the approved permit period and the actual working days.

The main objectives of the Study are as follows:

- To conduct a thorough review of the existing PPA method for utility trench works;
- To recommend a solution to improve the accuracy of the current PPA method; and
- To develop a new PPA method.

As a first step toward achieving the objectives of this Study, a literature review of excavation permit application and utility management practices in United Kingdom (UK), Australia, Singapore and Mainland China has been conducted. The websites of relevant authorities have been searched to find the information on their excavation permit application and utility management practices. In addition, as shown in Table 1-1, contacts to some local authorities have been made by email and/or phone to request for relevant information. Moreover, visits to Singapore, Shanghai and Wuhan have been conducted to interview and communicate with the local authorities. Please note that a local authority in this Study refers to a “street authority”, “road authority”, “highway authority” or other terms as used in different countries.

In the literature review, the excavation works conducted by UUs on public streets/roads and highways are normally referred to as street works. This literature review is mainly focused on the procedures and requirements of street work permit applications including the processing, approval, variation, revocation and permit period assessment based on the relevant legislations, regulations and codes of practices in the countries mentioned in the above. Moreover, some utility management aspects, such as the work coordination, traffic impact assessment, defects liability and minimum depth requirements, are also reviewed. Technical aspects such as reinstatement methods and backfill materials are not included in this review.

Table 1-1 Contacted Local Authorities in United Kingdom, Australia, Singapore and Mainland China

Country	Department	Contact Information
UK	Traffic Management Division, Department for Transport, UK	Great Minster House, 76 Marsham Street, London SW1P 4DR
	Highways Authorities & Utilities Committee (HAUC), England	111 Buckingham Palace Road, London SW1W 0SR
	Roads Authorities and Utilities Committee (RAUC), Scotland	Y1.10 Saughton House, Broomhouse Drive, Edinburgh EH11 3XD
	Transport for London, London	Customer Services, TfL London Streets, 4th floor, Zone B5, 14 Pier Walk, London SE10 0ES
	Department of Highways, City of Manchester	227 Maple Street, Manchester NH 03103
	Transportation Department, Liverpool	Municipal Buildings, Dale Street, Liverpool L2 2DH
	Transport and Highways, Development Services, Sheffield City Council	Street Force, Olive Grove Depot, Olive Grove Road, Sheffield S2 3GE
	Birmingham City Council	Council House, Victoria Square, Birmingham B1 1BB
	Gloucestershire Highways	Imperial Gate Business Park, Corinium Avenue, Barnwood, Gloucester GL4 3BW
	Land and Environmental Services, Glasgow City Council	Land and Environmental Services, Richmond Exchange, 20 Cadogan Street, Glasgow G2 7AD
	Edinburgh City Council	Waverley Court, 4 East Market Street, Edinburgh EH8 8BG
Australia	Bureau of Infrastructure, Transport and Regional Economics, Department of Infrastructure and Transport	GPO Box 501, Canberra ACT, Australia, 2600
	Road and Traffic Authority, New South Wales (NSW)	101 Miller Street, North Sydney, NSW 2060
	Civic & Urban Services Division, Manly Council, NSW	Council Chambers, 1 Belgrave Street, Manly, NSW 2095
	North Sydney Council, NSW	PO Box 12, North Sydney, NSW 2059
	Woollahra Council, NSW	PO Box 61, Double Bay, NSW 1360
	City of Sydney Council, NSW	GPO Box 1591, Sydney, NSW 2001
	Vicroads, Victoria (VIC)	PO Box 1644, Melbourne, Victoria 3001
	City of Port Phillip Council, Vicroads	Private Bag 3, St Kilda, Victoria 3182
	Melbourne City Council, Vicroads	GPO Box 1603, Melbourne, Victoria 3001
	Department of Transport and Main Roads, Queensland	GPO Box 1412, Brisbane, Queensland 4001
	Road Infrastructure Management, Logan City Council, Queensland	PO Box 3226, Logan City, Queensland 4114
	Ipswich City Council, Queensland	PO Box 191, Ipswich, Queensland 4305
Singapore	Land Transport Authority	10 Ubi Avenue 3, Singapore 408865
Mainland China	Shanghai Urban Construction and Communication Commission, Shanghai	579 Xujiahui Road, Shanghai 200023
	Wuhan Urban and Rural Construction Commission Committee, Wuhan	443 Jianshe Road, Wuhan, Hubei 430030

1.2 Practices in the United Kingdom

1.2.1 Legislative Framework

The main legislative framework for managing street works of utilities on public streets, roads, footways, cycle paths and verges in UK includes the *New Roads and Street Works Act 1991* and the *Traffic Management Act 2004*.

1.2.1.1 New Roads and Street Works Act 1991

The *New Roads and Street Works Act 1991* (NRSWA) came into force on January 1, 1993, which replaced the *Public Utility Street works Act 1950*. The 1991 act covers the administration, coordination and physical undertaking of the street works on site and intends to reduce the disruption generated by the street works of utilities.

Under the NRSWA, street works are carried out by the UUs by virtue of a statutory right or a license granted by the local authorities. The UUs are required to give advance notices to the local authority of their planned works other than minor works. The periods of advance notices are prescribed in regulations and vary with circumstances. Under the NRSWA, the local authority can decide when the works should be done and can prohibit the digging up of resurfaced roads, except for emergencies, within 12 months.

The main provisions of the NRSWA on street works are listed as follows (UK Parliament 1991):

(1) Introductory Provisions, including the interpretations of street works, street authority, etc, and provisions on street work license, emergency works, etc. Under the NRSWA, a construction company to whom a statutory authority has contracted out work must obtain a license from the local authority. The local authority may attach appropriate conditions to this license in the interests of safety, to minimize inconvenience to those using the street, or to protect the structure of the street.
(2) Street Works Register, which will be maintained by a local authority for its own geographic area to contain information with respect to the street works. Local authorities have a duty to set up a computerized street works register.
(3) Notice and Coordination of Works, including the notice of work types and the starting date of works, direction on the working time, restriction on works following substantial street works and the duties of coordination on the local authorities and UUs. Under the NRSWA, the local authorities have a general duty to coordinate the execution of all street works in their own street works and the UUs should cooperate with both the local authorities and each other.
(4) General Requirements as to Execution of Street Works, such as the safety measures, avoidance of unnecessary delay or obstruction, qualifications of supervisors and operatives, etc.
(5) Requirements on the reinstatement, such as the materials, workmanship and standard of the reinstatement, the duty of the UUs and the power of the local authority.
(6) Charges, Fees and Contributions Payable by UUs, including the charge for occupation of the highway where works unreasonably prolonged, inspection fees, liabilities for cost of temporary traffic regulation and for cost of use of alternative route, contributions to costs of making good long-term damage, etc.
(7) Duties and Liabilities of UUs with respect to Apparatus affected by street works.
(8) Provisions with respect to Particular Authorities and UUs.
(9) Power of Local Authority or District Council to Undertake Street Works.
(10) Supplementary Provisions, including the recovery of costs or expenses, reckoning of periods, and terminologies.

1.2.1.2 Traffic Management Act 2004

The *Traffic Management Act 2004* (TMA) came into force on April 1, 2008. This act helps tackle congestion and reduce disruption on the road network by providing local authorities additional tools to better manage parking policies, traffic movement and the coordination of all activities on the network, including street works. It also places a network management duty (NMD) on local authorities to ensure the expeditious movement of traffic on their road network and facilitate the expeditious movement of traffic on those networks of neighboring authorities.

The provisions of TMA on street works generally are the amendments or improvements of the NRSWA. The TMA gives local authorities further powers to minimize unnecessary disruption caused by poorly planned works and to fulfill their duties through the permit scheme instead of the existing notice system by which the UUs with the street work license only need to forward advance notice of the proposed works and the local authorities cannot refuse a statutory excavation. The notice requirements of the NRSWA are still valid under the TMA. The key differences between the permit scheme under the TMA and the existing notice system under the NRSWA are (Butcher 2010):

(1) Under the permit scheme, the UUs need to book occupation of the street for specified periods for a specified purpose rather than the NRSWA notice system whereby the UUs are entitled to occupation of the street and must simply notify the highway authority of their intentions.
(2) Local authorities' own works are included within the permit scheme.
(3) Local authorities may attach conditions to permits which impose constraints on the way that work is carried out and information is provided, and can direct the timing of the work activities.
(4) The control that permit authorities have over variations to the permit conditions, particularly in the circumstances of extensions of time, gives greater opportunity to deliver completion dates.
(5) A permit fee will be payable by the statutory undertakers. This fee will relate to the proportion of total costs incurred by a permit authority that are attributable to statutory undertakers only (i.e. the fee payable will not cover the cost of local authorities own works).

Under the permit scheme, local authorities can be more proactive in the management and control of activities over where and when works can and cannot take place. Local authorities can decide whether or not to become a permit scheme operator, and can also decide the scope of its permit scheme and the level of its permit fees.

1.2.1.3 Street Works Regulations

According to the NRSWA and TMA, the Department for Transport (DfT) has some regulations on street works, which can be found on the website: http://www.dft.gov.uk/pgr/roads/network/local/streetworks/regulations/streetworksregulations. Some regulations are listed as follows:

- The Street Works (Charges for Unreasonably Prolonged Occupation of the Highway) (England) Regulations 2009
- The Traffic Management Permit Scheme (England) Regulations 2007
- The Street Works (Registers, Notices, Directions and Designations) (England) Regulations 2007
- The Street Works (Fixed Penalty) (England) Regulations 2007
- The Street Works (Inspection Fees) (England) (Amendment) Regulations 2004
- The Street Works (Recovery of Costs) (England) Regulations 2002
- The Street Works (Records) (England) Regulations 2002
- The Street Works (Sharing of Costs of Works) (England) Regulations 2001

- The Street Works (Charges for Occupation of the Highway) (England) Regulations 2001
- The Street Works Register (Registration Fees) Regulations 1999
- The Street Works (Qualifications of Supervisors and Operatives) Regulations 1992
- The Street Works (Maintenance) Regulations 1992

1.2.2 Some Utility Management Aspects

Some aspects of the utility management are discussed in the following based on the legislative and regulatory provisions specified in the NRSWA and TMA, and the street works regulations and codes of practices issued by the DfT and the Highway Authorities and Utilities Committee (HAUC). These aspects include street works coordination, notice system, permit scheme, permit period and overrun charges.

1.2.2.1 Register of UUs

According to the NRSWA, the *Street Works Qualifications Regulations* came into force on April 10, 2010. These regulations introduce the requirements that supervisors and operatives must be reassessed every five years to confirm that they are still competent before they can re-register and continue to carry out street works. The NRSWA requires UUs to ensure that work to install, renew, maintain and inspect underground apparatus in the street is controlled by competent people. To meet these requirements, undertakers have to make sure that an operative, with the appropriate qualification(s), is on site when works are in progress. In addition, a suitably qualified supervisor must supervise street works in most cases. The supervisor does not need to be on site at all times, and can supervise more than one set of works. However, a supervisor qualification does not qualify the holder to work as a qualified operative or vice versa. A person may only act as a trained operative or supervisor for the type of work for which they hold the relevant qualification. Therefore, it may be necessary for a number of people with different qualifications to be involved with the work during its various stages. There is no limit to the number of qualifications held by one person (DfT and HAUC 2009b).

1.2.2.2 Street Works Coordination

(1) Purposes of Street Works Coordination

The street works of the UUs in the public street provide a service to their customers and, inevitably, will interfere with road users and nearby residential and business premises to some extent. Coordination enables differences between those competing for space or time in the street, including traffic, to be resolved in a positive and constructive way. The purposes of street works coordination are (UK Parliament 1991; DfT 2009)

- To ensure safety;
- To minimize the inconvenience to persons using the street (having regard, in particular, to the needs of people with a disability);
- To protect the structure of the street and the integrity of apparatus in it.
- To avoid serious traffic disruption;
- To avoid works on recently resurfaced or reconstructed streets; and
- To avoid planned works within a short time of earlier works.

(2) Legislative Requirements on Local Authorities and UUs

The NRSWA has placed duties on local authorities and UUs to coordinate all works in the public street. Two most important elements are: (i) The duty of local authorities to coordinate all works in the public street (Section 59 of NRSWA); and (ii) The duty of UUs to cooperate in this process (Section 60 of NRSWA).

The TMA requires the duties of the local authorities and UUs by (DfT and HAUC 2007b):

- Introducing the NMD on local traffic authorities to manage their road networks to keep traffic moving. Traffic in this context means all highway users. The duty includes the coordination of activities on the network.
- Necessitating cooperation with other authorities to help keep traffic moving on their networks.
- Requiring the appointment of a traffic manager by each authority.
- Involving cooperation among different parts of an authority where their activities impact on the road network.

(3) Main Coordination Approaches

The DfT and the HAUC issued the *Code of Practice for the Co-ordination of Street Works and Works for Road Purposes and Related Matters* in 2009. The legislative and regulatory provisions explained in this Code may be best viewed as three pillars of coordination (DfT and HAUC 2009a):

- The Notice System: Notices provide valuable information to aid the coordination process, while notice periods provide time for appropriate steps to be taken.
- Streets Subject to Special Controls: Designation procedures allow for attention to be focused on particularly sensitive streets. Traffic-sensitive streets are especially important in this context.
- Coordination Tools: The legislation provides tools to help the coordination process, including powers to restrict further works following substantial street works and to direct the timing, date and location of street works.

(4) Principles of Effective Coordination

Successful coordination requires accurate and timely information, along with good communication between local authorities and UUs. To achieve a successful coordination, local authorities and UUs must adhere to three key points in the coordination process (DfT and HAUC 2009a):

- The need to balance the potentially conflicting interests of road users and UUs' customers;
- The importance of cooperation and regular communication between local authorities and UUs; and
- An acknowledgement that works programs and practices may have to be adjusted to meet the statutory objectives of the coordination provisions.

The efficient coordination of street works is one of the most important aspects of street works legislation, benefiting street authorities, UUs and road users. The key principles of effective coordination are (HAUC 2001, DfT and HAUC 2007b, DfT and HAUC 2009a):

- Earliest possible sharing of information and consultation among interested parties. Longer notice periods should be given and notice information should be updated wherever possible.
- Regular input and attendance of relevant personnel (those who are empowered to take decisions) at coordination meetings.
- Utilities and authorities sharing business development plans and replacement programs for ageing apparatus and highway assets with the coordinating authority.
- Communication of decisions at the earliest opportunity so that other UUs' plans can be adapted, if necessary.
- Cross-boundary coordination among neighboring authorities, utilities and others, especially for all planned works and planned maintenance on strategic routes.

(5) Coordination Phases

The coordination process of local authorities has four phases (DfT and HAUC 2009a):

- Information: The local authority needs accurate and timely information on what is proposed and when it is happening.
- Analysis: The local authority needs a means of assimilating and analyzing this information.
- Consideration: The local authority must consider whether any changes are required to minimize disruption before it agrees to the proposals.
- Co-operation: All parties must co-operate with the local authority to achieve the minimum disruption.

1.2.2.3 Notice System

Under the NRSWA, the UUs are required to give advance notice to the local authority of its planned works other than minor works. The NRSWA specified various notice requirements on the local authorities and UUs. The notice system performs at least seven functions (DfT and HAUC 2009a):

- It is a vital component of the co-ordination process;
- It enables emergency notices, which can prompt the emergency procedures of other organizations;
- It triggers the inspection regime;
- It forms the basis of records for reinstatement guarantee purposes;
- It records who has worked at a particular location;
- It facilitates charging regimes; and
- It is an essential element of the local authority's responsibility for keeping a register.

(1) Notice Periods

The NRSWA has specified the minimum notice periods for different categories of works as shown in Table 1-2 (DfT 2007). Whenever possible, longer notice should be given. The basic principle on the length of the notice period is: the greater the disruption, the longer the notice period required (DfT and HAUC 2009a). The UUs should contact the street authority early in their planning cycle so that it is aware of any directions or restrictions that may affect works.

(2) Notice Types

The main notice types specified in the NRSWA include:

- Advance notice of certain works (Section 54)
- Notice of starting date (Section 55)
- Immediate works notice (Sections 55 or 57)
- Notice of actual start (Sections 74 (5B) and 74 (5C))
- Works clear notice (Section 74 (5C))
- Works closed notice (Section 74 (5C))
- Notice of completion of reinstatement (Section 70)

Besides, local authorities may challenge a duration estimate if they do not consider the proposed duration is reasonable. The local authority can give the UUs its own estimate and reasoning using a Duration Challenge Notice (Section 74 (4) of NRSWA). Similarly, if the UUs need to change its duration estimate caused by the unforeseen delay of works, the UUs may give a Notice of Revised Duration Estimate at any time before the estimated end date. Such estimates should provide full justification for the extension.

Table 1-2 Minimum Notice Periods of NRSWA

Works Categories	Works Definitions	Notice of Works (Section 54 of NRSWA)	Notice of Starting Date (Section 55 of NRSWA)	Notice of Emergency (Section 57 of NRSWA)
Major works	Works that take more than 10 working days to complete or require road closure	3 months	10 working days	N/A
Standard works	Works that take between four and 10 working days to complete	N/A	10 working days	N/A
Minor works	Works that take up to three working days to complete	N/A	3 working days	N/A
Immediate works – Urgent	Works, other than emergency works, whose execution is required (or which the person responsible for the works believes, on reasonable grounds, to be required)	N/A	2 hours after	N/A
Immediate works – Emergency	Works required to end or prevent circumstances, either existing or imminent, that might cause damage to people or property	N/A	N/A	2 hours after

1.2.2.4 Permit Scheme

The TMA allows the local authorities using a permit scheme. The DfT has made provisions based on the TMA with respect to the content, preparation, submission, approval, operation, variation or revocation of permit schemes. The *Traffic Management Permit Scheme (England) Regulations* 2007 came into force on April 1, 2008. The Regulations include the application for scheme, permit scheme content, publicity, sanctions, fees, registers and other enactments of permit scheme. In the Regulations, the "Permit Authority" means the relevant local authorities which have submitted, or intend to submit, that permit scheme to the Secretary of State.

(1) Permit Application

Prior to submitting a permit scheme to the Secretary of State, the Permit Authority shall widely consult for new permit schemes. When submitting a permit scheme, the Permit Authority shall provide the Secretary of State with the following information (DfT 2007):

- The name of every person who is a local authority for one or more of the specified streets;
- What the objectives of the Permit Authority are for that permit scheme;
- How the Permit Authority proposes to ensure that it will comply with the obligation set out in Regulation 40;
- How and when the Permit Authority proposes to evaluate that permit scheme so as to measure whether the objectives for it have been met;
- The costs and benefits (whether or not financial) which the Permit Authority anticipates will result from that permit scheme;
- The evidence considered by the Permit Authority when it decided to include any

provisions in the permit scheme as to the fees which may be charged, and the reasons for its decision;
- The date on or after which the Permit Authority proposes that the permit scheme should come into effect;
- Details of any transitional arrangements which the Permit Authority would wish to apply in relation to the permit scheme coming into effect; and
- A summary of the responses received to the consultation undertaken and of the changes made to the permit scheme following that consultation.

A permit scheme can be varied and revoked. Before asking the Secretary of State to vary or revoke a permit scheme the Permit Authority shall consult the persons referred to in permit consultation.

(2) Permit Scheme Content

A permit scheme shall specify the proposed works which that permit scheme is designed to control, area within which the carrying out of specified works is to be controlled and streets (or types of streets) within its specified area to which controls on the carrying out of specified works are to apply (DfT and HAUC 2007a). In general, a permit scheme (DfT 2007):
- Shall include provision requiring a permit to be obtained from the Permit Authority before specified works are carried out in a specified street.
- Shall specify persons (or types of persons) to whom and circumstances (or types of circumstances) in which the requirement in paragraph (1) shall not apply.
- Shall specify the information which shall accompany a permit application, and may specify the manner in which, and the time within which, such applications shall be submitted.
- Shall require each application for a permit to be limited to one street.
- Shall require each application for a permit or for a variation of a permit to provide an estimate of the likely duration of the works of that application.
- Shall provide for each permit to specify the duration within which the specified works on a specified street are by that permit authorized.
- May provide for different classes of permit to be required in relation to different circumstances.
- May provide that where it is proposed that the relevant specified works are to be carried out in more than one phase, a separate permit shall be obtained in respect of each phase.
- Shall include provision requiring a copy of each application for a permit to be provided by the applicant upon request to any relevant authority and to any other person having apparatus in the street to which the application relates.
- Shall set time limits within which the Permit Authority shall respond to applications for permits, provisional advance authorizations, variations of permits and variations to permit conditions.
- Shall include provision for the Permit Authority to have power to vary and revoke permits and permit conditions.
- Shall specify the information which shall accompany an application for the variation or revocation of a permit or of permit conditions, and may specify the manner in which and the time within which such applications shall be submitted.
- Shall include a statement of the Permit Authority’s policy as to the circumstances in which it will review, vary or revoke a permit and permit conditions on its own initiative.

(3) Provisional Advance Authorizations

A permit scheme may include provision requiring a Provisional Advance Authorization (PAA) for certain specified works in specified streets to be obtained as part of the application for certain classes of permit. Where a permit scheme includes such a provision, it shall specify the information which shall accompany an application for a PAA, and may specify the manner in which such applications shall be submitted and the time within which such applications shall be submitted. Each application for a PAA shall be limited to one street. A grant of the PAA does not prevent the Permit Authority from deciding not to grant the permit to which that authorization relates.

(4) Conditions Attached to Permits

A permit scheme shall specify conditions or include provisions for the Permit Authority to attach conditions to permits, and shall specify the types of condition. In general, the types of condition include (DfT 2007):

- Days on which permit works may not be carried out;
- Times of day during which permit works may not be carried out;
- The area (including areas not forming part of the street) which may be occupied in connection with the permit works;
- The prohibition or restriction of traffic pursuant to orders or notices under Section 14 of the Road Traffic Regulation Act 1984 (temporary prohibition or restriction on roads) (a);
- Traffic management arrangements to be made in connection with the permit works (including arrangements for the particular benefit of persons with a disability);
- The manner in which the specified works are to be carried out;
- Consultation and publicity in relation to the specified works, including the display of information at the location of those works; and
- Notification of progress in relation to the specified works.

Besides, the types of condition may also include (DfT 2007):

- Requiring the local authority to consult with any person who has apparatus likely to be affected by the permit works; and
- Requiring the local authority to take all reasonably practicable steps to comply with any requirement made by that person which is reasonably necessary for the protection of the apparatus or for securing access to it.

(5) Sanctions

A Permit Authority may give the UU a fixed penalty notice if the UU is committing or has committed an offence such as (DfT 2007):

- Action which may be taken for unauthorized works;
- Offence to undertake works without a required permit; and
- Offence to breach a permit condition.

The fixed penalty notice means a notice offering the UU the opportunity of discharging any liability to conviction for a fixed penalty offence by payment of a penalty. A fixed penalty notice may not be given more than 91 days after the commission of the offence beginning with the day of its commission (DfT 2007).

1.2.2.5 Permit Period and Overrun Charges

The NRSWA requires street works to be completed as quickly as possible. A “prescribed period” has been set at two days, starting on the day works begin, during which no overrun charges can be levied. The “prescribed period” does not relate to time required to carry out any particular type of works. Therefore, it is not to be used to judge the duration of proposed works (DfT and HAUC 2009a). If the UUs have reasons to believe that the

duration of works will exceed the "prescribed period", the UUs may submit to the local authority an estimate of their likely duration. The period stated in an estimate shall be taken as a "reasonable period" when it is agreed by the local authority. The local authority can challenge the estimated duration of the proposed works by giving written notice of its own estimated duration of works and reasons for the challenge. The UUs may either accept this new estimate as the reasonable period or start discussions with the local authority. In default of agreement, the estimated duration shall be determined by arbitration to be reasonable.
If the works are prolonged due to reasonably unforeseen circumstances, such as weather or ground conditions, the local authority and UUs should agree a revised duration. However, if the works are unreasonably prolonged, i.e., works are not completed within either the "prescribed period" or the "reasonable period", the NRSWA specifies that the local authorities can charge for occupation of the highway (Section 74 of NRSWA). The local authority may levy a charge for each day, or part of a day, in excess of the prescribed or reasonable period. The amount of the charge shall be determined in such manner as may be prescribed by reference to the time taken to complete the works and the extent to which the surface of the highway is affected by the works. Different rates of charge may be prescribed according to the place and time at which the works are executed and such other factors as appear to be relevant. According to the *Street Works (Charges for Unreasonably Prolonged Occupation of the Highway) (England) Regulations 2009*, daily overrun charges will range from £2,500 for the busiest roads to £100 for the quietest roads. This allows the most significant works to be better targeted in an attempt to reflect the cost of the disruption caused by overrunning works.

For Section 74 purposes, the estimated duration of works is measured from the start date to the end date given in the notice of actual start. However, the actual duration used to assess whether works have overrun is measured from the notice of actual start to the completion of all activities in that phase of works, including any necessary reinstatement. The estimated start and end dates given in notifications can be working or non-working days. The UUs should specify the actual dates on which they intend to start and end the works in order to assist coordination. Authorities may or may not allow works to be carried out on non-working days (and outside normal working hours) depending on local circumstances (DfT and HAUC 2009a).

1.2.2.6 Practices in Laying Service Pipes and Cables

The *Code of Practice for Recording of Underground Apparatus in Streets* came into operation on May 1, 2003. It provides some general specifications on the routes and depths of pipes and cables of the gas, electricity, telecommunications, sewerage and water services. For example, service pipes and cables are normally laid at shallower depths than mains. The typical depths are indicated for pipes and cables of different services. Therefore, this code facilitates the UU in identifying the existing underground pipes and cables.

(1) Telecommunication

Telecommunication cables can be copper, co-axial or optical fiber and are currently laid in PVC duct that may be colored grey, green, white or purple. Older duct may be earthenware, asbestos cement, iron or pitch fiber. Common cable colors include light grey, black, mauve, brown and orange. Fiber optic cables may additionally be laid in a sub-duct within the main duct. The duct ranges in size from 25mm to 110mm external diameter (DfT and HAUC 2002). Services may enter premises from underground or overhead from cables supported by poles. Underground cable services are normally laid from a supply cable situated in the nearest footway which is normally between 250mm and 450mm cover to the crown of the duct. However, site conditions may cause the duct to be laid shallower or deeper. Marker tape is sometimes laid above the duct and can be green, yellow with a blue legend or white

with a black legend. Duct laid in carriageway is normally laid between 450mm cover and 600mm cover, dependent on the type of carriageway and street authority requirements. Again, site conditions may cause the duct to be laid shallower or deeper (DfT and HAUC 2002).

(2) Electricity

Electricity cables are generally laid directly in the ground and are connected to the nearest adequate mains cable. Service cables are installed to meet the load required and may often be identical to the cables used as mains feeders. Most electricity cables are colored black, though some high voltage cables are red. Where ducts are used they are normally colored black if of modern plastic construction. Protection tiles may be placed in the ground above a cable, made out of concrete, clay or plastic. Where marker tapes are used, they are usually colored yellow with a black legend (DfT and HAUC 2002). Most electricity service cables are laid at a depth of 600mm cover under carriageways and 450mm cover in footways, though these depths can alter due to unforeseen circumstances or because of interference by other excavators some time later. It is common practice for the main feeder cable to be laid only on one side of the street. Service cables to properties on the other side of the street will therefore cross the carriageway. In most cases there will be no permanent surface marker posts or other visible signs to indicate the presence of cables (DfT and HAUC 2002).

(3) Gas

Gas pipes are normally laid directly in the ground and are connected to the nearest suitable gas main, which could be on the opposite side of the street. Gas services are normally laid at approximately 600mm in the carriageway and 450mm in the footway, rising to approximately 375mm in private ground. However, there may be a number of circumstances that cause gas services to be laid at shallower depths. The actual depths of services should be determined by careful working practices. Gas pipes were traditionally made of iron or steel, sometimes encased in black bitumen or black PVC (DfT and HAUC 2002). Where ducts are used, they are usually colored yellow or pale green, though in the past ducts, which were mostly used for street crossings, were made from a variety of materials, including pitch fiber, PVC, steel or clay. Where marker tape is used it is usually colored yellow with a black legend (DfT and HAUC 2002).

(4) Water

Water pipes laid in the street up to the boundary of the premises include communication pipe and supply pipe. The former usually ends in a stopcock. The stopcock box will usually indicate the line of the pipe, as will an underground meter box if one has been fitted. Older water pipes were laid in lead, copper galvanized steel or black polyethylene (DfT and HAUC 2002). Water mains are normally laid at a depth of 900mm cover and communication and supply pipes usually at a depth of approximately 750mm cover to avoid freezing in cold weather (DfT and HAUC 2002).

(5) Sewer

Sewer pipes and drains have to operate with a line and level which cannot be varied in order to provide a fall to aid gravity flow of the effluent and often have to cross the footway at right angles in order to reach the public sewer in the carriageway. Older sewers were usually of brick but smaller sizes were often of fired clay or earthenware. The most popular materials today are concrete, earthenware, ductile iron, asbestos cement and plastics. Manholes at approximately 80m intervals in the carriageway will indicate the line of the main sewer in a street and manholes at the boundary of each premise will indicate the line of the private drain connecting with it (DfT and HAUC 2002).

1.2.3 Practices in London

1.2.3.1 London Permit Scheme

To satisfy the requirement of the NMD, the TfL issued the *London Permit Scheme (LoPS) for Road Works and Street Works* according to the TMA and the *Traffic Management Permit Schemes (England) Regulations 2007*. The LoPS started on January 11, 2010. In its first month of operation, TfL received more than 4,500 permit applications under the LoPS and almost 700 were refused. As well as providing a clear opportunity to coordinate street works, TfL also consider that the LoPS is providing a wealth of data on the sort of works being undertaken on the road network and how long they should take. This intelligence will be invaluable in future efforts to minimize disruption.

According to the LoPS, the general workflow of street works application and processing is shown in Figure 1-1 and Figure 1-2.

1.2.3.2 LoPS Content

The LoPS mainly includes the following aspects:

- Scope of permit scheme, which identifies the registerable activities/works, categories of activities/works (major, standard, minor and immediate) and specifies the areas and streets/roads
- Provisional advance authorization (PAA), which is sought prior to an application for a permit in respect of major activities and is effectively an early provisional permit issued before the final details of an activity have been worked out
- Permit application and decisions in respect of permit applications, e.g., permit application procedures, requirements (e.g. format, content) and decisions (e.g. refusal) on the permit application
- Timing of applications and responses, e.g., forward notice periods and response times
- Permit requirements and conditions
- Permit variation, revocation, inspection and sanction
- Permit fees and dispute resolution
- Street works register: LoPS registers use geographic information system (GIS) and each register will be maintained against the same digital map base to ensure consistency between all holdings of street-related data. This geographical dataset will be vector based, nationally consistent, maintained and seamless, with changes published on a regular update cycle.
- Other related matters and procedures, such as the road closure and traffic restriction, charges for unreasonably prolonged occupation, etc.

1.2.3.3 Permit Application

Permit applications in London must be made electronically using the Electronic Transfer of Notices (EToN) system. Where this is not possible, the UUs may use alternative means, i.e., by fax, post or hand delivery and must comply with the requirements set out in the Technical Specification for EToN. An application shall relate to proposed activities in only one street. Interim and permanent reinstatements are treated as separate phases in the LoPS and the UUs must obtain separate permits for each. Each application for a permit must include detailed descriptions of work activities, proposed techniques, accurate location, work duration (including the proposed start and end dates of the works, working hours of day and the weekend and holiday in which the work is carried out), traffic management, depth, reinstatement type, etc.

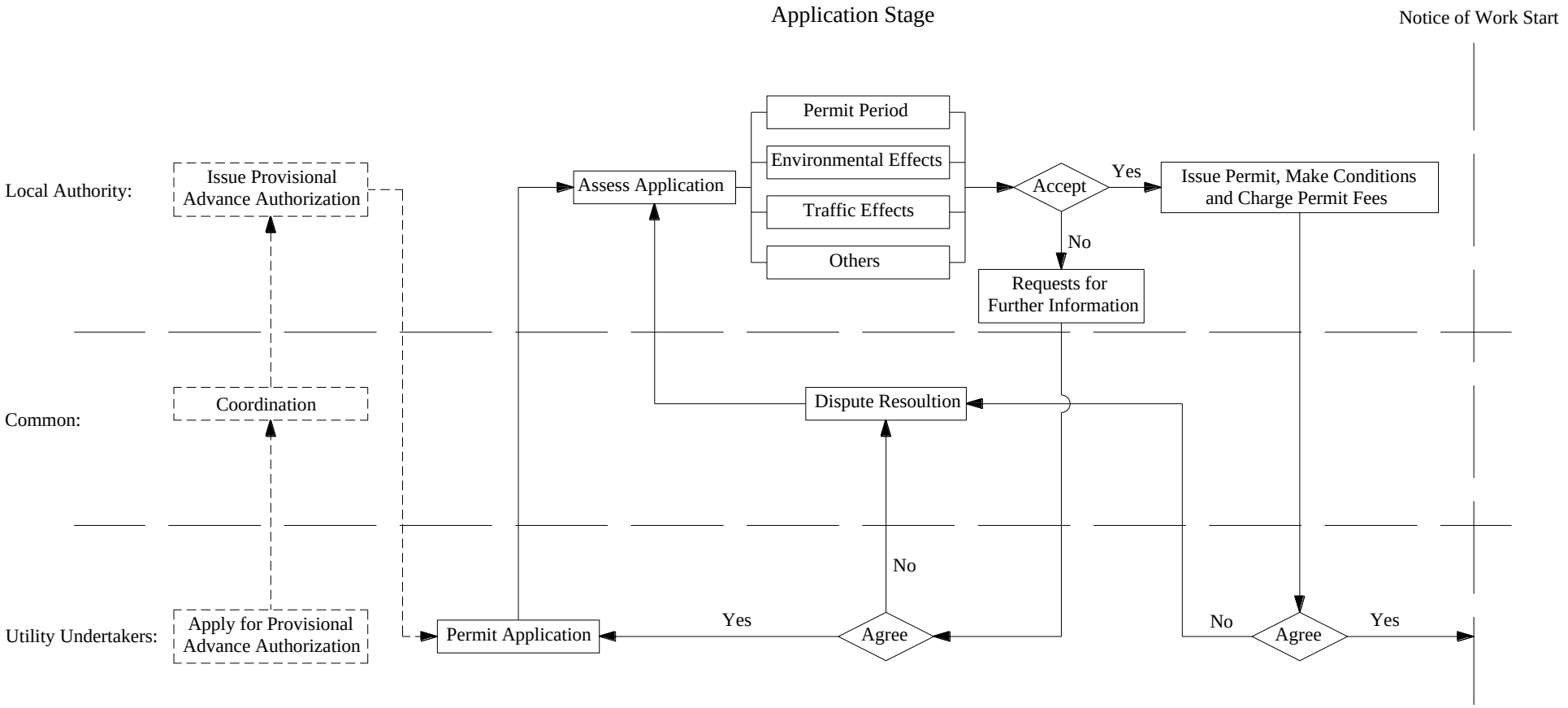

Figure 1-1 Street Works Application in London

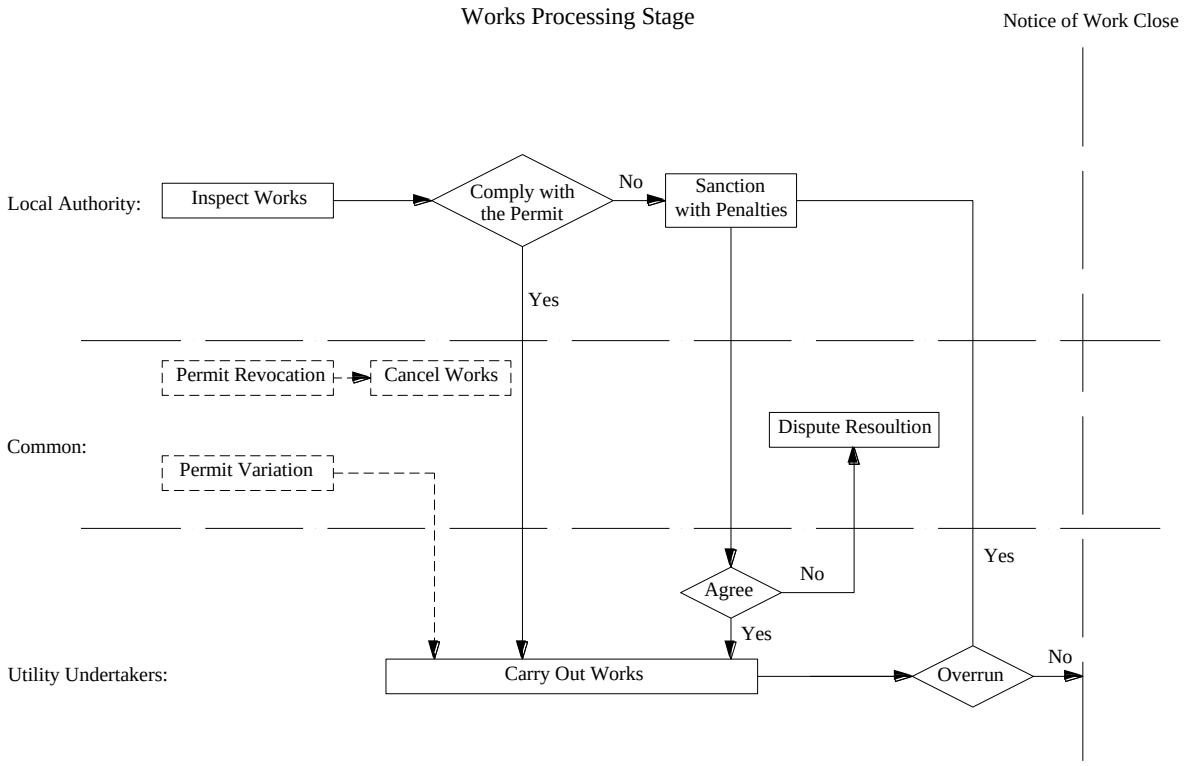

Figure 1-2 Street Works Processing in London

An application may be refused or be requested for further information. The reasons for refusal may include (TfL 2009):

- Overlapping Activities: Where other activities are scheduled to take place in the same street, or other streets affected by the proposed activity, at the same time.
- Timing and Duration: The proposed duration may clash with other proposed activities or events or, the activities can be completed more speedily.
- Location of Activity: The proposed location of activities is unacceptable to the authority.

1.2.3.4 Permit Period

A permit is valid only for the period of time given on the permit. This will, in most circumstances, be the period of time applied for by the UUs. The permit authority may consider an alternative period is appropriate and UUs may appeal if they disagree. On main roads (i.e., category 0, 1, and 2 streets and category 3 and 4 streets that are traffic-sensitive for all or part of the time), the start and end of the permit period will match the start and finish dates for the activity (TfL 2009). The UUs need to apply a permit variation if they want to carry out works out of these time periods. On category 3 and 4 streets that are not traffic sensitive, permit start and end dates allow for flexibility in the start of the activity but once the activity is started it must be completed within the activity duration period specified in the permit. The starting window is five working days for major and standard activities and two working days for minor activities. This is in line with the validity period within the NRSWA notice system (TfL 2009).

The start and end dates will be in calendar days, even though many aspects of the permit scheme will operate on working days. Where a permit allows working at weekends or on Bank Holidays, then the permit start and end dates will also accommodate that, even if those days do not count towards the reasonable period under the NRSWA (TfL 2009).

Unforeseen circumstances can delay the completion of activities. The UUs must apply for and obtain a variation of its permit, if the activity is likely to extend beyond the permit end date or the activity duration set in the conditions is likely to be exceeded. Such an application must provide full justification for the extension. If the UUs fail to obtain a permit variation and the completion date is delayed without reasonable explanations, LoPS may levy a charge for each day, or part of the overrun days according to Section 74 of the NRSWA.

1.2.3.5 Permit Conditions

According to the NRSWA, the local authority can attach conditions to permits and also specify the types of conditions that will be applied. The conditions on a permit can also be changed after the permit has been issued. The LoPS specifies some standard conditions as follows (TfL 2009):

- Display of permit and linked permit reference numbers
- Duration and timing of permits
- Reasonable period for Section 74 purposes (it will be the same as the duration of the activity)

Also, the LoPS presents some further possible conditions as follows (TfL 2009):

- Limit on days and times of day
- Road space (i.e., the road occupation with effects on the congestion and disruption)
- Needs of people with disabilities
- Traffic management provisions
- Methodology for carrying out activities
- Advanced publicity (i.e. advanced notice to the public about the disruption on the road)
- Environmental factors
- Conditions upon immediate activities before permit issued

1.2.3.6 Disruption Effect Score

Effective coordination is essential to minimize traffic disruption whilst allowing UUs the necessary time and space to complete their works. It needs to take into account street work proposals of every scale and duration. The disruptive effect of any proposal should not be considered in isolation. The combined effect of all the activities taking place on a road network will impact on the traffic.

The disruption effect score (DES) is based on the reduction in capacity resulting from a restriction in the street. It is derived from a number of simple factors that can be easily established for any given activity. These factors are: (i) The total width of a road (W); (ii) The extent to which the activities reduce the available width (S); and (iii) The daily traffic flow (P) (TfL 2009).

The following algorithm is used to calculate the DES (TfL 2009):

$$DES = [(P \times 100)/(1600 \times (W - S)/3.65)]$$

The DES is not a mandatory requirement. It can be used for the traffic impact assessment (TfL 2009):

- Severe: DES is greater than or equal to 75;
- Moderate: DES is greater than or equal to 50 and less than 75;
- Slight: DES is greater than or equal to 25 and less than 50; and
- None: DES is less than 25.

1.2.4 Practices in Manchester

1.2.4.1 Street Excavation Requirements

The Department of Highways of the City of Manchester issued the *Standard Specifications for Road, Drain & Sewer Construction* in 2004. In general, this Regulation specifies street excavation requirements in the following aspects (Manchester Highway Commission 2004):

(1) *General*: This part specifies the general requirements on the street excavation permit, such as the permit fee and working time. For example, work authorized by a permit shall be performed between 7:00 a.m. and 9:00 p.m., Monday through Friday from April 1 through November 15, unless the permittee obtains written consent from the public works director to do the work during another time.
(2) *Encumbrances and traffic control*: This part specifies the requirements on the road encumbrance, traffic control and safety signs. For example, if the street excavation restricts complete traffic movement, the UUs must have an "encumbrance permit" in addition to the street excavation permit.
(3) *Protection of work area*: This part specifies the requirements on the work area, such as the tree protection and rubbish clearance.
(4) *Proof of compliance*: This part requires the UUs provide the proof of compliance to the Regulation. Acceptable proof shall be by, but not limited to, approved independent laboratory tests, approved independent field tests, shop drawings and certificates of compliance from manufacturers. Specific tests as required by regulations and specifications shall be performed as ordered.
(5) *Paving policy*: This part specifies the duration requirements on the permanent and temporary road restoration pavement. For example, permanent base pavement shall be installed within five days from the date of completion of the work
(6) *Street restoration and patching guidelines*: This part specifies the technical requirements on the road restoration pavement. For example, after a City street had been overlaid, no excavation permits will be issued for a period of two years; After a City street has been newly constructed or reconstructed, no excavation permits will be issued for a period of five years.
(7) *Insurance requirements*: The UUs need to furnish a continuing surety bond for a period of 30 months in the amount of $5,000 (except that the UUs may be required up to ten times that amount depending upon the volume of the work being performed by the UUs) guaranteeing the fulfillment of the Regulation and the responsibility for a period of 30 months following the completion of the work.
(8) *Emergency provisions*: This part specifies the provisions of emergency cases.
(9) *Street excavation general instructions*: This part specifies the general requirements on the street excavation. Also, it specifies the contents of construction plans for major and minor underground installations submitted for permits.
(10) *Winter excavation permits*: This part specifies the requirements on the winter works between November 15 and April 1.

1.2.4.2 Some Details of the Regulation

Some details of the *Standard Specifications for Road, Drain & Sewer Construction* are provided in the following:

(1) A set of plans showing the work to be performed must accompany each request for a permit. The original copy of the approved application and permit form and an approved set of work and plans must be kept on the job at all times.
(2) The location of all utility facilities shall be determined sufficiently ahead of excavation work to avoid damage to those facilities and permit their relocation if necessary. The UUs shall notify the Department of Highways the day construction has begun.
(3) No more than 200 feet measured longitudinally shall be opened in any street at one

time, except by special permission of the Department of Highways. No opening or excavation in any street shall extend beyond the centerline of the street before being backfilled and the surface of the street made passable to traffic.

(4) The Department of Highways will notify UUs of it's schedule of overlay and reconstruction activities. This notification will allow time for UUs to perform work as needed prior to the Highway Department's work.

(5) If work for which a permit has been issued does not commence within five days from the date of the permit, the street excavation permit becomes "void". The permit may be extended by the Department of Highways if a request for an extension is made prior to the permit becoming void. Once a permit has become void, it will be considered as if the permit was never issued, but the fee will not be refunded.

(6) A "late permit" at a fee of $200 will be required if any excavation is begun without a street excavation permit which is in effect at the time of the excavation. Emergency excavations or closing of City highways shall be done by obtaining an emergency permit from the Department of Highways.

(7) Each applicant must obtain from the Department of Highways a copy of the specifications and regulations governing street excavations in Manchester streets.

1.3 Practices in Australia

The street works on the public highways and streets are governed by each state in Australia. This Study uses the practices in Victoria as an example to discuss the management of street works in Australia.

1.3.1 Legislative Framework

The main legislation on controlling street works in Victoria includes the *Road Safety Act 1986* and *Road Management Act 2004* (RMA). The RMA was passed on May 11, 2004 with an aim to provide a more efficient and safer Victorian road network, and is the result of extensive stakeholder and community consultation. Section 63 of the RMA specifies that street works must obtain a consent (i.e., permit) from a local authority. Schedule 7 of the RMA sets down specific duties for UUs. The major requirements on street works include the following (VicRoads 2004):

(1) Utilities will be required to obtain consent from the local authority for works impacting on roads and provide notification of the installation of infrastructure, subject to exemptions in regulations (e.g. emergency works).

(2) Utilities will be required to adequately reinstate roads after completion of repairs or new works.

(3) Utilities will be required to notify local authorities following completion of works, subject to exemptions in regulations.

(4) Utilities will be required to notify other works and infrastructure managers where they will be affected by the street works.

(5) Utilities will be required to consult with affected members of the community.

(6) Utilities will be responsible for the repair of road infrastructure damaged by failure of utility infrastructure.

(7) People who conduct works on a road will be required to have an appropriate traffic management plan and to use appropriately trained and qualified staff.

(8) Utilities will be required to take reasonable measures to maintain utility infrastructure or works to a satisfactory standard.

The VicRoads is a state government agency that assists the Victoria Government to achieve its integrated transport policy objectives. To establish a coordinated management system for public roads that will promote safe and efficient State and local public road networks and provide for the responsible use of road reserves for other legitimate purposes (such as the

provision of utility services), VicRoads issued the *Road Management (Works and Infrastructure) Regulations* in 2005 and the *Code of Practice for Management of Road and Utility Infrastructure in Road Reserves* in 2008. The former prescribes exemptions from the requirements to obtain consent before conducting certain works under the RMA. It also prescribes restrictions on the powers of local authority to impose conditions on consents, fees for applications for written consent, and periods within which certain notices must be given or consent is to be taken to have been given (VicRoads 2005). The latter prescribes two main issues in the management of street works of utilities, consent application and risk management, which are discussed in the following sections.

1.3.2 Consent (Permit) Application

1.3.2.1 Consent Application Process

The RMA requires the UUs proposing to carry out works in, on, under or over a road to obtain the consent of the local authority, except where exemptions specified in the *Road Management (Works and Infrastructure) Regulations* apply. The process of consent application is shown in Figure 1-3 (VicRoads 2008).

1.3.2.2 Information to be Provided in Application for Consent

The VicRoads does not have a web-based consent application system. The preferred method for issuing applications/notices is e-mail. An example of the application form used in Melbourne is shown in Appendix 1-1. It is stated that the UUs should discuss proposed works as early as possible with the local authority, preferably prior to forwarding any application, and coordinate the detailed development plans for street works. Generally, application for consent to carry out works should (VicRoads 2008):

- State the date of submission of the application;
- State the proposed duration of the works;
- Give the purpose for which the UUs wish to enter the road reserve;
- Describe the type of activities the UUs intend to undertake including: (i) the location of the utility; (ii) the scope and type of work; (iii) the proposed timing of the works; and (iv) the proposed methods of minimizing the effects of the work on any road infrastructure, road safety, public transport, access to public transport services, and/or traffic operations (e.g. a traffic management plan);
- Confirm notification has been provided to other utilities whose assets might be affected by the proposed works;
- Confirm notification has been given to, or consultation has been undertaken with, the relevant provider of public transport or public transport infrastructure manager whose assets, services or passengers may be affected by the proposed works;
- Confirm the process of consultation with others (such as abutting land owners) likely to be significantly affected by the proposed works; and
- Confirm that health and safety risks associated with the proposed works and the ongoing operation of the proposed utility infrastructure have been considered.

1.3.2.3 Response Time of Local Authority

The local authority should deal promptly with applications for consent and indicate whether it would provide consent to a written application from the utility, or whether it has concerns with regard to the proposed works. If the local authority is in agreement with the proposed works being carried out, written consent should be provided as quickly as possible, to ensure that the proposed street works can proceed as planned. The local authority response to applications for consent needs to be within 20 business days or prescribed time frame, and provide the utility with a clear decision of whether consent is provided for the proposed works.

1.3.2.4 Reasonable Conditions May be Imposed by Local Authority

The local authority may impose reasonable conditions in considering applications for consent. Examples of typical conditions are outlined as follows (VicRoads 2008):

- The location of any proposed infrastructure;
- The use of any road infrastructure;
- The timing and commencement of any works;
- Reasonable conditions for open trenching of road infrastructure;
- Reinstatement of infrastructure including the timing and quality of reinstatement works;
- Arrangements for reasonable advance notice of the works to the public and other authorities;
- Requirements for reasonable access to abutting properties to be maintained during the works or alternative arrangements for access; and
- Reasonably practicable steps to reduce or eliminate disruption to traffic and public transport services.

1.3.3 Some Utility Management Aspects

1.3.3.1 Common Requirements on Underground Utilities

(1) Depth of Underground Utilities

Underground utility infrastructure should be placed at depths that will minimize the risk of accidental damage when road authorities and others are carrying out work in road reserves. Underground utility infrastructure should also be laid (VicRoads 2008):

- To depths that conform to existing utility regulations and standards;
- At a sufficient depth to allow the road authority to maintain and repair the road pavement and road-related infrastructure such as drainage without damaging utility assets;
- (Where it is laid under tram or train tracks) to a depth which enables tram or train operations and track maintenance to occur without damaging utility assets; and
- Where practicable, new utility infrastructure should be located: more than 300 mm below the bottom of the road pavement and (where it is laid under tram or train tracks) more than 1.2 meters below the top of the rails.

As a guide, for most roads the desirable minimum depth of cover for utility infrastructure under road pavement should be 600 mm below finished road surface level. Where utility infrastructure cannot be installed with sufficient cover, suitable protection of the infrastructure such as sleeving, should be provided by the utility to minimize the risk of accidental damage. If this is not practicable or cost-effective, utilities and road authorities should negotiate a suitable alternative treatment.

(2) Spacing Between Underground Utilities

Underground utility infrastructure should be separated by distances that conform to existing utility regulations and standards. Wherever possible, different types of underground utility infrastructure should be adequately separated to minimize the risk of accidental damage when utilities are installing, upgrading or maintaining their infrastructure (VicRoads 2008).

1.3.3.2 Risk Management

The UUs should consider the timing of their works on roads taking into account safety implications, inconvenience and disruption to all road users (e.g. traffic disruption), abutting residents, businesses and utility customers. Where the work requires a risk assessment considering the above factors, the UUs should prepare a risk management plan to identify risk mitigation measures they intend to adopt when carrying out works in road reserves. The risk management plan should contain (VicRoads 2008):

- An analysis of each of the above risk areas to determine the inherent risk rating;
- An evaluation of those risk areas to determine whether the risk ratings are at an acceptably low level or whether they are high enough to warrant some treatment;
- For the risks that warrant some treatment, the proposed mitigation measures to reduce the risk to an acceptably low level;
- Details of the positions of the persons responsible for the operation of the risk management plan;
- Details of the training to be provided to staff and contractors to ensure the risk management plan is followed; and
- The process for monitoring and review of the plan to help identify improvements and to ensure the plan remains up to date.

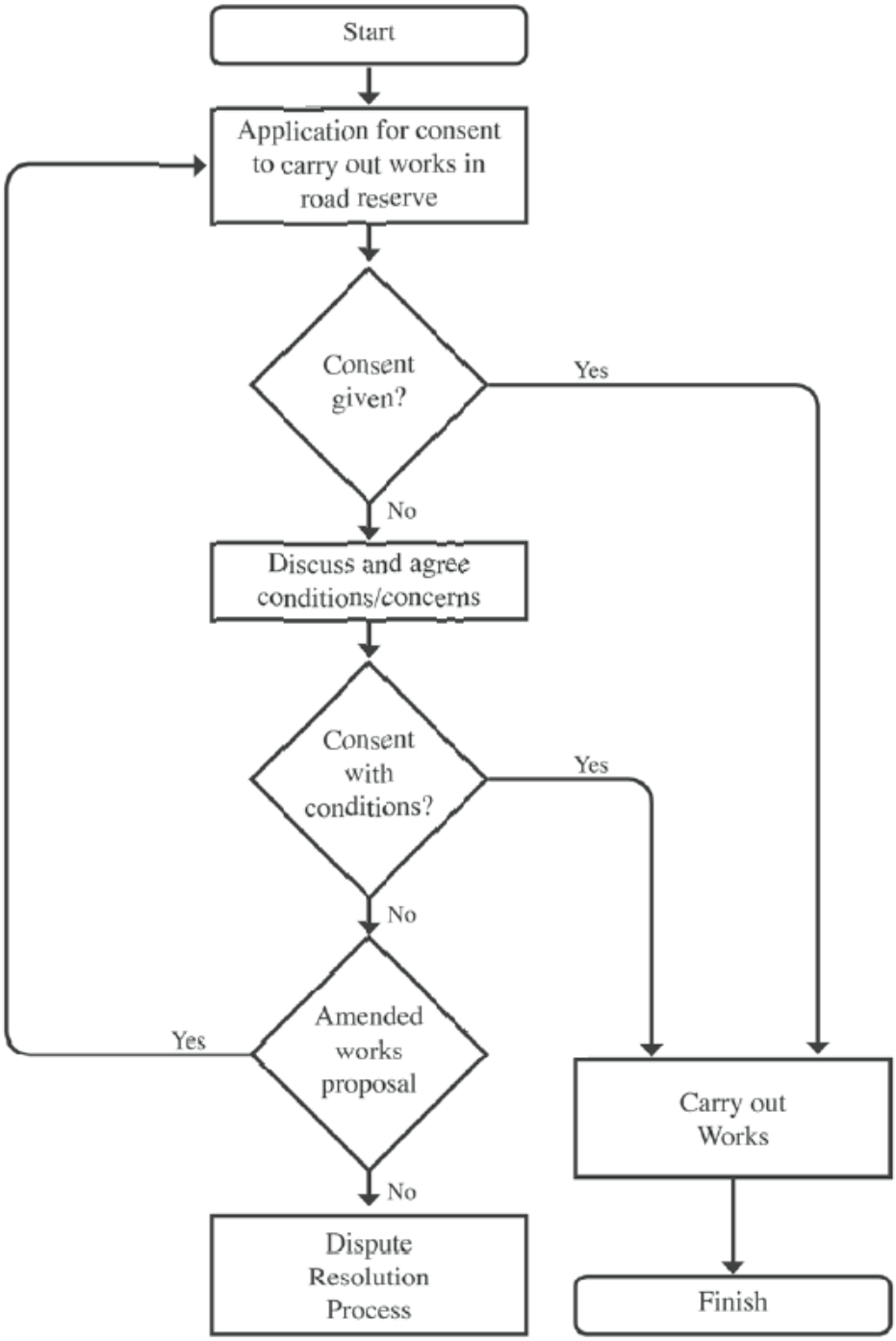

Figure 1-3 Process for Consent Applications in Victoria, Australia (VicRoads 2008)

1.4 Practices in Singapore

1.4.1 Legislative Framework

In Singapore, the main legislative framework for controlling street works on the public streets, roads, footways, cycle paths and verges in Singapore is the 1995 *Street Works Act*. This act relates to the construction, improvement, repair, maintenance and management of streets, back-lanes and other matters connected therewith, and the prevention of obstruction of five-footways and private footways. All works on the public streets are regulated by the Land Transport Authority (LTA). The LTA has published the *Street Works (Works on Public Streets) Regulations* and the *Code of Practice for Works on Public Streets* that set out the procedures and requirements for carrying out street works. These ensure street works are carried out safely with minimal inconvenience to road users.

In the *Code of Practice for Works on Public Streets*, the LTA specified technical requirements on street works, such as the restricted area; positions of utilities, manhole, valves, hydrants and over ground boxes; extent of lane occupation; temporary traffic control; protection to road carriageways/adjoining structures/road-related facilities; decking system; etc. It also specified the requirements on the site inspection, reinstatement, materials, etc.

1.4.2 Permit Application

The general submission process for permit to carry out street works on public streets is shown in Figure 1-4. Here, some relevant issues, such as pre-consultation approval, permit application, deviation and revocation, are discussed based on the *Code of Practice for Works on Public Streets*.

1.4.2.1 Pre-Consultation Approval

Work proposals that affect public streets and/or road infrastructure shall consult LTA to obtain in-principle pre-consultation approval before the commencement of street work. These work proposals include following street works (LTA 2008):

- Work proposal that requires Master Plan Committee (MPC) adoption
- Improvement or upgrading schemes for utility services
- Engineering work with excavation of 4m depth or deeper
- Tunneling works and other engineering works

The submission for pre-consultation approval should include but not be limited to the following (LTA 2008):

- Proposed extent of street works including route alignment and excavation area
- Preliminary impact analysis of the works on public streets or road infrastructure(s)
- Proposed feasible method of street work execution, e.g., open-cut, pipe-jacking
- Letters of clearance from other relevant authorities

1.4.2.2 Permit Application

An application has to be submitted to the LTA for permission to carry out street works on public streets after the necessary pre-consultation approvals have been obtained from the relevant authorities. The types of street works shall include but not be limited to the following (LTA 2008):

- Excavation to lay or repair utility services
- Soil investigation works
- Parking of a vehicular crane on the road to carry out hoisting work or a boom lift on the road to carry out painting work to building facades, etc.
- External works of developments
- Any other works that affect the public streets/areas.

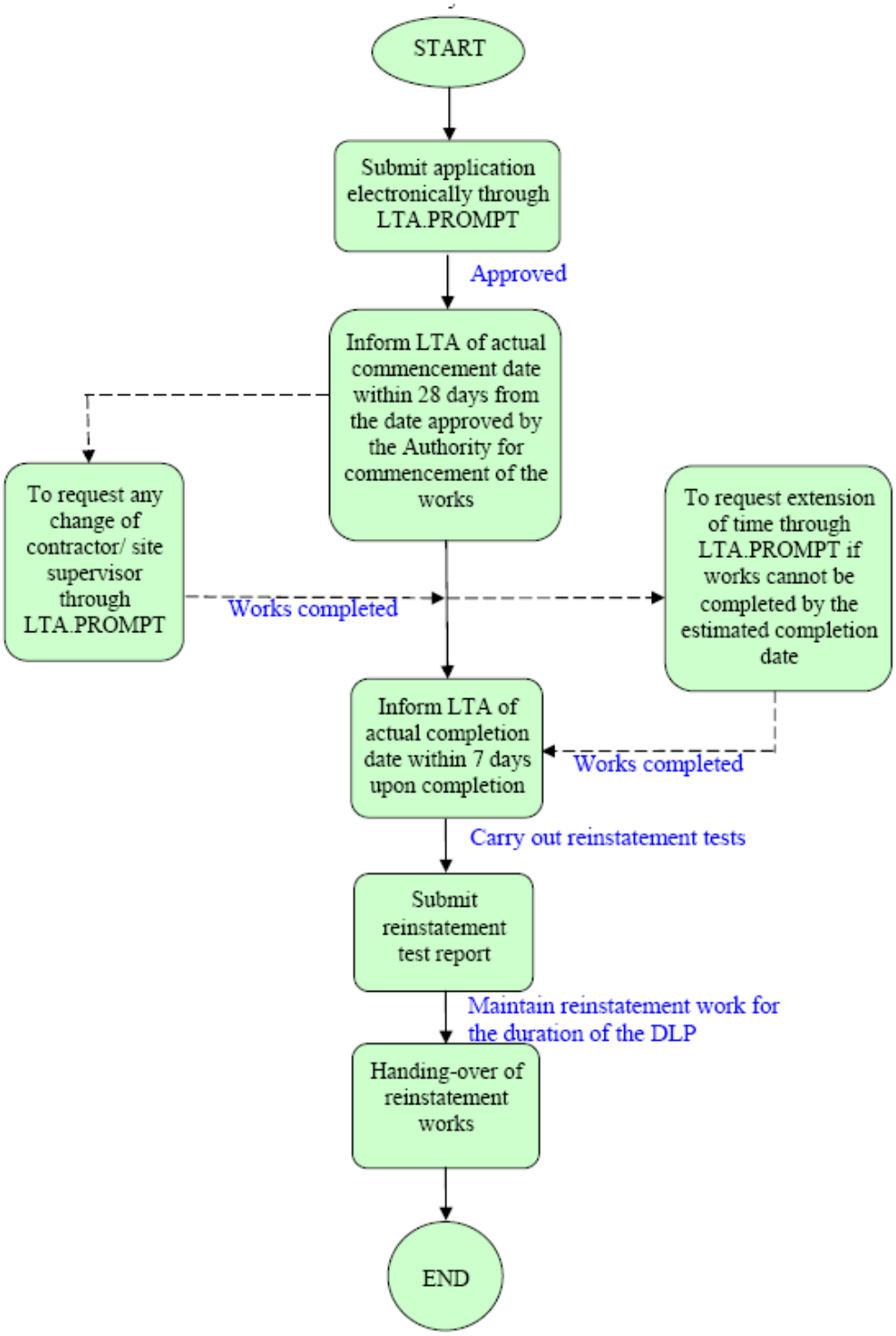

Figure 1-4 Process for Permit to Carry Out Works on Public Streets in Singapore (LTA 2008)

All applications are to be submitted electronically through the "Permit for Road Occupation Management Portal (LTA.PROMPT)" at https://prompt.lta.gov.sg. The UUs must register online as an applicant with the LTA.PROMPT before they are allowed to make any submissions for permission to carry out street works. An application for street works proposal shall be submitted by the UUs or the appointed professional engineer and accompanied by the following items (LTA 2008):

- Plan for street works
- Engineering evaluation report

- Instrumentation proposal
- Method statement of work
- Contingency plans & Emergency procedure
- Pre-condition survey report
- Construction schedule
- Traffic control plan, where applicable
- Relevant documents indicating planning approval from the competent authority

When a permit is issued for an application, the UUs must submit the actual commencement date of their street works through LTA.PROMPT at least 7 days in advance. Hence, the actual commencement date must be a future date, as backdating of an actual commencement date is not allowed.

1.4.2.3 Permit Period and Daily Rate of Street Works

The regulations and the codes of practices do not specify provisions relating to the length of the permit period. Through a telephone interview of a LTA staff, it is found that LTA has the prescribed daily rates of street works which are used for different utility types to estimate the durations of street works. However, the estimated durations of street works only are used as the reference in determining the permit periods. The prescribed daily rates of street works as shown in Table 1-3 are based on following assumptions:

- Depth of laying : 1.0m – 1.5m
- Working hours : 9.30a.m – 4.30pm (Monday-Friday)
- Installed by open-cut method on carriageway
- Exclude final reinstatement

Table 1-3 Prescribed Daily Rates of Street Works in Singapore

No.	Utility Type	Daily Rate of Works	Remarks
1	Telecommunication: PVC/UPVC pipe	12m	1 – 12 uPVC pipes
2	Telecommunication: PVC/UPVC pipe	6m	16 or more uPVC pipes
3	Telecommunication: Optical fiber cable	1500m	48c, 96c, 144c (only pulling work from manhole, no excavation work)
4	Electricity: Distribution cable	25m	22kV/ 6.6kV/ LV
5	Electricity: Transmission cable	40m	66kV/ 230kV, 400kV
6	Water pipe	13m	500mm diameter & below
7	Water pipe	7m	500mm – 900mm diameter
8	Sewer pipe (<6m depth)	4m	900mm diameter & below
9	Sewer pipe (<6m depth)	2.5m	1000mm – 1800mm diameter
10	Sewer pipe (>6m depth)	2.5m	900mm diameter & below
11	Sewer pipe (>6m depth)	1.5m	1000mm – 1800mm diameter
12	Sewer pipe (>6m depth)	1.0m	2000mm – 2400mm diameter
13	Gas main	25m	<300mm diameter
14	Gas main	12m	>300mm diameter
15	Gas main (high pressure mains)	Vary	Length varies, but duration could last between 1-2 years, depending on site complexity
16	Roadside drain	1m	0.45m to 3m wide drain
17	Drainage (>3m wide)	Vary	Length varies, but duration could last between 1-2 years, depending on site complexity

1.4.2.4 Permit Deviation and Revocation

The permit will be revoked if no street works are commenced within 28 days (herein referred to as the "validity period") from the date approved by the LTA for the commencement of the street works. If any street works depart or deviate from the approved plan, amendment plan shall be submitted to the LTA for approval. A new application has to be submitted if there is a change unless otherwise specified by the LTA. The UUs shall supervise the street works for which a permit has been granted according to the statutory and technical requirements, guidelines and codes of practice of all relevant authorities and agencies and any other conditions as specified by the LTA (LTA 2008).

1.4.3 Some Utility Management Aspects

1.4.3.1 Street Works Coordination

LTA chairs the Road Opening Coordination Committee (ROCC) which plans and coordinates street works by the various agencies. The ROCC comprises members from utility services agencies, service providers, Housing & Development Board, Public Utilities Board and National Parks Board. The committee meets monthly to plan and schedule their street works so as to minimize newly resurfaced roads being dug other than for urgent works.

To minimize disruption, LTA coordinates street works with other agencies and stipulates regulations on street works and traffic control. It also checks the sites to ensure that the roads are safely reinstated after the work is completed. The UUs are required to take following measures to minimize the impact of street works on traffic flow (LTA 2006):

- Using the one for one lane replacement method. Contractors are required to open up a new lane for every lane closed for street works. This will ensure that traffic can flow as normal during the street works period. However, this method can only be used at sites where there is sufficient space for replacement lanes.
- Using the trenchless method when site constraints do not favor the one for one lane replacement method.
- Using the steel decking method. This involves the placing of steel decks over trenches to allow traffic to flow normally across the steel decks.
- Allowing only one traffic lane to be closed when street work is being carried out.
- Prohibiting street works during peak hours except for emergency works.
- Stopping the street work if it is leading to traffic congestion.

1.4.3.2 Defects Liability Period

Upon completion of the street works, the UUs must notify the authority of the actual completion date through LTA.PROMPT within 7 days. The UUs shall also submit in the same notification a post condition photographic survey report of reinstated works and the surrounding roads as well as ground conditions. If the street works cannot be completed by the estimated completion date, the UUs must submit a request for extension of time through LTA.PROMPT before the estimated completion date. Otherwise, any street works beyond the estimated completion date will be considered as unauthorized works. The UUs shall then submit the reinstatement test report, where applicable, through the LTA.PROMPT to the LTA. Where applicable, the defects liability period (DLP) to be imposed will be determined by the LTA depending on the type of street works and depth of excavation. The DLP is a warranty period that starts after the completion of a satisfactory permanent reinstatement. The UUs shall ensure that the reinstatement work is maintained in a defect-free condition during the DLP and any defect which appears during the DLP shall be promptly rectified. Upon expiry of the DLP, the UUs shall apply for the handing-over of the reinstatement works to the LTA through the LTA.PROMPT (LTA 2008).

The DLP shall only begin when the Authority is satisfied with the permanent reinstatement. The DLP shall run for (LTA 2008):

- 1 year for street works where the depth of excavation or cover over the utility line/equipment is 1.5m or less; and
- 2 years for street works where the depth of excavation or cover over the utility line/equipment is more than 1.5m.

1.4.3.3 Common Requirements on Underground Utilities

(1) Minimum Depth Requirements

All utilities shall be laid at a minimum depth as prescribed in Table 1-4. The minimum depth of utility laid below the public streets shall be measured from the road surface/side table to the top of utilities pipes/cables (LTA 2008).

Table 1-4 Minimum Depth Requirements of Underground Utilities in Singapore (LTA 2008)

Road Category	Location	Minimum Depth Requirements	Alternative Depth Requirement for Fiber Optic Cables
Expressway Road	Carriageway	No services allowed	No services allowed
	Sidetable	1.2m	0.3m
Major Arterial Road	Carriageway	1.0m	1.0m
	Sidetable	1.2m	0.3m
Primary/Local Access Road	Carriageway	1.0m	0.8m
	Sidetable	1.2m	0.3m

Utility owner may consider the alternative depth requirements for fiber optic cables laying only, subject to compliance with the following conditions (LTA 2008):

- Telecommunication companies/cable owners to look into necessary safeguarding measures and identification markers to protect their cables from damage.
- No one after taking reasonable precautions should be held liable for damaging cables laid at shallow depth.
- Telecommunication companies/cable owners to bear diversion costs when their cables laid at revised shallow depth are affected by public infrastructure works.
- Telecommunication companies/cable owners to ensure that their cable route meets the statutory requirements of other utility agencies/service providers e.g. no new services are currently allowed to be laid over other existing services.

(2) Spacing Requirements

All utilities laid shall have a lateral clearance from the rigid pavement. The minimum lateral clearance is 2.0 meter or the depth of the utilities, whichever is greater, from the edge of rigid pavement. All utilities laid shall also comply with the statutory requirements of other utility owners. Utility owner shall seek approval from LTA Road Infrastructure Management Division for laying of services over/under-crossing culverts and other road structures (LTA 2008).

1.4.3.4 Restricted Area of Street Works

“Restricted area” refers to any public street where no breaking up or opening up of a street is allowed. The objective of the restriction is to enhance road safety and reduce inconvenience to road users. There shall be no street works allowed on “restricted areas”. These areas include:

- Road reserves of expressway;
- Carriageways with "specially treated" areas such as rigid pavement, semi-rigid pavement, enhanced school zone, street print, etc.;
- Bridges and underpasses;
- Roads which are under "no-opening period"; and
- Carriageways within 50 meters of traffic junction.

1.4.3.5 Demerit Points System

According to the *Street Works (Works on Public Streets) Regulations*, the UUs will be issued demerit points and/or fines if they fail to comply with the requirements or committed any defaults such as the non-compliance with road safety regulations, indiscriminate occupation of roads, and failure to reinstate roads according to requirements.

The UUs who accumulate 200 or more demerit points within a calendar month will be suspended from carrying out new work on public streets at least 3 months. The length of the suspension depends on the number of suspensions that the contractor already had in the past two years. During the period of suspension, the defaulting UUs cannot be appointed for any new work application.

1.4.3.6 Traffic Control and Safety Measures

The UUs shall also ensure that appropriate traffic control plans are implemented on site according to the *Code of Practice for Traffic Control at Work Zone*. They shall also ensure that appropriate information signs informing road users of impending works are posted strategically on site at least 1 week in advance of the commencement of street works. The signs shall contain information such as the type of street works, agency responsible for the street works, the start and end dates of the street works and the contact numbers for enquiries.

To ensure safety for road users while street works are being carried out, the UUs are required to place signs and traffic cones to alert motorists of street works ahead of them, provide alternative paths for pedestrians, and engage site supervisors trained in road safety and street works to oversee the work. LTA inspects work sites regularly to check that traffic safety measures are in place and the roads are reinstated properly.

For UUs who need to carry out street works on public streets, the occupation of carriageway for these street works shall be restricted to only one traffic lane width at any time. Traffic lane shall not be occupied during the peak hours. The UUs are required to use construction methods such as covering trenches with steel decking, pipe jacking and tunneling to avoid the occupation of the lanes. Otherwise, the LTA may require the UUs to temporarily provide an alternative to replace the affected traffic lane.

1.5 Practices in Mainland China

1.5.1 Legislative Framework

In Mainland China, the street works are managed according to the *Highway Law* (中华人民共和国公路法), the *Regulation on Highway Management* (公路管理条例), and the *Regulation on the Administration of Urban Roads* (城市道路管理条例). The legislative and regulatory issues related to this Study are discussed in the following sections.

1.5.1.1 Highway Law and Regulation on Highway Management

In Article 44, Part Five (Road Administration) of Highway Law and Article 27, Part Four (Road Administration) of Regulation on Highway Management, it is stated that no unit or

individual is allowed to occupy or excavate roads without permits. For the construction works of railways, airports, power stations, communication facilities, water conservancy and others which need to occupy, dig or reroute roads, the UUs shall first obtain consent from relevant transport authorities and the Traffic Police if there exist the potential influences towards traffic safety to the public. After the construction works, the UUs shall restore roads with the original technical standards or pay corresponding economic compensation.

1.5.1.2 Regulation on the Administration of Urban Roads

Articles 30 – 38 of Part Four (Road Administration) are the provisions on the management of street works. It is stated that no UU or individual is allowed to occupy or excavate roads without consents from the relevant transport authorities and the police force. The occupation and/or excavation of public streets must obtain approvals from the municipal engineering department and the police force with the approval documents issued by the city planning department and the relevant designs. The excavation shall be prohibited within five years for new, broadened or reconstructed roads and be prohibited within three years for roads having major repair. Special cases need to obtain a permit from the people's government at or above the county level. With respect to emergency cases of the buried pipelines, the excavation of public streets may be conducted immediately and, in the meanwhile, a report shall be submitted to the municipal engineering department and police force for approvals within twenty-four hours.

The occupation and/or excavation of public streets shall be at the approved location and within the approved areas and periods. The change of the location, expansion of the area or extension of the period shall obtain an approval in advance. Clear signs and protective fences shall be set up on the work sites. After the completion of the works, the construction unit shall immediately clean up the work sites and notify the municipal engineering department for inspection. The occupation and/or excavation of public streets shall pay fees for the occupation and/or the reinstatement of public streets. In the light of the need of municipal construction or other special needs, the municipal engineering department can reduce the area, shorten the period or stop the occupation and refund some of the fees already paid for the occupation.

1.5.2 Practices in Shanghai

1.5.2.1 Administrative Structure of Utility Management

The street works in Shanghai are managed by the Shanghai Urban Construction and Communications Commission (SHUCCC). The Road Works Supervision and Management Department (RWSMD) is responsible to control total areas of road excavation, audit road excavation plans and supervise construction safety of road excavation sites. The Municipal Engineering Administration Department (MEAD) is responsible for the management of street works, the approval of road occupation/excavation permits and the sanction of contravention penalties.

1.5.2.2 Shanghai Urban Roads Management Regulation

Articles 23-28, 32 and 37 of the *Shanghai Urban Roads Management Regulation* provide provisions on the management of street works in Shanghai. It is stated that no unit or individual is allowed to occupy or excavate roads without approvals from the relevant transport authorities and the Traffic Police. In Shanghai, there are occupation permits and excavation permits related to the occupation and/or excavation on public streets. The occupation permit is issued for the temporary occupation of public streets. The applicant shall obtain the permit from the Traffic Police and pay occupation fees and deposits. The

excavation permit is issued for the occupation/excavation of public streets for utilities. The applicant shall obtain the license from the MEAD and pay reinstatement fees.

On the excavation permit, the MEAD shall indicate the date of starting works, the deadline of restoration of road access and the occupied areas. The excavation period is the length from the date of starting work to the deadline of restoration of road access. It shall be calculated based on the monthly issued construction plan of pipelines excavation on urban roads. The license shall notice that works overrunning the approved periods will be treated as the temporary road occupation except that caused by the government and the force majeure. It shall also specify the procedures of applying road occupation and the standards of charging occupation fees.

The UUs shall conduct works within the approved excavation period. If the UUs can not finish the works in the approved period, they need to apply the extension with an advance notice at least 5 days before the ending date and pay fees and deposits for the road occupation. The occupation fees will be calculated using a baseline of 3 months. The actual occupation fees are decided by the occupied areas and the actual occupation periods after the extension. The MEAD shall make the decision to approve or not approve the extension with a period of no longer than 3 months.

1.5.2.3 Road Excavation Plans

The RWSMD shall first determine annual control indexes of total road excavation areas of Shanghai according to annual construction plans of public road, metro and utility works and the historical data on annual road excavation areas. Based on these annual control indexes, the SHUCCC will coordinate with the Traffic Police and UUs to strictly work out annual road excavation plans for public roads, especially for strategic routes, at the end of December of each year. These annual plans may be revised at June according to the practical situations of road use and actual requirements of UUs. Generally, the annual plans will consider but not be limited to following rules:

- One excavation plan is made for individual road segments which may involve one or more UUs;
- UUs shall conduct utility works at the same time with the construction works of new, broadened or reconstructed roads. The excavation shall be prohibited within five years if UUs disclaim this chance; and
- The excavation plan integrating two or more UUs will have a priority in determining annual road excavation plan.

In terms of annual road excavation plans, each district/county shall monthly decide control indexes of daily road excavation areas, which shall be used as the grounds for approving road occupation/excavation permits. Besides, the RWSMD or the MEAD of each district/county shall work out monthly road excavation plans at the end of previous month. All utility works listed in the monthly road excavation plans shall first be included in the annual road excavation plan and obtain the road occupation/excavation permits.

1.5.2.4 Road Excavation Permits

The road excavation permits include the major excavation permit and the minor excavation permit. For drainage, water supply and gas, utility works with pipes more than 50 meters and utility works of electricity and telecommunication with cables more than 100 meters, the UUs need to apply the major excavation permit.

The application for the occupation/excavation of public streets will be processed by a web-based Excavation Application Management System (http://www.srpso.gov.cn:90/plansys/) which is maintained by the RWSMD. The UUs need to provide the application form (as shown in Appendix 1-2), work plans, site layout, coordination records and traffic management plan approved by the Traffic Police. Upon receiving the application, the MEAD shall inform its decision upon receiving a written application within 20 days and check and issue the permit specifying the starting date, ending date, occupation areas, standard of occupation fees, etc. The occupation fees are related to the work duration and occupation area. If the UUs can not complete in the specified period, they need to apply the extension with an advance notice at least 5 days before the ending date. With respect to the emergency cases of the buried pipelines, the excavation of public streets may be conducted immediately and, in the meanwhile, a report shall be submitted to the MEAD and Traffic Police for approvals within twenty-four hours.

Besides, the excavation normally shall be prohibited within five years for new, broadened or reconstructed roads and be prohibited within three years for roads having major repair. Special cases need to obtain a permit from the government at or above the county level and be charged one to five times of reinstatement fees in terms of the advance periods.

1.5.2.5 Application of Trenchless Technologies

The SHUCCC encourages the application of trenchless technologies, such as the pipe jacking and common duct. The percentage of utility works using trenchless technologies increased from 4% in 2002 to 30% in 2008. However, the percentage decreased to 10% - 20% in recent two years due to the technical problems of trenchless technologies. For example, when the pipe jacking is used, the cables of electricity and telecommunication may deviate from the preassigned position if the cables need to bypass underground pipelines or obstructions.

As to the application of the common duct, one common duct with 2 meters high, 6.6 km length has been constructed under the Shanghai World Expo Park. It includes pipes or cables of the electricity, telecommunication, water supply, traffic signals and other public utilities. Although the common duct can reduce repeated road excavation and save social costs, the huge initial investment (RMB 17 billion) and maintenance costs restrict the application of the common duct. The SHUCCC do not have the inclination to promote the construction of the common duct.

1.5.2.6 Underground Information System

The Underground Information System of Shanghai was built from 2005. This system contains information of underground pipelines, underground structures and geological conditions. Underground pipelines normally include pipes and cables of five main utility trades: drainage, water supply, electricity, telecommunications and gas. The basic information of underground pipelines, such as the dimensions, materials and buried years, are classified and coded in this system. The data collection method mainly is the site survey, which is currently directed by Shanghai Surveying and Mapping Institute and conducted by UUs. The average survey cost is RMB 3000-5000 per km.

The system maintenance and data update are mainly conducted by two methods. One is to update data for every six months or one year. The other one is to update data immediately after the completion of the utility work. These two methods are applied in different districts. The drawback of the former method is the less accuracy. However, due to the restriction of manpower, the proportion of second method is about 50%.

1.5.3 Practices in Wuhan

Currently, the utility management in Wuhan is governed by different administrative departments. The utility works of water supply and electricity are governed by the Government. The excavation permits of these trades only need the approval of Traffic Police and the coordination of other UUs. Wuhan Urban and Rural Construction Committee (WURCC) has established a specific utility management office on September, 2010. Also, it has drawn a draft regulation of utility management, which focuses on four areas: (1) utility damage prevention; (2) pipeline allocation and transfer; (3) reduce of repeated road excavation; (4) waste of underground space.

The WURCC designed five stages of utility works which are conducted with the road construction: detail planning, preliminary design, drawing design, construction, and as-built acceptance. In the detail planning stage, the utility works are planned associated with the road construction plans. In the preliminary design stage, different utility works are coordinated. In the drawing design stage, the construction procedures and methods are determined. The utility works will be carried out associated with the road construction. Finally, the as-built drawings are recorded in the as-built acceptance stage.

1.6 Conclusions

A literature review of street work permit application and utility management practices in United Kingdom, Australia, Singapore and Mainland China has been conducted. The information on street work permit application and utility management practices of these countries is collected from the websites of relevant authorities and through contacts with a number of local authorities by email, phone and/or interview.

Based on the collected information of relevant legislations, regulations and codes of practice in these countries, the procedures and requirements of processing street work permit applications and permit period assessment have been reviewed. From the literature review, it is observed that legislative frameworks and codes of practice for managing street work permits have been widely established in these countries. Some major findings are listed in the following:

- A permit system including the whole process of permit application, approval, variation, revocation and extension has been widely established in these countries.
- The permit fee is widely charged in these countries. Moreover, most countries also charge the overrun penalties to street works with unreasonable extensions.
- In London and Singapore, a pre-evaluation of the permit application is required for capital street works.
- The regulations on street work coordination are only specified in the UK. Other countries also have some codes of practice to improve the street work coordination.
- Most countries assess and approve permit periods based on engineers' experience and rough production rates of some major trench activities.
- In terms of PPA methods for utility trench works, few countries have developed a detailed method to estimate the work duration.
- The applications of street work permit usually are processed through the computer system.

Moreover, some relevant aspects of utility management process such as the depth/spacing requirements of underground utilities, risk management and defects liability have also been reviewed. It is found that requirements on one or several aspects have been issued in many countries through regulations and/or codes of practices.

Appendix 1-1 Application Form of Street Excavation in Melbourne, Australia

Application for **Road Opening Permit**

Community Amenity Local Law No. 3 Clause 11

PLEASE ALLOW 5 BUSINESS DAYS FOR ASSESSMENT OF THIS APPLICATION

City of Port Phillip, Private Bag No 3, St Kilda 3182
phone: (03) 9209 6216 | fax: (03) 9536 2745 | email: devpermits@portphillip.vic.gov.au

OFFICE USE ONLY
Licence Number:

Application requirements?

- Public Liability Insurance
- Memorandum of Consent (if applicable)
- Site Plan/Drawing
- Traffic Management Plan (if applicable)
- Legal Point of Discharge (if applicable)
- Payment of application fee

NO ASSESSMENT UNDERTAKEN IF ALL NECESSARY SUPPORTING INFORMATION AND DOCUMENTATION ARE NOT PROVIDED. ALL FIELDS ON THIS APPLICATION FORM ARE MANDATORY.

Costs involved?

- Application Fee: $75.00
- Permit Fee: $95.00
- Deposit: Up to 5m² - $550.00

A PERMIT WILL NOT BE ISSUED UNTIL ALL FEES AND CHARGES HAVE BEEN PAID IN FULL.

Where do I lodge my completed application?

Please fax, email or lodge in person the completed application, payment of the application fee, and all associated documents.

OFFICE USE ONLY
Date Received:
Date Lodged:

A Property and Applicant Details

Site of Works _____

Reason for Works _____

Applicant/Business Name _____

Applicant/Business Address _____

A.C.N _____

Telephone _____ **Mobile** _____ **Fax** _____

Date of Works **From** _____ **To** _____

Type of Opening Asphalt footpath ☐ Concrete footpath ☐ Road ☐
Laneway / R.O.W ☐ Bluestone ☐
Other, please specify: _____

Size of Opening L _____ x W _____ = A _____

B Application Requirements (Copy MUST be submitted with an application form)

☐ **1 Public Liability Insurance** *see Principal's Indemnity Agreement over page*

Insurer: _____

Policy no: _____

Expiry Date: _____

☐ **2 Memorandum of Consent** *if applicable*

A MOC is required from the Coordinating Road Authority to conduct work in a road reserve (e.g. public/ arterial roads). Additionally, under the Road Safety (Road Rules Regulations), if a major traffic control item (e.g. introducing a speed reduction, or the installation of temporary traffic lights) is to be utilised, a MOC must be obtained.

☐ **3 Site Plan/Drawing**

Site plan/drawing must clearly show the following: (a) the area of the opening including all dimensions; and (b) safety measures (signs, barricades, line markings etc) for the management of pedestrians.

☐ **4 Traffic Management Plan** *if applicable*

The plan must show all safety measures for the management of traffic and pedestrian safety (e.g. signs, barricades, line markings), dimensions (e.g. area of use, area remaining, distance from any intersections), and any obstructions (e.g. signs, trees, bicycle racks, street furniture).

☐ **5 Legal Point of Discharge** *if applicable*

A legal point of discharge must be obtained before a permit for Stormwater drainage works can be issued. Please contact Building Solutions on (03) 9209 6253 to apply.

C Payment

Payments are accepted via credit card, cheque or money order. Cash and EFTPOS payments are also accepted at St Kilda and Port Melbourne Town Halls or 222 Bank Street, South Melbourne.

NO PERMITS WILL BE ISSUED UNTIL FULL PAYMENT IS RECEIVED.

Please tick the preferred payment option:

- ☐ I enclose a cheque payable to the City of Port Phillip Council for the application fee of $75.00
- ☐ please debit from my (Card details) the application fee of $75.00
- ☐ I enclose a cheque payable to the City of Port Phillip Council for the application fee, permit fee and security deposit totalling $720.00
- ☐ please debit from my (Card details) the application fee, permit fee and security deposit totalling $720.00

Card Type: **Visa** ☐ **Amex** ☐ **Mastercard** ☐

Card No:

				—					—					—				

Expiry Date:

		—		

Cardholder's Name: _____ **Signature:** _____

D Principal's Indemnity Agreement

PUBLIC LIABILITY INSURANCE

Obligation to Insure

The Permit Holder shall at all times during the agreed Term, be the holder of a current Public Liability Policy of insurance ("The Public Liability Policy") in respect of the activities specified herein in the name of the Permit Holder providing coverage for a minimum sum of $10M (or more). The Public Liability Policy shall be effected with an insurer approved by the Council.

The Public Liability Policy shall cover such risks and be subject only to such conditions and exclusions as are approved by the Council and shall extend to cover the Council in respect to claims for personal injury or property damage arising out of the negligence of the Hirer/User/Permit holder.

COUNCIL'S INDEMNITY

The Permit Holder agrees to indemnify and to keep indemnified, the Council, its servants and agents, and each of them from and against all actions, costs, claims, charges, expenses, penalties, demands and damages whatsoever which may be brought or made or claimed against them, or any of them, in connection with the Permit Holders performance or purported performance of its obligations under the Permit once granted and be directly related to the negligent acts, errors or omission of the Permit Holder.

The Permit Holder's liability to indemnify the Council shall be reduced proportionally to the extent that any act or omission of the Council, its servants or agents, contributed to the loss or liability.

E Acceptance of Terms & Conditions (This form MUST be signed by the applicant)

I declare that I am the applicant; and that all information in this application is true and correct.

I accept and undertake to comply with the conditions specified on the permit and I undertake to pay, on demand, any sum necessary to make up the full cost of restoration for any damage caused by works. I agree to inspect the site and report on any existing damage to Council's assets prior to commencing work. Failure to report such damage will make me liable to pay full restoration costs.

The Permit Holder is responsible for the safeguarding of the public against injury and for maintaining the site during the existence of the work in a safe condition at all times.

If for some reason the work cannot be undertaken on the day of approval, I undertake to contact the City of Port Phillip on that day to advise. Otherwise a new permit will need to be applied for if the work is rescheduled.

I understand and accept that all fees are non-refundable.

By signing this application, I agree that I have read, acknowledged, and accepted all of the terms and conditions, and disclosures contained in this document.

Applicant's Name _____ **Date:** _____

Applicant's Signature _____

PRIVACY NOTIFICATION:

Personal information required on this form is for the purposes of dealing with this request. It will be used solely by Council and its contractors for this primary purpose or other directly related purposes. Please note that payment details will not be disclosed to Council's contractors. The applicant understands that the personal information provided is for the purposes of dealing with the request and he/she may apply to Council for access to and/or amendment of the information. Request for access and/or correction should be made to Council's Information Privacy Officer (phone Council Assist on 03 9209 6777).

Appendix 1-2 Application Form of Street Excavation in Shanghai, China

<table>
<tr><td>申请单位（章）</td><td colspan="3">地　　址</td><td colspan="2">邮　编</td></tr>
<tr><td></td><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td>经　办　人</td><td colspan="2"></td><td>联系电话</td><td colspan="2"></td></tr>
<tr><td colspan="2">工程（或设施）名称</td><td colspan="2">管线口径或容量（尺寸）</td><td colspan="2">路面种类</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="4">施 工 地 点</td><td colspan="2">掘动路面尺寸</td></tr>
<tr><td colspan="4">东南
路自　　路至　　路之口　门牌第　　号
西北</td><td colspan="2">处长　　米宽　　米</td></tr>
<tr><td colspan="6">施工日期　　年　　月　　日开工至　　月　　日完工</td></tr>
<tr><td colspan="6">掘路地点草图（大型工程须随同申请单位检送 1/500 管线平面图一式四份）</td></tr>
<tr><td>执照有效期止</td><td colspan="5"></td></tr>
<tr><td rowspan="2">下有地下管线请事先联系各单位</td><td>燃　气</td><td></td><td>供　水</td><td></td><td>通信电缆</td><td></td><td>信息电缆</td><td></td></tr>
<tr><td>电力电缆</td><td></td><td>电车电缆</td><td></td><td>排　水</td><td></td><td>其　他</td><td></td></tr>
<tr><td colspan="2">旧料再生利用情况</td><td colspan="6"></td></tr>
<tr><td colspan="8">市政工程管理部门意见：

（盖章）：
年　　月　　日</td></tr>
</table>

Chapter 2: Permit Period Assessment Practices in Hong Kong

2.1 Legal and Regulatory Framework

The Land (Miscellaneous Provisions) Ordinance (LMPO) (Cap. 28) is the primary ordinance governing road openings. With a view to strengthen control of road openings and to minimize delays in completion of street works, the LMPO was amended in 2003 and the amendments came into effect on 1 April 2004. Under the amendment, the LMPO also require Government departments to obtain excavation permits for their excavation works.

For effective management of road openings, HyD has established a standing committee comprising representatives from the UUs, contractor associations, the Traffic Police, Transport Department, and Environmental Protection Department to regularly discuss issues related to the operation under the LMPO. Practical problems encountered and uncertainties in requirements are thoroughly discussed and resolved through the standing committee.

2.1.1 Excavation Permit and Emergency Excavation Permit

Under the LMPO, a person shall obtain an excavation permit (XP) or an emergency excavation permit (EXP) from Director of Highways (DHy) before undertaking any excavation works in unleased Government land which is a street, including slopes, maintained by HyD. A person who excavates without a permit is liable to a fine of up to $50,000 and to imprisonment for 6 months. An XP will be issued upon payment of appropriate prescribed fee to allow the permittee to perform excavations in the prescribed periods. An EXP allows the permittee to excavate for each emergency incident for an initial period of not more than 7 days. If the works for an emergency incident last for more than 7 days, the permittee shall apply for an XP before the expiry of the initial period. An EXP is valid for 6 months.

It is a standard administrative practice to limit the extent of an XP to works that fall within a 450m diameter circle. Where an excavated area cannot be completely bounded by a circle with 450m diameter, the applicant can choose either (i) to divide his works into portions, each of which can be completely bounded by a circle with 450m diameter, or (ii) to apply for a capital works excavation permit (CWXP) which can cover an excavated area exceeding the limit of 450m diameter circle. Also, an XP for Small Scale Works (SSW) may be issued to cover small excavation works not exceeding $4m^2$ and of duration not longer than 48 hours on footways or not longer than 24 hours on carriageways.

2.1.2 Permit Fees and Economic Costs

To recover the administrative costs of issuing the permits and carrying out audit inspections on compliance of permit conditions, HyD charges the application fee, extension fee and daily fee as $1,860, $590 and $32, respectively. HyD may refund a sum which is equivalent to the daily fee paid for the period from the completion of the excavations to the expiry date of the permit or to the end of the extended permit period. To minimize delays in completion of street works, a daily economic cost will be charged to a permittee if excavations involving carriageways cannot be completed on time without accepted reasons, and extension is required. The daily economic costs charged according to the class of street affected are $18,000, $7,000 and $1,500 for strategic streets, sensitive streets and other streets, respectively. HyD may refund the whole or any part of the economic costs paid for an

extension of an excavation permit if the permittee states the reasons and sets out evidences in an application for a refund of the economic costs within one month from the date of the notification of the result of the extension application and HyD is satisfied that the extension is caused by reasons such as the weather and the Government orders, other than the fault of the permittee.

2.1.3 Permit Conditions

To strengthen the control of the performance and standard of excavation works, HyD stipulates conditions in the XP for the permittee to comply with. The permittee may nominate a contractor as a "nominated permittee", subject to that the contractor consents to take up the responsibility of complying with the conditions in the permit and that HyD approves the nomination of a contractor as a nominated permittee. The nominated permittee becomes responsible for complying with some of the permit conditions otherwise to be complied with by the permittee. Contraventions of the permit conditions can attract fines of up to $50,000, and up to $200,000 for those related to public safety. Failure to comply with the LMPO and permit conditions may render the permittee, his contractor, or both to prosecutions. HyD has set up an enforcement team to handle such cases. As government departments cannot be prosecuted, a reporting mechanism has been included in the LMPO for cases involving contravention by Government departments.

2.1.4 Issue, Refusal and Termination of XP/EXP

HyD may, on payment of the appropriate prescribed fee and subject to such conditions as he thinks fit, issue an XP/EXP or extend the period for which an XP/EXP is valid. An XP/EXP shall be valid for the period specified therein as that for which it is valid unless it is terminated. HyD may refuse to issue an XP/EXP if it reasonably believes that the applicant is not fit for the issue of the permit or the application to which the permit relates is unreasonable. Besides, HyD may also refuse to issue an XP/EXP or extend the period for which an XP/EXP is valid if the circumstances of the case are inappropriate or the applicant fails to submit the application within the specified time limit. HyD may terminate the permit if there is a breach of any condition of an XP/EXP. A notice of the termination will be sent to the permittee of the permit and the nominated permittee (if any) in relation to the permit and a notice of the termination posted at a conspicuous place on the unleased street to which the permit relates.

2.1.5 Review of Assessment

HyD shall make an assessment on the periods and extension periods of an XP/EXP and the reasons of the extension. If the applicant is aggrieved by the assessment, the applicant can appeal to the Chief Highway Engineer (CHE). If the applicant is not satisfied with the decision of the CHE and the matter is not settled at this level, the applicant may appeal to the DHy who chairs a Review Board to review the case. The LMPO authorizes the Secretary for Development (SDEV) to appoint a Review Panel of not more than 20 persons whom he considers suitable to sit as members of a Review Board to review the applicant's appeal against the CHE's decisions.

2.2 Administrative Structure

To process XP applications, HyD has set up an Excavation Permit Processing Team (XPPT) in each of the Urban and New Territories Regional Offices. When an application is received, the Inspector of Works (IOW) examines the proposed works, checks for possible conflicts with road opening restrictions, facilitates the permit applicant to coordinate the works with other road opening works in the vicinity, consults the Transport Department (TD) and Hong Kong Police Force (HKPF) on temporary traffic arrangements and working hours, assesses

the permit duration required, and checks that the required permit fees are paid. Upon satisfactory completion of the above procedures, the XPPT issues the required XP with a set of Conditions of Permit to be complied with respectively by the permittee, the nominated permittee, or both. The permit conditions describe the measures to take, the quality of works required, and remedial actions the Authority can take if certain conditions are not complied with. The XPPT is also responsible for processing permit extension applications and inspection of reinstatement works after the excavation.

To monitor the performance of excavation works, an Audit Inspection Team (AIT) has been established in HyD to audit compliance with permit conditions while the works are in progress. An Enforcement Team (ET) is also established to undertake necessary enforcement actions. These teams are independent of HyD works offices to ensure fair treatment. Figure 2-1 shows HyD's administrative structure for excavation management.

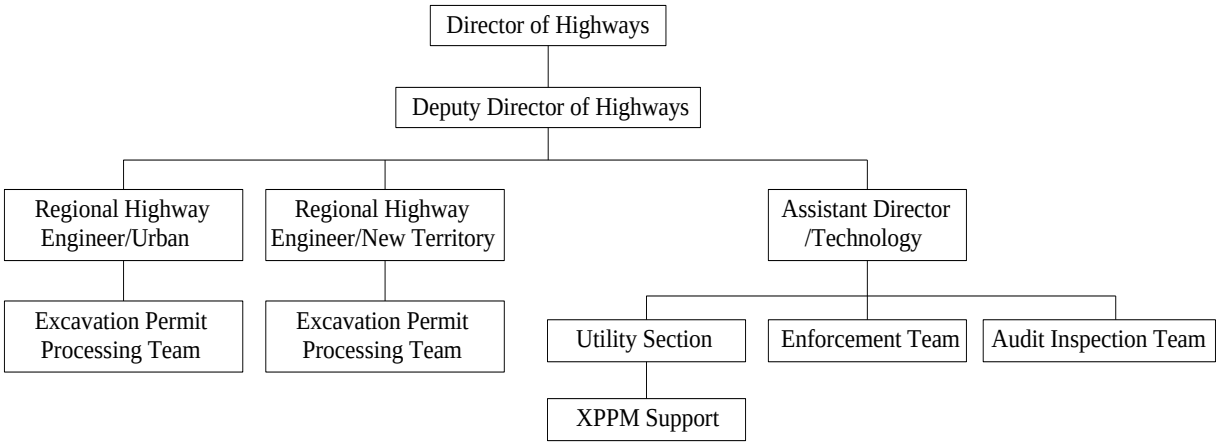

Figure 2-1 HyD's Administrative Structure

2.3 Computer System – From UMS to XPMS

HyD had developed and implemented a Utility Management System (UMS) since October 1997 to improve XP processing efficiency. In 2002, an Internet Interface for the UMS (IIUMS) was developed to enable applicants to apply for XPs through the Internet. The UMS was further enhanced in 2004 to cope with the new requirements of the amended LMPO. With the changes in business over the years, the basic computer system architecture and programs of the UMS had become major limiting factors in further improving the efficiency of XP application processing. A new computer system, the Excavation Permit Processing System (XPMS), was developed and put into use in August 2009. XPMS has improved the processing efficiency, transparency and user friendliness. Specifically, the major improvements are:

- UMS and IIUMS used two separate databases and every day, the systems had to be shut down twice to synchronize data between the systems. The single database in the XPMS eliminates the system downtime, shortens the processing time, and allows real time enquiry on the database.
- The digital maps in UMS and IIUMS were stored in different formats and much conversion was required to update the map data between systems. The XPMS uses the same data format as other HyD systems and thus minimizes the map data updating time lag;
- XPMS shortens the processing lead time by allowing the coordination of road opening works in the vicinity and seeking traffic advice from the Traffic Police and Transport Department to proceed in parallel.

- In XPMS, the start dates and end dates of the various processes and the logical relationships between them can be traced easily, enabling better monitoring of processing efficiency, identification of bottlenecks for improvement, and providing prompts to users in advance and reminders for users to take appropriate actions.
- XPMS interfaces are more user friendly, allowing users to clearly track their application status and to select and sort their required information easily.

2.4 Excavation Permit Processing and Management

With the implementation of the LMPO, the procedures for the application and administration of XPs are compiled in an Excavation Permit Processing Manual (XPPM). As shown in Figure 2-2 the XP processing and management normally consists of the following steps:

- Registration
- Assessment
- Permit Processing
- Work Management

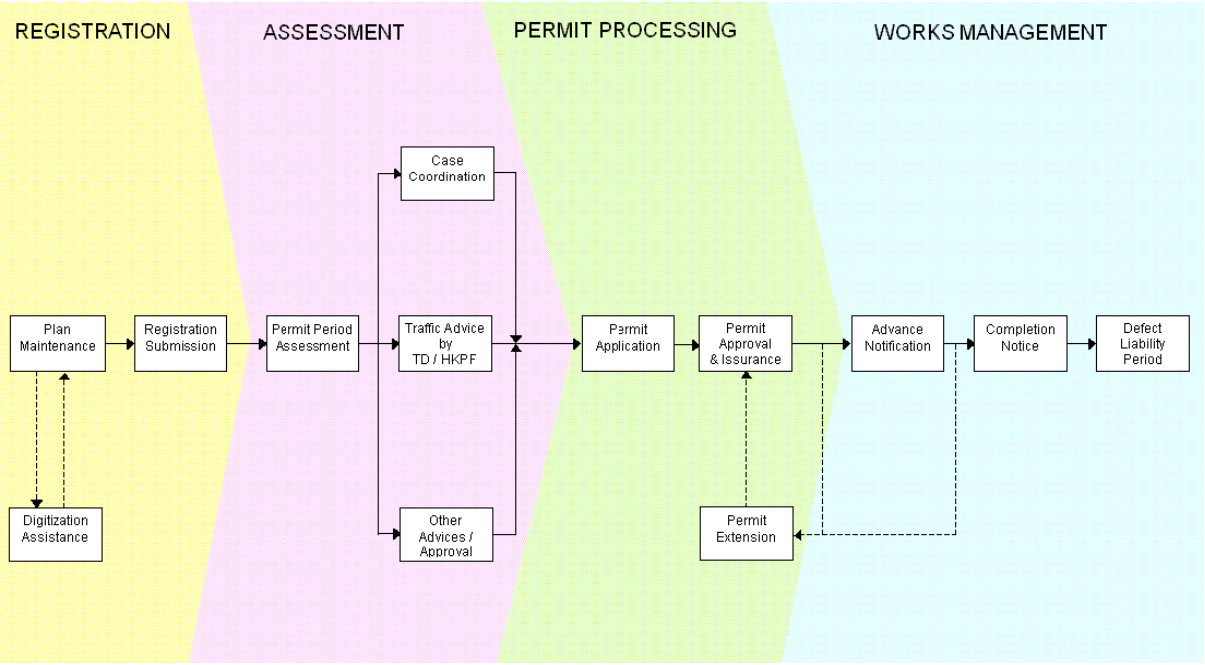

Figure 2-2 XP Processing and Management Procedures in Hong Kong

2.4.1 Phase 1: Registration

2.4.1.1 Plan Registration

The applicant, including a utility undertaking (UU) or government department, is required to firstly register his proposed excavation works in the Excavation Permit Management System (XPMS) by creating a plan. An applicant can apply for an XP for each plan. A plan is allowed to have more than one excavation item within an area which can be completely bounded by a circle with 450m diameter. Each item represents an excavation on carriageway, footway, back/side lane, verge, cycle track or roadside slope maintained by HyD. The applicant should avoid grouping works items without intrinsic relations into a single Plan. The minimum registration lead time requirement varies according to the location and duration of the proposed excavation works (see Table 2-1).

Table 2-1 Minimum Registration Lead Time in Hong Kong

Category		Minimum Lead Time
(i)	(a) Works on carriageway of trunk roads/primary distributors; or (b) Works on any carriageway exceeding 3 months	6 months
(ii)	(a) Works on carriageway (other than trunk roads/primary distributors) not exceeding 3 months; or (b) Works not on carriageway but exceeding 3 months	2 months
(iii)	Works not on carriageway and not exceeding 3 months	1 month

2.4.1.2 Program Input of a New Excavation Plan

To complete the registration of a new excavation plan, the program input includes:

- All mandatory textual information, such as location and proposed start date;
- The alignment of the proposed trench/excavation and the area with point/line/polygon. XPMS will work out the extent of the excavation that the XP will cover based on the input of the intended excavation locations.
- The work program created by the Gantt chart in XPMS

The applicant can at any time revert the plan to the registration stage in order to update the proposed start date, work program or plan alignment. For instance, the work program needs to be changed when TD or HKPF imposes restrictions on the working hours, or on the staging of works which leads to a longer working period.

2.4.1.3 Spatial Check

In order to avoid the occurrence of repeated opening at the location of the proposed work, XPMS would carry out spatial check to find out whether:

- Any other UU has carried out excavation at that location not more than 3 months before the intended commencement date of the proposed work;
- Any other UU will carry out excavation at that location within 3 months after the intended completion date of the proposed work;
- The applicant has ever carried out excavation at that location not more than 6 months before the intended commencement date of his proposed work; and
- The applicant will carry out excavation at that location again within 6 months after the intended completion date of his proposed work.

If repeated opening is identified, the applicant should adjust the proposed start date of his plan or apply for waiver through XPMS.

2.4.1.4 Waiver Processing

When a plan fails to pass the spatial check and the applicant considers that violation cannot be avoided, the applicant may apply for the waivers corresponding to the restrictions, such as the road opening restriction, repeated opening restriction and registration lead time. The waiver application will be submitted to the IOW for vetting and then the respective HyD officer for approval when the plan is registered. As XPMS cannot distinguish any exempted repeated opening items (such as trial hole/trench and joint bay), under such case, the applicant is still required to submit waiver application via XPMS to the respective HyD Regional Office for approval. If the repeated opening is confirmed as an exempted item, the waiver will be granted shortly.

2.4.2 Phase 2: Assessment

2.4.2.1 Permit Period Assessment

When the applicant creates a new plan (other than emergency work), the applicant has to decide under which one of the following categories the plan falls within:

- Short duration works: the duration shall not exceed 14 working days.
- Standard works: the duration will be computed using a standard template for each commonly undertaken activity for each trade.
- Non-standard works: the duration will be substantiated by the applicant.

For standard works, HyD has developed standard templates to do the permit period assessment (PPA) and grant the permittee the permit period. For non-standard works, the applicant is required to create a simple Gantt chart by completing the template as provided in XPMS. Alternatively, the applicant can make use of the readily available standard work templates by modifying suitable fields.

Once the applicant registers the plan with alignment successfully in XPMS, the IOW will retrieve the new plan details together with the permit period calculation and assess the permit period calculated by the applicant. The IOW can either accept or amend with reasons the permit period proposed by the applicant. If necessary, the IOW may request the applicant to submit more information before accepting or amending the permit period proposed by the applicant. The IOW will normally complete the PPA and inform the applicant the result of his assessment via XPMS in 10 working days for standard works and 20 working days for non-standard works. If the applicant does not agree with the assessment, the applicant can discuss with the Engineer/Chief Technical Officer (E/CTO) and submit a new PPA if necessary. If the case still cannot be settled, the E/CTO should issue an XP based on his assessment and also notify the permittee the result of his assessment at the same time. The permittee can appeal to the CHE within 28 days from the date of service of the notice. The CHE may vary the E/CTO's assessment and a new permit will be issued to supersede the original permit.

2.4.2.2 Case Coordination

HyD has long been collaborating with the UUs, other government departments, and utilities in managing road openings. HyD has established a 3-tier collaboration system that facilitates communication and cooperation to improve the performance of road opening works and coordinate conflicting excavation plans. This 3-tier collaboration system consists of the Joint Utilities Policy Group (JUPG) at the policy management level, the Utilities Technical Liaison Committee (UTLC) at the technical management level, and the Road Opening Coordinating Committees (ROCC) at the regional operation level. In general, the objectives of the coordination of conflicting excavation plans are to:

- Disallow repeated openings
- Disallow time gaps between works under successive plans
- Encourage overlapping as far as possible
- Avoid excessive total opening up length

The IOW will check whether the proposed work is in conflict with any other work that is within 30m from the proposed work. If no conflict is found, a new case will be formed to contain the plan and the IOW will set the case status to "coordinated". If the IOW finds that the proposed work is in conflict with other works, the conflicting plans will be grouped into an "uncoordinated" case for the concerned applicants' actions. Whenever a new case is formed, a program showing all the plans within the case will be generated by XPMS

automatically for the coordination purpose. The maximum number of plans in a case for coordination should try to restrict to less than 10 plans. Also, a case should not cover a road length longer than 1km. The start and end dates are abstracted real time from each individual plan and presented in the form of a Gantt Chart.

For a new uncoordinated case consisting of newly registered plans, the applicant of the plan with the earliest proposed start date should take the lead in coordinating with other parties except the utility works are required as a result of a HyD project and the utility excavations will be partially or entirely within HyD project sites for which the responsible HyD staff shall initiate the coordination. The lead coordinator shall then work out a coordinated program with other UUs within the case. When the coordinated program agreed by other UUs is arrived, all concerned UUs must immediately amend their plans respectively to reflect the coordinated program and the lead coordinator can put forward the case to HyD for acceptance through XPMS. If one of the UUs fails to update the program or refused to revise the program, the lead coordinator can submit the program for acceptance and state the reasons for assessment. If the IOW is satisfied with the coordination, he should update the case status to "coordinated". Otherwise, the leading applicant should be informed of any deficiency requiring rectification. The criteria to determine whether a proposed coordinated case is acceptable are as follows:

- Within a section of 20m in the same bound of a footway or carriageway, only one XP should normally be working at any one time.
- Overlapping of time programs for different plans is allowed provided that the XPs could commence in a coordinated manner.
- Time gaps between works under successive plans within the same case should be avoided.
- The overall duration of the coordinated program should be the shortest possible.

The "coordinated" plans are not allowed to change the start/end dates except that the plan duration is shortened by bringing forward its end date. Under such circumstance, the status of the subject plan remains "coordinated" and the system will alert the change to other users within the same case. Those coordinated successive plans may consider bringing forward their programs to eliminate the time gaps. Any new "uncoordinated" successive plan must bring forward its program to eliminate time gaps, if any.

2.4.2.3 Traffic Advice

The applicant should submit the temporary traffic management (TTM) proposal to Transport Department (TD)/Hong Kong Police Force (HKPF) for agreement if:

- The proposed works involve opening on carriageway of Traffic Impact Assessment (TIA)/ Day-Time Ban (DTB) routes;
- The proposed works would necessitate closure of any lane of a carriageway;
- The proposed works involve change of traffic flow directions of a carriageway; or
- The proposed works involve diverting pedestrian traffic onto a carriageway.

TD and HKPF will provide comments within 1 month. For works affecting TIA/DTB routes, the applicant should also follow the procedures as stipulated in HyD's Guidance Notes No. RD/GN/021 - *Guidelines on Traffic Impact Assessment & Day-Time Ban Requirements for Road Works on Traffic Sensitive Routes*. If the proposed work will affect traffic aids (e.g., traffic signs, directional signs, road markings, traffic light signal posts, illuminated traffic bollards, railings, crash barriers), upon TD's request, the applicant is required to submit the record photos before and after the work through reporting Advance Notification (AN) and

Completion Notice (CN) respectively for TD's acceptance. For plans which do not need TTM proposal, the applicant should submit lighting, signing and guarding (LSG) proposal to HKPF for agreement after registration via XPMS. HKPF would reply to the applicant within 2 weeks for a LSG proposal.

TD/HKPF can provide comments on the TTM/LSG proposal to the applicant via XPMS. The applicant shall revise his TTM/LSG proposal according to the comments given by TD/HKPF and resubmit it to TD/HKPF through XPMS. When the revised TTM/LSG proposal is agreed by TD/HKPF, the plan will be passed to the permit processing stage. XPMS will withhold the accepting function at XPMS until the lead time between TD's/HKPF's acceptance date and the intended works start date is less than 120 days, although comments to the TTM/LSG can still be made. XPMS will alert TD/HKPF to proceed with the plans with TTM/LSG readily for agreement.

2.4.2.4 Status Reversion

The status of a "coordinated" plan will be reverted to different stages due to various reasons. Some examples of status reversion are listed as follows:

- When the plan duration needs to be prolonged, the subject plan will be reverted to "PPA" stage;
- When the plan alignment needs to be changed, the subject plan will be reverted to "plan registration" stage;
- When TD/HKPF considers that the TTM/LSG proposal will cause significant impact to the vehicular/pedestrian traffic, TD/HKPF may turn down the proposal and the subject plan will be reverted back to the "registration" stage.

2.4.3 Phase 3: Permit Processing

2.4.3.1 Permit Application

After the "coordinated" status is given and the TTM and/or LSG proposal(s) have been accepted by TD/HKPF, the applicant may proceed to apply for an XP. Application for a permit is to be submitted at least 5 working days prior to the commencement of work. The maximum lead time for XP application prior to the commencement of works is 120 days.

2.4.3.2 Permit Approval and Issuance

Upon receipt of the application, the IOW should check whether the proposed works have any potential conflict with other planned/existing works and whether there are any special event(s) which may affect the proposed works and then recommend the responsible E/CTO to accept the XP application with suitable permit conditions and/or suggest the applicant to revise the proposed start date to suit the latest situation. The E/CTO should make decision based on IOW's recommendation.

2.4.3.3 Refusal of Permit

The E/CTO may refuse to issue an XP/EXP if it is reasonably believed that the applicant cannot comply with the conditions imposed under the permit or the applicant does not have sufficient financial resources to make or maintain an excavation to which the permit relates. The E/CTO may also refuse to issue an XP/EXP if the E/CTO thinks that the application is unreasonable, such as the proposed works are unclear (e.g. without clear dimension of works). Besides, if the circumstances of the application, in the opinions of the E/CTO, are inappropriate (e.g., excavation may affect the celebration events for some great festivals), the application may also be refused. In addition, the E/CTO may, on reasonable grounds, refuse to issue an XP if the applicant fails to submit the application at least 5 working days before

his intended commencement date of works or the street to which the permit relates is a newly constructed street. For the case of rejecting an application, SE or CHE should be consulted before rejecting the XP application.

2.4.3.4 Permit Extension

The applicant should apply for an extension of permit period and submit a permit extension application not fewer than 7 working days before the expiry date of the permit. An application which is lodged shorter than this period shall be regarded as a late application. In case the application is not submitted before 12:00 a.m. of the permit expiry date, the extension application process so far completed will be terminated. The required information in the permit extension application includes:

- An updated work program to include the required extension period for assessment;
- A reduced plan alignment representing the works to be done during the extension; and
- An updated LSG/TTM for subsequent agreement by HKPF/TD if any change on the LSG/TTM is required owing to the extension.

XPMS will perform spatial check to determine the category of carriageways affected. For cases in which more than one category of carriageways are affected, the most expensive daily economic cost will be charged. Other UUs in the same coordinated case will be notified when an extension application is made. They can make any comments for this extension application for HyD reference.

The E/CTO can either accept or amend (with reasons) the permit extension period proposed by the permittee within 7 working days. Normally, the E/CTO will approve the application for extension of permit period except in some special circumstances, such as the contractor has not diligently carried out the work resulting in slow progress and failure to complete the works within the permit period. If an extension is not accepted, a rejection letter stating the reason of refusal will be sent in hard copy to the permittee and the E/CTO shall assess time required to reinstate the trench and issue an XP extension if the remaining period of XP is inadequate. If the permittee does not agree with the permit extension assessment made by the E/CTO, the permittee can appeal to the CHE within 28 days from the date of service of notice of result.

2.4.3.5 Nominated Permittee

Private companies (such as UUs and construction companies) and the government departments should write to the HyD to register as an XPMS User together with the following document and information:

- A copy of the company's valid business registration certificate (only required for private companies);
- Nomination of a maximum two staff of the company to be the user account administrator(s); and
- Name, post title, telephone number and e-mail address of the nominated staff.

The applicant may nominate his contractor as a nominated permittee. For a normal XPMS User, the nomination procedure can all be done via XPMS. The nominated contractor shall send a notice to the HyD giving consent to the nomination and agreement to comply with the permit conditions. The nominee or the permittee shall submit evidence to substantiate the nominee's capability both in terms of technical and management experience and financial capability.

Upon receipt of application, the E/CTO should assess the nomination application and notify the permittee and the nominee the result of the assessment, with reasons if the nomination is disapproved. The assessment of the nomination application is not required for excavation works on the footway of which the area is not more than $100m^2$ and excavation works on the carriageway of which the area is not more than $10m^2$. The nominated permittee can be withdrawn by the permittee, the nominee or the HyD. Also, HyD may register contractors working for the applicant as acceptable nominated permittees for that respective applicant in advance of the XP or EXP applications. In this case, the applicant should submit to HyD in advance a list of contractors based on which the applicant will nominate his contractors as nominated permittees.

2.4.3.6 Permit Fees

An XP will only be issued upon payment of appropriate prescribed fees. HyD charges the application fee, extension fee and daily fee as $1,860, $590 and $32, respectively. The applicant can choose to settle the permit fee by individual demand notes (DNs), or setting up a deposit account with HyD. For government departments, DNs should be settled by a transfer voucher. The economic cost would be paid by individual DNs even though the applicant has a deposit account with HyD. When the excavation works are confirmed to be satisfactorily completed before the expiry date, HyD may refund a sum which is equivalent to the daily fee paid in respect of the period commencing from the completion of the excavation and expiring on the expiry date of the permit or the extended period of the permit.

2.4.4 Phase 4: Works Management

2.4.4.1 Advance Notice

For each XP under which works are about to commence, the applicant shall submit an Advance Notice (AN) to HyD through XPMS not more than 14 days but not less than 2 working days, excluding Sunday and Public Holiday, in advance of the intended commencement date. If an AN was submitted and later it turns out that the intended commencement date must be postponed, the applicant should cancel the AN via XPMS immediately, and then submit a new AN once the commencement date is ascertained. The new AN is allowed to be submitted less than 2 working days prior to the commencement of works.

2.4.4.2 Site Audit Inspection

Upon receipt of any AN, the AIT shall carry out audit inspections of the excavation sites. If it is found that the works have not commenced as stated in the AN, AIT will note down that they have visited the site and no works have been observed. It will not be regarded as a non-compliance of permit conditions. AIT conducts audit inspections on excavation sites under HyD's LMPO jurisdiction. By 7:00 pm each day, the audit inspection results are published through the Internet to allow the audited permittees to check for non-compliances identified and to take immediate corrective actions. AIT issues advisory letters to permittees/nominated permittees when the contraventions are to an extent that will invite enforcement actions. The advisory letters are referred to ET at the same time.

Upon receiving a referral from AIT, ET will investigate the case and collect evidence on the contravention. ET also takes action on complaints from other parties, and from their own inspection of XP sites. The evidence of contravention collected is provided to the Prosecution Division of the Justice Department for advice on whether summons should be made. Where the contravention is by a permittee which is a Government department, HyD will write to the relevant department to ask for an investigation whether it is due to the negligence of a public

officer. Where it is confirmed that a public officer (or a group of officers) is responsible, DHy will submit a report to Secretary for Development, who will take necessary actions to ensure that the contravention is stopped and to avoid the recurrence of similar cases.

2.4.4.3 Termination of Permit

HyD may terminate the permit if there is a breach of any condition of an XP/EXP especially when the offences endanger the interest of the public (e.g. site safety issue). Upon receipt of the notification of offences, ET will investigate and collect evidence for prosecution. CHE will assess the site situation and decide whether a suspension instruction should be issued to the permittee to temporarily suspend the work under permit conditions. CHE will inform AIT and ET immediately after issue of such instruction and request the permittee and the nominated permittee to take immediate action to rectify the situation. CHE will uplift the suspension instruction if the permittee and the nominated permittee have satisfactorily adopted all necessary safety precautions to protect the public or any person making or maintaining an excavation to which the permit relates from any danger or injury; provide adequate support for the structural stability of buildings, roads, slopes, structures, pipes, lighting posts, utility services or similar installation adjacent to the excavation so as to prevent the public or any person from being endangered by a fall or displacement of earth, rock or other material.

If the permittee or the nominated permittee fails to rectify the imminently dangerous situation promptly or as advised by AIT during their follow-up site audit on sites with major non-compliance, CHE will consider immediately terminating the XP and carrying out the rectification. The termination needs to seek the approval of the Deputy Director of Highways (DDHy) via the Assistant Director/Technical. A notice of the termination should be sent to the permittee or the nominated permittee or be posted at a conspicuous place on the unleased land to which the permit relates.

2.4.4.4 Completion Notice

If the whole duration of an XP or an extension is completely used to finish up the planned works and the reinstatement works, report completion through XPMS is not necessary. The respective HyD Regional Office will arrange a reinstatement inspection between 14 to 21 working days after the permit expiry date. However, if any one of the following situations is encountered, the permittee should report completion within 14 working days from the permit expiry date through XPMS:

- The permanent reinstatement (PR) will be carried out by others;
- The PR will be carried out by HyD at the permittee's own cost;
- Temporary structure(s)/installation(s) will be removed at a certain period after the expiry of the XP;
- No excavation has been carried out on site;
- The permit involves traffic aids reinstatement works; and
- There has been a completion notice (CN) rejected before.

In addition, if the actual excavated alignments are significantly smaller than the approved plan alignments, the permittee should submit sketches showing the actual excavated alignments within 14 working days after the permit expiry date to the respective HyD regional office for their reference in order to avoid unnecessary argument on the quality and extent of reinstatement areas. Furthermore, in case of early completion of works, the permittee is also required to report completion through XPMS immediately after completion.

On receipt of the CN, HyD will arrange reinstatement inspection within 7 working days. After site inspection, the responsible IOW will inform the permittee via XPMS whether he agrees that the works have been satisfactorily completed. If the IOW disagrees, he will inform the permittee via XPMS about the item(s) which do not comply with the requirements/specifications and request the permittee to rectify.

The permittee shall keep all as-built records in respect of the level and alignment of the underground services and installations laid or placed on footways and carriageways for 5 years and 7 years respectively from the date of submission of CN or the permit expiry date, whichever is the earlier. These records shall be certified by a recognized professional. The permittee shall provide the certified as-built records upon request by the E/CTO of the respective HyD Regional Office.

Apart from as-built records, the permittee shall submit to the E/CTO, within 2 months from the date of submission of CN or from the permit expiry date (whichever is the earlier), the original copy or certified true copy of the necessary soil/others materials test certificates/ report as required under the permit conditions unless exempted in the approved work list by the Authority. In case defective reinstatement is identified in the test results, the Permittee should initiate a small scale works or a rectification permit to rectify corresponding reinstatement area even the CN might have already been approved. In this circumstance, the permit has already been moved to the defect liability period (DLP) stage, the start date of DLP of the permit will be updated by the approved CN submission date of the rectification permit or small scale works.

2.4.4.5 Defect Liability Period

In the case of permanent reinstatement by the Authority, the permittee shall remain fully responsible for the maintenance of the backfilling and the temporary reinstatement until a period of 14 working days has elapsed from the date of submission of CN. In the case of subsidence of the permanently reinstated pavement (permanent reinstatement by either the Authority or the permittee) or deterioration in the permanent reinstatement itself (permanent reinstatement by the permittee) within 12 months from the date of submission of CN/ the permit expiry date (whichever is the earlier), the permittee shall carry out the necessary remedial works at his own expense, unless the permittee can prove that the defect was caused by a third party. Where necessary, the Authority will carry out the remedial work and the permittee shall pay all expenses incurred by the Authority pursuant to section 10Q of the LMPO. The responsible IOW of the respective maintenance district in the HyD Regional Office should arrange inspection to identify any defects associated with the reinstatement before the end of the liability period. The permittee will be required to make good the defects if any.

Chapter 3: Permit Period Assessment Methods in Current Templates

3.1 Introduction

This Chapter discusses the methods used to assess the permit periods of trench works for various utility trades including Drainage Services Department (DSD), electricity (ELE), fixed telecommunication network (FTN) services, Gas (GAS) services, and Water Supplies Department (WSD). To better understand current practice of permit period assessment, the templates could be analyzed from five perspectives: (1) trade type, (2) road class, (3) relationships between work activities and standard templates, (4) parameters determining duration of each work activity, and (5) formulas to calculate permit periods. Road class is a major criterion to classify different kinds of PPA templates for a utility trade. In general, PPA templates could be divided into three categories: flexible carriageway, rigid carriageway, and footway. Furthermore, for road crossings of rigid and flexible carriageways, additional requirements need to be taken into consideration in the corresponding templates to reflect their specific features.

In each utility trade, a number of general work activities are extracted and assigned to all the templates. Table 3-1 lists the general work activities in various utility trades. There are 15 common activities for all templates, including taking over site (011), fencing off site (021), major traffic arrangement (022), locating utilities (031), breaking up road surface and removing spoil (041), excavating trench in soft materials, installing shoring & removing spoil (051), supporting & protecting utilities, temporary decking (055), lay bedding/pipe/duct/cable (061), backfilling & soil test (071), reinstatement (072), concrete curing (073), road marking and furniture (074), demobilization (075), and report of completion (081). Apart from the 15 common work activities, each trade has a number of special work activities. For example, DSD has four special work activities: demolishing existing manholes (053), tunneling (056), water/air testing (062), and constructing manholes (063). In total, there are 19, 21, 23, 23, and 28 work activities for DSD, ELE, FTN, GAS, and WSD, respectively.

For each trade, not all general work activities are applicable to all road categories. For example, in DSD templates, there exists one work activity 022 – “Major traffic arrangement”, which is meaningless for utility works on footway. In this situation, a matrix representing relationships between work activities and standard templates is necessary to give users an intuition sense of general work activities. To calculate the permit period of one utility project, durations of work activities should be examined in detail and overlap between sequential work activities should be taken into consideration. Duration of each work activity could be determined by different kinds of project parameters including dimensions of works (length, width, and depth), surrounding condition of utility works, and productivity rates (e.g., equipment, labor and other resources deployed on site). It is necessary to capture the relationship between work activities and different project parameters so that the duration of a specific work activity could be represented by a formula consisting of these parameters. Given the many different parameters and their uncertainties, the construction period of a utility work can only be roughly estimated by the corresponding template. In the following, the permit period assessment period in the current templates is discussed using the DSD template as an example.

Table 3-1 Work Activities in Various Utility Trades

Activity Code	DSD	ELE	FTN	GAS	WSD
011	Take over site				
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)				
022	Major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway)				
031	Locate utilities (e.g., cable / gas pipe location)				
041	Break up road surface and remove spoil				
051	Excavate trench in soft material, install shoring and remove spoil				
052	Support and protect utilities				
053	Demolish existing manholes	Telephone pit/pipe removal and reconstruction (by power company)	Demolish existing jointing chamber (Joint Box)		
054		Telephone pit/pipe removal and reconstruction (by other UUs)	Demolish existing jointing chamber (Manhole)		
055	Temporary decking				
056	Tunneling (e.g. under tram track per carriageway lane)				
057		Construct duct bank			
061	Lay bedding and pipes (pipes/cables/ducts)				
062	Water/air testing	Erect platform for cable laying	Construct jointing chamber (Joint Box)	Construct Manhole/ Pit/Valve Chamber	Connect new main to live main
063	Construct manholes	Locate cable/jointing position, arrange shutdown/outage, cable jointing and accessories installation.	Construct jointing chamber (Manhole)	Construct/Modify Above Ground Service Governor	Teeing off from new main
064			Modify jointing chamber frame and covers	Construct/Modify Above Ground District Governor	Construct thrust block
065			Construct/Demolish kiosk/cabinet foundation	Construct/Modify Underground Governor (Single Stream)	Install and construct valve chamber
066			Erect telephone pole	Construct/Modify Underground Governor (Twin Stream)	Construct DN600 Inspection Tee Chamber
067			Repair ducts/cables (per 10m linear duct length)	Soundness test (air / hydraulic)	Construct Washout Pump pit

Table 3-1 Work Activities in Various Utility Trades (Continued)

Activity Code	DSD	ELE	FTN	GAS	WSD
068				Arrange for temp. suspension of gas supply with customer	Install & construct Waste Detection Meter Chamber
069				Connect new main/service to live main/service	Install & construct Single/ Double Air Valve Chamber
0610					Pressure testing
0611					Cleaning and Sterilization
0612					Water sampling
0613					Arrange newspaper/radio announcement on supply interruption for final connection
0614					Final connection & resumption of water supply
071	Backfill trench and soil test				
072	Reinstatement				
073	Concrete curing				
074	Road marking and furniture				
075	Demobilization (site clearance)				
081	Check reinstatement quality and report completion of road opening works				
Number of Work Activities	19	21	23	23	28

3.2 Standard PPA Templates in the XPMS

As shown in Table 3-2, there are eight standard templates for trench works in each utility trade according to the road type and the length of the trench works. For trench works in flexible or rigid carriageways, there are three standard templates corresponding to 10m, 50m and road crossing respectively. For trench works in footways, there are two standard templates corresponding to 10m and 50m respectively. Standard templates for 50m DSD works on flexible carriageways, rigid carriageways, and footways are denoted as D1, D2, and D3 and for 10m DSD works as D4, D5, and D6. Standard templates for DSD works on road crossings of flexible and rigid carriageways are denoted as D7 and D8.

Table 3-2 Summary of Templates for DSD Standard Works

Road Category	10m	50m	Road Crossing
Flexible carriageway	D4	D1	D7
Rigid carriageway	D5	D2	D8
Footway	D6	D3	

3.3 Standard Work Activities in PPA Templates

3.3.1 Standard Work Activities for a Particular Utility Trade

In the PPA templates, the work activities are also standardized. In all standard PPA templates for a particular utility trade, the divisions of work activities are almost the same. The standard work activities in DSD templates are listed in Table 3-3. Each work activity has a unique code in the templates. The first two numbers of the work activity code indicate the group of works and the third number the sequence of the work activity in the corresponding group. For example, there are eight work groups in DSD templates: 01- take over site, 02 – traffic arrangement, 03 – locate utilities, 04 – break up surface and remove spoil, 05 – excavation, 06 – laying pipes, 07 – back fill and reinstatement, and 08 – report completion of work. The number of work activities in each group are different, for example, only one work activity in work group 01 and six work activities in work group 05.

Table 3-3 Standard Work Activities in DSD Templates

Activity Code	Description of Work Activity
011	Take over site
021	Fence off site with necessary temporary traffic arrangements (following the approved TTM; demarcation of site by appropriate signs and guarding, relocation of road signs, etc)
022	Major traffic arrangements (e.g. trial run as requested by the Police, temporary rerouting of carriageway)
031	Locate utilities
041	Break up road surface and remove spoil
051	Excavate trench in soft material, install shoring and remove spoil
052	Support and protect utilities
053	Demolish existing manholes
055	Temporary decking
056	Tunneling (e.g. under tram track per carriageway lane)
061	Lay bedding and pipes
062	Water/air testing
063	Construct manholes
071	Backfill trench and soil test
072	Reinstatement
073	Concrete curing
074	Road marking and furniture
075	Demobilization (site clearance)
081	Check reinstatement quality and report completion of road opening works

3.3.2 Standard Work Activities Applicable to Different PPA Templates

Not all standardized work activities for trench works in a utility trade are applicable in all PPA templates for that trade. For example, Table 3-4 shows the work activities included in each of the PPA templates for DSD trench works, in which "√" indicates a work activity exists in the corresponding template while "X" means a work activity is not included in the corresponding template. Specifically, "022 - Major traffic arrangement" and "056 - Tunneling (e.g. under tram track per carriageway lane)" are not applicable to footways and "073 - Concrete curing" is not applicable to flexible carriageways.

Table 3-4 Application of Work Activities in Various DSD Templates

Activity Code	D1	D2	D3	D4	D5	D6	D7	D8
011	√	√	√	√	√	√	√	√
021	√	√	√	√	√	√	√	√
022	√	√	X	√	√	X	√	√
031	√	√	√	√	√	√	√	√
041	√	√	√	√	√	√	√	√
051	√	√	√	√	√	√	√	√
052	√	√	√	√	√	√	√	√
053	√	√	√	√	√	√	√	√
055	√	√	√	√	√	√	√	√
056	√	√	X	√	√	X	√	√
061	√	√	√	√	√	√	√	√
062	√	√	√	√	√	√	√	√
063	√	√	√	√	√	√	√	√
071	√	√	√	√	√	√	√	√
072	√	√	√	√	√	√	√	√
073	X	√	√	X	√	√	X	√
074	√	√	√	√	√	√	√	√
075	√	√	√	√	√	√	√	√
081	√	√	√	√	√	√	√	√

3.4 Logical Relationships of Work Activities in PPA Templates

The codes of work activities in PPA templates are designed in a way to indicate the sequences in carrying out these activities in the trench works. For example, Figure 3-1 shows the sequences and work logic of the work activities of DSD trench works. Arrows in Figure 3-1 indicate the relationships of the work activities. It can be seen that some work activities have to be done in sequence and others can be done in parallel. The number on the arrow indicates the overlap of time between two sequential work activities, i.e., there is 1 day overlap between activity 022 (major traffic arrangement) and activity 031 (locate utilities) and 1 day overlap between activity 041 (break up road surface and remove spoil) and activity 051 (excavate trench in soft material, install shoring and remove spoil).

3.5 Factors Affecting Working Periods of Utility Trench Works

The whole working period of a utility trench work is dependent on the work activities involved, their relationships (e.g., sequence, work logic and overlap as shown in Figure 3-1) and the duration of each work activity. The duration of a work activity is determined by the scope/quantity of this activity and the production rate in carrying out this activity. The length, depth, and width dimensions of the trench roughly represent the scale of a trench work. These dimensions normally determine the scope/quantity of each work activity involved in this trench work. The duration of most work activities depends heavily on the scope/quantity of the work, for example, the duration of 051 (excavating soft materials and removing the spoil) on the total volume of soft material to be excavated. A few work activities are not much dependent on the scale of work. For example, the durations of 011 (taking over site), 022 (major traffic arrangement), and 081 (report of completion) are assigned with a fixed value, for example, 1 day, 10 days, and 1 day respectively in the DSD templates, no matter what the work scales are.

The production rate is influenced by a wide range of factors, e.g., the number of labors and machines deployed, labor skills, and worksite conditions. For some work activities, work is done partly by equipment and partly by labor manually. In this context, there are two types of productivity rates, equipment productivity rate and manual productivity rate. In the PPA templates, it is assumed that one gang of people is employed for the manual work of 10m trench works and two gangs of people for the manual work of 50m trench works. The site conditions refer to constraints on the working time, climatic conditions, hard rock, and site constraints.

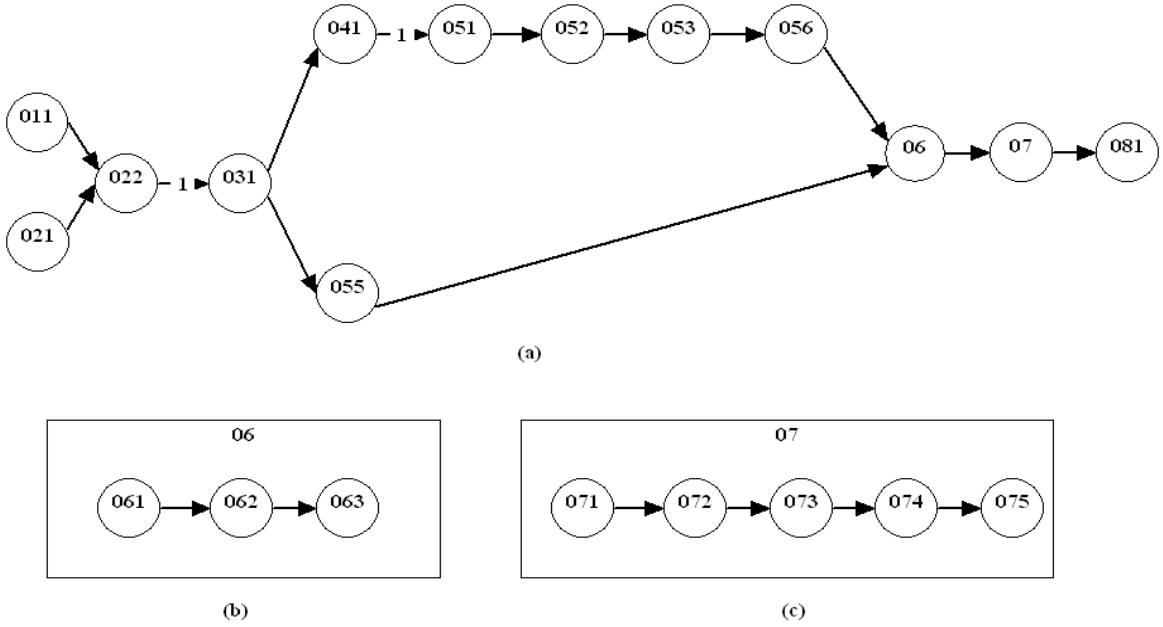

Figure 3-1 Sequence and Overlaps of Work Activities in Laying Drainage Pipe

3.6 Worksite Conditions and Multiplication Factors (MFs)

3.6.1 Four Types of Worksite Conditions

Four types of worksite conditions are used in current PPA templates: time constraint, climatic condition, hard rock and site constraint. Each type of conditions is subdivided into several divisions:

(1) The time constraint is subdivided into seven divisions: A1 (10:00 – 16:00 only (Police/ customer restriction)), A2 (2.5 hours × 2 per day), A3 (3 working hours per day), A4 [Construction Noise Permit (CNP), 19:00 to 23:00 only], A5 (CNP, 21:00 to 23:00 only), A6 (CNP, Night and Sunday/ holidays), and A7 (others).

(2) The climatic condition refers to the rainy season that includes April, May, June, July, August and September. On the basis of statistical rainfalls from 1961 to 1990, the working days lost in each month could be obtained and the months losing at least 10% of working days are included in the rainy season. The MF is calculated as average working days of non-rainy months over the average working days of rainy months.

(3) The hard rock condition has four levels: C1 (hard rock > 80%), C2 (50% < hard rock <= 80%), C3 (30% < hard rock <= 50%), and C4 (10% < hard rock <= 30%).

(4) Site constraints include two categories: one is congested underground installations and the other is steep road (>1:10)/staircase. Typical examples of congested underground installations are footway in the urban area or footway of <3.5m width in the rural area.

Table 3-5 MFs of Current PPA Templates

Site Condition	Division	Description	MFs
A - Time constraint	A1	10:00-16:00 only (Police / customer restriction)	2
	A2	2.5 hours × 2 per day (e.g. 09:00 - 11:30 and 14:30 - 17:00 for restaurants, schools or busy shopping areas)	2.4
	A3	3 working hours per day (e.g. 13-16 at Kam Wah St. market)	4
	A4	CNP - 19:00 to 23:00 only	3
	A5	CNP - 21:00 to 23:00 only	6
	A6	CNP - Night (19 to 23) and Sunday/holidays (10 to 17)	2.3
	A7	Others	
B - Climatic condition	B1	Rainy season (April to September with % days lost > 10%) - necessity for additional preventive measures such as water pumping, erection of bund walls etc.	1.1
C - Hard rock	C1	Hard rock > 80%	6.5
	C2	Hard rock > 50% & < = 80%	5.2
	C3	Hard rock > 30% & < = 50%	3.2
	C4	Hard rock > 10% & < = 30%	1.9
D - Site constraint (physical)	D1	Congested underground installations (e.g. footway of urban area or footway of <3.5m width in rural area)	1.5
	D2	Steep road (> 1 : 10) / staircase	1.8

3.6.2 Multiplication Factors for Different Worksite Conditions

Different worksite conditions have varying degrees of influence on the durations of different work activities. In current PPA templates, the effect of a worksite condition on the duration of a work activity is represented by a MF. The stronger the effect of a worksite condition, the larger the value of the MF is used to reflect this effect. Table 3-5 lists the worksite conditions and the corresponding MFs used to reflect their effects.

3.7 Predictor Variables for the Durations of Various Work Activities

As discussed in the sections above, the duration of a work activity of a trench work for a particular utility trade is in general determined by a number of variables. These variables include the road category (Cat), dimensions of the trench, equipment productivity rate (EPR), manual productivity rate (MPR), percentage of equipment work (PEW) in the work load, and worksite conditions. The road category includes flexible carriageway (FCW), rigid carriageway (RCW), footway (FT), road crossing of flexible carriageway (RCFCW), and road crossing of rigid carriageway (RCRCW). The trench dimensions include length (L), width (W), and depth (D). Regarding the four types of worksite conditions, as shown in Table 3-5, there are seven time constraints (A1-A7), one climatic condition (B1), four hard rock conditions (C1-C4), and two site constraints (D1 and D2). The option values of B1, D1, and D2 are Boolean, i.e., “yes” or “no”. A particular variable may not be applicable to all standardized work activities of trench works in a particular utility trade. For example, in DSD PPA templates, the variables applicable to various work activities are listed in Table 3-6.

Table 3-6 Parameters Affecting the Durations of Different Work Activities

Activity Code	Road Category	L	W	D	PEW	EPR	MPR	A	B	C	D1	D2
011	√											
021	√	√										
022	√											
031	√	√										
041	√	√	√		√	√	√	√	√			
051	√	√	√	√	√	√	√	√	√	√	√	√
052	√							√	√		√	
053	√							√				
055	√	√	√					√				√
056	√							√				
061	√	√	√		√	√	√	√			√	
062	√	√										
063	√							√				
071	√	√	√	√	√	√	√	√	√			
072	√	√	√		√	√	√	√	√			
073	√											
074	√											
075	√											
081	√											

3.8 Calculation of Permit Periods of Trench Works in Current PPA Templates

In current PPA templates for a particular utility trade, the permit period of a trench work with less than 10m length is assumed to be the same as that of a trench work with 10m length if other predictor variables are the same or in the same category for width and depth. For example, the possible combinations of width and depth for DSD trench works are shown in Table 3-7.

In current PPA templates, the durations of various work activities of a trench work with 10m or 50m length are calculated based on the production rates predefined for various work activities and the MFs applicable to them. Then the permit period of the 10m or 50m trench work is calculated taking into consideration the logical relationships (e.g., sequences and overlaps) of the work activities involved. For trench works with a length more than 10m, their permit periods are calculated by linear interpolation or extrapolation.

Table 3-7 Possible Combinations of Width and Depth in DSD Templates

Width	Depth
(0.0,1.0]	(0.0,1.2]
(1.0,1.5]	(0.0,1.2]
	(1.2,2.5]
(1.5,2.0]	(0.0,1.2]
	(1.2,2.5]
(2.0,3.5]	(2.0,3.0]
	(3.0,4.0]

Chapter 4: Deviation Analysis of Permit Data

4.1 Timeframe of Permit Data Used for Deviation Analysis

The permit data used for deviation analysis include all normal excavation permits (XPs) that were registered on or after April 1, 2004 and completed by December 31, 2009, excluding those for short-duration works. There are 57,734 XPs lying in this timeframe.

4.2 Number of XPs in Different Ranges of Actual Working Day and Permit Day

The total of 57,734 XPs can be classified into seven categories in terms of the length of the actual working period of the XP, which is divided into seven ranges: (1) 1-14 days, (2) 15-30 days, (3) 31-60 days, (4) 61-90 days, (5) 91-180 days, (6) 181-360 days, and (7) > 360 days. Similarly, XPs can be classified into these seven categories in terms of the length of the permit day. Table 4-1 and Table 4-2 show the number of XPs in each range of the actual working days and the permit days, respectively.

4.3 Definitions of Permit Period Deviation

The absolute permit period deviation (PPD) is defined as follows:

$$Absolute\ PPD = Permit\ days - Actual\ working\ days$$

The relative PPD may be defined in two types. Type 1 definition is as follows:

$$Relative\ PPD = \frac{Permit\ Days - Actual\ Working\ Days}{Actual\ Working\ Days} \times 100\%$$

Type 2 definition is as follows:

$$Relative\ PPD = \frac{Permit\ Days - Actual\ Working\ Days}{Permit\ Days} \times 100\%$$

Type 2 definition is used in the Final Report of this Study. In the following, the PPD refers to the type 2 relative PPD if it is not specifically indicated.

4.4 Permit Period Deviation before Removing Data Outliers

The absolute PPDs and relative PPDs of all XPs are shown in Table 4-1 according to the ranges of the actual working period and in Table 4-2 in terms of the ranges of the permit period. It is observed that:

(1) The relative PPD decreases with the increase of the actual working period.
(2) The relative PPD decreases with the increase of the permit period except for the XPs in the range of 1-14 days.
(3) The absolute PPD increases with the increase of the permit period. This trend is not shown when the range is in terms of the actual working period.
(4) 35,671 XPs (accounting for 61.79% of the total XPs) are completed within one month. Only 2,239 XPs (3.88% of the total XPs) are completed within more than six months.
(5) 37,234 XPs (64.50% of the total XPs) have permit periods of one to three months. The permit days in range 31-60 days are the most common approved periods for XPs.

Table 4-1 Deviation Analysis in Ranges of Actual Working Days

Actual Working Days	Number of XPs	Accumulative Permit Days	Accumulative Actual Working Days	Average Permit Days	Average Actual Working Days	Absolute PPD	Relative PPD
1-14	20,278	864,347	149,079	43	7	36	82.75%
15-30	15,393	808,880	334,373	53	22	31	58.66%
31-60	12,313	878,514	532,184	71	43	28	39.42%
61-90	4,226	412,587	304,868	98	72	26	26.11%
91-180	3,285	519,704	410,032	158	125	33	21.10%
181-360	1,567	436,556	387,744	279	247	31	11.18%
≥361	672	385,939	376,186	574	560	15	2.52%
Total	57,734	4,306,527	2,494,466	75	43	32	42.08%

Table 4-2 Deviation Analysis in Ranges of Permit Days

Permit Days	Number of XPs	Accumulative Permit Days	Accumulative Actual Working Days	Average Permit Days	Average Actual Working Days	Absolute Deviation	Relative Deviation
1-14	898	9,853	5,203	11	6	5	47.19%
15-30	9,527	234,080	103,380	25	11	14	55.84%
31-60	23,393	1,048,080	511,398	45	22	23	51.21%
61-90	13,843	1,000,955	556,645	72	40	32	44.39%
91-180	6,598	821,227	470,749	124	71	53	42.68%
181-360	2,407	601,880	408,515	250	170	80	32.13%
≥361	1,068	590,452	438,576	553	411	142	25.72%
Total	57,734	4,306,527	2,494,466	75	43	32	42.08%

4.5 Removal of Data Outliers

Table 4-3 shows the PPDs (minimum, maximum, mean and standard deviations) in each range of the actual working period. For each range, XPs of which the actual working periods lie outside the interval [μ-3σ, μ+3σ] are treated as outliers. Table 4-3 also lists the number of outliers in each range and their percentage as of the total number of XPs in that range. There are 1,276 (2.21%) outliers. Similarly, Table 4-4 shows the deviations of the permit period in each range of the permit period. For each range, XPs of which the permit periods lie outside the interval [μ-3σ, μ+3σ] are treated as outliers. Table 4-4 also lists the number of outliers in each range and their percentage as of the total number of XPs in that range. There are 1,424 (2.47%) outliers. After removing the 1,424 outliers, there are 56,310 XPs remaining.

4.6 Multidimensional Analysis of Excavation Permits

In the following sections, multidimensional analysis is conducted using the remaining XP data from the following perspectives:

- Excavation works in all utility trades;
- Excavation works in five specific trades (DSD, ELE, FTN, GAS and WSD);
- Non-standard excavation works in the five specific trades;
- Standard excavation works in the five specific trades; and
- Single-item standard excavation works in the five specific trades.

Table 4-3 Outliers in Ranges of Actual Working Days

Actual Working Days	Number of XPs	Minimum Deviation	Maximum Deviation	Mean Deviation	σ	[μ-3σ, μ+3σ]	Outliers
1-14	20,278	-550.00%	99.76%	78.09%	16.80%	[0.2769,1.2849]	363 (1.79%)
15-30	15,393	-275.00%	96.74%	50.56%	21.60%	[-0.1424,1.1536]	252 (1.64%)
31-60	12,313	-525.00%	97.37%	30.19%	25.69%	[-0.4688,1.0726]	200 (1.62%)
61-90	4,226	-245.83%	93.30%	13.56%	31.72%	[-0.816,1.0872]	125 (2.95%)
91-180	3,285	-511.54%	92.39%	2.41%	48.70%	[-1.4369,1.4851]	109 (3.31%)
181-360	1,567	-978.57%	80.83%	-5.82%	69.89%	[-2.1549,2.0385]	106 (6.76%)
≥361	672	-782.35%	69.63%	-8.89%	62.16%	[-1.9537,1.7759]	121 (18.01%)
Total	57,734	-978.57%	99.73%	48.21%	38.19%		1276 (2.21%)

Table 4-4 Outliers in Ranges of Permit Days

Permit Days	Number of XPs	Minimum Deviation	Maximum Deviation	Mean Deviation	σ	[μ-3σ, μ+3σ]	Outliers
1-14	898	-550.00%	92.86%	44.76%	54.43%	[-1.1853,2.0805]	23 (2.56%)
15-30	9,527	-978.58%	96.66%	55.90%	38.12%	[-0.5846,1.7026]	408 (4.28%)
31-60	23,393	-782.35%	98.33%	51.52%	35.75%	[-0.5573,1.5877]	568 (2.43%)
61-90	13,843	-537.14%	98.88%	44.31%	38.88%	[-0.7233,1.6095]	289 (2.09%)
91-180	6,598	-415.84%	99.44%	43.31%	39.54%	[-0.7531,1.6193]	114 (1.73%)
181-360	2,407	-252.05%	99.70%	32.52%	35.98%	[-0.7542,1.4046]	17 (0.56%)
≥361	1,068	-134.93%	99.73%	26.55%	33.11%	[-0.7278,1.2588]	5 (0.48%)
Total	57,734	-978.57%	99.73%	48.21%	38.19%		1424 (2.47%)

4.7 Deviation Analysis for Excavation Works in All Utility Trades

4.7.1 Overview

As mentioned above, there are 56,310 XPs after removing the outliers. Table 4-5 and Figure 4-1 show the results of the deviation analysis for these XPs. It should be mentioned that in Table 4-5 the XPs included in each year refer to XPs that are ended by 31 December of that year as indicated in the first completion notice. It is observed that:

(1) The overall relative PPD of these XPs is 41.03%, the average permit days are 75 days, the average actual working days are 44 days, and the average absolute PPD is 31 days.
(2) The relative PPD decreases over time, from 53.04% in 2004 to 37.07% in 2009.
(3) The number of XPs from 2007 to 2009 is stable, around 9,400 XPs per year.
(4) The accumulative permit days increase year by year, from 291,751 days in 2005 to 940,550 days in 2009.

Table 4-5 Deviation Analysis for Excavation Works in All Trades

Item	2004	2005	2006	2007	2008	2009	Total
PPD	53.04%	45.41%	41.26%	41.19%	37.67%	37.07%	41.03%
Number of XPs	6,363	11,557	10,222	9,434	9,465	9,269	56,310
Accumulative Permit Days	291,751	670,147	697,185	738,558	888,949	940,500	4,227,090
Accumulative Actual Working Days	137,019	365,864	409,515	434,321	554,122	591,856	2,492,697
Average Permit Days	46	58	68	78	94	101	75
Average Actual Working Days	22	32	40	46	59	64	44

(5) The average permit days and average actual working days also increase year by year, for the former from 46 days in 2004 to 101 days in 2009 and for the latter from 22 days in 2004 to 64 days in 2009.

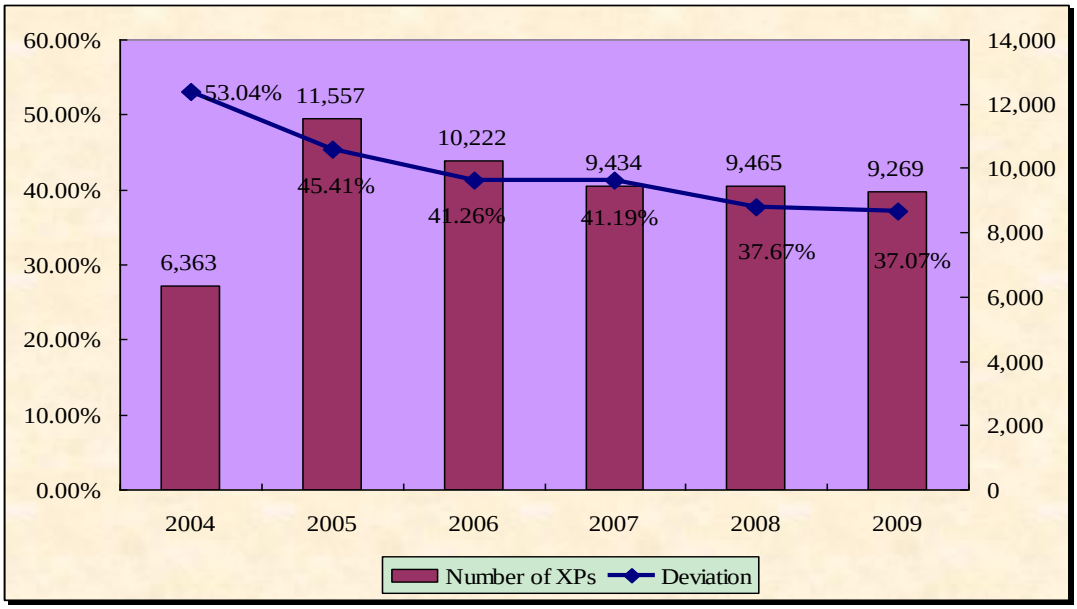

Figure 4-1 Annual PPDs and Numbers of XPs in All Trades from 2004 and 2009

4.7.2 Deviation Analysis by Region

There are three regions in Hong Kong, i.e., Hong Kong, Kowloon, and New Territories. Table 4-6, Table 4-7, Table 4-8 and Figure 4-2 show the results of deviation analysis by region. It is observed that:

(1) The PPD in Hong Kong is much higher than those in Kowloon and New Territories. In general, the PPDs of all three regions decrease from 2004 to 2009, for Hong Kong from 62.49% to 45.69%, for Kowloon from 51.11% to 30.95%, and for New Territories from 48.77% to 36.97%.

(2) The number of XPs (26,245 XPs) in New Territories is much higher than that in Hong Kong (12,954 XPs) and that in Kowloon (17,111 XPs), accounting for 46.61% of the total XPs (56,310 XPs).

(3) Average permit days and average actual working days increase year by year in all three regions. For Hong Kong, the former increase from 50 days in 2004 to 120 days in 2009 and the latter from 19 days in 2004 to 65 days in 2009; for Kowloon, the former from 44 days in 2004 to 117 days in 2009 and the latter from 22 days in 2004 to 81 days in 2009; for New Territories, the former from 45 days in 2004 to 81 days in 2009 and the latter from 23 days in 2004 to 51 days in 2009.

Table 4-6 Deviation Analysis by Region for All Trades

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
Hong Kong	62.49%/ 1,518	52.63%/ 2,635	48.62%/ 2,166	51.4%/ 2,129	48.19%/ 2,391	45.69%/ 2,115	49.9%/ 12,954
Kowloon	51.11%/ 1,942	44.72%/ 3,562	38.97%/ 3,041	32.85%/ 2,762	28.62%/ 2,795	30.95%/ 3,009	35.25%/ 17,111
New Territories	48.77%/ 2,903	41.62%/ 5,360	39.06%/ 5,015	41.57%/ 4,543	38.05%/ 4,279	36.97%/ 4,145	40.08%/ 26,245
Total	53.04%/ 6,363	45.41%/ 11,557	41.26%/ 10,222	41.19%/ 9,434	37.67%/ 9,465	37.07%/ 9,269	41.03%/ 56,310

Table 4-7 Accumulative Permit Days and Accumulative Actual Working Days by Region for All Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Hong Kong	76,067/	171,309/	162,558/	190,851/	253,841/	254,122/	1,108,748/
	28,532	81,143	83,519	92,763	131,503	138,003	555,463
Kowloon	85,607/	209,970/	218,576/	246,815/	309,150/	352,619/	1,422,737/
	41,855	116,069	133,394	165,741	220,678	243,474	921,211
New Territories	130,077/	288,868/	316,051/	300,892/	325,958/	333,759/	1,695,605/
	66,632	168,652	192,602	175,817	201,941	210,379	1,016,023
Total	291,751/	670,147/	697,185/	738,558/	888,949/	940,500/	4,227,090/
	137,019	365,864	409,515	434,321	554,122	591,856	2,492,697

Table 4-8 Average Permit Days and Average Actual Working Days by Region for All Trades

Permit Days/Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Hong Kong	50/19	65/31	75/39	90/44	106/55	120/65	86/43
Kowloon	44/22	59/33	72/44	89/60	111/79	117/81	83/54
New Territories	45/23	54/31	63/38	66/39	76/47	81/51	65/39
Total	46/22	58/32	68/40	78/46	94/59	101/64	75/44

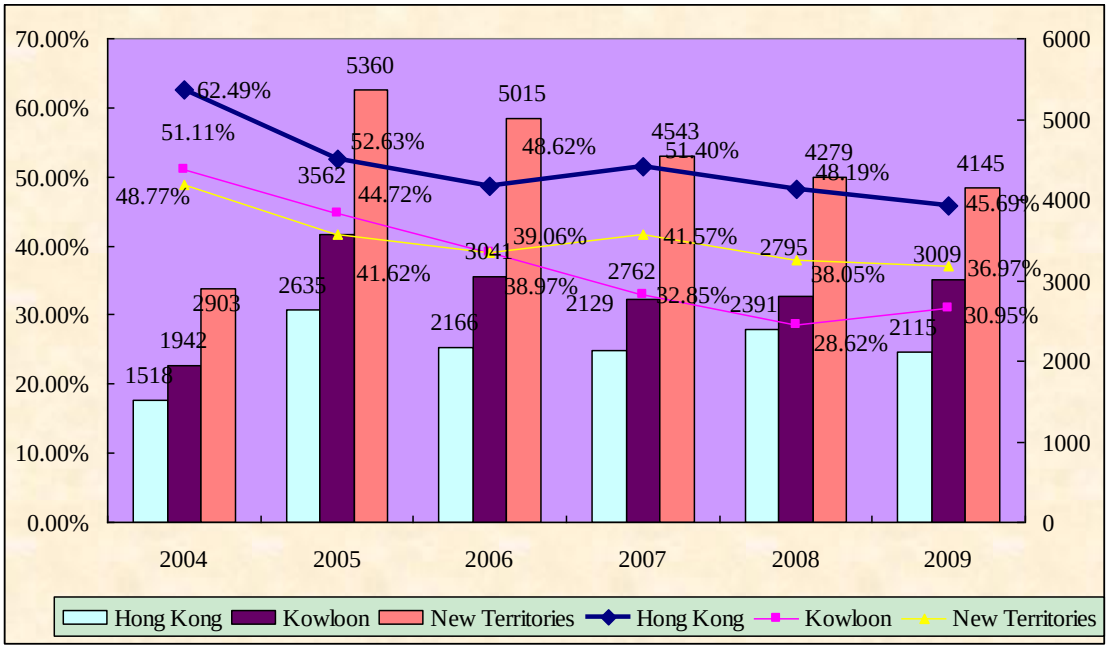

Figure 4-2 Deviation Analysis by Region for All Trades

4.7.3 Deviation Analysis by Work Type

There are three work types, short-duration works, standard works, and non-standard works. In this section, deviation analysis is done only for standard and non-standard works. The results of deviation analysis for standard and non-standard works are shown in Table 4-9, Table 4-10, Table 4-11 and Figure 4-3. It is observed that:

(1) The number of standard XPs was 7,014 in 2005. This number is decreased in 2006 and kept stable from 2006 (6,095 XPs) to 2009 (6,131 XPs);

(2) The number of non-standard XPs continuously decreases from 2005 (4,543 XPs) to 2009 (3,138 XPs).

Table 4-9 Deviation Analysis by Work Type for All Trades

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
Non-Standard Works	48.14%/ 2,434	39.77%/ 4,543	37.27%/ 4,127	40.4%/ 3,777	37.5%/ 3,409	38.81%/ 3,138	39.29%/ 21,428
Standard Works	55.87%/ 3,929	49.15%/ 7,014	44.27%/ 6,095	41.74%/ 5,657	37.77%/ 6,056	35.98%/ 6,131	42.19%/ 34,882
Total	53.04%/ 6,363	45.41%/ 11,557	41.26%/ 10,222	41.19%/ 9,434	37.67%/ 9,465	37.07%/ 9,269	41.03%/ 56,310

Table 4-10 Accumulative Permit Days and Accumulative Actual Working Days by Work Type for All Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Non-Standard Works	107,015/ 55,499	267,459/ 161,102	299,902/ 188,127	301,501/ 179,696	349,362/ 218,353	362,859/ 222,023	1,688,098/ 1,024,800
Standard Works	184,736/ 81,520	402,688/ 204,762	397,283/ 221,388	437,057/ 254,625	539,587/ 335,769	577,641/ 369,833	2,538,992/ 1,467,897
Total	291,751/ 137,019	670,147/ 365,864	697,185/ 409,515	738,558/ 434,321	888,949/ 554,122	940,500/ 591,856	4,227,090/ 2,492,697

Table 4-11 Average Permit Days and Average Actual Working Days by Work Type for All Trades

Permit Days/Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Non-Standard Works	44/23	59/35	73/46	80/48	102/64	116/71	79/48
Standard Works	47/21	57/29	65/36	77/45	89/55	94/60	73/42
Total	46/22	58/32	68/40	78/46	94/59	101/64	75/44

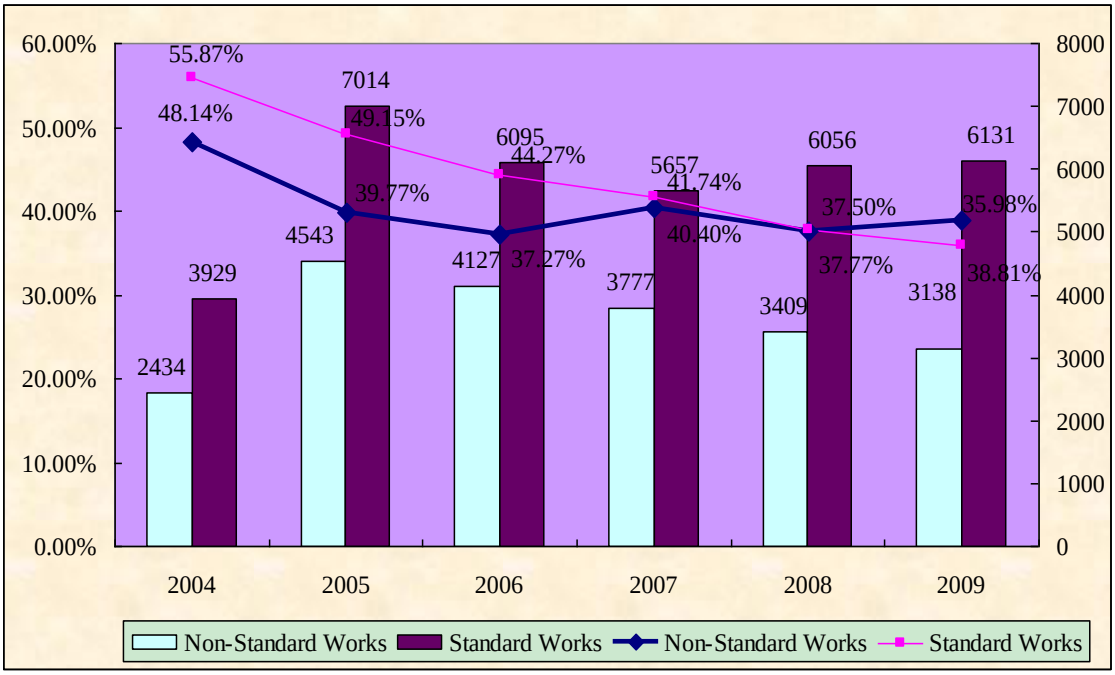

Figure 4-3 Deviation Analysis by Work Type for All Trades

(3) In general, the PPDs of both standard and non-standard works decrease from 2004 to 2009, with the former from 55.87% in 2004 to 35.98% in 2009 and the latter from 48.14% in 2004 to 38.81% in 2009.

(4) The annual PPD of standard works is higher than that of non-standard works for years

2004 to 2006 although the gap decreases slightly; from 2007, the gap gets quite close, e.g., in 2008, the PPD is 37.50% for non-standard works and 37.77% for standard works with a minimal difference of 0.27%.

(5) The PPD of non-standard works is more stable than that of standard works, with the former a range of 37.50% to 40.40% and the latter a range of 35.98% to 49.15% for the period from 2005 to 2009.

(6) The average permit days and average actual working days show a trend of increase year by years for both standard and non-standard works from 2004 to 2009. For the standard works, the former increase from 47 days in 2004 to 94 days in 2009 and the latter from 21 days in 2004 to 60 days in 2009. For the non-standard works, the former increase from 44 days in 2004 to 116 days in 2009 and the latter from 23 days in 2004 to 71 days in 2009.

4.7.4 Deviation Analysis by Multiplication Factors

The PPD is analyzed from the perspective of whether the permit involves MFs. The results are shown in Table 4-12, Table 4-13, Table 4-14 and Figure 4-4. It is observed that:

(1) For years 2004 to 2006, the PPDs of XPs involving MFs are larger than that of XPs not involving MFs and years 2007 to 2009 the reverse.

(2) In total, the overall PPD for XPs involving MFs is a little larger than that of XPs not involving MFs; the former is 41.86% and the latter is 40.58%.

(3) More than half of the excavation works (36,700 XPs of 56,310 XPs) have not used MFs.

(4) The number of XPs using MFs in general decreases year by year since 2005 while the number of XPs without using MFs does not show such a decreasing trend. It seems that the number of XPs without using MFs keeps stable from 2006 (6,594 XPs) to 2009 (6,467 XPs).

(5) The average permit days and average actual working days show a trend of increase year by year from 2004 to 2009 for both excavation works using MFs and without using MFs. For the excavation works using MFs, the former increase from 50 days in 2004 to 100 days in 2009 and the latter from 22 days in 2004 to 64 days in 2009. For the excavation works without using MFs, the former increase from 43 days in 2004 to 102 days in 2009 and the latter from 21 days in 2004 to 64 days in 2009.

Table 4-12 Deviation Analysis by MFs for All Trades

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	51.33%/ 3,434	43.55%/ 7,535	40.14%/ 6,594	41.66%/ 6,295	38.43%/ 6,375	37.72%/ 6,467	40.58%/ 36,700
Use MFs	54.75%/ 2,929	48.63%/ 4,022	43.23%/ 3,628	40.35%/ 3,139	36.2%/ 3,090	35.54%/ 2,802	41.86%/ 19,610
Total	53.04%/ 6,363	45.41%/ 11,557	41.26%/ 10,222	41.19%/ 9,434	37.67%/ 9,465	37.07%/ 9,269	41.03%/ 56,310

Table 4-13 Accumulative Period Days and Accumulative Actual Working Days by MFs for All Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	146,341/ 71,225	425,497/ 240,197	444,645/ 266,155	474,591/ 276,868	585,477/ 360,497	660,501/ 411,373	2,737,052/ 1,626,315
Use MFs	145,410/ 65,794	244,650/ 125,667	252,540/ 143,360	263,967/ 157,453	303,472/ 193,625	279,999/ 180,483	1,490,038/ 866,382
Total	291,751/ 137,019	670,147/ 365,864	697,185/ 409,515	738,558/ 434,321	888,949/ 554,122	940,500/ 591,856	4,227,090/ 2,492,697

Table 4-14 Average Permit Days and Average Actual Working Days by MFs for All Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	43/21	56/32	67/40	75/44	92/57	102/64	75/44
Use MFs	50/22	61/31	70/40	84/50	98/63	100/64	76/44
Total	46/22	58/32	68/40	78/46	94/59	101/64	75/44

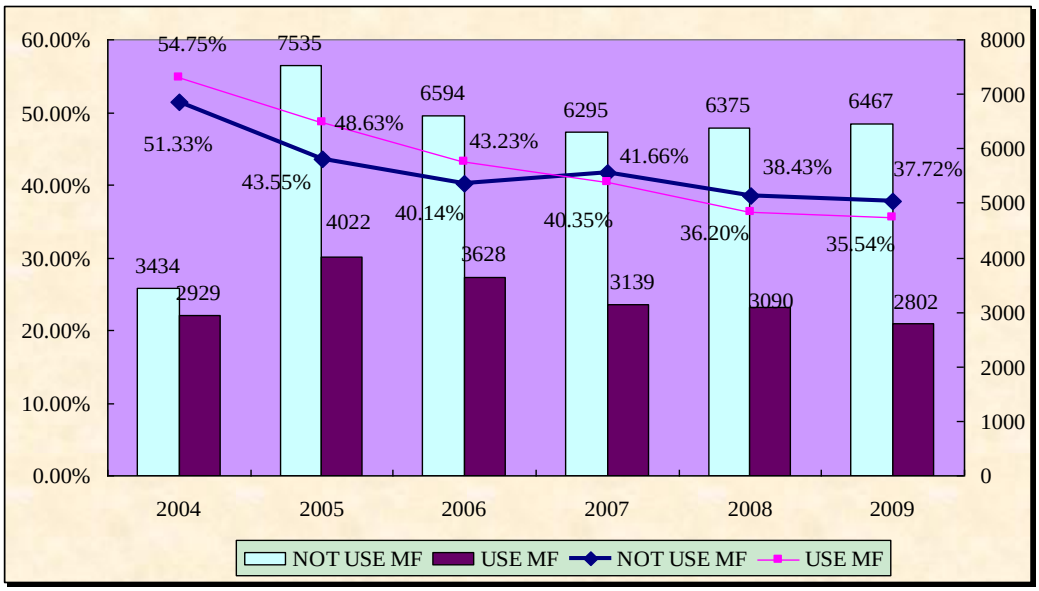

Figure 4-4 Deviation Analysis by MFs for All Trades

4.7.5 Deviation Analysis by Road Type

HyD defines roads into 12 types: "expressway", "primary distributor", "rural trunk road", "urban trunk road", "district distributor", "feeder road", "local distributor", "new street or road", "no road type", "rural road A", "rural road B", and "non-motorable road (i.e., footway)". The results of deviation analysis by road type are shown in Table 4-15, Table 4-16, and Table 4-17. It is observed that:

(1) Most of the excavation works are on the "primary distributor" (8,029 XPs), "district distributor" (12,597 XPs), and "local distributor" (20,386 XPs). Excavation works on these three types of roads account for 72.83% of the total number of excavation works.

(2) The three types of roads that have the highest PPD are "Rural Road B" (46.04%), "Rural Trunk Road" (43.12%), and "Local Distributor" (42.81%).

4.7.6 Deviation Analysis for Footway and Carriageway

The results of deviation analysis by footway and carriageway are shown in Table 4-18, Table 4-19, Table 4-20, Table 4-21, Table 4-22 and Figure 4-5. It is observed that:

(1) More than half of the excavation works are on the footway (32,989 XPs, accounting for 58.58% of total XPs). 10,583 (18.79%) excavation works are on both footways and carriageways. 6,963 XPs (12.36%) are solely on carriageways.

(2) The average actual working period on the carriageway (41 days) is longer than that on the footway (34 days).

(3) The PPD of excavation works on footway decreases year by year, from 54.65% in 2004 to 39.47% in 2009. In general, the excavation works on carriageway and those on "both footway & carriageway" show a decreasing trend of PPDs, with the former from 62.76% in 2004 to 45.11% in 2009 and the latter from 54.79% in 2004 to 30.04% in 2009.

(4) The average permit days and average actual working days for all the categories by footway and carriageway increase year by year.

Table 4-15 Deviation Analysis by Road Type for All Trades

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
Expressway	50.13%/ 37	36.48%/ 55	28.36%/ 46	33.38%/ 30	26.93%/ 40	40.38%/ 47	33.56%/ 255
Primary Distributor	54.99%/ 831	44.83%/ 1,660	39.24%/ 1,348	37.8%/ 1,330	34.4%/ 1,383	33.64%/ 1,477	38.28%/ 8,029
Rural Trunk Road	58.81%/ 36	47.95%/ 70	51.97%/ 72	48.23%/ 75	32.39%/ 63	30.79%/ 55	43.12%/ 371
Urban Trunk Road	47.95%/ 102	48.65%/ 173	32.69%/ 205	40.55%/ 197	26.91%/ 190	17.21%/ 216	30.25%/ 1,083
District Distributor	53.81%/ 1,544	47.58%/ 2,634	41.93%/ 2,150	41.45%/ 2,048	37.94%/ 2,143	37.72%/ 2,077	41.78%/ 12,596
Feeder Road	33.91%/18	48.49%/19	12.25%/30	59.89%/18	49.%/17	49.5%/22	39.39%/124
Local Distributor	53.35%/ 2,426	46.86%/ 4,158	44.02%/ 3,624	42.8%/ 3,437	38.38%/ 3,435	39.57%/ 3,305	42.81%/ 20,385
New Street or Road	53.95%/ 216	39.55%/ 127	31.03%/ 121	39.26%/ 80	30.61%/ 42	38.65%/ 25	40.8%/ 611
No Road Type	50.98%/ 542	43.75%/ 1,539	39.73%/ 1,500	39.98%/ 1,400	40.47%/ 1,402	38.59%/ 1,329	40.83%/ 7,712
Rural Road A	48.8%/ 396	39.48%/ 678	40.68%/ 669	38.94%/ 469	40.27%/ 458	39.46%/ 397	40.59%/ 3,067
Rural Road B	48.44%/ 76	39.45%/ 170	42.82%/ 165	47.94%/ 140	50.53%/ 126	48.32%/ 130	46.04%/ 807
Non-motorable Road, Footway	51.89%/ 139	33.21%/ 274	35.14%/ 292	44.88%/ 206	42.44%/ 166	43.48%/ 188	40.48%/ 1,265
Total	53.04%/ 6,363	45.41%/ 11,557	41.26%/ 10,222	41.19%/ 9,434	37.67%/ 9,465	37.07%/ 9,269	41.03%/ 56,310

Table 4-16 Accumulative Permit Days and Accumulative Actual Working Days by Road Type for All Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Expressway	1,484/ 740	3,525/ 2,239	5,625/ 4,030	3,005/ 2,002	4,423/ 3,232	3,551/ 2,117	21,613/ 14,360
Primary Distributor	40,389/ 18,180	102,735/ 56,681	94,820/ 57,610	113,403/ 70,536	150,517/ 98,743	171,900/ 114,066	673,764/ 415,816
Rural Trunk Road	1,680/692	3,992/ 2,078	5,170/ 2,483	4,665/ 2,415	5,079/ 3,434	4,920/ 3,405	25,506/ 14,507
Urban Trunk Road	5,024/ 2,615	13,940/ 7,158	20,278/ 13,649	24,079/ 14,314	29,227/ 21,361	41,833/ 34,635	134,381/ 93,732
District Distributor	71,635/ 33,089	151,702/ 79,522	149,959/ 87,078	162,264/ 95,011	208,532/ 129,416	223,513/ 139,202	967,605/ 563,318
Feeder Road	575/ 380	926/ 477	1,771/ 1,554	895/ 359	847/ 432	1,612/ 814	6,626/ 4,016
Local Distributor	109,620/ 51,133	241,401/ 128,277	243,788/ 136,463	269,739/ 154,292	312,466/ 192,532	321,936/ 194,541	1,498,950/ 857,238
New Street or Road	10,455/ 4,815	8,033/ 4,856	7,251/ 5,001	6,278/ 3,813	4,178/ 2,899	2,075/ 1,273	38,270/ 22,657
No Road Type	22,895/ 11,222	81,517/ 45,850	95,667/ 57,656	95,155/ 57,116	108,048/ 64,316	108,620/ 66,707	511,902/ 302,867
Rural Road A	18,117/ 9,275	37,648/ 22,783	43,120/ 25,580	36,164/ 22,080	36,877/ 22,026	34,562/ 20,924	206,488/ 122,668
Rural Road B	3,652/ 1,883	9,178/ 5,557	11,403/ 6,520	9,460/ 4,925	10,142/ 5,017	10,829/ 5,596	54,664/ 29,498
Non-motorable Road, Footway	6,225/ 2,995	15,550/ 10,386	18,333/ 11,891	13,205/ 7,279	18,613/ 10,714	15,110/ 8,540	87,036/ 51,805
Total	291,751/ 137,019	670,147/ 365,864	697,185/ 409,515	738,558/ 434,321	888,949/ 554,122	940,500/ 591,856	4,227,090/ 2,492,697

Table 4-17 Average Permit Days and Average Actual Working Days by Road Type for All Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Expressway	40/20	64/41	122/88	100/67	111/81	76/45	85/56
Primary Distributor	49/22	62/34	70/43	85/53	109/71	116/77	84/52
Rural Trunk Road	47/19	57/30	72/34	62/32	81/55	89/62	69/39
Urban Trunk Road	49/26	81/41	99/67	122/73	154/112	194/160	124/87
District Distributor	46/21	58/30	70/41	79/46	97/60	108/67	77/45
Feeder Road	32/21	49/25	59/52	50/20	50/25	73/37	53/32
Local Distributor	45/21	58/31	67/38	78/45	91/56	97/59	74/42
New Street or Road	48/22	63/38	60/41	78/48	99/69	83/51	63/37
No Road Type	42/21	53/30	64/38	68/41	77/46	82/50	66/39
Rural Road A	46/23	56/34	64/38	77/47	81/48	87/53	67/40
Rural Road B	48/25	54/33	69/40	68/35	80/40	83/43	68/37
Non-motorable Road, Footway	45/22	57/38	63/41	64/35	112/65	80/45	69/41
Total	46/22	58/32	68/40	78/46	94/59	101/64	75/44

(5) In terms of excavation works on the carriageway (in total 6,963 XPs), most of them are on the primary distributor (1,037 XPs, accounting for 14.89% of total XPs on carriageway with deviation 51.49%), district distributor (1,645 XPs, 23.64% with 49.03%) and local distributor (2,564 XPs, 36.82% with 50.99%). Excavation works on these three types of roads account for 75.35% of the total number of excavation works on the carriageway.
(6) The PPDs of excavation works on carriageway with different road types vary largely, from 38.54% of the "Non-motorable road, Footway" to 58.27% of the "Rural Road B".
(7) Regarding excavation works on the footway (in total 32,989XPs), most of them are on the local distributor (11,837 XPs, accounting for 35.88% of the total XPs on footway with deviation 46.78%), district distributor (7,745 XPs, 23.48% with 44.80%), and primary distributor (5,128 XPs, 15.54% with 40.54%). Excavation works on these three types of roads account for 74.90% of the total number of excavation works on the footway.
(8) The PPDs of excavation works on footway with different road types vary from 36.25% of the "Expressway" to 50.60% of the "rural road B".
(9) The standard deviations of PPDs of excavation works on carriageway and footway are 6.48% and 4.87%, respectively, which shows that excavations works on footway are less impacted by road types compared to that on carriageway.

4.7.7 Deviation Analysis by Trade

Utility trades in Hong Kong include ASD (Architect Service Department), CED (Civil Engineering and Development Department), DSD, ELE, FTN, GAS, HTL (Tramway), HYD, WSD, and OTH (Others). The results of deviation analysis for excavation works of these trades are shown in Table 4-23, Table 4-24 and Table 4-25. It is observed that:

(1) The PPDs of different trades vary largely. For example, the PPD of ASD is 6.37% while that of FTN is 59.41%. The three trades that have the highest PPDs are FTN (59.41%), HYD (52.84%) and HTL (52.22%).
(2) Average permit days of different trades vary largely, from 42 days of FTN to 181 days of DSD. Average actual working days of different trades vary largely, from 17 days of FTN to 135 days of DSD.
(3) The three trades with the largest number of XPs are HYD (16,735 XPs, 29.72% of total XPs with PPD 52.84%), ELE (16,116 XPs, 28.62% with PPD 35.16%) and FTN (8,627 XPs, 15.32% with PPD 59.41%).

Table 4-18 Deviation Analysis for Footway and Carriageway in All Trades

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Both footway and carriageway	54.79%/ 854	43.34%/ 2,101	35.98%/ 1,829	33.02%/ 1,675	29.4%/ 2,048	30.04%/ 2,076	34.09%/ 10,583
Carriageway	62.76%/ 662	57.49%/ 1,137	47.6%/ 1,145	50.99%/ 1,293	45.23%/ 1,392	45.11%/ 1,334	49.25%/ 6,963
Footway	54.65%/ 3,953	47.19%/ 6,661	44.78%/ 5,922	44.08%/ 5,761	40.81%/ 5,427	39.47%/ 5,265	44.03%/ 32,989
Neither footway or carriageway	35.25%/ 894	32.39%/ 1,658	32.42%/ 1,326	37.67%/ 705	43.49%/ 598	45.99%/ 594	37.18%/ 5,775
Total	53.04%/ 6,363	45.41%/ 11,557	41.26%/ 10,222	41.19%/ 9,434	37.67%/ 9,465	37.07%/ 9,269	41.03%/ 56,310

Table 4-19 Accumulative Permit Days and Accumulative Actual Working Days for Footway and Carriageway in All Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Both footway and carriageway	57,132/ 25,832	172,391/ 97,674	186,808/ 119,595	223,530/ 149,720	307,946/ 217,410	357,039/ 249,793	1,304,846/ 860,024
Carriageway	33,057/ 12,312	70,306/ 29,888	85,377/ 44,737	97,258/ 47,664	130,957/ 71,723	127,253/ 69,844	544,208/ 276,168
Footway	163,101/ 73,970	342,438/ 180,826	340,051/ 187,771	365,893/ 204,602	397,740/ 235,433	396,146/ 239,781	2,005,369/ 1,122,383
Neither footway or carriageway	38,461/ 24,905	85,012/ 57,476	84,949/ 57,412	51,877/ 32,335	52,306/ 29,556	60,062/ 32,438	372,667/ 234,122
Total	291,751/ 137,019	670,147/ 365,864	697,185/ 409,515	738,558/ 434,321	888,949/ 554,122	940,500/ 591,856	4,227,090/ 2,492,697

Table 4-20 Average Permit Days and Average Actual Working Days for Footway and Carriageway in All Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Both footway and carriageway	67/30	82/46	102/65	133/89	150/106	172/120	123/81
Carriageway	50/19	62/26	75/39	75/37	94/52	95/52	78/40
Footway	41/19	51/27	57/32	64/36	73/43	75/46	61/34
Neither footway or carriageway	43/28	51/35	64/43	74/46	87/49	101/55	65/41
Total	46/22	58/32	68/40	78/46	94/59	101/64	75/44

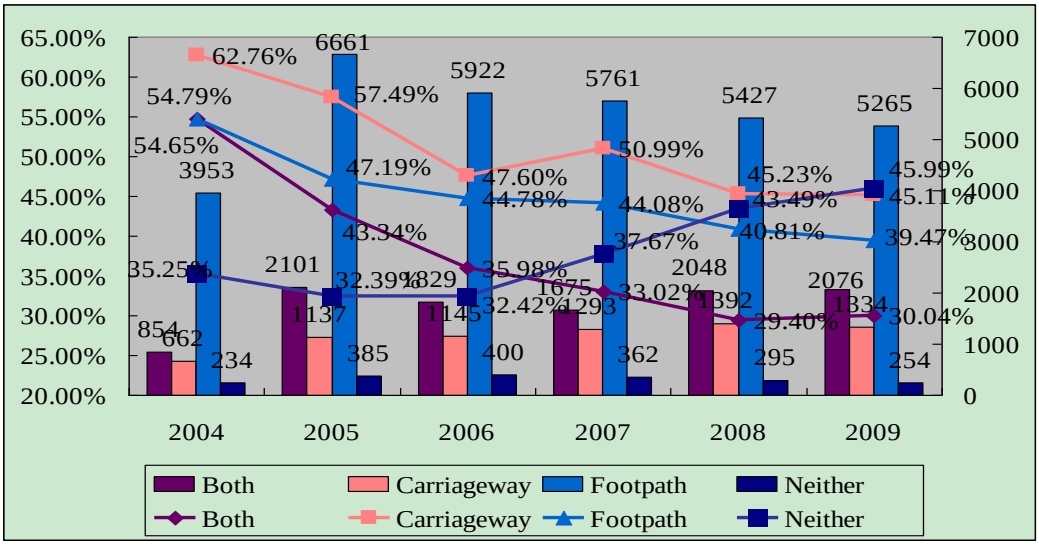

Figure 4-5 Deviation Analysis for Footway and Carriageway in All Trades

Table 4-21 Deviation Analysis by Road Type for All Trades on Carriageway

Road Type	PPD	Number of XPs	Permit Days	Actual Working Days	Average Permit Days	Average Actual Working Days
Expressway	39.40%	42	3,794	2,299	90	55
Primary Distributor	51.49%	1,037	90,084	43,698	87	42
Rural Trunk Road	50.03%	46	3,686	1,842	80	40
Urban Trunk Road	37.95%	218	28,979	17,982	133	82
District Distributor	49.03%	1,645	124,238	63,325	76	38
Feeder Road	42.23%	15	779	450	52	30
Local Distributor	50.99%	2,564	189,871	93,056	74	36
New Street or Road	43.23%	48	3,072	1,744	64	36
No Road Type	50.83%	621	40,637	19,982	65	32
Rural Road A	44.25%	358	30,484	16,994	85	47
Rural Road B	58.27%	183	14,053	5,865	77	32
Non-motorable Road, Footway	38.54%	186	14,531	8,931	78	48
Total	49.25%	6,963	544,208	276,168	78	40

Table 4-22 Deviation Analysis by Road Type for All Trades on Footway

Road Type	PPD	Number of XPs	Permit Days	Actual Working Days	Average Permit Days	Average Actual Working Days
District Distributor	44.80%	7,745	472026	260536	61	34
Expressway	36.25%	130	10863	6925	84	53
Feeder Road	40.98%	77	4143	2445	54	32
Local Distributor	46.78%	11,837	674084	358725	57	30
New Street or Road	39.51%	420	24085	14569	57	35
No Road Type	39.86%	4,086	263787	158653	65	39
Non-motorable Road, Footway	50.11%	696	39932	19924	57	29
Primary Distributor	40.54%	5,128	340057	202187	66	39
Rural Road A	46.15%	1,691	95547	51451	57	30
Rural Road B	50.60%	337	19209	9489	57	28
Rural Trunk Road	46.19%	259	15353	8262	59	32
Urban Trunk Road	36.87%	583	46283	29217	79	50
Total	44.03%	32,989	2005369	1122383	61	34

Table 4-23 Deviation Analysis by Trade for All Trades

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
ASD	22.92%/58	1.18%/172	4.06%/131	16.77%/128	3.69%/147	2.6%/117	6.37%/753
CED	61.68%/49	45.37%/168	31.11%/231	29.43%/293	34.83%/299	41.99%/343	36.61%/1,383
DSD	62.96%/121	51.33%/117	56.39%/104	37.08%/193	9.06%/193	22.87%/209	25.57%/937
ELE	45.4%/ 1,835	38.85%/ 3,465	33.76%/ 3,049	31.64%/ 2,599	31.89%/ 2,430	34.58%/ 2,738	35.16%/ 16,116
FTN	60.79%/ 1,185	55.76%/ 2,025	56.76%/ 1,665	61.98%/ 1,109	61.83%/ 1,366	61.27%/ 1,277	59.41%/8,627
GAS	49.29%/ 374	44.49%/ 572	42.86%/ 458	33.04%/ 526	32.14%/ 613	26.16%/ 448	35.58%/ 2,991
HTL	69.27%/12	64.38%/18	52.52%/27	30.34%/20	53.29%/28	32.78%/9	52.22%/114
HYD	55.13%/ 2,175	48.71%/ 3,629	47.4%/3,035	57.57%/ 2,870	55.02%/ 2,710	54.5%/ 2,316	52.84%/ 16,735
OTH	20.64%/48	48.1%/345	30.74%/282	36.09%/437	33.55%/328	37.57%/571	36.99%/2,011
WSD	60.39%/ 506	47.72%/ 1,046	38.91%/1,240	35.87%/ 1,259	27.51%/ 1,351	22.8%/ 1,241	33.06%/ 6,643
Total	53.04%/ 6,363	45.41%/ 11,557	41.26%/ 10,222	41.19%/ 9,434	37.67%/ 9,465	37.07%/ 9,269	41.03%/ 56,310

Table 4-24 Accumulative Permit Days and Accumulative Actual Working Days by Trade for All Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
ASD	2,042/ 1,574	9,433/ 9,322	6,806/ 6,530	8,919/ 7,423	10,578/ 10,188	8,892/ 8,661	46,670/ 43,698
CED	5,044/ 1,933	18,913/ 10,332	39,350/ 27,107	48,681/ 34,353	56,965/ 37,123	69,555/ 40,349	238,508/ 151,197
DSD	6,407/ 2,373	6,283/ 3,058	11,448/ 4,993	24,943/ 15,693	51,759/ 47,070	69,029/ 53,242	169,869/ 126,429
ELE	85,491/ 46,676	203,339/ 124,336	192,581/ 127,568	185,111/ 126,533	180,326/ 122,824	201,395/ 131,762	1,048,243/ 679,699
FTN	39,871/ 15,634	77,641/ 34,348	66,223/ 28,638	45,255/ 17,206	66,717/ 25,469	68,276/ 26,441	363,983/ 147,736
GAS	24,205/ 12,274	43,753/ 24,289	41,005/ 23,430	63,243/ 42,345	79,076/ 53,660	62,258/ 45,970	313,540/ 201,968
HTL	1,061/326	1,255/447	1,887/896	1,101/767	1,715/801	601/404	7,620/3,641
HYD	93,958/ 42,157	204,525/ 104,901	202,812/ 106,669	191,937/ 81,431	225,624/ 101,486	202,423/ 92,109	1,121,279/ 528,753
OTH	1,846/ 1,465	16,367/ 8,494	14,348/ 9,937	19,958/ 12,756	20,015/ 13,299	42,713/ 26,665	115,247/ 72,616
WSD	31,826/ 12,607	88,638/ 46,337	120,725/ 73,747	149,410/ 95,814	196,174/ 142,202	215,358/ 166,253	802,131/ 536,960
Total	291,751/ 137,019	670,147/ 365,864	697,185/ 409,515	738,558/ 434,321	888,949/ 554,122	940,500/ 591,856	4,227,090/ 2,492,697

Table 4-25 Average Permit Days and Average Actual Working Days by Trade for All Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
ASD	35/27	55/54	52/50	70/58	72/69	76/74	62/58
CED	103/39	113/62	170/117	166/117	191/124	203/118	172/109
DSD	53/20	54/26	110/48	129/81	268/244	330/255	181/135
ELE	47/25	59/36	63/42	71/49	74/51	74/48	65/42
FTN	34/13	38/17	40/17	41/16	49/19	53/21	42/17
GAS	65/33	76/42	90/51	120/81	129/88	139/103	105/68
HTL	88/27	70/25	70/33	55/38	61/29	67/45	67/32
HYD	43/19	56/29	67/35	67/28	83/37	87/40	67/32
OTH	38/31	47/25	51/35	46/29	61/41	75/47	57/36
WSD	63/25	85/44	97/59	119/76	145/105	174/134	121/81
Total	46/22	58/32	68/40	78/46	94/59	101/64	75/44

4.8 Deviation Analysis for Excavation Works in the Five Trades (DSD, ELE, FTN, GAS and WSD)

4.8.1 Overview

In this section, deviation analysis is conducted for five specific trades, i.e., DSD, ELE, FTN, GAS and WSD. There are 35,314 XPs in these five trades. Table 4-26 and Figure 4-6 show the analysis results for an overview of these XPs. It is observed that:

(1) The PPD decreases year by year, from 52.31% in 2004 to 31.26% in 2009, with an overall PPD of 37.25%.
(2) Accumulative permit days and accumulative actual working days increase year by year, with the former from 187,800 days in 2004 to 616,316 days in 2009 and the latter from 89,564 days to 423,668 days.
(3) Average permit days and average actual working days increase year by year, with the former from 47 days in 2004 to 104 days in 2009 and the latter from 22 days to 72 days.
(4) The average permit days and average actual working days are 76 days and 48 days.

Table 4-26 Deviation Analysis for the Five Trades (DSD, ELE, FTN, GAS and WSD)

Item	2004	2005	2006	2007	2008	2009	Total
Deviation	52.31%	44.63%	40.19%	36.41%	31.85%	31.26%	37.25%
Number of XPs	4,021	7,225	6,516	5,686	5,953	5,913	35,314
Accumulative Permit Days	187,800	419,654	431,982	467,962	574,052	616,316	2,697,766
Accumulative Actual Working Days	89,564	232,368	258,376	297,591	391,225	423,668	1,692,792
Average Permit Days	47	58	66	82	96	104	76
Average Actual Working Days	22	32	40	52	66	72	48

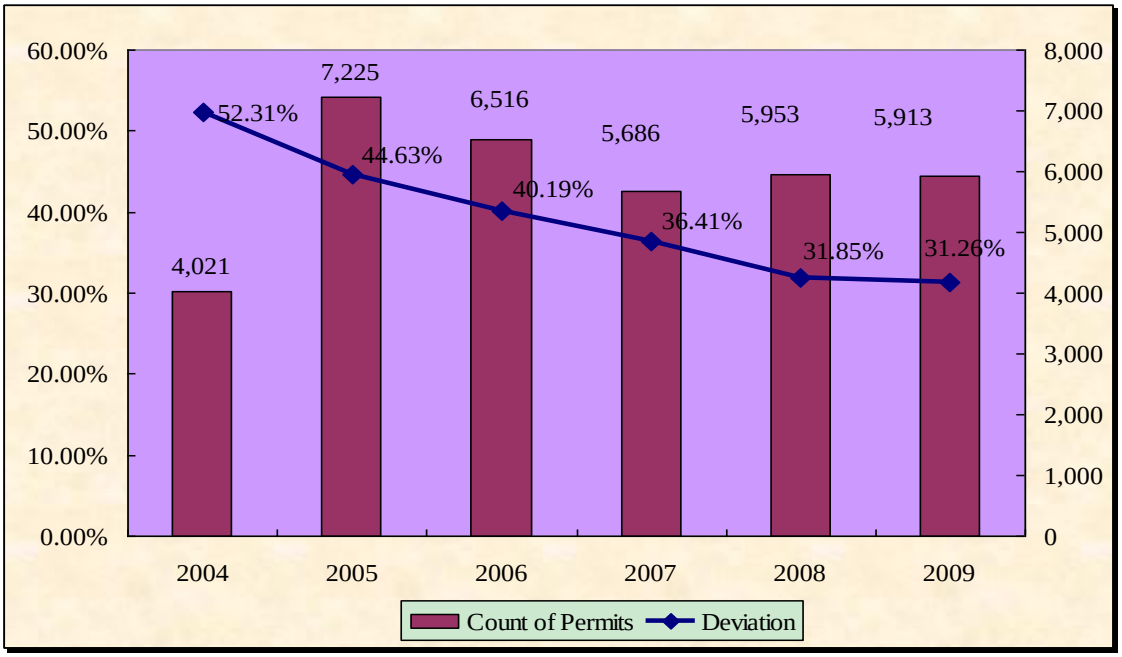

Figure 4-6 Annual PPDs and Numbers of XPs in the Five Trades from 2004 to 2009

4.8.2 Deviation Analysis by Region

The results of deviation analysis for the five trades by regions are provided in Table 4-27, Table 4-28, Table 4-29 and Figure 4-7. It is observed that:

(1) The PPD in Hong Kong (40.61%) is higher than that in New Territories (37.05%), which is much higher than that in Kowloon (31.44%).
(2) The number of XPs in Hong Kong (7,575 XPs) is much lower than that in Kowloon (12,267 XPs) and that in New Territories (15,472 XPs).
(3) Average permit days and average actual working days increase in all three regions.
(4) The average permit days of Hong Kong (84 days) and Kowloon (86 days) are quite close, and they are much higher than those of New Territories (65 days).
(5) The average actual working days of Hong Kong (45 days) and New Territories (41 days) are quite close, which are much smaller than those of Kowloon (59 days).

Table 4-27 Deviation Analysis by Region for the Five Trades

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Hong Kong	59.62%/ 917	51.58%/ 1,488	50.9%/ 1,372	47.94%/ 1,205	43.5%/ 1,375	40.61%/ 1,218	47.15%/ 7,575
Kowloon	47.32%/ 1,310	42.93%/ 2,523	36.71%/ 2,324	29.66%/ 1,950	23.39%/ 1,991	26.73%/ 2,169	31.44%/ 12,267
New Territories	51.7%/ 1,794	42.39%/ 3,214	37.38% /2,820	35.73%/ 2,531	33.34%/ 2,587	30.82%/ 2,526	37.05%/ 15,472
Total	52.31%/ 4,021	44.63%/ 7,225	40.19%/ 6,516	36.41%/ 5,686	31.85%/ 5,953	31.26%/ 5,913	37.25%/ 35,314

Table 4-28 Accumulative Permit Days and Accumulative Actual Working Days by Region for the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Hong Kong	46,456/ 18,757	93,624/ 45,330	97,964/ 48,102	115,157/ 59,952	145,809/ 82,383	140,671/ 83,544	639,681/ 338,068
Kowloon	58,021/ 30,566	147,156/ 83,981	165,810/ 104,940	179,347/ 126,149	234,789/ 179,881	270,540/ 198,229	1,055,663/ 723,746
New Territories	83,323/ 40,241	178,874/ 103,057	168,208/ 105,334	173,458/ 111,490	193,454/ 128,961	205,105/ 141,895	1,002,422/ 630,978
Total	187,800/ 89,564	419,654/ 232,368	431,982/ 258,376	467,962/ 297,591	574,052/ 391,225	616,316/ 423,668	2,697,766/ 1,692,792

Table 4-29 Average Permit Days and Average Actual Working Days by Region for the Five Trades

Permit Days/Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Hong Kong	51/20	63/30	71/35	96/50	106/60	115/69	84/45
Kowloon	44/23	58/33	71/45	92/65	118/90	125/91	86/59
New Territories	46/22	56/32	60/37	69/44	75/50	81/56	65/41
Total	47/22	58/32	66/40	82/52	96/66	104/72	76/48

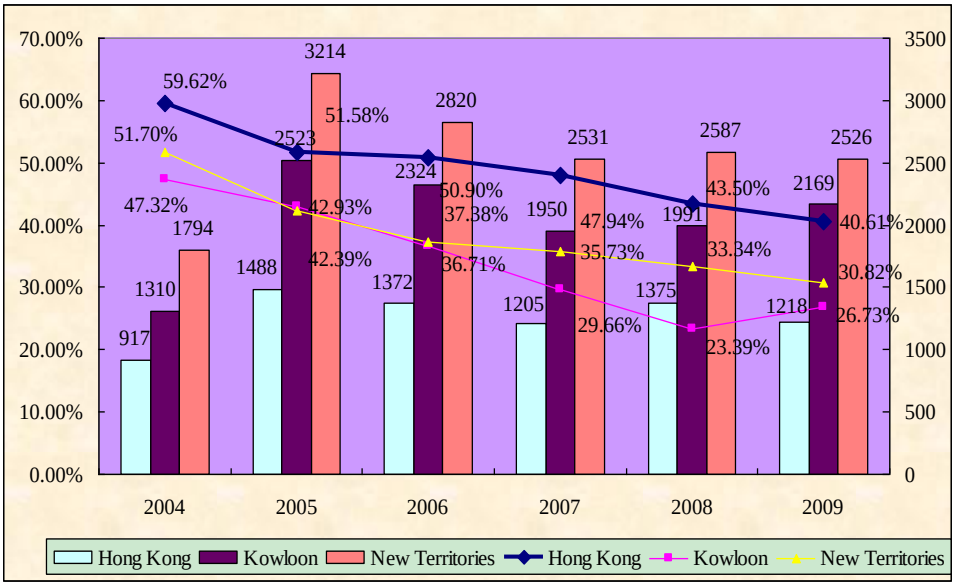

Figure 4-7 Deviation Analysis by Region for the Five Trades

4.8.3 Deviation Analysis by Work Type

The results of deviation analysis for the five trades by work type are provided in Table 4-30, Table 4-31, Table 4-32 and Figure 4-8. It is observed that:

(1) The number of standard XPs varies from 3,413 XPs in 2004 to 6,175 XPs in 2005. The numbers of standard XPs are roughly same from 2006 (5,538 XPs) to 2009 (5,271 XPs). The number of non-standard XPs decreases from 2005 (1,050 XPs) to 2009 (642 XPs).

(2) In general, the PPD decreases for both standard and non-standard works from 2004 to 2009, with the former from 52.97% in 2004 to 33.04% in 2009 and the latter from 48.73% in 2004 to 23.01% in 2009.

(3) The PPDs of standard works are significantly higher than that of non-standard works for years 2004 to 2009.

(4) The average permit days and average actual working days show a general trend of increase for both standard and non-standard works from 2004 to 2009.

Table 4-30 Deviation Analysis by Work Type for the Five Trades

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Non-Standard Works	48.73%/ 608	32.62%/ 1,050	32.81%/ 978	24.09%/ 792	18.41%/ 712	23.01%/ 642	26.83%/ 4,782
Standard Works	52.97%/ 3,413	46.98%/ 6,175	41.79%/ 5,538	39.05%/ 4,894	34.75%/ 5,241	33.04%/ 5,271	39.44%/ 30,532
Total	52.31%/ 4,021	44.63%/ 7,225	40.19%/ 6,516	36.41%/ 5,686	31.85%/ 5,953	31.26%/ 5,913	37.25%/ 35,314

Table 4-31 Accumulative Permit Days and Accumulative Actual Working Days by Work Type for the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Non-Standard Works	29,449/ 15,099	68,657/ 46,263	76,912/ 51,681	82,659/ 62,748	101,833/ 83,085	109,339/ 84,179	468,849/ 343,055
Standard Works	158,351/ 74,465	350,997/ 186,105	355,070/ 206,695	385,303/ 234,843	472,219/ 308,140	506,977/ 339,489	2,228,917/ 1,349,737
Total	187,800/ 89,564	419,654/ 232,368	431,982/ 258,376	467,962/ 297,591	574,052/ 391,225	616,316/ 423,668	2,697,766/ 1,692,792

Table 4-32 Average Permit Days and Average Actual Working Days by Work Type for the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Non-Standard Works	48/25	65/44	79/53	104/79	143/117	170/131	98/72
Standard Works	46/22	57/30	64/37	79/48	90/59	96/64	73/44
Total	47/22	58/32	66/40	82/52	96/66	104/72	76/48

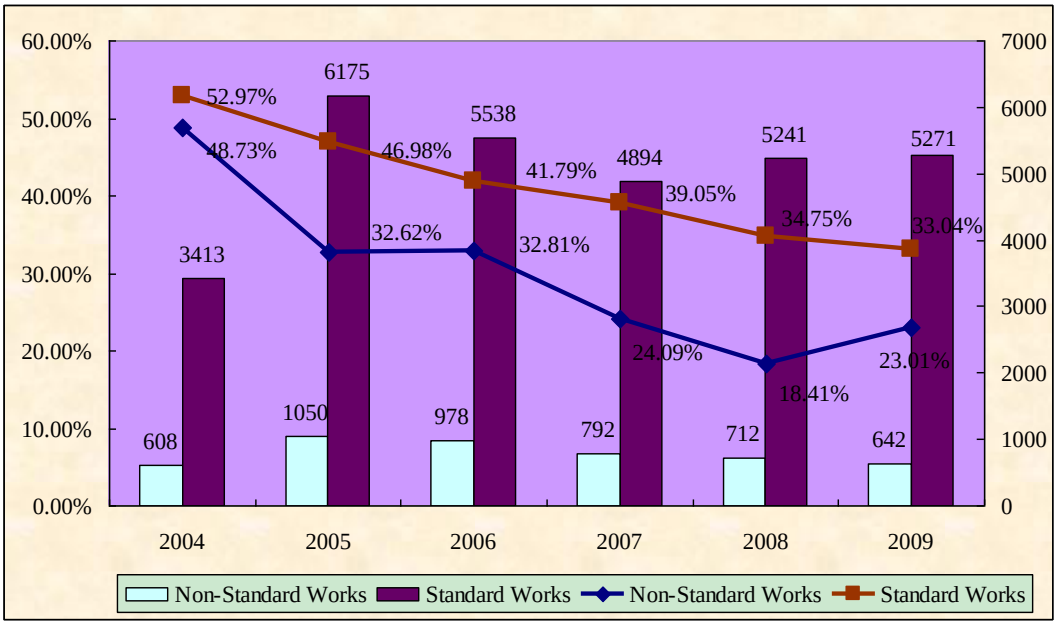

Figure 4-8 Deviation Analysis by Work Type for the Five Trades

4.8.4 Deviation Analysis by Multiplication Factors

The PPDs of the five trades, from the perspective of whether the XP involves MFs, are shown in Table 4-33, Table 4-34, Table 4-35 and Figure 4-9. It is observed that:

(1) For years 2005 to 2009, the PPD of XPs involving MFs is larger than that of XPs not involving MFs. In average, the PPD of XPs involving MFs (39.26%) is larger than that of XPs not involving MFs (35.34%).

(2) In general, more than half of XPs do not involve MFs. There is a trend that the number of XPs involving MFs decreases year by year.

(3) The average permit days continuously increase for both XPs involving MFs and not involving MFs, with the former from 48 days in 2004 to 99 days in 2009 and the latter from 44 days in 2004 to 108 days in 2009. The average working days continuously increase for both XPs involving MFs and not involving MFs, with the former from 23 days in 2004 to 66 days in 2009 and the latter from 20 days in 2004 to 75 days in 2009.

Table 4-33 Deviation Analysis by MFs for the Five Trades

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	53.82%/ 1,474	42.85%/ 3,688	39.68%/ 3,209	35.03%/ 2,932	29.84%/ 3,170	30.08%/ 3,418	35.34%/ 17,891
Use MFs	51.52%/ 2,547	46.38%/ 3,537	40.65%/ 3,307	37.77%/ 2,754	34.04%/ 2,783	33.01%/ 2,495	39.26%/ 17,423
Total	52.31%/ 4,021	44.63%/ 7,225	40.19%/ 6,516	36.41%/ 5,686	31.85%/ 5,953	31.26%/ 5,913	37.25%/ 35,314

Table 4-34 Accumulative Period Days and Accumulative Actual Working Days by MFs for the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	64,615/ 29,841	208,568/ 119,193	206,169/ 124,364	233,258/ 151,545	299,829/ 210,357	369,027/ 258,013	1,381,466/ 893,313
Use MFs	123,185/ 59,723	211,086/ 113,175	225,813/ 134,012	234,704/ 146,046	274,223/ 180,868	247,289/ 165,655	1,316,300/ 799,479
Total	187,800/ 89,564	419,654/ 232,368	431,982/ 258,376	467,962/ 297,591	574,052/ 391,225	616,316/ 423,668	2,697,766/ 1,692,792

Table 4-35 Average Permit Days and Average Actual Working Days by MFs for the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	44/20	57/32	64/39	80/52	95/66	108/75	77/50
Use MFs	48/23	60/32	68/41	85/53	99/65	99/66	76/46
Total	47/22	58/32	66/40	82/52	96/66	104/72	76/48

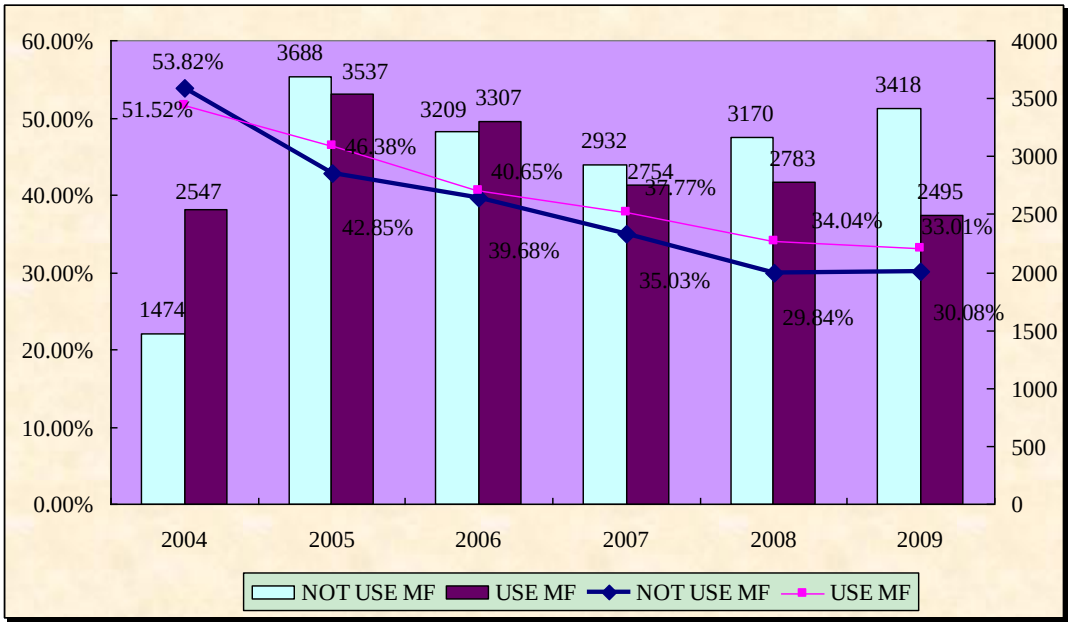

Figure 4-9 Deviation Analysis by MFs for the Five Trades

4.8.5 Deviation Analysis by Road Type

The deviation analysis of the five trades by road type is shown in Table 4-36, Table 4-37 and Table 4-38. It is observed that:

Table 4-36 Deviation Analysis by Road Type for the Five Trades

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
Expressway	48.05%/9	30.91%/23	37.76%/21	16.95%/16	31.52%/23	38.01%/27	32.12%/119
Primary Distributor	53.71%/ 507	41.51%/ 1,012	36.96%/ 829	31.28%/ 715	28.23%/ 778	26.33%/ 856	32.96%/ 4,697
Rural Trunk Road	64.67%/22	52.63%/49	49.03%/37	37.07%/38	24.06%/36	21.89%/24	38.14%/206
Urban Trunk Road	41.3%/61	45.23%/80	25.72%/ 104	31.78%/89	18.9%/96	12.86%/ 110	23.01%/540
District Distributor	51.64%/99 7	45.79%/ 1,617	40.38%/ 1,320	36.98%/1,1 56	31.%/1,260	32.26%/1, 276	37.54%/ 7,626
Feeder Road	35.19%/6	46.58%/11	-13.68%/18	50.53%/11	30.57%/4	60.06%/11	29.28%/61
Local Distributor	53.02%/ 1,531	46.49%/ 2,676	42.57%/ 2,427	37.95%/2,1 47	32.55%/ 2,319	34.01%/2, 256	39.03%/ 13,356
New Street or Road	49.58%/ 149	32.33%/ 73	39.09%/ 82	43.67%/ 59	51.85%/ 26	18.24%/ 12	42.03%/ 401
No Road Type	49.44%/ 387	42.14%/ 1,056	38.85%/ 1,046	36.02%/ 956	35.6%/ 953	32.46%/91 3	37.36%/ 5,311
Rural Road A	56.54%/ 207	44.41%/ 398	37.45%/ 384	35.31%/ 283	35.43%/ 280	37.23%/ 227	39.68%/ 1,779
Rural Road B	55.72%/45	53.55%/77	48.95%/79	43.76%/92	49.84%/86	38.23%/80	46.85%/459
Non-motorable Road, Footway	49.44%/ 100	39.9%/153	49.19%/16 9	44.3%/120	40.05%/92	38.68%/12 1	43.2%/ 755
Total	52.31%/ 4,021	44.63%/ 7,225	40.19%/ 6,516	36.41%/ 5,686	31.85%/ 5,953	31.26%/ 5,913	37.25%/ 35,314

Table 4-37 Accumulative Permit Days and Accumulative Actual Working Days by Road Type for the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Expressway	385/ 200	1,637/ 1,131	1,830/ 1,139	1,746/ 1,450	2,500/ 1,712	2,294/ 1,422	10,392/ 7,054
Primary Distributor	24,581/ 11,378	62,934/ 36,809	55,735/ 35,133	65,266/ 44,853	93,947/ 67,429	108,074/ 79,613	410,537/ 275,215
Rural Trunk Road	1,203/ 425	2,837/ 1,344	2,164/ 1,103	2,301/ 1,448	3,612/ 2,743	2,663/ 2,080	14,780/ 9,143
Urban Trunk Road	2,942/ 1,727	7,457/ 4,084	9,811/ 7,288	13,013/ 8,878	17,827/ 14,458	28,267/ 24,633	79,317/ 61,068
District Distributor	46,175/ 22,329	92,797/ 50,301	90,636/ 54,038	97,035/ 61,148	131,050/ 90,427	144,583/ 97,942	602,276/ 376,185
Feeder Road	270/175	614/328	1,067/1,213	562/278	193/134	696/278	3,402/2,406
Local Distributor	71,759/ 33,711	154,723/ 82,800	164,171/ 94,282	181,780/ 112,801	217,753/ 146,866	225,814/ 149,020	1,016,000/ 619,480
New Street or Road	7,005/ 3,532	4,649/ 3,146	4,723/ 2,877	4,772/ 2,688	2,054/ 989	921/ 753	24,124/ 13,985
No Road Type	16,753/ 8,470	56,166/ 32,497	65,276/ 39,914	65,825/ 42,112	70,682/ 45,520	72,383/ 48,885	347,085/ 217,398
Rural Road A	10,161/ 4,416	22,680/ 12,607	23,828/ 14,905	22,178/ 14,348	20,703/ 13,367	16,378/ 10,280	115,928/ 69,923
Rural Road B	1,888/ 836	4,310/ 2,002	4,351/ 2,221	6,378/ 3,587	6,653/ 3,337	6,374/ 3,937	29,954/ 15,920
Non-motorable Road, Footway	4,678/ 2,365	8,850/ 5,319	8,390/ 4,263	6,860/ 3,821	7,078/ 4,243	7,869/ 4,825	43,725/ 24,836
Total	187,800/ 89,564	419,654/ 232,368	431,982/ 258,376	467,962/ 297,591	574,052/ 391,225	616,316/ 423,668	2,697,766/ 1,692,792

(1) Most of the excavation works are on the "primary distributor" (4,697 XPs, accounting for 13.30% of the total XPs), "district distributor" (7,626 XPs, 21.59%) and "local distributor" (13,356, 37.82%). Excavation works on these three types of roads account for 72.72% of the total number of excavation works.
(2) The three types of roads that have the highest PPD are "rural road B" (46.85%), "non-motorable road, footway" (43.20%), and "new streets or road" (42.03%).

Table 4-38 Average Permit Days and Average Actual Working Days by Road Type for the Five Trades

Permit Days/Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Expressway	43/22	71/49	87/54	109/91	109/74	85/53	87/59
Primary Distributor	48/22	62/36	67/42	91/63	121/87	126/93	87/59
Rural Trunk Road	55/19	58/27	58/30	61/38	100/76	111/87	72/44
Urban Trunk Road	48/28	93/51	94/70	146/100	186/151	257/224	147/113
District Distributor	46/22	57/31	69/41	84/53	104/72	113/77	79/49
Feeder Road	45/29	56/30	59/67	51/25	48/34	63/25	56/39
Local Distributor	47/22	58/31	68/39	85/53	94/63	100/66	76/46
New Street or Road	47/24	64/43	58/35	81/46	79/38	77/63	60/35
No Road Type	43/22	53/31	62/38	69/44	74/48	79/54	65/41
Rural Road A	49/21	57/32	62/39	78/51	74/48	72/45	65/39
Rural Road B	42/19	56/26	55/28	69/39	77/39	80/49	65/35
Non-motorable Road, Footway	47/24	58/35	50/25	57/32	77/46	65/40	58/33
Total	47/22	58/32	66/40	82/52	96/66	104/72	76/48

4.8.6 Deviation Analysis for Footway and Carriageway

The deviation analysis of the five trades by footway and carriageway is shown in Table 4-39, Table 4-40, Table 4-41, Table 4-42, Table 4-43 and Figure 4-10. It is observed that:

(1) The PPDs of excavation works on the carriageway of different road types vary largely, from 21.25% of the "Urban Trunk Road" to 49.96% of the "New Street or Road".
(2) The PPDs of excavation works on the footway of different road types vary from 37.92% of the "Feeder Road" to 52.14% of the "Non-motorable Road, Footway".
(3) The standard deviation of PPDs on the carriageway is 14.42%, which is much higher than that on the footway (4.79%).
(4) The average actual working day on the carriageway (53 days) is more than that on the footway (35 days).
(5) More than half of the works are on the footway (22,444 XPs, accounting 63.55% of total XPs). There are 8,300 XPs (23.50%) conducted on both footway and carriageway, and only 2,639 XPs (12.36%) on the carriageway.
(6) Most of the excavations works on the carriageway (in total 2,639 XPs) are on the primary distributor (248 XPs with overall deviation 38.99%), district distributor (572 XPs with 37.01%) and local distributor (1,139 XPs with 42.44%). Excavation works on these three types of roads account for 75.35% of the total excavation works on the carriageway.
(7) Most of the excavation works on the footway (22,444 XPs in total) are on the primary distributor [3,470 XPs with a deviation of 42.48%), district distributor (5,236 XPs with a deviation of 45.86%), and local distributor (8,381 XPs with a deviation of 46.31%). Excavation works on these three types of roads account for 74.81% of the total number of excavation works on the footway.

Table 4-39 Deviation Analysis for Footway and Carriageway in the Five Trades

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Both footway and carriageway	54.19%/ 644	43.42%/ 1,712	36.1%/ 1,460	31.66%/ 1,264	28.06%/ 1,574	28.28%/ 1,646	32.97%/ 8,300
Carriageway	57.09%/ 266	51.62%/ 463	47.12%/ 511	42.27%/ 420	29.18%/ 456	33.52%/ 524	40.03%/ 2,640
Footway	50.81%/ 2,877	44.17%/ 4,665	41.29%/ 4,145	39.11%/ 3,640	35.73%/ 3,628	33.68%/ 3,489	39.78%/ 22,444
Neither footway or carriageway	54.61%/ 234	47.97%/ 385	45.08%/ 400	37.38%/ 362	39.43%/ 295	40.24%/ 254	42.97%/ 1,930
Total	52.31%/ 4,021	44.63%/ 7,225	40.19%/ 6,516	36.41%/ 5,686	31.85%/ 5,953	31.26%/ 5,913	37.25%/ 35,314

Table 4-40 Accumulative Permit Days and Accumulative Actual Working Days for Footway and Carriageway in the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Both footway and carriageway	43,674/ 20,005	139,057/ 78,684	150,183/ 95,970	180,528/ 123,368	250,768/ 180,397	295,678/ 212,062	1,059,888/ 710,486
Carriageway	15,548/ 6,672	31,296/ 15,140	37,582/ 19,873	38,186/ 22,043	57,020/ 40,379	55,568/ 36,940	235,200/ 141,047
Footway	119,016/ 58,547	232,448/ 129,776	222,134/ 130,406	225,787/ 137,488	248,007/ 159,390	247,994/ 164,462	1,295,386/ 780,069
Neither footway or carriageway	9,562/ 4,340	16,853/ 8,768	22,083/ 12,127	23,461/ 14,692	18,257/ 11,059	17,063/ 10,196	107,279/ 61,182
Total	187,800/ 89,564	419,654/ 232,368	431,982/ 258,376	467,962/ 297,591	574,052/ 391,225	616,303/ 423,660	2,697,753/ 1,692,784

Table 4-41 Average Permit Days and Average Actual Working Days for Footway and Carriageway in the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Both footway and carriageway	68/31	81/46	103/66	143/98	159/115	180/129	128/86
Carriageway	58/25	68/33	74/39	91/52	125/89	106/71	89/53
Footway	41/20	50/28	54/31	62/38	68/44	71/47	58/35
Neither footway or carriageway	41/19	44/23	55/30	65/41	62/37	67/40	56/32
Total	47/22	58/32	66/40	82/52	96/66	104/72	76/48

Table 4-42 Deviation Analysis by Road Type for the Five Trades on Carriageway

Road Type	Deviation	Number of XPs	Permit Days	Actual Working Days	Average Permit Days	Average Actual Working Days
Expressway	28.72%	6	397	283	66	47
Primary Distributor	38.99%	248	32760	19987	132	81
Rural Trunk Road	80.61%	5	361	70	72	14
Urban Trunk Road	21.25%	35	8829	6953	252	199
District Distributor	37.01%	572	53431	33656	93	59
Feeder Road	44.33%	4	203	113	51	28
Local Distributor	42.44%	1139	93367	53740	82	47
New Street or Road	49.96%	17	1137	569	67	33
No Road Type	46.64%	246	16676	8899	68	36
Rural Road A	37.47%	150	13631	8523	91	57
Rural Road B	48.41%	84	6220	3209	74	38
Non-motorable Road, Footway	38.39%	133	8188	5045	62	38
Total	40.03%	2639	235200	141047	89	53

Table 4-43 Deviation Analysis by Road Type for the Five Trades on Footway

Road Type	Deviation	Number of XPs	Permit Days	Actual Working Days	Average Permit Days	Average Actual Working Days
District Distributor	45.86%	5236	297789	161228	57	31
Expressway	43.03%	83	5893	3357	71	40
Feeder Road	37.92%	43	2218	1377	52	32
Local Distributor	46.31%	8381	453143	243306	54	29
New Street or Road	47.80%	300	16624	8677	55	29
No Road Type	39.47%	2954	189484	114697	64	39
Non-motorable Road, Footway	52.14%	473	21979	10520	46	22
Primary Distributor	42.48%	3470	215754	124104	62	36
Rural Road A	46.87%	1132	58293	30972	51	27
Rural Road B	52.83%	242	14140	6670	58	28
Rural Trunk Road	41.66%	151	9180	5356	61	35
Urban Trunk Road	40.00%	376	26595	15957	71	42
Total	44.61%	22841	1311092	726221	57	32

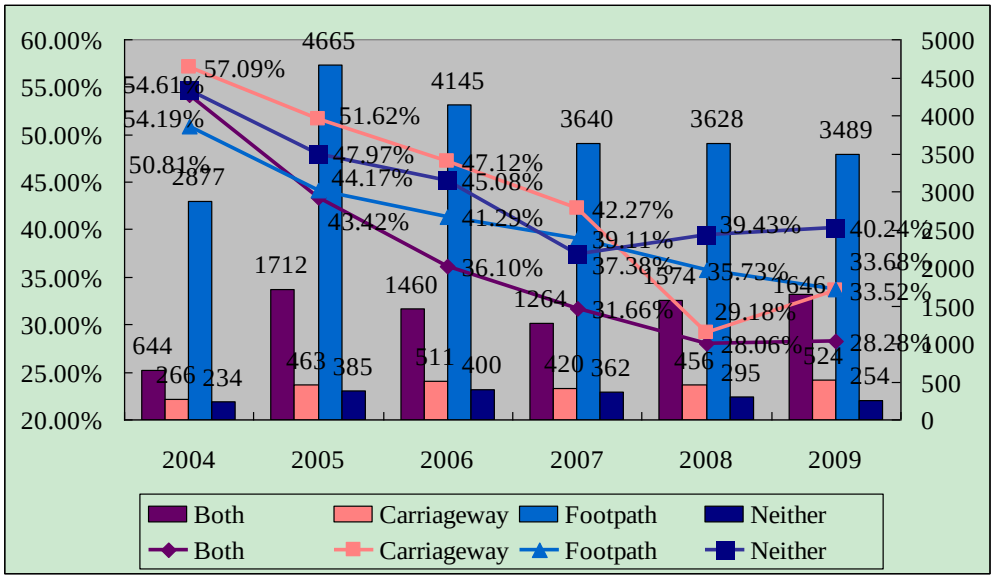

Figure 4-10 Deviation Analysis for Footway and Carriageway in the Five Trades

4.8.7 Deviation Analysis by Trade

The results of deviation analysis for each of the five trades are shown in Table 4-44, Table 4-45, Table 4-46 and Figure 4-11. It is observed that:

Table 4-44 Deviation Analysis by Trade for the Five Trades

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
DSD	62.96%/ 121	51.33%/ 117	56.39%/ 104	37.08%/ 193	9.06%/ 193	22.87%/ 209	25.57%/ 937
ELE	45.4%/ 1,835	38.85%/ 3,465	33.76%/ 3,049	31.64%/ 2,599	31.89%/ 2,430	34.58%/ 2,738	35.16%/ 16,116
FTN	60.79%/ 1,185	55.76%/ 2,025	56.76%/ 1,665	61.98%/ 1,109	61.83%/ 1,366	61.27%/ 1,277	59.41%/ 8,627
GAS	49.29%/ 374	44.49%/ 572	42.86%/ 458	33.04%/ 526	32.14%/ 613	26.16%/ 448	35.58%/ 2,991
WSD	60.39%/ 506	47.72%/ 1,046	38.91%/ 1,240	35.87%/ 1,259	27.51%/ 1,351	22.8%/ 1,241	33.06%/ 6,643
Total	52.31%/ 4,021	44.63%/ 7,225	40.19%/ 6,516	36.41%/ 5,686	31.85%/ 5,953	31.26%/ 5,913	37.25%/ 35,314

(1) The PPDs of different trades vary largely. For example, the PPD of all excavation works of DSD is 25.57% while that of FTN is 61.27%.
(2) Average permit days of different trades vary largely, from 42 days of FTN to 181 days of DSD. Similarly, average actual working days of different trades vary largely, from 17 days of FTN to 135 days of DSD.
(3) The trade that has the largest number of XPs is ELE (16,116, accounting for 45.64% of total XPs). The trade that has the highest PPD is FTN (61.27%).

Table 4-45 Accumulative Permit Days and Accumulative Actual Working Days of the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	6,407/ 2,373	6,283/ 3,058	11,448/ 4,993	24,943/ 15,693	51,759/ 47,070	69,029/ 53,242	169,869/ 126,429
ELE	85,491/ 46,676	203,339/ 124,336	192,581/ 127,568	185,111/ 126,533	180,326/ 122,824	201,395/ 131,762	1,048,243/ 679,699
FTN	39,871/ 15,634	77,641/ 34,348	66,223/ 28,638	45,255/ 17,206	66,717/ 25,469	68,276/ 26,441	363,983/ 147,736
GAS	24,205/ 12,274	43,753/ 24,289	41,005/ 23,430	63,243/ 42,345	79,076/ 53,660	62,258/ 45,970	313,540/ 201,968
WSD	31,826/ 12,607	88,638/ 46,337	120,725/ 73,747	149,410/ 95,814	196,174/ 142,202	215,358/ 166,253	802,131/ 536,960
Total	187,800/ 89,564	419,654/ 232,368	431,982/ 258,376	467,962/ 297,591	574,052/ 391,225	616,316/ 423,668	2,697,766/ 1,692,792

Table 4-46 Average Permit Days and Average Actual Working Days of the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	53/20	54/26	110/48	129/81	268/244	330/255	181/135
ELE	47/25	59/36	63/42	71/49	74/51	74/48	65/42
FTN	34/13	38/17	40/17	41/16	49/19	53/21	42/17
GAS	65/33	76/42	90/51	120/81	129/88	139/103	105/68
WSD	63/25	85/44	97/59	119/76	145/105	174/134	121/81
Total	47/22	58/32	66/40	82/52	96/66	104/72	76/48

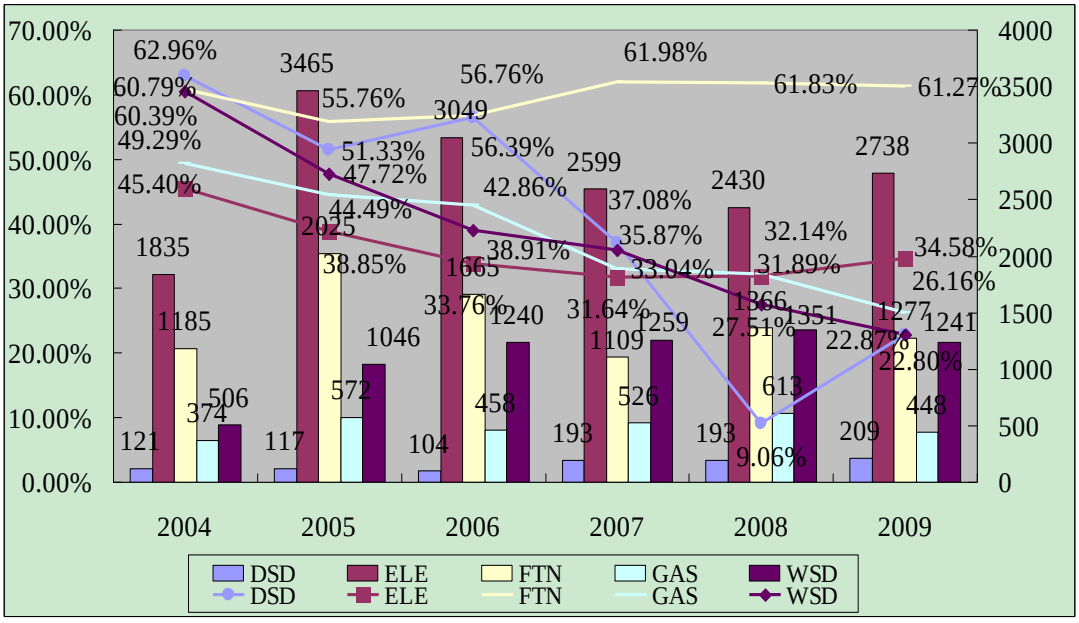

Figure 4-11 Deviation Analysis by Trade for the Five Trades

4.9 Deviation Analysis for Non-Standard Works of the Five Trades

4.9.1 Overview

The results of deviation analysis for non-standard works of the five trades are shown in Table 4-47 and Figure 4-12. It is observed that:

(1) There are 4,782 non-standard XPs in the five trades. For these non-standard XPs, the relative PPD is 26.83%, the average permit period 98 days, the average actual working period 72 days, and the average absolute PPD 26 days.
(2) In general, the PPD decreases over time from 48.73% in 2004 to 23.01% in 2009.
(3) In general, the number of non-standard XPs continuously decreases over time, from 1,050 in 2005 to 642 in 2009.
(4) In general, the average permit days and average actual working days increase over time, for the former from 48 days in 2004 to 170 days in 2009 and for the latter from 25 days in 2004 to 131 days in 2009.

Table 4-47 Deviation Analysis for Non-Standard Works of the Five Trades

Item	2004	2005	2006	2007	2008	2009	Total
Deviation	48.73%	32.62%	32.81%	24.09%	18.41%	23.01%	26.83%
Number of XPs	608	1,050	978	792	712	642	4,782
Accumulative Permit Days	29,449	68,657	76,912	82,659	101,833	109,339	468,849
Accumulative Actual Working Days	15,099	46,263	51,681	62,748	83,085	84,179	343,055
Average Permit Days	48	65	79	104	143	170	98
Average Actual Working Days	25	44	53	79	117	131	72

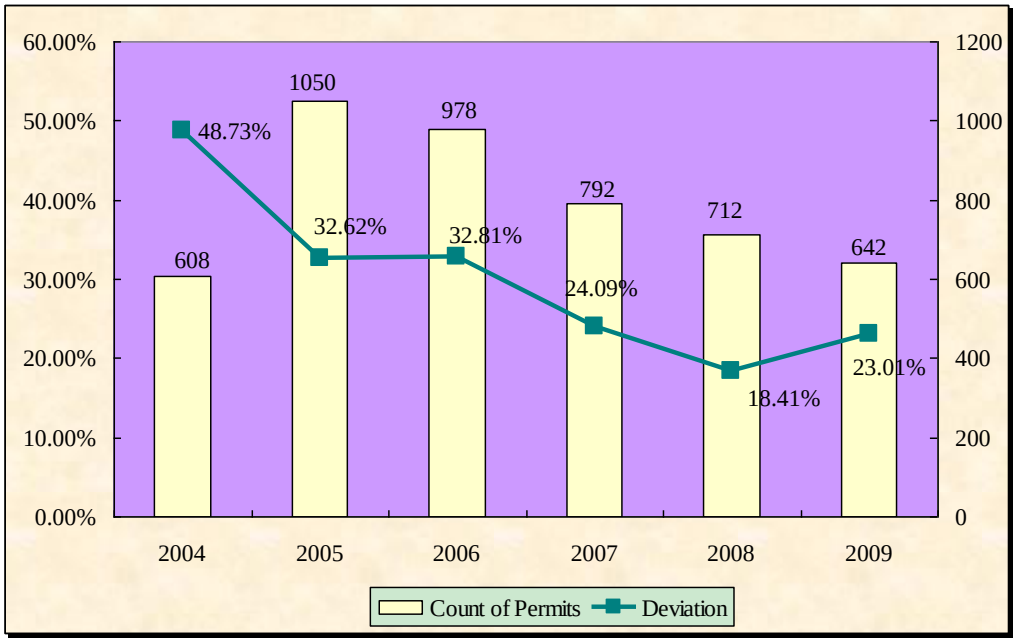

Figure 4-12 Annual PPDs and Numbers of Non-Standard Works of the Five Trades

4.9.2 Deviation Analysis By Region

The results of deviation analysis for non-standard works in the five trades by region are provided in Table 4-48, Table 4-49, Table 4-50 and Figure 4-13. It is observed that:

(1) The number of non-standard XPs in Hong Kong (941) is lower than that in Kowloon (1,022). The sum of these two regions is much less than that in New Territories (2,819).
(2) The PPD in Hong Kong (33.66%) is much higher than that in New Territories (26.71%), which is much higher than that in Kowloon (20.29%).

(3) For Hong Kong and New Territories, the PPDs have a decreasing trend of over time, the former from 55.12% in 2004 to 24.72% in 2009 and the latter 50.00% to 16.52%.
(4) There is an increasing trend over time for the average permit days or the actual working days in the three regions.

Table 4-48 Deviation Analysis by Region for Non-Standard Works of the Five Trades

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Hong Kong	55.12%/ 154	43.41%/ 176	41.93%/ 157	43.9%/ 183	22.18%/ 159	24.72%/ 112	33.66%/ 941
Kowloon	36.75%/ 119	19.65%/ 235	28.53%/ 186	6.24%/ 157	11.41%/ 170	29.93%/ 155	20.29%/ 1,022
New Territories	50%/ 335	34.17%/ 639	31.27%/ 635	22.13%/ 452	20.7%/ 383	16.52%/ 375	26.71%/ 2,819
Total	48.73%/ 608	32.62%/ 1,050	32.81%/ 978	24.09%/ 792	18.41%/ 712	23.01%/ 642	26.83%/ 4,782

Table 4-49 Accumulative Permit Days and Accumulative Actual Working Days by Region for Non-Standard Works of the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Hong Kong	7,449/ 3,343	12,716/ 7,196	15,308/ 8,890	21,718/ 12,184	30,163/ 23,473	32,062 24,136	119,416/ 79,222
Kowloon	5,703/ 3,607	15,439/ 12,406	16,490/ 11,785	19,569/ 18,348	29,897/ 26,485	33,307/ 23,339	120,405/ 95,970
New Territories	16,297/ 8,149	40,502/ 26,661	45,114/ 31,006	41,372/ 32,216	41,773/ 33,127	43,970/ 36,704	229,028/ 167,863
Total	29,449/ 15,099	68,657/ 46,263	76,912/ 51,681	82,659/ 62,748	101,833/ 83,085	109,339/ 84,179	468,849/ 343,055

Table 4-50 Average Permit Days and Average Actual Working Days by Region for Non-Standard Works of the Five Trades

Permit Days/Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Hong Kong	48/22	72/41	98/57	119/67	190/148	286/216	127/84
Kowloon	48/30	66/53	89/63	125/117	176/156	215/151	118/94
New Territories	49/24	63/42	71/49	92/71	109/86	117/98	81/60
Total	48/25	65/44	79/53	104/79	143/117	170/131	98/72

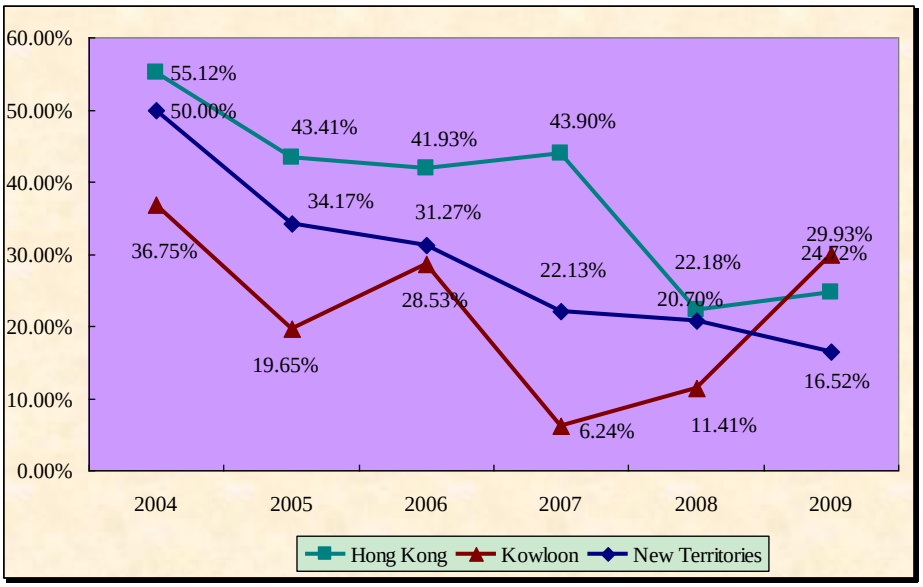

Figure 4-13 Deviation Analysis by Region for Non-Standard Works of the Five Trades

4.9.3 Deviation Analysis by Trade

The results of deviation analysis by trace for non-standard works are shown in Table 4-51, Table 4-52, Table 4-53 and Figure 4-14. It is observed that:

(1) The PPDs of the non-standard works of different trades vary largely, from 24.41% of DSD to 55.23% of FTN, with an average PPD of 26.83% for the five trades.
(2) The trade that has the largest number of non-standard XPs is ELE (1,787, accounting for 37.37% of total non-standard XPs in the five trades).
(3) The trade that has the highest PPD is FTN (55.23%).
(4) The average permit days of different trades vary largely, from 39 days of FTN to 172 days of DSD, with an average of 98 days for the five trades.
(5) The average actual working days of different trades vary largely, from 17 days of FTN to 130 days of DSD, with an average of 72 days for the five trades.

Table 4-51 Deviation Analysis by Trade for Non-Standard Works of the Five Trades

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
DSD	43.36%/ 76	40.4%/ 84	52.47%/ 78	37.15%/ 141	14.76%/ 142	19.3%/ 165	24.41%/ 686
ELE	31.31%/ 161	18.97%/ 454	18.63%/ 398	7.64%/ 332	10.01%/ 244	21.8%/ 198	15.73%/ 1,787
FTN	59.05%/ 57	56.39%/ 47	42.18%/ 21	56.84%/ 18	59.36%/ 13	55.79%/ 7	55.23%/ 163
GAS	38.65%/ 4	40.4%/ 14	53.58%/ 5	22.22%/ 7	42.72%/ 14	52.97%/ 3	41.91%/ 47
WSD	57.58%/ 310	46.26%/ 451	42.54%/ 476	38.05%/ 294	29.23%/ 299	28.37%/ 269	38.42%/ 2,099
Total	48.73%/ 608	32.62%/ 1,050	32.81%/ 978	24.09%/ 792	18.41%/ 712	23.01%/ 642	26.83%/ 4,782

Table 4-52 Accumulative Permit Days and Accumulative Actual Working Days by Trade for Non-Standard Works of the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	3,208/ 1,817	4,022/ 2,397	8,167/ 3,882	18,492/ 11,623	35,532/ 30,286	57,030/ 44,356	126,451/ 94,361
ELE	8,135/ 5,588	34,098/ 27,629	35,126/ 28,540	39,824/ 36,019	131,465/ 89,011	165,143/ 109,324	413,791/ 296,111
FTN	1,707/ 699	1,979/ 863	972/ 562	1,346/ 474	4,994/ 1,893	23,503/ 9,677	34,501/ 14,168
GAS	207/ 127	448/ 267	517/ 240	414/ 322	1,181/ 653	21,563/ 17,581	24,330/ 19,190
WSD	16,192/ 6,868	28,301/ 15,115	32,504/ 18,640	26,121/ 15,990	34,761/ 23,994	103,266/ 79,817	241,145/ 160,424
Total	29,449/ 15,099	68,848/ 46,271	77,286/ 51,864	86,197/ 64,428	207,933/ 145,837	370,505/ 260,755	840,218/ 584,254

Table 4-53 Average Permit Days and Average Actual Working Days by Trade for Non-Standard Works of the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	42/24	48/29	105/50	131/82	250/213	313/244	180/134
ELE	51/35	75/61	88/72	112/101	74/50	76/50	77/55
FTN	30/12	42/18	46/27	43/15	46/17	57/23	51/21
GAS	52/32	32/19	103/48	59/46	74/41	159/129	134/105
WSD	52/22	63/33	68/39	86/53	109/75	172/133	98/65
Total	48/25	66/44	79/53	103/77	88/62	105/74	90/62

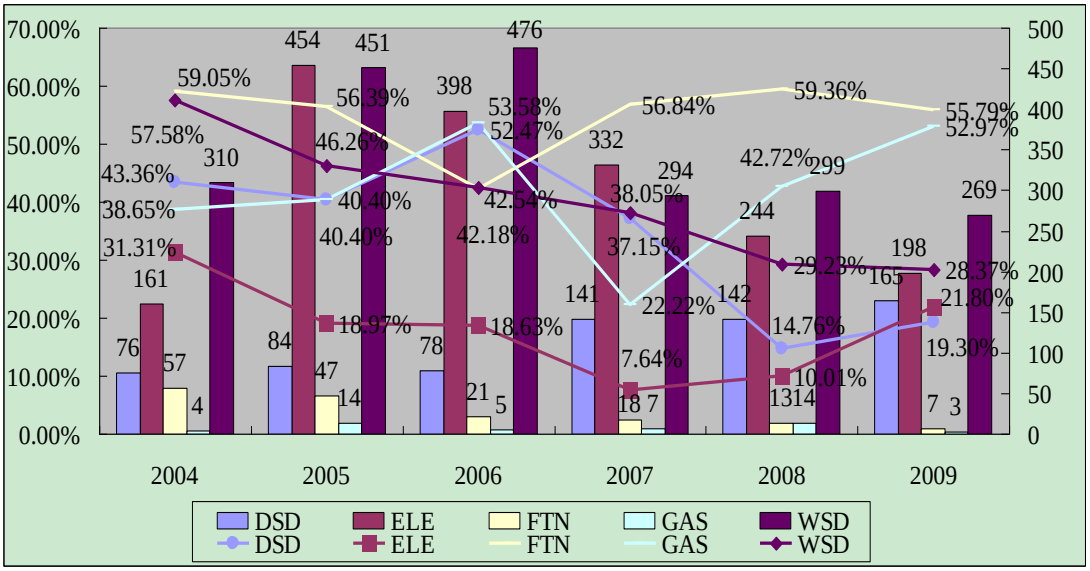

Figure 4-14 Deviation Analysis by Trade for Non-Standard Works of the Five Trades

4.10 Deviation Analysis for Standard Works of the Five Trades

4.10.1 Overview

The deviation analysis results of standard XPs of the five trades are shown in Table 4-54 and Figure 4-15. It is observed that:

(1) There are 30,532 standard XPs in the five trades, with an average PPD of 39.44%.
(2) The average permit days of all standard XPs in the five trades are 73 days, the average actual working days are 44 days, and the average absolute PPD is 29 days.
(3) The PPD of standard XPs in the five trades decreases over time, from 52.97% in 2004 to 33.04% in 2009.
(4) The average permit days and average actual working days of standard XPs in the five trades increase in general year by year, for the former from 46 days in 2004 to 96 days in 2009 and for the latter from 22 days in 2004 to 64 days in 2009.

Table 4-54 Deviation Analysis for Standard Works of the Five Trades

Item	2004	2005	2006	2007	2008	2009	Total
Deviation	52.97%	46.98%	41.79%	39.05%	34.75%	33.04%	39.44%
Number of XPs	3,413	6,175	5,538	4,894	5,241	5,271	30,532
Accumulative Permit Days	158,351	350,997	355,070	385,303	472,219	506,977	2,228,917
Accumulative Working Days	74,465	186,105	206,695	234,843	308,140	339,489	1,349,737
Average Permit Days	46	57	64	79	90	96	73
Average Actual Working Days	22	30	37	48	59	64	44

4.10.2 Deviation Analysis by Region

The results of deviation analysis of standard works of the five trades by region are provided in Table 4-55, Table 4-56, Table 4-57 and Figure 4-16. It is observed that:

(1) The overall PPD in Hong Kong (50.25%) is much higher than that in New Territories (40.12%), which is much higher than that in Kowloon (32.88%).
(2) The number of standard XPs in Hong Kong (6,634 XPs, accounting for 21.73% of the total XPs) is much lower than that in Kowloon (11,245, 36.83%), which is less than that in New Territories (12,653, 41.44%).
(3) In general, the average permit days and actual working days increase year by year in all three regions. The average permit days of New Territories (61 days) are smaller than

those of Hong Kong (78 days), which are smaller than those of Kowloon (83 days). The average actual working days of Hong Kong (39 days) and New Territories (37 days) are quite close, which are much smaller than those of Kowloon (56 days).

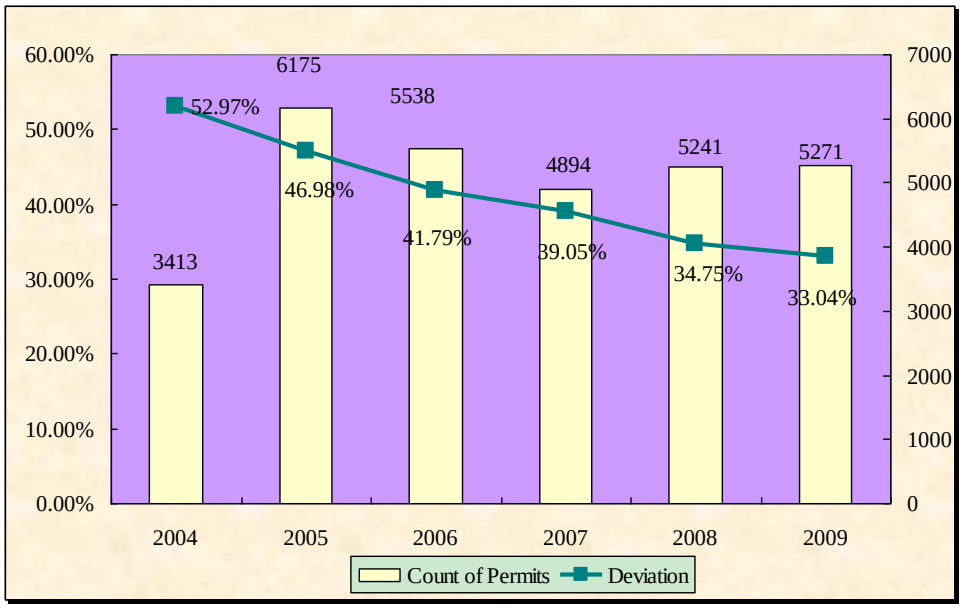

Figure 4-15 Annual PPDs and Numbers of Standard Works of the Five Trades

Table 4-55 Deviation Analysis by Region for Standard Works of the Five Trades

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Hong Kong	60.48%/ 763	52.87%/ 1,312	52.56%/ 1,215	48.88%/ 1,022	49.06%/ 1,216	45.3%/ 1,106	50.25%/ 6,634
Kowloon	48.47%/ 1,191	45.66%/ 2,288	37.61%/ 2,138	32.53%/ 1,793	25.13%/ 1,821	26.28%/ 2,014	32.88%/ 11,245
New Territories	52.12%/ 1,459	44.79%/ 2,575	39.62%/ 2,185	39.98%/ 2,079	36.82%/ 2,204	34.72%/ 2,151	40.12%/ 12,653
Total	52.97%/ 3,413	46.98%/ 6,175	41.79%/ 5,538	39.05%/ 4,894	34.75%/ 5,241	33.04%/ 5,271	39.44%/ 30,532

Table 4-56 Accumulative Permit Days and Accumulative Actual Working Days by Region for Standard Works of the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Hong Kong	39,007/ 15,414	80,908/ 38,134	82,656/ 39,212	93,439/ 47,768	115,646/ 58,910	108,609/ 59,408	520,265/ 258,846
Kowloon	52,318/ 26,959	131,717/ 71,575	149,320/ 93,155	159,778/ 107,801	204,892/ 153,396	237,233/ 174,890	935,258/ 627,776
New Territories	67,026/ 32,092	138,372/ 76,396	123,094/ 74,328	132,086/ 79,274	151,681/ 95,834	161,135/ 105,191	773,394/ 463,115
Total	158,351/ 74,465	350,997/ 186,105	355,070/ 206,695	385,303/ 234,843	472,219/ 308,140	506,977/ 339,489	2,228,917/ 1,349,737

Table 4-57 Average Permit Days and Average Actual Working Days by Region for Standard Works of the Five Trades

Permit Days/Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Hong Kong	51/20	62/29	68/32	91/47	95/48	98/54	78/39
Kowloon	44/23	58/31	70/44	89/60	113/84	118/87	83/56
New Territories	46/22	54/30	56/34	64/38	69/43	75/49	61/37
Total	46/22	57/30	64/37	79/48	90/59	96/64	73/44

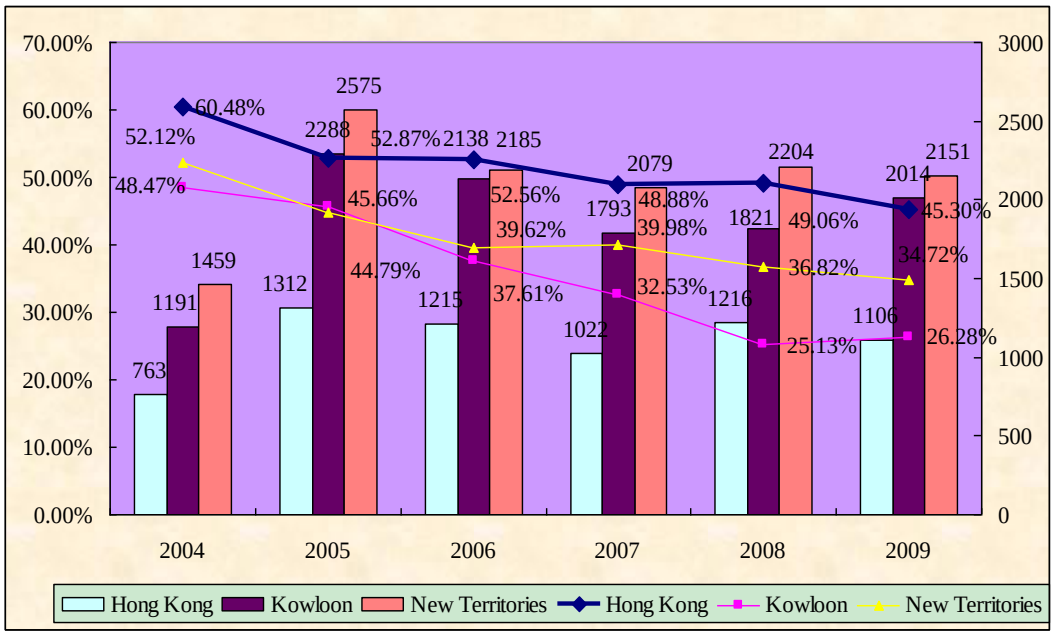

Figure 4-16 Deviation Analysis by Region for Standard Works of the Five Trades

4.10.3 Deviation Analysis by Multiplication Factors

The results of the deviation analysis of standard works in the five trades by MFs are presented in Table 4-58, Table 4-59, Table 4-60 and Figure 4-17. It is observed that:

(1) In total, more than half of standard XPs applied MFs.
(2) For years 2004 to 2009, the PPD of XPs involving MFs is larger than that of XPs not involving MFs.
(3) Overall, the PPD of XPs involving MFs (39.26%) is quite close to that of XPs not involving MFs (39.7%).
(4) The average permit days continuously increase year by year for XPs involving MFs, from 48 days in 2004 to 99 days in 2009.
(5) The average actual working days continuously increase year by year for XPs involving MFs, from 23 days in 2004 to 66 days in 2009.

Table 4-58 Deviation Analysis by MFs for Standard Works of the Five Trades

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	58.08%/ 866	47.87%/ 2,638	43.77%/ 2,231	41.04%/ 2,140	35.71%/ 2,459	33.06%/ 2,776	39.7%/ 13,110
Use MFs	51.52%/ 2,547	46.38%/ 3,537	40.65%/ 3,307	37.77%/ 2,754	34.05%/ 2,782	33.01%/ 2,495	39.26%/ 17,422
Total	52.97%/ 3,413	46.98%/ 6,175	41.79%/ 5,538	39.05%/ 4,894	34.75%/ 5,241	33.04%/ 5,271	39.44%/ 30,532

Table 4-59 Accumulative Permit Days and Accumulative Actual Working Days by MFs for Standard Works of the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	35,166/ 14,742	139,911/ 72,930	129,257/ 72,683	150,599/ 88,797	198,056/ 127,326	259,688/ 173,834	912,677/ 550,312
Use MFs	123,185/ 59,723	211,086/ 113,175	225,813/ 134,012	234,704/ 146,046	274,163/ 180,814	247,289/ 165,655	1,316,240/ 799,425
Total	158,351/ 74,465	350,997/ 186,105	355,070/ 206,695	385,303/ 234,843	472,219/ 308,140	506,977/ 339,489	2,228,917/ 1,349,737

Table 4-60 Average Permit Days and Average Actual Working Days by MFs for Standard Works of the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	41/17	53/28	58/33	70/41	81/52	94/63	70/42
Use MFs	48/23	60/32	68/41	85/53	99/65	99/66	76/46
Total	46/22	57/30	64/37	79/48	90/59	96/64	73/44

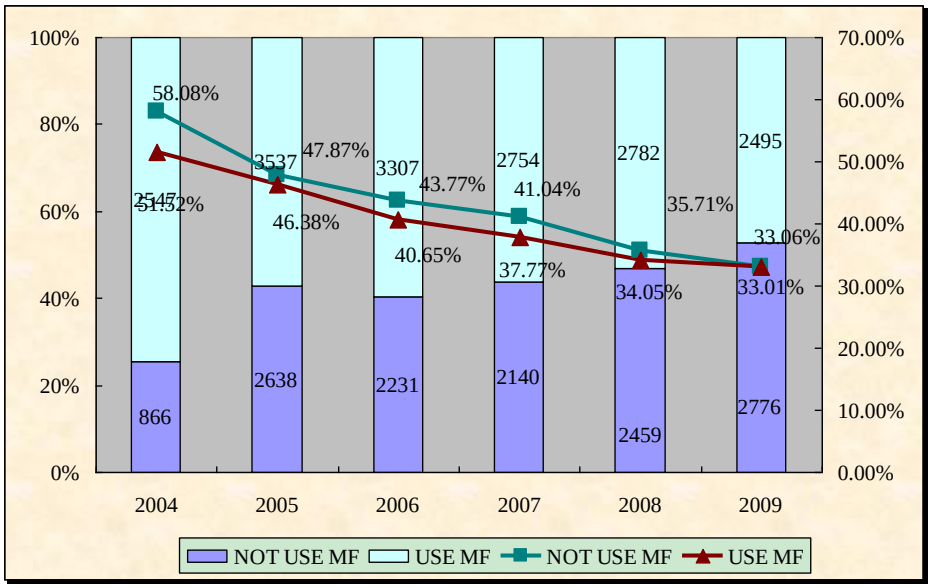

Figure 4-17 Deviation Analysis by MFs for Standard Works of the Five Trades

4.10.4 Deviation Analysis for Standard Works Not Involving Multiplication Factors

Deviation Analysis by Trade for Standard Works not Involving MFs: The results are provided in Table 4-61, Table 4-62, Table 4-63 and Figure 4-18. It is observed that:

(1) The PPD has an overall decreasing trend, from 58.08% in 2004 to 33.06% in 2009. The PPD of WSD decreases year by year, from 71.02% in 2004 to 22.24% in 2009. The PPD of GAS decreases from 57.3% in 2004 to 27.66% in 2009. The PPD of FTN in general maintains quite a high level from 2004 (62.53%) to 2009 (58.98%).

(2) Except for DSD that has only a small number of standard works, the PPD is more than 33% for other four trades. FTN has the largest PPD (58.69%).

(3) In general, the average permit days and average actual working days increase over time for FTN, GAS and WSD.

Table 4-61 Deviation Analysis by Trade for Standard Works of the Five Trades Not Involving MFs

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
DSD	29.57%/ 2	57.27%/ 3	-1.53%/ 4	24.35%/ 18	8.13%/ 13	36.85%/ 20	31.44%/ 60
ELE	50.66%/ 364	43.78%/1,300	36.12%/ 912	36.67%/ 862	30.98%/ 718	35.12%/ 1,033	37.85%/ 5,189
FTN	62.53%/ 359	57.05%/ 857	55%/ 747	59.87%/ 464	60.7%/ 801	58.98%/ 862	58.69%/ 4,090
GAS	57.3%/ 80	46.39%/ 234	45.26%/ 198	28.76%/ 243	30.45%/ 334	27.66%/ 225	34.2%/ 1,314
WSD	71.02%/ 61	47.87%/ 244	44.45%/ 370	43.61%/ 553	28.8%/ 593	22.24%/ 636	33.23%/ 2,457
Total	58.08%/ 866	47.87%/ 2,638	43.77%/ 2,231	41.04%/ 2,140	35.71%/ 2,459	33.06%/ 2,776	39.7%/ 13,110

Table 4-62 Accumulative Permit Days and Accumulative Actual Working Days by Trade for Standard Works of the Five Trades Not Involving MFs

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	115/ 81	454/ 194	326/ 331	1,199/ 907	1,635/ 1,502	8,473/ 5,351	12,202/ 8,366
ELE	14,797/ 7,301	67,040/ 37,693	46,567/ 29,746	49,319/ 31,236	40,302/ 27,818	62,423/ 40,500	280,448/ 174,294
FTN	11,224/ 4,206	31,880/ 13,692	28,922/ 13,015	18,743/ 7,521	39,550/ 15,543	47,567/ 19,511	177,886/ 73,488
GAS	3,913/ 1,671	14,765/ 7,915	11,917/ 6,523	21,991/ 15,666	32,171/ 22,375	24,831/ 17,962	109,588/ 72,112
WSD	5,117/ 1,483	25,772/ 13,436	41,525/ 23,068	59,347/ 33,467	84,398/ 60,088	116,394/ 90,510	332,553/ 222,052
Total	35,166/ 14,742	139,911/ 72,930	129,257/ 72,683	150,599/ 88,797	198,056/ 127,326	259,688/ 173,834	912,677/ 550,312

Table 4-63 Average Permit Days and Average Actual Working Days by Trade for Standard Works of the Five Trades Not Involving MFs

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	58/41	151/65	82/83	67/50	126/116	424/268	203/139
ELE	41/20	52/29	51/33	57/36	56/39	60/39	54/34
FTN	31/12	37/16	39/17	40/16	49/19	55/23	43/18
GAS	49/21	63/34	60/33	90/64	96/67	110/80	83/55
WSD	84/24	106/55	112/62	107/61	142/101	183/142	135/90
Total	41/17	53/28	58/33	70/41	81/52	94/63	70/42

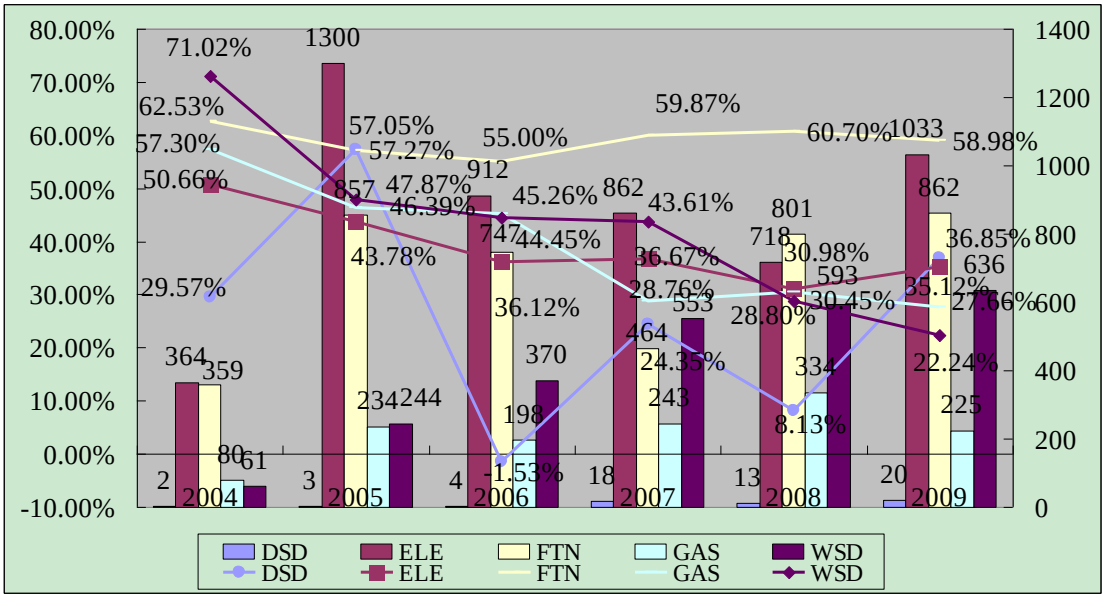

Figure 4-18 Deviation Analysis by Trade for Standard Works of the Five Trades Not Involving MFs

Deviation Analysis by Road Type for Standard Works not Involving MFs: The results are provided in Table 4-64. It is observed that the "primary distributor" (1,674 XPs, accounting for 12.77% of total XPs), "district distributor" (2,740 XPs, 20.90%), and "local distributor" (4,920 XPs, 37.53%) have the largest numbers of standard works not involving MFs.

4.10.5 Deviation Analysis for Standard Works Involving Multiplication Factors

Deviation Analysis by Trade for Standard Works Involving MFs: The results are provided in Table 4-65, Table 4-66, Table 4-67 and Figure 4-19. It is observed that:

(1) The PPD has an overall decreasing trend, from 51.52% in 2004 continuously decreasing to 33.01% in 2009.
(2) The average PPD by trade for all standard works from 2004 to 2009 ranges from 27.22% (DSD) to 60.27% (FTN), and the average PPD of all standard works in this period is 39.26%.
(3) The PPD of GAS and that of WSD continuously decrease year by year, the former from 47.84% in 2004 to 24.99% in 2009 and the latter from 59.53% in 2004 to 20.72% in 2009.
(4) The PPD of FTN maintains quite a high level from 2004 to 2009. It shows a general increasing trend from 59.53% in 2004 to 66.74% in 2009.
(5) In general, the average permit days and average actual working days increase for DSD, ELE, GAS and WSD. For FTN, the average permit days in general slightly increase while the average actual working days are quite stable.
(6) For all standard excavation works in the five trades, in general, the average permit days and average actual working days increase over time, the former from 48 days in 2004 to 99 days in 2009 and the latter from 23 days to 66 days. The average permit days and average actual working days for this period are 76 days and 46 days respectively.

Deviation Analysis by Road Type for Standard Works Involving MFs: The results are provided in Table 4-68. It is observed that "no road type" (2,392 XPs, accounting for 13.73% of the total standard XPs in the five trades), "primary distributor" (2,787 XPs, 16.00%), "district distributor" (3,882 XPs, 22.82%), and "local distributor" (6,665 XPs, 38.26%) have the largest numbers of standard works involving MFs.

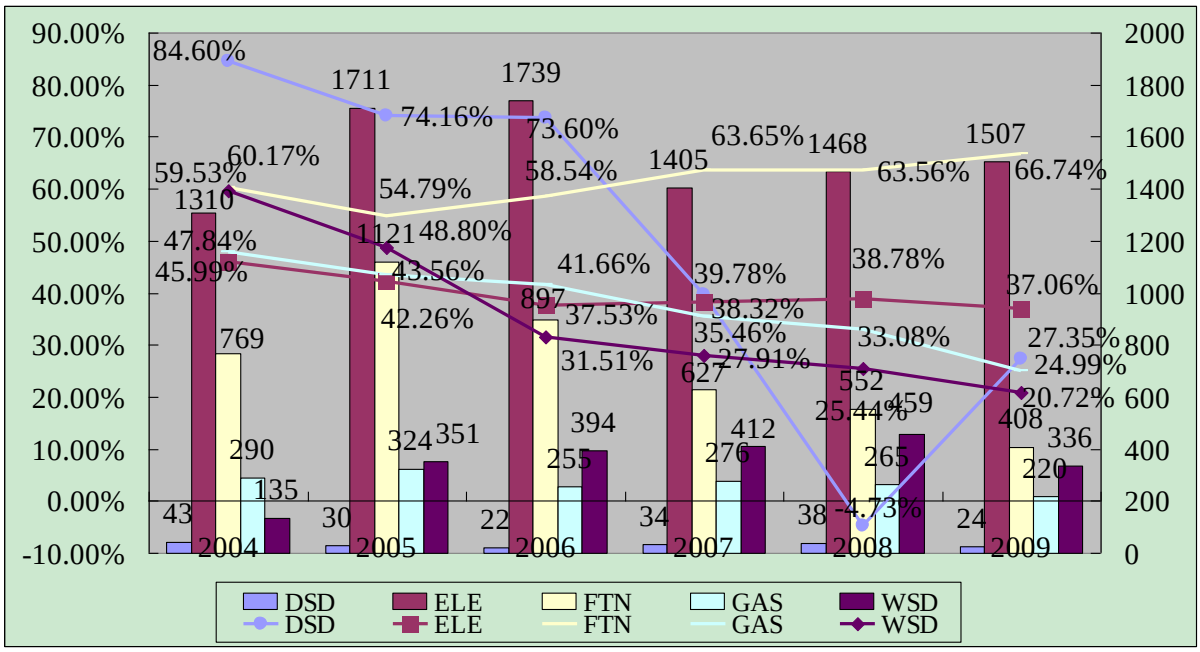

Figure 4-19 Deviation Analysis by Trade for Standard Works of the Five Trades Involving MFs

Table 4-64 Deviation Analysis by Road Type for Standard Works of the Five Trades Not Involving MFs

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Expressway	53.1%/2	54.03%/7	43.73%/7	70.%/2	62.76%/8	35.73%/12	47.06%/38
Primary Distributor	57.99%/113	41.96%/356	38.94%/251	33.75%/252	29.68%/288	29.28%/414	34.1%/1,674
Rural Trunk Road	51.18%/4	48.76%/21	45.45%/13	41.06%/16	54.72%/16	43.55%/7	47.37%/77
Urban Trunk Road	45.81%/6	50.99%/27	29.52%/29	36.84%/33	32.36%/41	18.73%/55	30.1%/191
District Distributor	59.02%/231	49.71%/599	42.21%/454	43.31%/426	33.22%/487	34.23%/543	40.36%/2,740
Feeder Road	33.93%/2	25.41%/3	37.02%/4	62.55%/6	21.13%/1	63.32%/7	49.41%/23
Local Distributor	58.42%/315	49.04%/979	44.58%/831	41.9%/819	39.1%/945	35.56%/1,031	41.58%/4,920
New Street or Road	54.14%/12	45.13%/31	51.72%/25	45.51%/24	44.48%/15	25.11%/4	46.24%/111
No Road Type	53.87%/106	45.06%/405	46.8%/423	40.27%/372	33.56%/462	30.64%/527	37.84%/2,295
Rural Road A	65.33%/48	53.1%/149	42.37%/127	42.73%/108	38.87%/133	40.85%/108	44.88%/673
Rural Road B	42.48%/11	46.77%/29	47.66%/29	50.49%/46	55.02%/41	37.25%/31	47.17%/187
Non-motorable Road, Footway	58.45%/16	57.78%/32	65.26%/38	35.72%/36	29.78%/22	34.89%/37	43.84%/181
Total	58.08%/866	47.87%/2,638	43.77%/2,231	41.04%/2,140	35.71%/2,459	33.06%/2,776	39.7%/13,110

Table 4-65 Deviation Analysis by Trade for Standard Works of the Five Trades Involving MFs

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
DSD	84.6%/43	74.16%/30	73.6%/22	39.78%/34	-4.73%/38	27.35%/24	27.22%/191
ELE	45.99%/1,310	42.26%/1,711	37.53%/1,739	38.32%/1,405	38.78%/1,468	37.06%/1,507	39.49%/9,140
FTN	60.17%/769	54.79%/1,121	58.54%/897	63.65%/627	63.56%/552	66.74%/408	60.27%/4,374
GAS	47.84%/290	43.56%/324	41.66%/255	35.46%/276	33.08%/265	24.99%/220	36.25%/1,630
WSD	59.53%/135	48.8%/351	31.51%/394	27.91%/412	25.44%/459	20.72%/336	29.83%/2,087
Total	51.52%/2,547	46.38%/3,537	40.65%/3,307	37.77%/2,754	34.05%/2,782	33.01%/2,495	39.26%/17,422

Table 4-66 Accumulative Permit Days and Accumulative Actual Working Days by Trade for Standard Works of the Five Trades Involving MFs

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	3,084/475	1,807/467	2,955/780	5,252/3,163	14,592/15,282	12,132/8,814	39,822/28,981
ELE	62,559/33,787	102,201/59,014	111,087/69,401	98,171/60,549	107,761/65,973	114,133/71,838	595,912/360,562
FTN	26,940/10,729	43,782/19,793	36,329/15,061	25,796/9,376	26,569/9,683	20,329/6,762	179,745/71,404
GAS	20,085/10,476	28,540/16,107	28,571/16,667	40,838/26,357	45,847/30,679	37,191/27,897	201,072/128,183
WSD	10,517/4,256	34,756/17,794	46,871/32,103	64,647/46,601	79,394/59,197	63,504/50,344	299,689/210,295
Total	123,185/59,723	211,086/113,175	225,813/134,012	234,704/146,046	274,163/180,814	247,289/165,655	1,316,240/799,425

Table 4-67 Average Permit Days and Average Actual Working Days by Trade for Standard Works of the Five Trades Involving MFs

Permit Days/Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	72/11	60/16	134/35	154/93	384/402	506/367	208/152
ELE	48/26	60/34	64/40	70/43	73/45	76/48	65/39
FTN	35/14	39/18	41/17	41/15	48/18	50/17	41/16
GAS	69/36	88/50	112/65	148/95	173/116	169/127	123/79
WSD	78/32	99/51	119/81	157/113	173/129	189/150	144/101
Total	48/23	60/32	68/41	85/53	99/65	99/66	76/46

Table 4-68 Deviation Analysis by Road Type for Standard Works of the Five Trades Involving MFs

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Expressway	39.44%/4	33.41%/13	43.25%/9	8.52%/10	25.12%/13	43.39%/6	26.45%/55
Primary Distributor	53.68%/336	45.27%/520	37.89%/472	34.67%/373	35.28%/386	32.11%/339	38.18%/2,426
Rural Trunk Road	57.63%/11	57.65%/22	51.26%/14	41.11%/15	11.39%/12	27.07%/11	35.05%/85
Urban Trunk Road	39.92%/43	48.27%/39	25.33%/63	34.28%/42	17.32%/41	10.1%/42	21.67%/270
District Distributor	50.25%/611	48.14%/789	42.19%/679	40.71%/560	32.26%/633	32.71%/610	39.31%/3,882
Feeder Road	34.15%/3	60.58%/3	-26.55%/11	43.09%/4	36.07%/3	48.12%/3	11.69%/27
Local Distributor	52.65%/984	47.61%/1,338	44.11%/1,222	38.2%/1,035	34.34%/1,100	36.05%/986	40.88%/6,665
New Street or Road	51.17%/121	38.15%/31	33.17%/41	52.05%/27	69.12%/8	51.67%/1	46.93%/229
No Road Type	47.28%/229	43.51%/499	36.57%/487	34.75%/459	39.29%/408	38.35%/310	38.99%/2,392
Rural Road A	52.13%/128	38.59%/175	33.85%/170	36.7%/126	35.67%/87	40.85%/84	38.78%/770
Rural Road B	58.21%/23	58.05%/31	53.52%/34	47.65%/36	49.66%/29	47.01%/35	51.7%/188
Non-motorable Road, Footway	55.08%/54	46.68%/77	51.36%/105	45.63%/67	48.61%/62	45.53%/68	48.53%/433
Total	51.52%/2,547	46.38%/3,537	40.65%/3,307	37.77%/2,754	34.05%/2,782	33.01%/2,495	39.26%/17,422

Table 4-69 Deviation Analysis by Trade for Standard Works of the Five Trades

PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
DSD	82.62%/45	70.77%/33	66.14%/26	36.91%/52	-3.43%/51	31.25%/44	28.21%/251
ELE	46.88%/1,674	42.86%/3,011	37.11%/2,651	37.77%/2,267	36.65%/2,186	36.37%/2,540	38.97%/14,329
FTN	60.87%/1,128	55.74%/1,978	56.97%/1,644	62.06%/1,091	61.85%/1,353	61.3%/1,270	59.49%/8,464
GAS	49.38%/370	44.53%/558	42.72%/453	33.12%/519	32.%/599	26.06%/445	35.53%/2,944
WSD	63.29%/196	48.4%/595	37.59%/764	35.43%/965	27.17%/1,052	21.7%/972	31.62%/4,544
Total	52.97%/3,413	46.98%/6,175	41.79%/5,538	39.05%/4,894	34.75%/5,241	33.04%/5,271	39.44%/30,532

4.10.6 Deviation Analysis by Trade

The results of deviation analysis by template for the standard works of the five trades are shown in Table 4-69, Table 4-70, Table 4-71 and Figure 4-20. It is observed that:

(1) The PPDs of the standard works in different trades vary largely, from 28.21% of DSD to 59.49% of FTN. FTN has the highest PPD (59.49%).
(2) The PPDs of WSD, GAS and DSD in general decrease over time.
(3) The average permit days of different trades vary largely, from 42 days of FTN to 207 days of DSD. The average actual working days of different trades vary largely, from 17 days of FTN to 149 days of DSD.

Table 4-70 Accumulative Permit Days and Accumulative Actual Working Days by Trade for Standard Works of the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	3,199/ 556	2,261/ 661	3,281/ 1,111	6,451/ 4,070	16,227/ 16,784	20,605/ 14,165	52,024/ 37,347
ELE	77,356/ 41,088	169,241/ 96,707	157,654/ 99,147	147,490/ 91,785	148,063/ 93,791	176,556/ 112,338	876,360/ 534,856
FTN	38,164/ 14,935	75,662/ 33,485	65,251/ 28,076	44,539/ 16,897	66,119/ 25,226	67,896/ 26,273	357,631/ 144,892
GAS	23,998/ 12,147	43,305/ 24,022	40,488/ 23,190	62,829/ 42,023	78,018/ 53,054	62,022/ 45,859	310,660/ 200,295
WSD	15,634/ 5,739	60,528/ 31,230	88,396/ 55,171	123,994/ 80,068	163,792/ 119,285	179,898/ 140,854	632,242/ 432,347
Total	158,351/ 74,465	350,997/ 186,105	355,070/ 206,695	385,303/ 234,843	472,219/ 308,140	506,977/ 339,489	2,228,917/ 1,349,737

Table 4-71 Average Permit Days and Average Actual Working Days by Trade for Standard Works of the Five Trades

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	71/12	69/20	126/43	124/78	318/329	468/322	207/149
ELE	46/25	56/32	59/37	65/40	68/43	70/44	61/37
FTN	34/13	38/17	40/17	41/15	49/19	53/21	42/17
GAS	65/33	78/43	89/51	121/81	130/89	139/103	106/68
WSD	80/29	102/52	116/72	128/83	156/113	185/145	139/95
Total	46/22	57/30	64/37	79/48	90/59	96/64	73/44

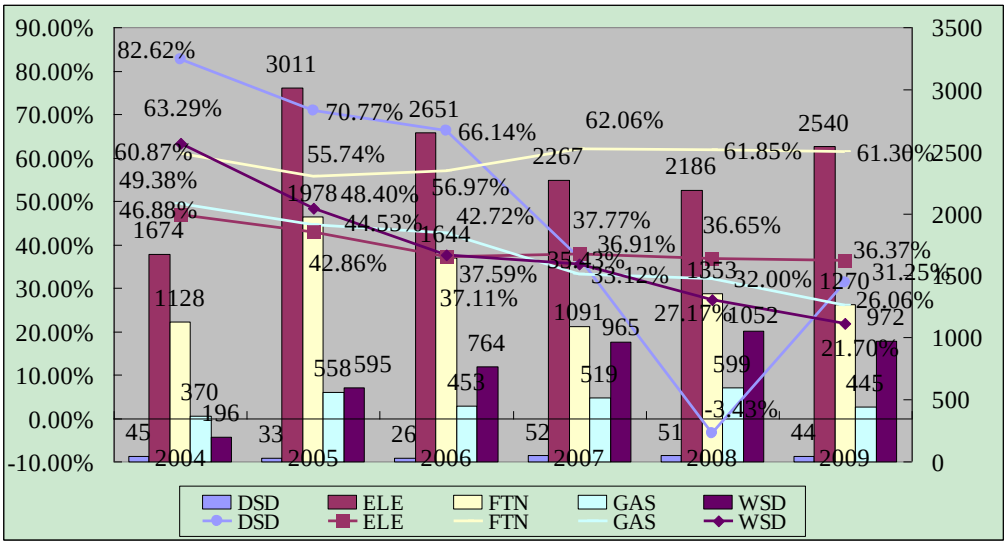

Figure 4-20 Deviation Analysis by Trade for Standard Works of the Five Trades

4.10.7 Deviation Analysis by Template

4.10.7.1 DSD Templates

There are 168 standard XPs in DSD from 2004 to 2009 that each involves only a single kind of template. The results of deviation analysis for different DSD templates are presented in Table 4-72, Table 4-73, Table 4-74 and Figure 4-21. It is observed that:

(1) The overall PPD of DSD templates is 32.40%.
(2) The most frequently used DSD template is the FT template (116 XPs), accounting for 68.94% of the total DSD XPs (168XPs) using a single kind of template. The RCRCW template is never used.
(3) The FT template has the highest PPD (40.81%). The PPDs of FCW template and RCW template are 19.13% and 28.69%, respectively.
(4) The number of XPs in DSD applying only of the FT templates fluctuates largely, from 20 XPs in 2006 to 44 XPs in 2007.
(5) The average actual working days increase largely for the excavation works using FT template, from 11 days in 2004 to 138 days in 2009. The same trend can be found in excavation works on other kinds of templates.

Table 4-72 Deviation Analysis by Template for DSD Standard Works (Applying One Kind Template)

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
FCW	91.15%/5	57.05%/2	1.03%/3	57.14%/1	-10.29%/8	69.38%/4	19.13%/23
FT	80.32%/21	77.91%/22	69.98%/15	40.93%/33	7.26%/16	-21.45%/9	40.81%/116
RCW	88.99%/4	81.61%/3	64.51%/2	28.12%/10	-4.43%/3	9.86%/4	28.69%/26
RCFCW	77.63%/1	-13.56%/1	-	-	37.07%/1	-	37.45%/3
Total	84.7%/31	71.96%/28	61.05%/20	38.73%/44	-2.72%/28	16.7%/17	32.4%/168

Table 4-73 Accumulative Permit Days and Accumulative Actual Working Days by Template for DSD Standard Works (Applying One Kind Template)

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	407/36	305/131	194/192	56/24	2,915/3,215	921/282	4,798/3,880
FT	1,128/ 222	1,331/ 294	1,166/ 350	2,744/ 1,621	1,929/ 1,789	1,021/ 1,240	9,319/ 5,516
RCW	663/73	174/32	355/126	665/478	1,062/1,109	1,399/1,261	4,318/3,079
RCFCW	76/17	59/67	-	-	116/73	-	251/157
Total	2,274/ 348	1,869/ 524	1,715/ 668	3,465/ 2,123	6,022/ 6,186	3,341/ 2,783	18,686/ 12,632

Table 4-74 Average Permit Days and Average Actual Working Days by Template for DSD Standard Works (Applying One Kind Template)

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	81/7	153/66	65/64	56/24	364/402	230/71	209/169
FT	54/11	61/13	78/23	83/49	121/112	113/138	80/48
RCW	166/18	58/11	178/63	67/48	354/370	350/315	166/118
RCFCW	76/17	59/67	/	/	116/73	/	84/52
Total	73/11	67/19	86/33	79/48	215/221	197/164	111/75

4.10.7.2 ELE Templates

There are 12,054 standard XPs in ELE from 2004 to 2009 that each involves only a single kind of template. The results of deviation analysis for different ELE templates are presented in Table 4-75, Table 4-76, Table 4-77 and Figure 4-22. It is observed that:

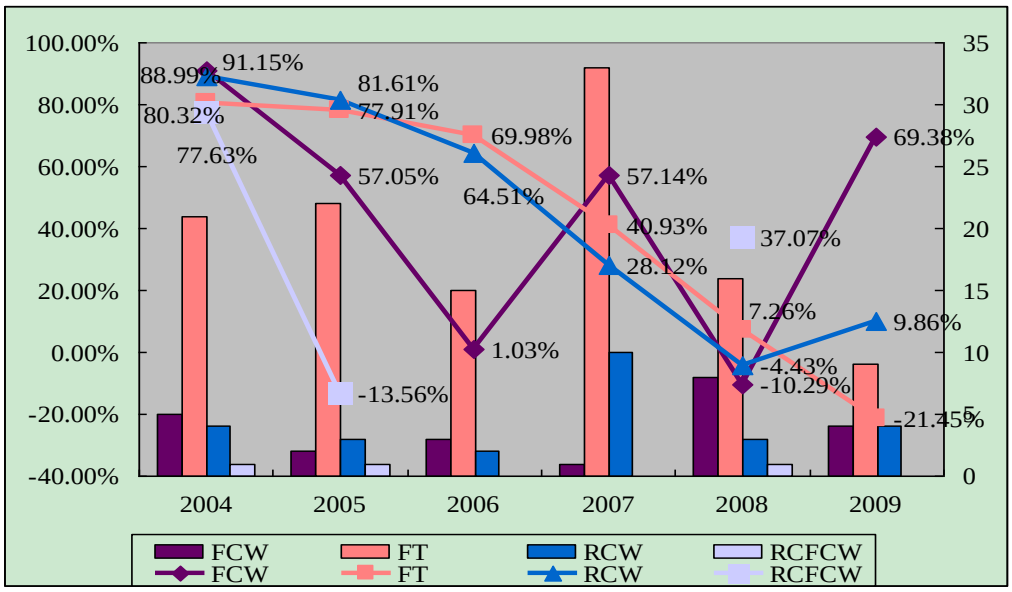

Figure 4-21 Deviation Analysis by Template for DSD Standard Works (Applying One Kind Template)

(1) The overall PPD of ELE templates is 38.10%.
(2) The most frequently used ELE template is the FT template (11,339 XPs), accounting for 94.06% of the total ELE XPs (12,054 XPs) using a single kind of template.
(3) The PPD of the RCFCW template (55.05%) is the highest. The PPD of the FCW template (48.04%) is quite close to that of the RCW template (48.05%).
(4) The PPD of the FT template decreases from 44.93% in 2004 to 33.57% in 2009. The same trend also appears in the FCW and RCW templates, with the former from 60.47% in 2004 to 45.46% in 2009 and the latter from 57.80% in 2004 to 43.61% in 2009.
(5) The PPDs of RCFCW template and RCW template exist large fluctuations.
(6) The number of XPs applying the FT template keeps stable from 2,021 XPs in 2006 to 1,900 XPs in 2009.
(7) The average permit days and actual working days of XPs in the FT template are increase from 2004 to 2009, with the former from 44 days to 61 days and the latter from 24 days to 41 days. The average permit days and average actual working days of XPs in the other templates fluctuate and do not show such an increasing trend.
(8) Overall, the average permit days and actual working days of ELE works keep increasing from 2004 to 2009, in which the former from 44 days to 61 days and the latter from 24 days to 40 days.

Table 4-75 Deviation Analysis by Template for ELE Standard Works (Applying One Kind Template)

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
FCW	60.47%/19	51.83%/41	39.76%/41	41.88%/32	56.68%/33	45.46%/24	48.04%/190
FT	44.93%/ 1,475	42.58%/ 2,425	35.14%/ 2,021	35.65%/ 1,796	33.54%/ 1,722	33.57%/ 1,900	37.2%/ 11,339
RCW	57.8%/11	60.31%/25	51.46%/20	48.88%/15	33.9%/19	43.61%/26	48.05%/116
RCFCW	54.3%/24	54.92%/34	57.62%/60	49.72%/43	57.15%/29	55.53%/74	55.05%/264
RCRCW	55.56%/4	62.82%/16	53.08%/39	67.42%/17	51.08%/28	46.21%/41	53.35%/145
Total	45.41%/ 1,533	43.18%/ 2,541	36.34%/ 2,181	36.53%/ 1,903	34.74%/ 1,831	34.74%/ 2,065	38.1%/ 12,054

Table 4-76 Accumulative Permit Days and Accumulative Actual Working Days by Template for ELE Standard Works (Applying One Kind Template)

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	817/ 323	2,628/ 1,266	2,716/ 1,636	2,204/ 1,281	2,322/ 1,006	1,608/ 877	12,295/ 6,389
FT	64,351/ 35,438	123,524/ 70,928	106,799/ 69,268	99,942/ 64,311	98,979/ 65,779	116,534/ 77,417	610,129/ 383,141
RCW	590/ 249	1,096/ 435	962/ 467	1,117/ 571	1,180/ 780	1,509/ 851	6,454/ 3,353
RCFCW	1,024/ 468	1,504/ 678	3,202/ 1,357	2,353/ 1,183	1,657/ 710	3,778/ 1,680	13,518/ 6,076
RCRCW	243/ 108	780/ 290	2,178/ 1,022	1,019/ 332	1,901/ 930	2,430/ 1,307	8,551/ 3,989
Total	67,025/ 36,586	129,532/ 73,597	115,857/ 73,750	106,635/ 67,678	106,039/ 69,205	125,859/ 82,132	650,947/ 402,948

Table 4-77 Average Permit Days and Average Actual Working Days by Template for ELE Standard Works (Applying One Kind Template)

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	43/17	64/31	66/40	69/40	70/30	67/37	65/34
FT	44/24	51/29	53/34	56/36	57/38	61/41	54/34
RCW	54/23	44/17	48/23	74/38	62/41	58/33	56/29
RCFCW	43/20	44/20	53/23	55/28	57/24	51/23	51/23
RCRCW	61/27	49/18	56/26	60/20	68/33	59/32	59/28
Total	44/24	51/29	53/34	56/36	58/38	61/40	54/33

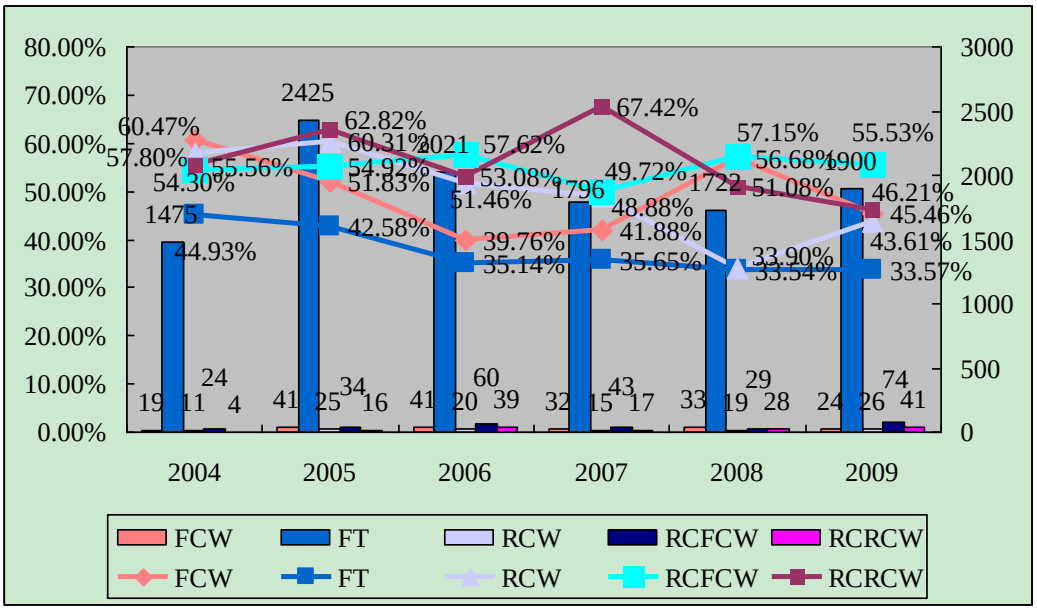

Figure 4-22 Deviation Analysis by Template for ELE Standard Works (Applying One Kind Template)

4.10.7.3 FTN Templates

There are 6,097 standard XPs in FTN from 2004 to 2009 that each involves only a single kind of template. The results of deviation analysis for different FTN templates are presented in Table 4-78, Table 4-79, Table 4-80 and Figure 4-23. It is observed that:

(1) The overall PPD of FTN templates is 61.64%.

(2) The most frequently used FTN template is the FT template (5,870 XPs), accounting for

96.28% of the total FTN XPs (6,097 XPs) using a single kind of template.

(3) The top three highest PPDs are RCW template (72.55%), FCW template (66.19%), and RCFCW template (65.63%). The lowest PPD is FT template (61.44%), which is a littler lower than that of the RCRCW template.

(4) In general, the PPD of the FT template keep stable from 62.49% in 2004 to 61.07% in 2009.

(5) The number of XPs applying the FT template varies largely, for example, 781 XPs in 2009 and 1,310 XPs in 2005. For other templates, only a small number of XPs use them.

(6) The average permit days and average actual working days of XPs applying the FT template increase, with the former from 31 days in 2004 to 47 days in 2009 and the latter from 12 days in 2004 to 18 days in 2009. The average permit days and actual working days of XPs apply the other templates fluctuate but do not show such an increasing trend.

(7) Overall, the average permit days and actual working days of FTN works increase from 2004 to 2009, with the former from 31 days to 47 days and the latter from 12 days to 18 days.

Table 4-78 Deviation Analysis by Template for FTN Standard Works (Applying One Kind Template)

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
FCW	69.06%/8	75.67%/13	56.76%/21	68.67%/18	65.15%/18	67.64%/15	66.19%/93
FT	62.49%/ 866	57.61%/ 1,310	60.85%/ 1,192	64.46%/ 810	63.65%/ 911	61.07%/ 781	61.44%/ 5,870
RCW	81.05%/4	61.45%/9	66.06%/7	78.75%/8	70.11%/7	85.13%/6	72.55%/41
RCFCW	69.53%/13	62.61%/20	65.86%/11	73.97%/3	56.%/1	67.54%/3	65.63%/51
RCRCW	71.82%/12	71.51%/11	53.11%/6	48.66%/9	73.26%/2	67.44%/2	63.27%/42
Total	62.87%/ 903	58.%/ 1,363	60.82%/ 1,237	64.56%/ 848	63.73%/ 939	61.36%/ 807	61.64%/ 6,097

Table 4-79 Accumulative Permit Days and Accumulative Actual Working Days by Template for FTN Standard Works (Applying One Kind Template)

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	223/69	448/109	740/320	833/261	746/260	550/178	3,540/1,197
FT	27,007/ 10,130	44,858/ 19,014	42,736/16,731	31,022/ 11,026	40,331/ 14,661	36,714/ 14,294	222,668/ 85,856
RCW	190/36	441/170	221/75	320/68	271/81	269/40	1,712/470
RCFCW	361/110	690/258	413/141	73/19	25/11	114/37	1,676/576
RCRCW	330/93	344/98	177/83	335/172	86/23	43/14	1,315/483
Total	28,111/ 10,438	46,781/ 19,649	44,287/ 17,350	32,583/ 11,546	41,459/ 15,036	37,690/ 14,563	230,911/ 88,582

Table 4-80 Average Permit Days and Average Actual Working Days by Template for FTN Standard Works (Applying One Kind Template)

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	28/9	34/8	35/15	46/15	41/14	37/12	38/13
FT	31/12	34/15	36/14	38/14	44/16	47/18	38/15
RCW	48/9	49/19	32/11	40/9	39/12	45/7	42/11
RCFCW	28/8	35/13	38/13	24/6	25/11	38/12	33/11
RCRCW	28/8	31/9	30/14	37/19	43/12	22/7	31/12
Total	31/12	34/14	36/14	38/14	44/16	47/18	38/15

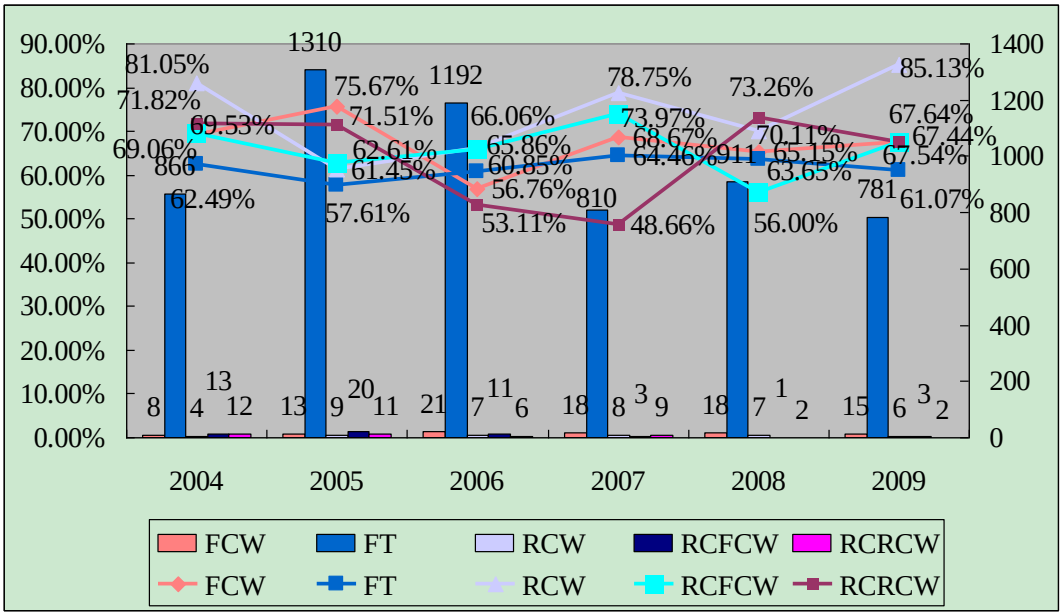

Figure 4-23 Deviation Analysis by Template for FTN Standard Works (Applying One Kind Template)

4.10.7.4 GAS Templates

There are 1,921 standard XPs in GAS from 2004 to 2009 that each involves only a single kind of template. The results of deviation analysis for different GAS templates are presented in Table 4-81, Table 4-82, Table 4-83 and Figure 4-24. It is observed that:

(1) The overall PPD of GAS templates is 37.21%.

(2) The most frequently used GAS template is the FT template (1,641 XPs), accounting for 85.42% of the total GAS XPs (1,921 XPs) using a single kind of template.

(3) The RCRCW template has the highest PPD (68.76%). However, this template is the least frequently used, namely, only three XPs. The RCFCW template has the second highest PPD (45.79%).

(4) The PPDs of FT template and RCFCW template decrease year by year, with the former from 48.74% in 2004 to 28.60% in 2009 and the latter from 85.88% in 2005 to 25.95% in 2009. The PPDs of FCW and RCW templates also show a decreasing trend.

(5) The number of XPs applying FT template keeps stable from 309 XPs in 2005 to 319 XPs in 2009.

(6) The average permit days and average actual working days of XPs applying the FT template increase from 2004 to 2008, with the former from 48 days to 78 days and the latter from 25 days to 54 days. The average permit days and actual working days of XPs applying the other templates do not show such an increasing trend.

Table 4-81 Deviation Analysis by Template for GAS Standard Works (Applying One Kind Template)

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
FCW	44.6%/33	37.69%/38	41.96%/28	24.02%/31	35.23%/37	35.15%/31	35.19%/198
FT	48.74%/ 203	48.31%/ 309	46.72%/ 283	31.15%/ 306	30.55%/ 319	28.6%/ 221	37.35%/ 1,641
RCW	60.41%/15	74.63%/10	41.84%/4	51.15%/10	13.74%/12	30.78%/16	36.94%/67
RCFCW	-	85.88%/2	39.24%/1	35.74%/5	32.3%/2	25.95%/2	45.79%/12
RCRCW	-	-	29.03%/1	-	77.07%/2	-	68.76%/3
Total	48.98%/ 251	48.04%/ 359	45.87%/ 317	31.39%/ 352	31.4%/ 372	30.01%/ 270	37.21%/ 1,921

(7) Overall, the average permit days and average actual working days of GAS works increase from 2004 to 2008, with the former from 52 days to 94 days and the latter from 27 days to 65 days.

Table 4-82 Accumulative Permit Days and Accumulative Actual Working Days by Template for GAS Standard Works (Applying One Kind Template)

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	2,278/ 1,262	3,428/ 2,136	2,667/ 1,548	4,309/ 3,274	7,335/ 4,751	4,040/ 2,620	24,057/ 15,591
FT	9,812/ 5,030	17,273/ 8,928	16,311/ 8,691	23,756/ 16,356	24,988/ 17,354	15,655/ 11,178	107,795/ 67,537
RCW	1,081/428	536/136	196/114	1,832/895	1,928/ 1,663	4,525/ 3,132	10,098/ 6,368
RCFCW	-	439/62	79/48	319/205	291/197	501/371	1,629/883
RCRCW	-	-	124/88	-	593/136	-	717/224
Total	13,171/ 6,720	21,676/ 11,262	19,377/ 10,489	30,216/ 20,730	35,135/ 24,101	24,721/ 17,301	144,296/ 90,603

Table 4-83 Average Permit Days and Average Actual Working Days by Template for GAS Standard Works (Applying One Kind Template)

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	69/38	90/56	95/55	139/106	198/128	130/85	122/79
FT	48/25	56/29	58/31	78/53	78/54	71/51	66/41
RCW	72/29	54/14	49/29	183/90	161/139	283/196	151/95
RCFCW	-	220/31	79/48	64/41	146/99	251/186	136/74
RCRCW	-	-	124/88	-	297/68	-	239/75
Total	52/27	60/31	61/33	86/59	94/65	92/64	75/47

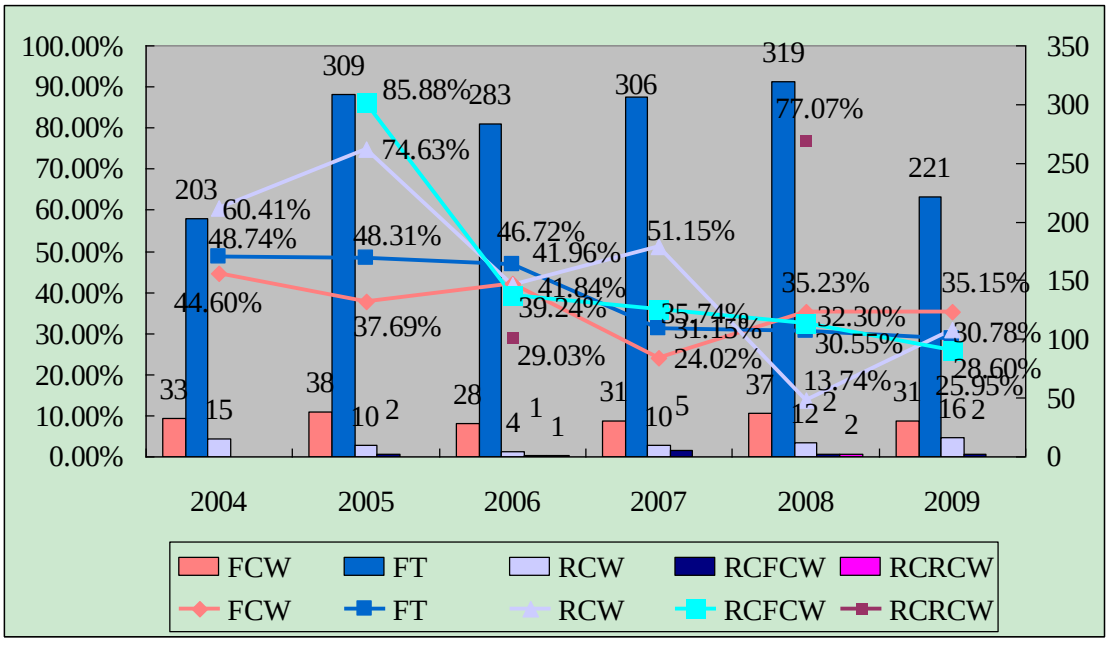

Figure 4-24 Deviation Analysis by Template for GAS Standard Works (Applying One Kind Template)

4.10.7.5 WSD Templates

There are 3,216 standard XPs in WSD from 2004 to 2009 that each involves only a single kind of template. The results of deviation analysis for different WSD templates are presented in Table 4-84, Table 4-85, Table 4-86 and Figure 4-25. It is observed that:

(1) The overall PPD of WSD templates is 36.87%.
(2) The most frequently used WSD template is the FT template (2,666 XPs), accounting for 82.90% of the total WSD XPs (3,216 XPs) using a single kind of template.
(3) The RCRCW template has the highest PPD (65.43%). However, this template is the least frequently used with only 7 (accounting for 0.22% of total XPs) XPs. The RCFCW template has the second highest PPD (55.04%) with only 11 (0.34%) XPs. The PPD of the FT template is 37.29%, which is a little higher than that of the FCW template (35.31%) and RCW template (33.62%).
(4) In general, the PPD of the FT template decreases from 60.88% in 2004 to 24.25% in 2009. The PPD of the RCW template follows a same decreasing trend from 52.53% in 2004 to 25.81% in 2009.
(5) The number of XPs applying the FT template varies largely, for example, 137 XPs in 2004 and 587 XPs in 2008.
(6) The average permit days and average actual working days of XPs applying the FT template increase from 2004 to 2009, with the former from 64 days to 123 days and the latter from 25 days to 93 days. The average permit days and actual working days of XPs on other road categories fluctuate and but do not show such an increasing trend.
(7) Overall, the average permit days and average actual working days of WSD works increase from 2004 to 2009, with the former from 66 days to 126 days and the latter from 25 days to 94 days.

Table 4-84 Deviation Analysis by Template for WSD Standard Works (Applying One Kind Template)

PPD/ Number of XPs	2004	2005	2006	2007	2008	2009	Total
FCW	71.15%/10	56.53%/50	33.7%/50	36.76%/71	27.95%/105	31.16%/88	35.31%/374
FT	60.88%/ 137	42.84%/ 372	43.56%/ 467	46.67%/ 574	33.93%/ 587	24.25%/ 529	37.29%/ 2,666
RCW	52.53%/5	60.84%/22	35.27%/29	35.83%/42	24.19%/34	25.81%/26	33.62%/158
RCFCW	77.84%/1	17.97%/1	-	-	60.8%/6	45.45%/3	55.04%/11
RCRCW	-	-	-	75.57%/4	81.48%/1	34.76%/2	65.43%/7
Total	61.54%/ 153	46.06%/ 445	41.74%/ 546	44.69%/ 691	32.49%/ 733	25.38%/ 648	36.87%/ 3,216

Table 4-85 Accumulative Permit Days and Accumulative Actual Working Days by Template for WSD Standard Works (Applying One Kind Template)

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	676/ 195	5,339/ 2,321	5,478/ 3,632	7,626/ 4,823	12,673/ 9,131	11,200/ 7,710	42,992/ 27,812
FT	8,820/ 3,450	28,470/ 16,273	38,980/ 22,001	47,608/ 25,391	62,737/ 41,450	64,881/ 49,147	251,496/ 157,712
RCW	415/ 197	2,656/ 1,040	4,117/ 2,665	4,996/ 3,206	6,330/ 4,799	4,909/ 3,642	23,423/ 15,549
RCFCW	185/41	128/105	-	-	477/187	231/126	1,021/459
RCRCW	-	-	-	352/86	135/25	187/122	674/233
Total	10,096/ 3,883	36,593/ 19,739	48,575/ 28,298	60,582/ 33,506	82,352/ 55,592	81,408/ 60,747	319,606/ 201,765

Table 4-86 Average Permit Days and Average Actual Working Days by Template for WSD Standard Works (Applying One Kind Template)

Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	68/20	107/46	110/73	107/68	121/87	127/88	115/74
FT	64/25	77/44	83/47	83/44	107/71	123/93	94/59
RCW	83/39	121/47	142/92	119/76	186/141	189/140	148/98
RCFCW	185/41	128/105	-	-	80/31	77/42	93/42
RCRCW	-	-	-	88/22	135/25	94/61	96/33
Total	66/25	82/44	89/52	88/48	112/76	126/94	99/63

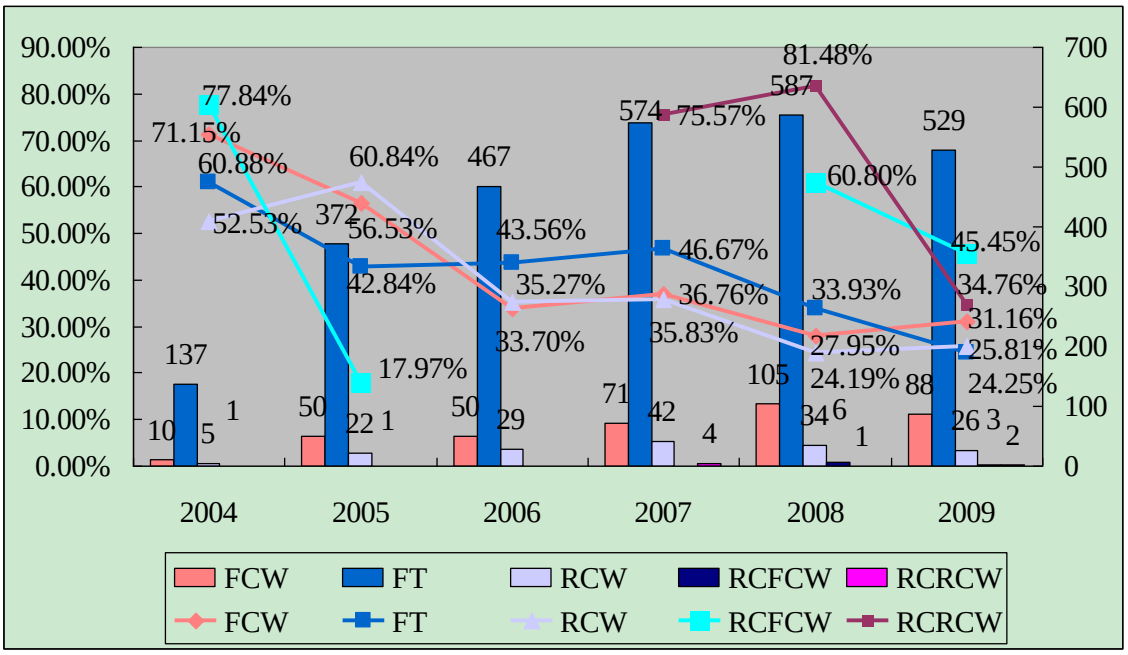

Figure 4-25 Deviation Analysis by Template for WSD Standard Works (Applying One Kind Template)

4.11 Deviation Analysis for Single-Item Standard Works of the Five Trades

4.11.1 Overview

The single-item standard work discussed in this Section satisfies the following conditions:

(1) It is a standard work in one single trade;

(2) It involves only one of the standard templates, which include flexible carriageway, rigid carriageway, footway, road crossing of flexible carriageway, and road crossing of rigid carriageway; and

(3) It has only one plan item in its XP.

Please note that in this section the template days refer to the number of days estimated by the corresponding template to complete an excavation work. Correspondingly, relative template period deviation (TPD) is defined as:

$$Relative\ TPD = \frac{Template\ Days - Actual\ Working\ Days}{Template\ Days} \times 100\%$$

There are 12,111 single-item standard XPs in the five trades. Table 4-87 and Figure 4-26 show the deviation analysis results for these XPs. It is observed that:

(1) In general, the PPD decreases, from 52.75% in 2004 to 42.47% in 2009, with an average

PPD of 46.57%. Also the TPD decreases from 64.23% in 2004 to 50.63% in 2009, with an average TPD of 56.44%.

(2) In general, accumulative template days, accumulative permit days, and accumulative actual working days increase from 81,918 days in 2004 to 121,890 days in 2009, from 62,010 days in 2004 to 104,602 days in 2009, and from 29,302 days to 60,174 days, respectively.

(3) Average permit days and average actual working days increase year by year, with the former from 40 days in 2004 to 57 days in 2009, and the latter from 19 days in 2004 to 33 days in 2009.

(4) In general, the average template days increase, from 52 days in 2004 to 66 days in 2009.

(5) The number of single-item permits seems to be stable from 2006 (2,262 XPs) to 2009 (1,845 XPs).

(6) The average template days, permit days and actual working days for all single-item standard XPs are 61 days, 50 days, and 27 days, respectively.

Table 4-87 Deviation Analysis for Single-Item Standard Works of the Five Trades

Item	2004	2005	2006	2007	2008	2009	Total
TPD	64.23%	59.38%	57.91%	52.54%	56.03%	50.63%	56.44%
PPD	52.75%	48.46%	47.1%	44.5%	46.57%	42.47%	46.57%
Number of XPs	1,567	2,428	2,262	1,971	2,038	1,845	12,111
Accumulative Template Days	81,918	139,762	135,647	123,760	137,162	121,890	740,139
Accumulate Permit Days	62,010	110,161	107,911	105,826	112,894	104,602	603,404
Accumulative Actual Working Days	29,302	56,773	57,089	58,738	60,314	60,174	322,390
Average Template Days	52	58	60	63	67	66	61
Average Permit Days	40	45	48	54	55	57	50
Average Actual Working Days	19	23	25	30	30	33	27

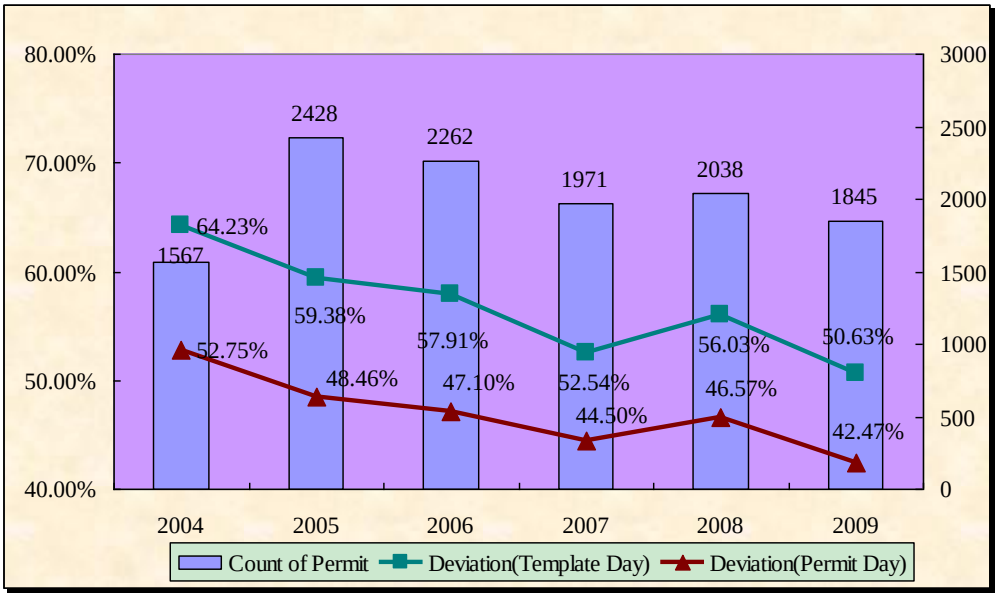

Figure 4-26 Annual PPDs and Numbers of Single-Item Standard Works of the Five Trades

4.11.2 Deviation Analysis by Region

The results of deviation analysis for the single-item standard works in the five trades by region are provided in Table 4-88, Table 4-89, Table 4-90, and Figure 4-27. It is observed that:

(1) The TPD in Hong Kong (65.10%) is much higher than that in Kowloon (51.20%) and that

in New Territories (56.44%).

(2) The number of single-item standard XPs in Hong Kong (2,961, accounting for 24.45% of total single-item XPs) is much smaller than that in Kowloon (4,791, 39.60%) and that in New Territories (4,359, 35.99%).

(3) Generally, average permit days and average actual working days increase in all three regions.

(4) The average template days of Hong Kong (61 days), Kowloon (62 days), and New Territories (60 days) are quite close, which is consistent with common sense.

(5) The average permit days of Kowloon (53 days) are higher than that of Hong Kong (50 days), which are higher than that of New Territories (47 days).

(6) The average actual working days of Hong Kong (45 days) and New Territories (41 days) are quite close, which are much smaller than those of Kowloon (59 days).

Table 4-88 Deviation Analysis by Region for Single-Item Standard Works of the Five Trades

TPD/PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Hong Kong	74.96%/ 63.92%/ 363	65.91%/ 55.83%/ 565	67.11%/ 57.96%/ 547	62.35%/ 55.74%/ 471	63.31%/ 55.99%/ 550	59.86%/ 55.25%/ 465	65.1%/ 56.94%/ 2,961
Kowloon	57.77%/ 49.1%/ 565	55.04%/ 48.14%/ 981	53.41%/ 44.39%/ 911	46.53%/ 37.53%/ 781	51.2%/ 41.12%/ 796	45.71%/ 37.23%/ 757	51.2%/ 42.49%/ 4,791
New Territories	62.18%/ 48.98%/ 639	60.23%/ 44.25%/ 882	57.38%/ 43.35%/ 804	53.42%/ 45.66%/ 719	55.96%/ 45.42%/ 692	49.65%/ 38.81%/ 623	56.44%/ 44.18%/ 4,359
Total	64.23%/ 52.75%/ 1,567	59.38%/ 48.46%/ 2,428	57.91%/ 47.1%/ 2,262	52.54%/ 44.5%/ 1,971	56.03%/ 46.57%/ 2,038	50.63%/ 42.47%/ 1,845	56.44%/ 46.57%/ 12,111

Table 4-89 Accumulative Template Days, Accumulative Permit Days and Accumulative Actual Working Days by Region for Single-Item Standard Works of the Five Trades

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Hong Kong	22,271/ 15,457/ 5,577	30,663/ 23,664/ 10,453	30,973/ 24,227/ 10,186	29,315/ 24,936/ 11,037	37,201/ 31,012/ 13,649	30,514/ 27,372/ 12,248	180,937/ 146,668/ 63,150
Kowloon	26,444/ 21,938/ 11,166	56,489/ 48,970/ 25,398	57,704/ 48,345/ 26,884	53,855/ 46,093/ 28,794	55,438/ 45,952/ 27,055	48,768/ 42,176/ 26,475	298,698/ 253,474/ 145,772
New Territories	33,203/ 24,615/ 12,559	52,610/ 37,527/ 20,922	46,970/ 35,339/ 20,019	40,590/ 34,797/ 18,907	44,523/ 35,930/ 19,610	42,608/ 35,054/ 21,451	260,504/ 203,262/ 113,468
Total	81,918/ 62,010/ 29,302	139,762/ 110,161/ 56,773	135,647/ 107,911/ 57,089	123,760/ 105,826/ 58,738	137,162/ 112,894/ 60,314	121,890/ 104,602/ 60,174	740,139/ 603,404/ 322,390

Table 4-90 Average Template Days, Average Permit Days and Average Actual Working Days by Region for Single-Item Standard Works of the Five Trades

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Hong Kong	61/43/15	54/42/19	57/44/19	62/53/23	68/56/25	66/59/26	61/50/21
Kowloon	47/39/20	58/50/26	63/53/30	69/59/37	70/58/34	64/56/35	62/53/30
New Territories	52/39/20	60/43/24	58/44/25	56/48/26	64/52/28	68/56/34	60/47/26
Total	52/40/19	58/45/23	60/48/25	63/54/30	67/55/30	66/57/33	61/50/27

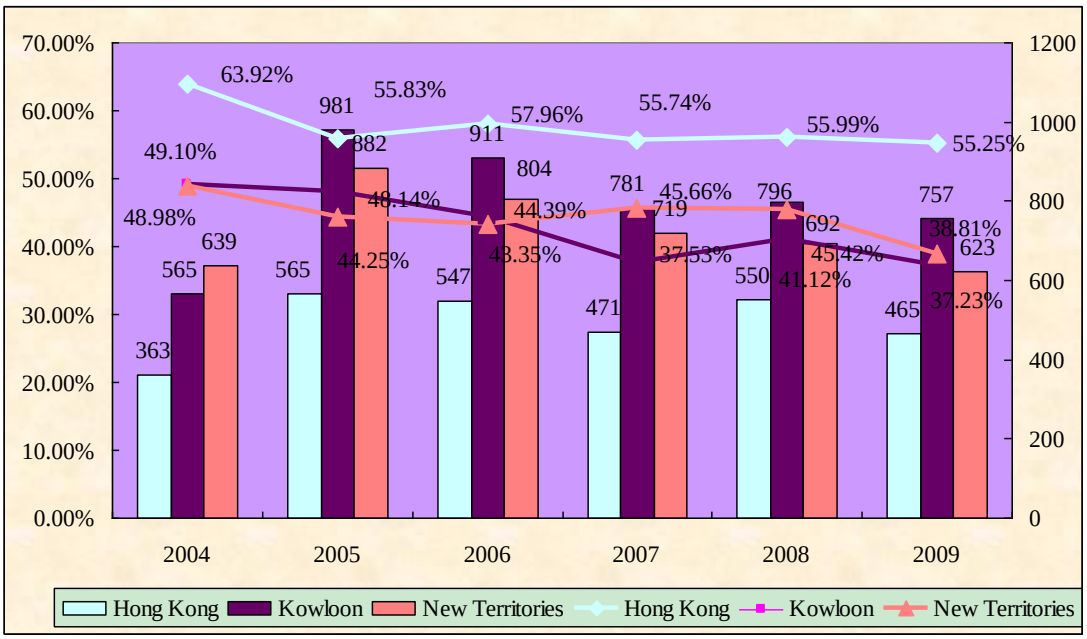

Figure 4-27 Deviation Analysis by Region for Single-Item Standard Works of the Five Trades

4.11.3 Deviation Analysis by Multiplication Factors

In view of whether the single-item standard XP involves MFs or not, the results of deviation analysis are shown in Table 4-91, Table 4-92, Table 4-93 and Figure 4-28. It is observed that:

(1) In total, the average TPD and PPD of single-item standard XPs involving MFs (57.1% and 46.85%) are larger than that of single-item standard XPs not involving MFs (55.41% and 46.14%). However, it is interesting that the TPDs of single-item standard XPs involving MFs are less than that of single-item standard XPs not involving MFs from 2008 to 2009.

(2) In general, the TPDs of both single-item standard XPs involving MFs and not involving MFs decrease, with the former from 64.13% in 2004 to 50.41% in 2009 and the latter from 64.62% in 2004 to 50.9% in 2009.

(3) The average template days increase year by year for both single-item standard XPs involving MFs and not involving MFs, with the former from 56 days in 2004 to 67 days in 2009 and the latter from 42 days in 2004 to 65 days in 2009. The average permit days follow the same trend.

(4) In general, the average permit days increase for both single-item standard XPs involving MFs and not involving MFs, with the former from 15 days in 2004 to 32 days in 2009 and the latter from 20 days in 2004 to 33 days in 2009.

Table 4-91 Deviation Analysis by MFs for Single-Item Standard Works of the Five Trades

TPD/PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	64.62%/ 56.94%/ 382	58.29%/ 47.26%/ 1,030	56.47%/ 47.15%/ 892	50.4%/ 43.17%/ 796	57.4%/ 47.67%/ 929	50.9%/ 42.18%/ 864	55.41%/ 46.14%/ 4,893
Use MFs	64.13%/ 51.61%/ 1,185	60.16%/ 49.33%/ 1,398	58.77%/ 47.06%/ 1,370	53.86%/ 45.34%/ 1,175	54.96%/ 45.74%/ 1,109	50.41%/ 42.72%/ 981	57.1%/ 46.85%/ 7,218
Total	64.23%/ 52.75%/ 1,567	59.38%/ 48.46%/ 2,428	57.91%/ 47.1%/ 2,262	52.54%/ 44.5%/ 1,971	56.03%/ 46.57%/ 2,038	50.63%/ 42.47%/ 1,845	56.44%/ 46.57%/ 12,111

Table 4-92 Accumulative Template Days, Accumulative Permit Days and Accumulative Actual Working Days by MFs for Single-Item Standard Works of the Five Trades

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	16,095/	58,299/	50,579/	47,298/	60,089/	55,963/	288,323/
	13,224/	46,106/	41,661/	41,279/	48,918/	47,525/	238,713/
	5,694	24,315	22,019	23,459	25,599	27,480	128,566
Use MFs	65,823/	81,463/	85,068/	76,462/	77,073/	65,927/	451,816/
	48,786/	64,055/	66,250/	64,547/	63,976/	57,077/	364,691/
	23,608	32,458	35,070	35,279	34,715	32,694	193,824
Total	81,918/	139,762/	135,647/	123,760/	137,162/	121,890/	740,139/
	62,010/	110,161/	107,911/	105,826/	112,894/	104,602/	603,404/
	29,302	56,773	57,089	58,738	60,314	60,174	322,390

Table 4-93 Average Template Days, Average Permit Days and Average Actual Working Days by MFs for Single-Item Standard Works of the Five Trades

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Not Use MFs	42/35/15	57/45/24	57/47/25	59/52/29	65/53/28	65/55/32	59/49/26
Use MFs	56/41/20	58/46/23	62/48/26	65/55/30	69/58/31	67/58/33	63/51/27
Total	52/40/19	58/45/23	60/48/25	63/54/30	67/55/30	66/57/33	61/50/27

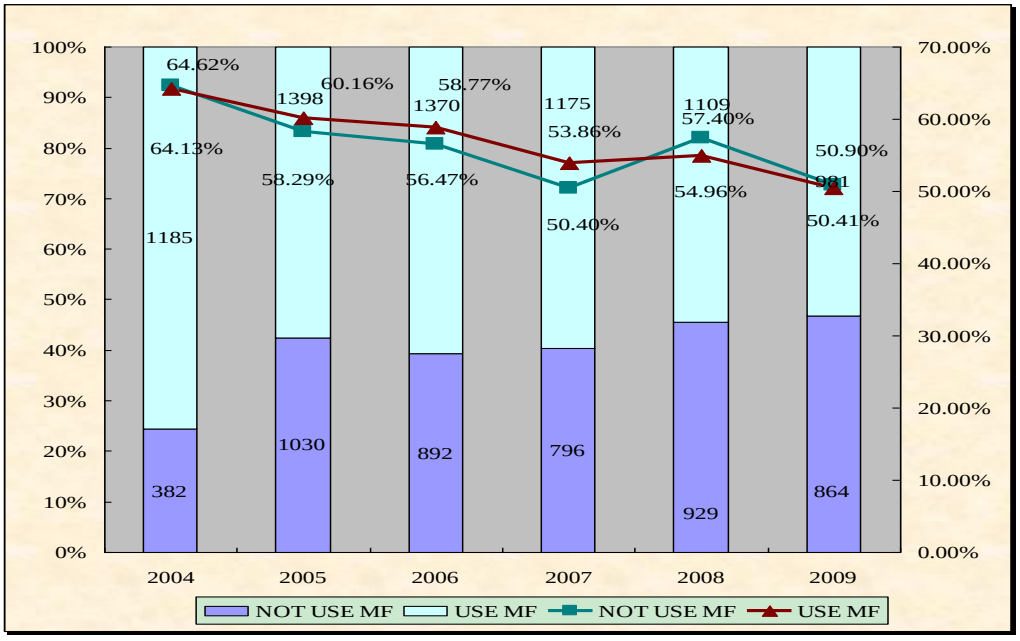

Figure 4-28 Deviation Analysis by MFs for Single-Item Standard Works of the Five Trades

4.11.4 Deviation Analysis for Footway and Carriageway

The results of deviation analysis for single-item standard XPs of the five trades on footway and carriageway are shown in Table 4-94, Table 4-95, Table 4-96 and Figure 4-29. It is observed that:

(1) More than half of the single-item standard works are on the footway (10, 428 XPs, accounting for 86.10% of the total single-item standard works). Only 610 XPs (5.04%) single-item standard works are on the carriageway.

(2) Overall, average TPD and PPD of single-item standard works on the footway (56.82 %

and 46.99%) are higher than those of single-item standard works on the carriageway (54.38% and 41.13%).

(3) In general, the TPD of single-item standard works on the carriageway has a decreasing trend, from 57.48% in 2004 to 37.13% in 2009.

(4) In general, the TPD of single-item standard works on the footway has a decreasing tread, from 52.27% in 2004 to 43.14% in 2009.

(5) The average actual working days on the carriageway (55 days) are more than the double of those on the footway (25 days).

Table 4-94 Deviation Analysis for Single-Item Standard Works of the Five Trades on Footway and Carriageway

TPD/PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
Carriageway	76.84%/ 57.48%/ 70	60.16%/ 50.04%/ 110	49.7%/ 36.08%/ 108	47.92%/ 33.88%/ 106	53.95%/ 42.4%/ 123	47.67%/ 37.13%/ 93	54.38%/ 41.13%/ 610
Footway	63.27%/ 52.27%/ 1,373	59.42%/ 47.79%/ 2,093	58.64%/ 47.52%/ 1,919	53.51%/ 46.19%/ 1,682	56.3%/ 47%/ 1,750	51.14%/ 43.14%/ 1,611	56.82%/ 46.99%/ 10,428
Neither	59.12%/ 53.93%/ 124	58.03%/ 53.61%/ 225	59.17%/ 53.01%/ 235	49.41%/ 40.82%/ 183	56.45%/ 48.7%/ 165	49.13%/ 42.48%/ 141	55.1%/ 48.59%/ 1,073
Total	64.23%/ 52.75%/ 1,567	59.38%/ 48.46%/ 2,428	57.91%/ 47.1%/ 2,262	52.54%/ 44.5%/ 1,971	56.03%/ 46.57%/ 2,038	50.63%/ 42.47%/ 1,845	56.44%/ 46.57%/ 12,111

Table 4-95 Accumulative Template Days, Accumulative Permit Days and Accumulative Actual Working Days for Single-Item Standard Works of the Five Trades on Footway and Carriageway

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Carriageway	7,477/ 4,073/ 1,732	11,413/ 9,102/ 4,547	11,766/ 9,259/ 5,918	13,007/ 10,245/ 6,774	16,663/ 13,323/ 7,674	13,033/ 10,848/ 6,820	73,359/ 56,850/ 33,465
Footway	68,901/ 53,021/ 25,305	118,117/ 91,803/ 47,932	111,204/ 87,637/ 45,995	99,254/ 85,752/ 46,147	111,502/ 91,933/ 48,722	100,379/ 86,256/ 49,041	609,357/ 496,402/ 263,142
Neither	5,540/ 4,916/ 2,265	10,232/ 9,256/ 4,294	12,677/ 11,015/ 5,176	11,499/ 9,829/ 5,817	8,997/ 7,638/ 3,918	8,478/ 7,498/ 4,313	57,423/ 50,152/ 25,783
Total	81,918/ 62,010/ 29,302	139,762/ 110,161 /56,773	135,647/ 107,911/ 57,089	123,760/ 105,826/ 58,738	137,162/ 112,894/ 60,314	121,890/ 104,602/ 60,174	740,139/ 603,404/ 322,390

Table 4-96 Average Template Days, Average Permit Days and Average Actual Working Days for Single-Item Standard Works of the Five Trades on Footway and Carriageway

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
Carriageway	107/58/25	104/83/41	109/86/55	123/97/64	135/108/62	140/117/73	120/93/55
Footway	50/39/18	56/44/23	58/46/24	59/51/27	64/53/28	62/54/30	58/48/25
Neither	45/40/18	45/41/19	54/47/22	63/54/32	55/46/24	60/53/31	54/47/24
Total	52/40/19	58/45/23	60/48/25	63/54/30	67/55/30	66/57/33	61/50/27

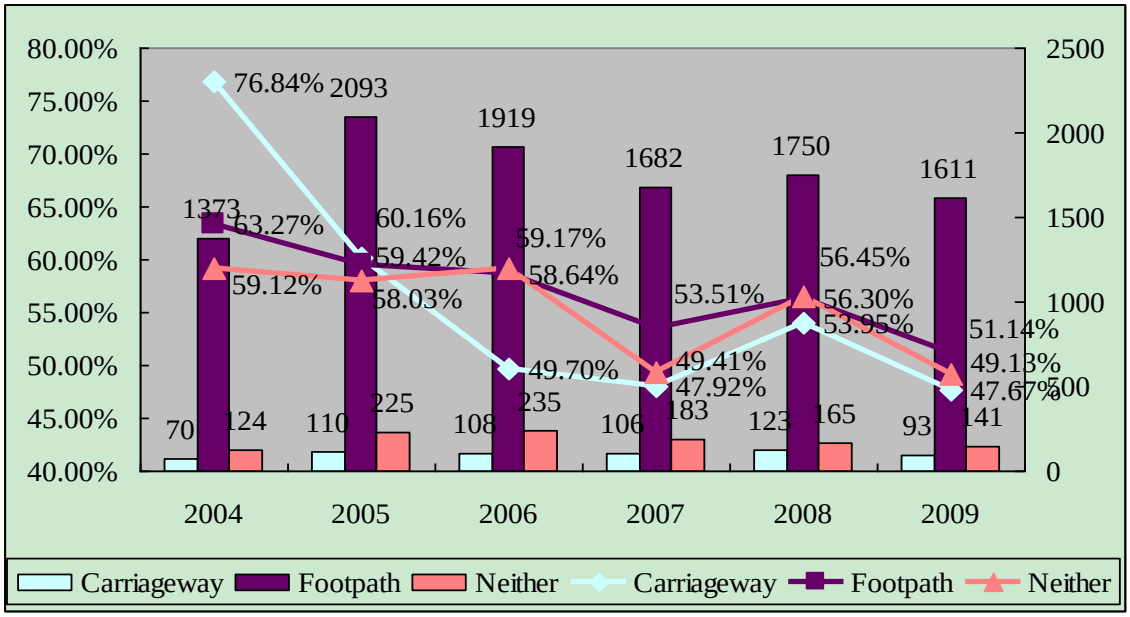

Figure 4-29 Deviation Analysis for Single-Item Standard Works of the Five Trades on Footway and Carriageway

4.11.5 Deviation Analysis by Trade

The results of deviation analysis for single-item standard works of the five trades are shown in Table 4-97, Table 4-98, Table 4-99 and Figure 4-30. It is observed that:

(1) The PPDs of single-item standard works in different trades vary largely. For example, the PPD by permit day of GAS is 39.98% while that of FTN is 63.33%.

(2) The average template days of different trades vary largely, from 52 days of FTN to 141 days of DSD. The average permit days of different trades vary largely, from 38 days of FTN to 97 days of DSD. The average actual working days of different trades vary largely, from 14 days of FTN to 42 days of DSD and WSD.

(3) The trade that has the largest number of single-item standard works is ELE (5,698, accounting for 47.05% of total single-item XPs). The trade that has the highest TPD is FTN (73.55%).

Table 4-97 Deviation Analysis by Trade for Single-Item Standard Works

TPD/PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
DSD	90.48%/	88.75%/	64.53%/	60.81%/	70.78%/	43.54%/	70.02%/
	83.59%/	82.41%/	47.97%/	53.26%/	54.84%/	20.19%/	56.36%/
	6	9	9	16	7	3	50
ELE	55.93%/	52.45%/	50.69%/	46.95%/	46.15%/	45.62%/	49.4%/
	46.36%/	44.35%/	38.44%/	38.95%/	36.59%/	37.02%/	40.03%/
	795	1,166	1,030	907	842	958	5,698
FTN	75.72%/	75.4%/	74.51%/	72.91%/	72.71%/	69.09%/	73.55%/
	64.46%/	59.35%/	63.28%/	64.89%/	65.34%/	63.04%/	63.33%/
	553	803	745	545	681	494	3,821
GAS	68.31%/	55.36%/	59.05%/	39.21%/	41.92%/	39.22%/	49.23%/
	48.33%/	47.83%/	51.63%/	31.53%/	34.44%/	36.65%/	39.98%/
	136	195	172	187	199	131	1,020
WSD	56.24%/	47.66%/	49.98%/	50.14%/	59.21%/	46.96%/	51.3%/
	55.06%/	44.28%/	45.43%/	44.3%/	48.51%/	36.59%/	44.45%/
	77	255	306	316	309	259	1,522
Total	64.23%/	59.38%/	57.91%/	52.54%/	56.03%/	50.63%/	56.44%/
	52.75%/	48.46%/	47.1%/	44.5%/	46.57%/	42.47%/	46.57%/
	1,567	2,428	2,262	1,971	2,038	1,845	12,111

Table 4-98 Accumulative Template Days, Accumulative Permit Days and Accumulative Actual Working Days by Trade for Single-Item Standard Works of the Five Trades

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	1,366/ 792/ 130	818/ 523/ 92	1,376/ 938/ 488	1,462/ 1,226/ 573	1,150/ 744/ 336	875/ 619/ 494	7,047/ 4,842/ 2,113
ELE	39,397/ 32,371/ 17,363	60,979/ 52,105/ 28,995	60,949/ 48,823/ 30,053	52,924/ 45,988/ 28,074	50,586/ 42,966/ 27,243	59,950/ 51,764/ 32,599	324,785/ 274,017/ 164,327
FTN	25,030/ 17,101/ 6,077	44,091/ 26,679/ 10,845	37,463/ 26,007/ 9,551	27,283/ 21,054/ 7,392	38,727/ 30,496/ 10,569	27,237/ 22,778/ 8,418	199,831/ 144,115/ 52,852
GAS	10,977/ 6,733/ 3,479	11,545/ 9,879/ 5,154	10,371/ 8,780/ 4,247	15,683/ 13,922/ 9,533	18,019/ 15,964/ 10,466	9,320/ 8,942/ 5,665	75,915/ 64,220/ 38,544
WSD	5,148/ 5,013/ 2,253	22,329/ 20,975/ 11,687	25,488/ 23,363/ 12,750	26,408/ 23,636/ 13,166	28,680/ 22,724/ 11,700	24,508/ 20,499/ 12,998	132,561/ 116,210/ 64,554
Total	81,918/ 62,010/ 29,302	139,762/ 110,161/ 56,773	135,647/ 107,911/ 57,089	123,760/ 105,826/ 58,738	137,162/ 112,894/ 60,314	121,890/ 104,602/ 60,174	740,139/ 603,404/ 322,390

Table 4-99 Average Template Days, Average Permit Days and Average Actual Working Days by Trade for Single-Item Standard Works of the Five Trades

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
DSD	228/132/22	91/58/10	153/104/54	91/77/36	164/106/48	292/206/165	141/97/42
ELE	50/41/22	52/45/25	59/47/29	58/51/31	60/51/32	63/54/34	57/48/29
FTN	45/31/11	55/33/14	50/35/13	50/39/14	57/45/16	55/46/17	52/38/14
GAS	81/50/26	59/51/26	60/51/25	84/74/51	91/80/53	71/68/43	74/63/38
WSD	67/65/29	88/82/46	83/76/42	84/75/42	93/74/38	95/79/50	87/76/42
Total	52/40/19	58/45/23	60/48/25	63/54/30	67/55/30	66/57/33	61/50/27

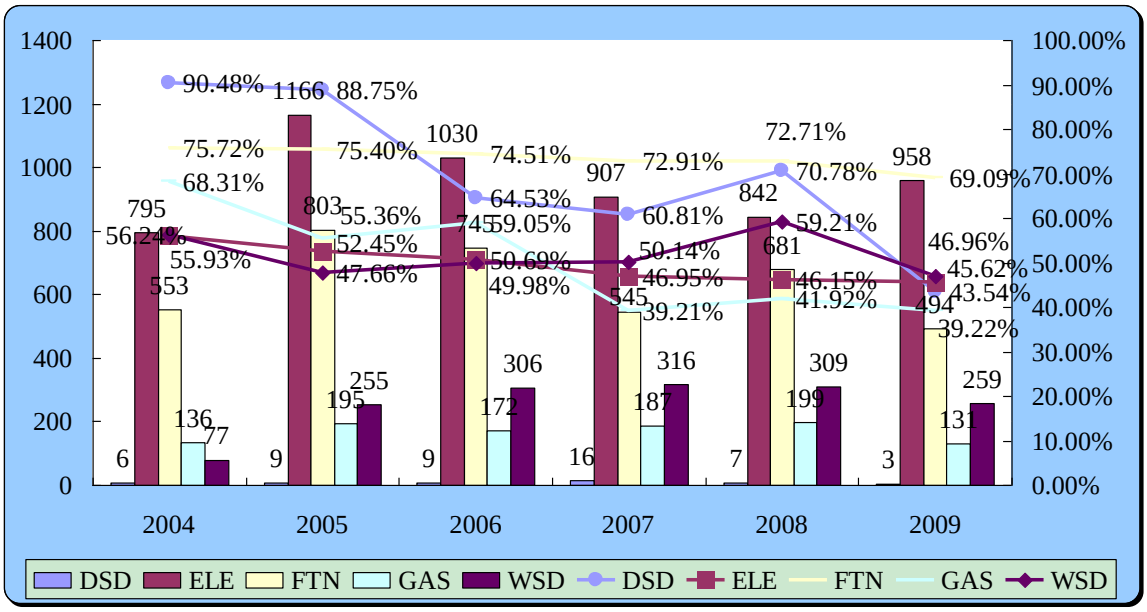

Figure 4-30 Deviation Analysis by Trade for Single-Item Standard Works of the Five Trades

4.11.6 Deviation Analysis by Template

In the XPMS, there are standard templates for assessing the permit period of excavation works in different trades. Specially, for each trade, standard templates include the following types: flexible carriageway, rigid carriageway, footway, road crossing of flexible carriageway, and road crossing of rigid carriageway. In the following, the accuracy of standard templates for the five trades is analyzed using historical XPs that involve only one single template. The results of deviation analysis by template for the five trades are shown in Table 4-100.

Table 4-100 Deviation Analysis by Template for Single-Item Standard Works

TPD/PPD/Number of XPs	DSD	ELE	FTN	GAS	WSD
FCW	57.99%/ 45.73%/ 8	59.12%/ 46.01%/ 113	72.63%/ 63.77%/ 48	56.76%/ 33.26%/ 104	50.54%/ 37.57%/ 130
FT	81.48%/ 66.74%/ 30	48.89%/ 39.8%/ 5,519	73.58%/ 63.27%/ 3,735	46.85%/ 41.39%/ 877	52.33%/ 46.19%/ 1,327
RCW	54.41%/ 7.79%/ 11	65.37%/ 46.95%/ 62	78.13%/ 70.00%/ 18	45.2%/ 36.83%/ 31	41.27%/ 34.61%/ 61
RCFCW	77.63%/ 77.63%/ 1	42.86%/ 50.97%/ 4	56.06%/ 67.35%/ 12	-6.78%/ 60.94%/ 6	59.8%/ 77.84%/ 1
RCRCW			64.02%/ 63.74%/ 8	28.42%/ 77.07%/ 2	59.57%/ 78.41%/ 3
Total	70.02%/ 56.36%/ 50	49.4%/ 40.03%/ 5,698	73.55%/ 63.33%/ 3,821	49.23%/ 39.98%/ 1,020	51.3%/ 44.45%/ 1,522

4.11.6.1 DSD Templates

There are 50 single-item standard XPs in DSD from 2004 to 2009. The results of deviation analysis for different DSD templates are presented in Table 4-101, Table 4-102, Table 4-103 and Figure 4-31. It is observed that:

(1) The overall TPD and PPD of DSD templates for single-item XPs are 70.02% and 56.36%, respectively.

(2) The most frequently used DSD template for single-item standard XPs is the FT template (30 XPs), accounting for 60% of the total DSD single-item XPs (50 XPs). The templates almost never used are the RCRCW (0 XP) and RCFCW (only 1 XP).

Table 4-101 Deviation Analysis by Template for DSD Single-Item Standard Works

TPD/PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
FCW	93.51%/ 92.21%/ 2	87.83%/ 60.34%/ 1	-119.18%/ -175.86%/ 1	64.71%/ 57.14%/ 1	51.01%/ 49.7%/ 2	80.17%/ 75.26%/ 1	57.99%/ 45.73%/ 8
FT	90.27%/ 0%/ 2	90.18%/ 86.21%/ 7	78.67%/ 61.52%/ 6	79.32%/ 79.32%/ 10	77.4%/ 52.78%/ 4	71.57%/ -17.11%/ 1	81.48%/ 66.74%/ 30
RCW	91.55%/ 91.47%/ 1	77.97%/ 77.97%/ 1	64.61%/ 64.51%/ 2	37.94%/ 3.69%/ 5	89.68%/ 84.15%/ 1	13.61%/ 14.57%/ 1	54.41%/ 47.79%/ 11
RCFCW	77.63%/ 77.63%/ 1	-	-	-	-	-	77.63%/ 77.63%/ 1
Total	90.48%/ 83.59%/ 6	88.75%/ 82.41%/ 9	64.53%/ 47.97%/ 9	60.81%/ 53.26%/ 16	70.78%/ 54.84%/ 7	43.54%/ 20.19%/ 3	70.02%/ 56.36%/ 50

Table 4-102 Accumulative Template Days, Accumulative Permit Days and Accumulative Actual Working Days by Template for DSD Single-Item Standard Works

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	185/	189/	73/	68/	347/	121/	983/
	154/	58/	58/	56/	338/	97/	761/
	12	23	160	24	170	24	413
FT	596/	570/	947/	764/	677/	313/	3,867/
	58/	406/	525/	764/	324/	76/	2,153/
	58	56	202	158	153	89	716
RCW	509/	59/	356/	630/	126/	441/	2,121/
	504/	59/	355/	406/	82/	446/	1,852/
	43	13	126	391	13	381	967
RCFCW	76/	-	-	-	-	-	76/
	76/						76/
	17						17
Total	1,366/	818/	1,376/	1,462/	1,150/	875/	7,047/
	792/	523/	938/	1,226/	744/	619/	4,842/
	130	92	488	573	336	494	2,113

Table 4-103 Average Template Days, Average Permit Days and Average Actual Working Days by Template for DSD Single-Item Standard Works

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	93/77/6	189/58/23	73/58/160	68/56/24	174/169/85	121/97/24	123/95/52
FT	298/29/29	81/58/8	158/88/34	76/76/16	169/81/38	313/76/89	129/72/24
RCW	509/	59/	178/	126/	126/	441/	193/
	504/	59/	178/	81/	82/	446/	168/
	43	13	63	78	13	381	88
RCFCW	76/76/17	-	-	-	-	-	76/76/17
Total	228/	91/	153/	91/	164/	292/	141/
	132/	58/	104/	77/	106/	206/	97/
	22	10	54	36	48	165	42

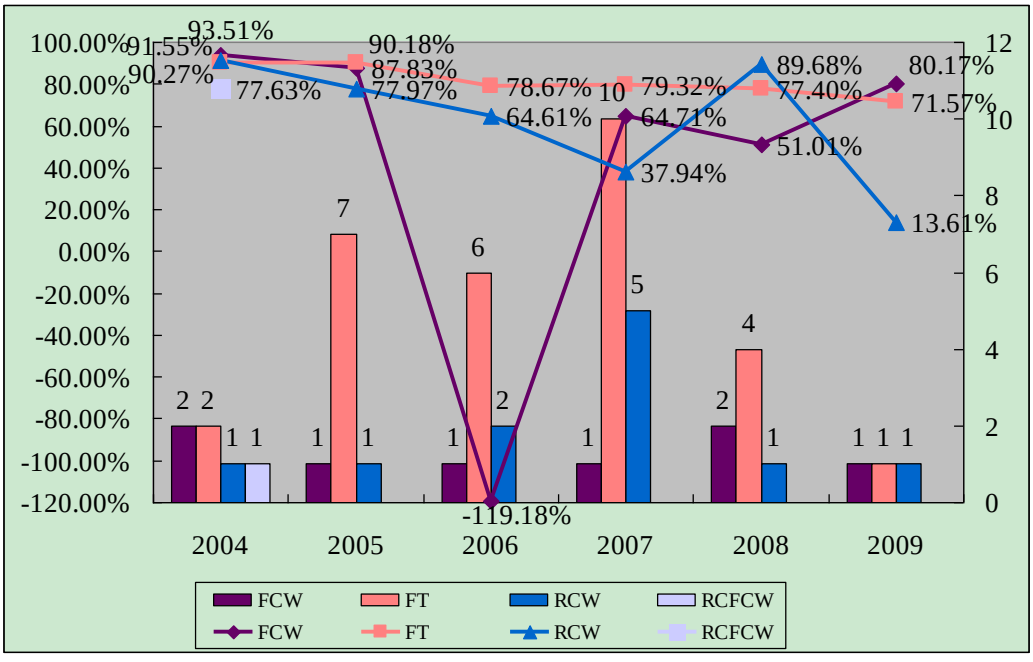

Figure 4-31 Deviation Analysis by Template for DSD Single-Item Standard Works

4.11.6.2 ELE Templates

There are 5,698 single-item standard ELE XPs from 2004 to 2009. The results of deviation analysis for different ELE templates are presented in Table 4-104, Table 4-105, Table 4-106 and Figure 4-32. It is observed that:

(1) The overall TPD and PPD of ELE templates are 49.40% and 40.03%, respectively.
(2) The most frequently used ELE template is the FT template (5,519 XPs), accounting for 96.86% of the total ELE single-item XPs (5,698 XPs).
(3) The TPD of the RCW template (65.37%) is the highest and that of the FCW template (59.12%) the second highest. The PPD of the RCFCW template (50.97%) is the highest. The PPD of the RCW template is 46.95% is quite close to that of the FCW template (46.01%).
(4) It is noted that the template days of the RCFCW template (total 133 days) are less than the permit days (total 155 days). The reason may be that the maximum length of the template is 3.5m but the actual length may be longer so that the permit days granted by HyD are longer than the template days.
(5) In general, the PPD of the FT template decreases from 45.99% in 2004 to 36.69% in 2009. The other templates do not show such a decreasing trend.

Table 4-104 Deviation Analysis by Template for ELE Single-Item Standard Works

TPD/PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
FCW	66.71%/	61.29%/	61.96%/	53.96%/	59.33%/	56.1%/	59.12%/
	60.78%/	49.81%/	41.83%/	32.66%/	51.28%/	48.26%/	46.01%/
	15	24	21	21	19	13	113
FT	55.53%/	52.09%/	50.27%/	46.52%/	45.54%/	44.65%/	48.89%/
	45.99%/	44.13%/	38.29%/	38.92%/	36.19%/	36.69%/	39.8%/
	772	1,129	998	880	812	928	5,519
RCW	71.43%/	64.76%/	60.31%/	70.22%/	55.63%/	71.11%/	65.37%/
	54.01%/	53.75%/	42.37%/	68.36%/	34.95%/	44.81%/	46.95%/
	6	13	10	6	11	16	62
RCFCW	56.41%/		70.%/			28.38%/	42.86%/
	57.5%/	-	85.%/	-	-	29.33%/	50.97%/
	2		1			1	4
Total	55.93%/	52.45%/	50.69%/	46.95%/	46.15%/	45.62%/	49.4%/
	46.36%/	44.35%/	38.44%/	38.95%/	36.59%/	37.02%/	40.03%/
	795	1,166	1,030	907	842	958	5,698

Table 4-105 Accumulative Template Days, Accumulative Permit Days and Accumulative Actual Working Days by Template for ELE Single-Item Standard Works

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	760/	1,338/	1,488/	1,944/	1,453/	1,050/	8,033/
	645/	1,032/	973/	1,329/	1,213/	891/	6,083/
	253	518	566	895	591	461	3,284
FT	38,157/	58,872/	58,670/	50,624/	48,076/	57,040/	311,439/
	31,412/	50,487/	47,279/	44,324/	41,032/	49,863/	264,397/
	16,967	28,206	29,175	27,073	26,183	31,569	159,173
RCW	441/	769/	771/	356/	1,057/	1,786/	5,180/
	274/	586/	531/	335/	721/	935/	3,382/
	126	271	306	106	469	516	1,794
RCFCW	39/		20/			74/	133/
	40/	-	40/	-	-	75/	155/
	17		6			53	76
Total	39,397/	60,979/	60,949/	52,924/	50,586/	59,950/	324,785/
	32,371/	52,105/	48,823/	45,988/	42,966/	51,764/	274,017/
	17,363	28,995	30,053	28,074	27,243	32,599	164,327

Table 4-106 Average Template Days, Average Permit Days and Average Actual Working Days by Template for ELE Single-Item Standard Works

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	51/43/17	56/43/22	71/46/27	93/63/43	76/64/31	81/69/35	71/54/29
FT	49/41/22	52/45/25	59/47/29	58/50/31	59/51/32	61/54/34	56/48/29
RCW	74/46/21	59/45/21	77/53/31	59/56/18	96/66/43	112/58/32	84/55/29
RCFCW	20/20/9	-	20/40/6	-	-	74/75/53	33/39/19
Total	50/41/22	52/45/25	59/47/29	58/51/31	60/51/32	63/54/34	57/48/29

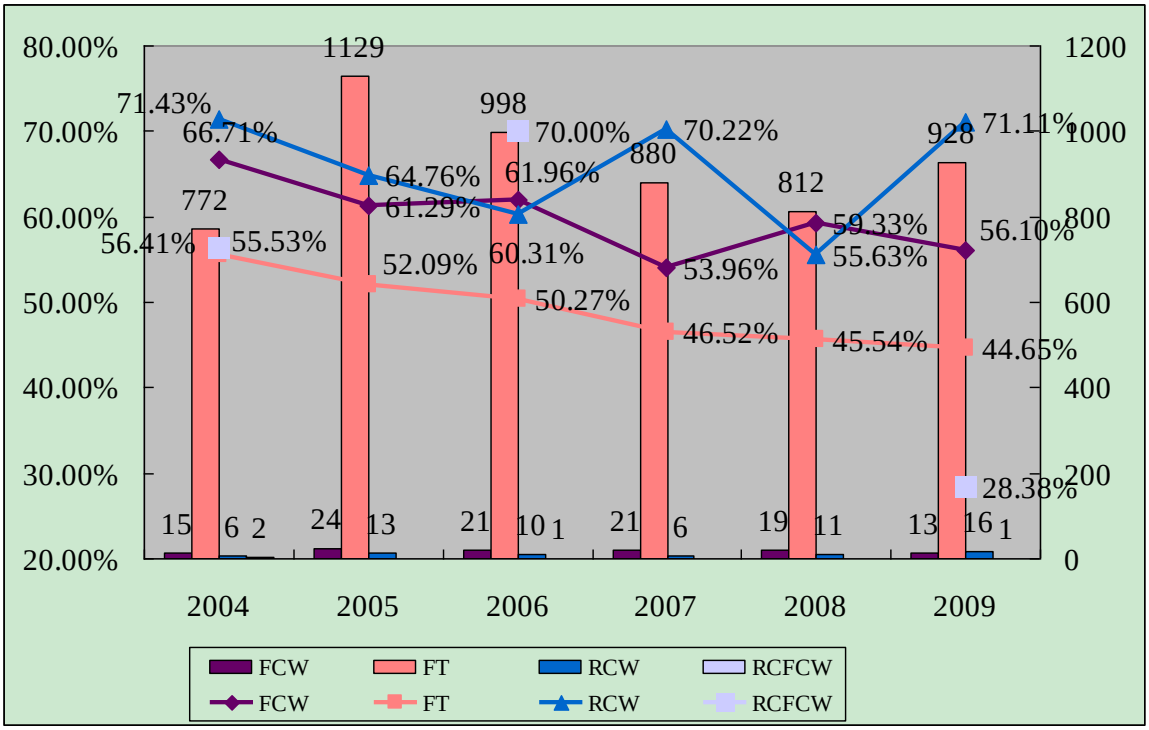

Figure 4-32 Deviation Analysis by Template for ELE Single-Item Standard Works

4.11.6.3 FTN Templates

There are 3,821 single-item standard FTN XPs from 2004 to 2009. The results of deviation analysis for different FTN templates are presented in Table 4-107, Table 4-108, Table 4-109 and Figure 4-33. It is observed that:

(1) The overall TPD and PPD of FTN templates are 73.55% and 63.33%, respectively.

(2) The most frequently used FTN template is the FT template (3,735 XPs), accounting for 97.75% of the total single-item FTN XPs (3,821 XPs).

(3) The top three highest TPDs are the RCW templates (78.13%), the FT templates (73.58%), and the FCW templates (72.63%).

(4) The highest PPD is the RCW template (70.00%) and the second highest is the RCFCW template (67.35%). The PPDs of the FT template (63.27%), the FCW template (63.77%), and the RCRCW (63.74%) are quite close.

(5) In general, the TPD of the FT template keeps stable from 75.85% in 2004 to 72.69% in 2008. The number of XPs applying the FT template varies largely, for example, 481 XPs in 2009 and 788 XPs in 2005.

(6) Overall, the average permit days and actual working days of FTN XPs increase from 2004 to 2009, with the former from 31 days to 46 days and the latter from 11 days to 17 days.

Table 4-107 Deviation Analysis by Template for FTN Single-Item Standard Works

TPD/PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
FCW	81.58%/ 70.63%/ 5	81.11%/ 71.69%/ 9	67.03%/ 55.05%/ 11	66.35%/ 58.76%/ 7	74.63%/ 67.84%/ 9	71.95%/ 68.16%/ 7	72.63%/ 63.77%/ 48
FT	75.85%/ 64.4%/ 538	75.41%/ 59.26%/ 788	74.66%/ 63.38%/ 727	72.92%/ 64.89%/ 531	72.69%/ 65.3%/ 670	68.96%/ 62.81%/ 481	73.58%/ 63.27%/ 3,735
RCW	82.22%/ 75.76%/ 1	61.46%/ 45.14%/ 3	73.91%/ 66.25%/ 5	85.48%/ 77.94%/ 5	78.26%/ 71.7%/ 1	88.27%/ 85.62%/ 3	78.13%/ 70.00%/ 18
RCFCW	40.38%/ 64.37%/ 5	74.19%/ 55.56%/ 1	56.76%/ 75%/ 2	78.95%/ 78.95%/ 1	-	62.24%/ 67.54%/ 3	56.06%/ 67.35%/ 12
RCRCW	68.49%/ 63.49%/ 4	70.97%/ 68.42%/ 2	-	21.05%/ 55.88%/ 1	56.76%/ 64.44%/ 1	-	64.02%/ 63.74%/ 8
Total	75.72%/ 64.46%/ 553	75.4%/ 59.35%/ 803	74.51%/ 63.28%/ 745	72.91%/ 64.89%/ 545	72.71%/ 65.34%/ 681	69.09%/ 63.04%/ 494	73.55%/ 63.33%/ 3,821

Table 4-108 Accumulative Template Days, Accumulative Permit Days and Accumulative Actual Working Days by Template for FTN Single-Item Standard Works

Template Days/ Permit Days/Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	228/143/ 42	487/325/ 92	634/465/ 209	532/434/ 179	469/370/ 119	303/267/ 85	2,653/2,004/ 726
FT	24,507/ 16,625/ 5,919	43,306/ 26,135/ 10,648	36,585/ 25,318/ 9,272	26,403/ 20,363/ 7,149	38,152/ 30,028/ 10,419	26,657/ 22,251/ 8,275	195,610/ 140,720/ 51,682
RCW	45/33/8	205/144/ 79	207/160/ 54	310/204/ 45	69/53/15	179/146/ 21	1,015/740/2 22
RCFCW	104/174/ 62	31/18/8	37/64/16	19/19/4	-	98/114/3 7	289/389/127
RCRCW	146/126/ 46	62/57/18	-	19/34/15	37/45/16	-	264/262/95
Total	25,030/ 17,101/ 6,077	44,091/ 26,679/ 10,845	37,463/ 26,007/ 9,551	27,283/ 21,054/ 7,392	38,727/ 30,496/ 10,569	27,237/ 22,778/ 8,418	199,831/ 144,115/ 52,852

Table 4-109 Average Template Days, Average Permit Days and Average Actual Working Days by Template for FTN Single-Item Standard Works

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	46/29/8	54/36/10	58/42/19	76/62/26	52/41/13	43/38/12	55/42/15
FT	46/31/11	55/33/14	50/35/13	50/38/13	57/45/16	55/46/17	52/38/14
RCW	45/33/8	68/48/26	41/32/11	62/41/9	69/53/15	60/49/7	56/41/12
RCFCW	21/35/12	31/18/8	19/32/8	19/19/4	-	33/38/12	24/32/11
RCRCW	37/32/12	31/29/9	-	19/34/15	37/45/16	-	33/33/12
Total	45/31/11	55/33/14	50/35/13	50/39/14	57/45/16	55/46/17	52/38/14

4.11.6.4 GAS Templates

There are 1,020 single-item standard GAS XPs from 2004 to 2009. The results of deviation analysis for different GAS templates are presented in Table 4-110, Table 4-111, Table 4-112 and Figure 4-34. It is observed that:

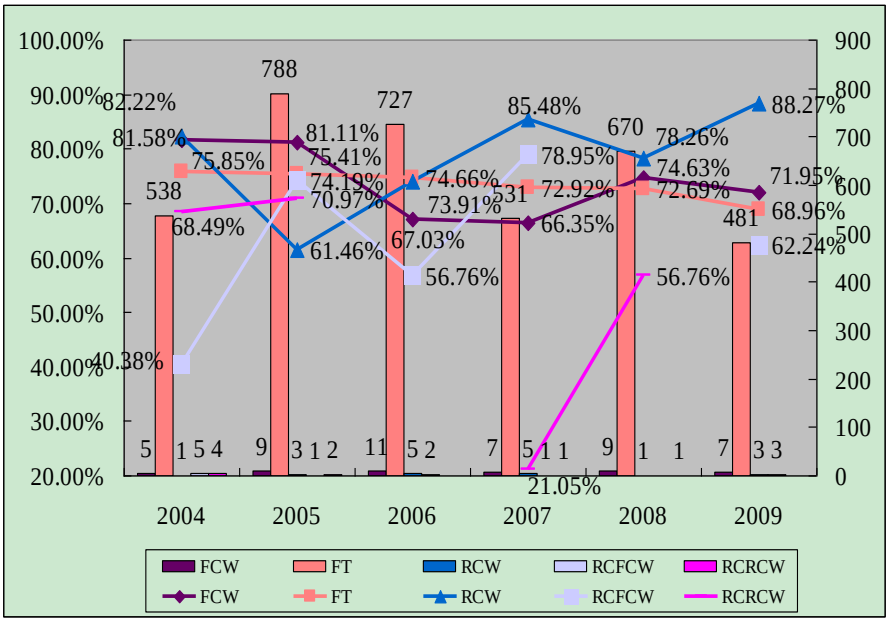

Figure 4-33 Deviation Analysis by Template for FTN Single-Item Standard Works

(1) The overall TPD and PPD of GAS templates are 49.23% and 39.98%, respectively.
(2) The most frequently used GAS template is the FT template (877 XPs), accounting for 86% of the total single-item GAS XPs.
(3) The top three highest TPDs are the FCW template (53.76%), the FT template (46.85%), and the RCW template (45.2%).
(4) The template with the highest PPD is the RCRCW template (77.07%) and the second highest is the RCFCW template (60.94%). However, only a few number of XPs applied these two kinds of templates, namely, 2 XPs for the former and 6 XPs for the latter.
(5) In general, the TPD and PPD of the FT template decrease, with the former from 59.75% in 2004 to 36.18% in 2009 and the latter from 50.81% in 2004 to 33.17% in 2009.
(6) The number of XPs applying the FT template varies largely, for example, 112 XPs in 2009 and 175 XPs in 2005.
(7) Overall, the average permit days and actual working days of GAS XPs increase from 2004 to 2008, with the former from 50 days to 80 days and the latter from 26 days to 53 days.

Table 4-110 Deviation Analysis by Template for GAS Single-Item Standard Works

TPD/PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
FCW	82.54%/ 32.66%/ 17	54.74%/ 21.98%/ 15	60.53%/ 47.2%/ 16	40.44%/ 18.59%/ 22	51.02%/ 37.22%/ 22	59.63%/ 52.25%/ 12	56.76%/ 33.26%/ 104
FT	59.75%/ 50.81%/ 113	54.7%/ 50.67%/ 175	58.75%/ 53.2%/ 153	38.33%/ 34.71%/ 159	38.33%/ 31.99%/ 165	36.18%/ 33.17%/ 112	46.85%/ 41.39%/ 877
RCW	66.01%/ 55.98%/ 6	68.5%/ 67.35%/ 4	51.5%/ 38.99%/ 3	48.27%/ 45.04%/ 3	30.48%/ 17.82%/ 9	46.08%/ 38.15%/ 6	45.2%/ 36.83%/ 31
RCFCW	-	73.58%/ 86.31%/ 1	-	-14.94%/ 48.19%/ 3	81.63%/ 90.82%/ 1	-420.%/ 32.99%/ 1	-6.78%/ 60.94%/ 6
RCRCW	-	-	-	-	28.42%/ 77.07%/ 2	-	28.42%/ 77.07%/ 2
Total	68.31%/ 48.33%/ 136	55.36%/ 47.83%/ 195	59.05%/ 51.63%/ 172	39.21%/ 31.53%/ 187	41.92%/ 34.44%/ 199	39.22%/ 36.65%/ 131	49.23%/ 39.98%/ 1,020

Table 4-111 Accumulative Template Days, Accumulative Permit Days and Accumulative Actual Working Days by Template for GAS Single-Item Standard Works

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	3,981/ 1,032/ 695	2,808/ 1,629/ 1,271	2,579/ 1,928/ 1,018	4,698/ 3,437/ 2,798	5,992/ 4,675/ 2,935	1,496/ 1,265/ 604	21,554/ 13,966/ 9,321
FT	6,487/ 5,308/ 2,611	8,271/ 7,596/ 3,747	7,592/ 6,693/ 3,132	10,030/ 9,475/ 6,186	10,302/ 9,341/ 6,353	6,153/ 5,876/ 3,927	48,835/ 44,289/ 25,956
RCW	509/ 393/ 173	254/ 245/ 80	200/ 159/ 97	868/ 817/ 449	1,486/ 1,257/ 1,033	1,621/ 1,413/ 874	4,938/ 4,284/ 2,706
RCFCW		212/ 409/ 56	-	87/ 193/ 100	49/ 98/ 9	50/ 388/ 260	398/ 1,088/ 425
RCRCW			-	-	190/ 593/ 136	-	190/ 593/ 136
Total	10,977/ 6,733/ 3,479	11,545/ 9,879/ 5,154	10,371/ 8,780/ 4,247	15,683/ 13,922/ 9,533	18,019/ 15,964/ 10,466	9,320/ 8,942/ 5,665	75,915/ 64,220/ 38,544

Table 4-112 Average Template Days, Average Permit Days and Average Actual Working Days by Template for GAS Single-Item Standard Works

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	234/61/41	187/109/85	161/121/64	214/156/127	272/213/133	125/105/50	207/134/90
FT	57/47/23	47/43/21	50/44/20	63/60/39	62/57/39	55/52/35	56/51/30
RCW	85/66/29	64/61/20	67/53/32	289/272/150	165/140/115	270/236/146	159/138/87
RCFCW	-	212/409/56	-	29/64/33	49/98/9	50/388/260	66/181/71
RCRCW	-	-	-	-	95/297/68	-	95/297/68
Total	81/50/26	59/51/26	60/51/25	84/74/51	91/80/53	71/68/43	74/63/38

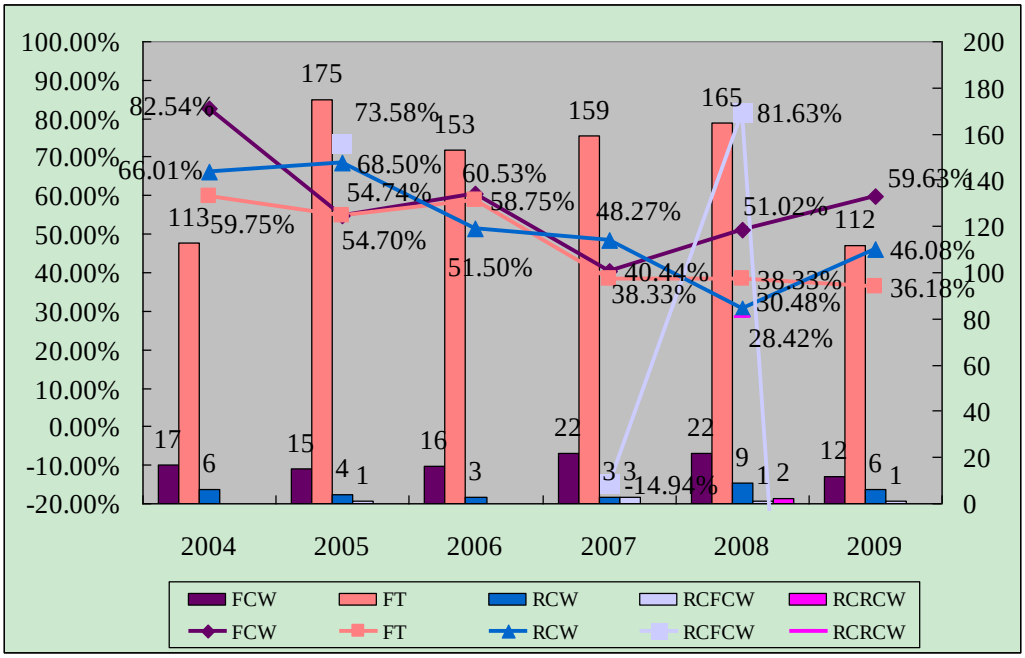

Figure 4-34 Deviation Analysis by Template for GAS Single-Item Standard Works

4.11.6.5 WSD Templates

There are 1,522 single-item standard WSD XPs from 2004 to 2009. The results of deviation analysis for different WSD templates are presented in Table 4-113, Table 4-114, Table 4-115 and Figure 4-35. It is observed that:

(1) The overall TPD and PPD of WSD templates are 51.3% and 44.45%, respectively.
(2) The most frequently used WSD template is the FT template (1,327 XPs), accounting for 87.19% of the total single-item WSD XPs (1,522 XPs).
(3) The TPD of the RCFCW is 59.8%, which is highest among all the templates and quite close to that of the RCRCW templates (59.57%).
(4) The PPD of the RCRCW templates is 78.41%, which is the highest among all the templates and quite close to that of the RCFCW templates (77.84%).
(5) In general, the TPD of the FT templates decreases from 55.56% in 2004 to 39.48% in 2009. The PPD of the FT template decreases from 55.56% in 2004 to 39.48% in 2009.

Table 4-113 Deviation Analysis by Template for WSD Single-Item Standard Works

TPD/PPD/Number of XPs	2004	2005	2006	2007	2008	2009	Total
FCW	2.53%/ 0.00%/ 1	57.94%/ 53.04%/ 29	39.33%/ 23.65%/ 24	67.04%/ 56.33%/ 12	57.28%/ 40.61%/ 41	37.93%/ 20.54%/ 23	50.54%/ 37.57%/ 130
FT	57.07%/ 55.56%/ 72	44.78%/ 41.78%/ 19	52.98%/ 49.88%/ 269	51.07%/ 45.29%/ 278	60.42%/ 50.85%/ 259	49.21%/ 39.48%/ 230	52.33%/ 46.19%/ 1,327
RCW	56.04%/ 44.7%/ 3	56.07%/ 54.81%/ 7	38.7%/ 31.15%/ 13	36.25%/ 29.19%/ 23	42.56%/ 34.43%/ 9	42.55%/ 36.16%/ 6	41.27%/ 34.61%/ 61
RCFCW	59.8%/ 77.84% /1	-	-	-	-	-	59.8%/ 77.84%/ 1
RCRCW	-	-	-	59.57%/ 78.41%/ 3	-	-	59.57%/ 78.41%/ 3
Total	56.24%/ 55.06%/ 77	47.66%/ 44.28%/ 255	49.98%/ 45.43%/ 306	50.14%/ 44.3%/ 316	59.21%/ 48.51%/ 309	46.96%/ 36.59%/ 259	51.3%/ 44.45%/ 1,522

Table 4-114 Accumulative Template Days, Accumulative Permit Days and Accumulative Actual Working Days by Template for WSD Single-Item Standard Works

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	79/ 77/ 77	4,175/ 3,739/ 1,756	2,975/ 2,364/ 1,805	974/ 735/ 321	5,173/ 3,721/ 2,210	3,546/ 2,770/ 2,201	16,922/ 13,406/ 8,370
FT	4,694/ 4,534/ 2,015	17,330/ 16,435/ 9,569	19,996/ 18,758/ 9,402	22,507/ 20,129/ 11,012	22,466/ 18,091/ 8,892	18,694/ 15,688/ 9,494	105,687/ 93,635/ 50,384
RCW	273/ 217/ 120	824/ 801/ 362	2,517/ 2,241/ 1,543	2,786/ 2,508/ 1,776	1,041/ 912/ 598	2,268/ 2,041/ 1,303	9,709/ 8,720/ 5,702
RCFCW	102/ 185/ 41	-	-	-	-	-	102/ 185/ 41
RCRCW	-	-	-	141/ 264/ 57	-	-	141/ 264/ 57
Total	5,148/ 5,013/ 2,253	22,329/ 20,975/ 11,687	25,488/ 23,363/ 12,750	26,408/ 23,636/ 13,166	28,680/ 22,724/ 11,700	24,508/ 20,499/ 12,998	132,561/ 116,210/ 64,554

(6) The number of XPs applying the FT template varies largely, for example, 19 XPs in 2005 and 278 XPs in 2007 but keeps stable from 269 XPs in 2006 to 230 XPs in 2009.
(7) Overall, the average template days of GAS works increase from 67 days in 2004 to 95 days in 2009.

Table 4-115 Average Template Days, Average Permit Days and Average Actual Working Days by Template for WSD Single-Item Standard Works

Template Days/ Permit Days/ Actual Working Days	2004	2005	2006	2007	2008	2009	Total
FCW	79/77/77	144/129/61	124/99/75	81/61/27	126/91/54	154/120/96	130/103/64
FT	65/63/28	79/75/44	74/70/35	81/72/40	87/70/34	81/68/41	80/71/38
RCW	91/72/40	118/114/52	194/172/119	121/109/77	116/101/66	378/340/217	159/143/93
RCFCW	102/185/41	-	-	-	-	-	102/185/41
RCRCW	-	-	-	47/88/19	-	-	47/88/19
Total	67/65/29	88/82/46	83/76/42	84/75/42	93/74/38	95/79/50	87/76/42

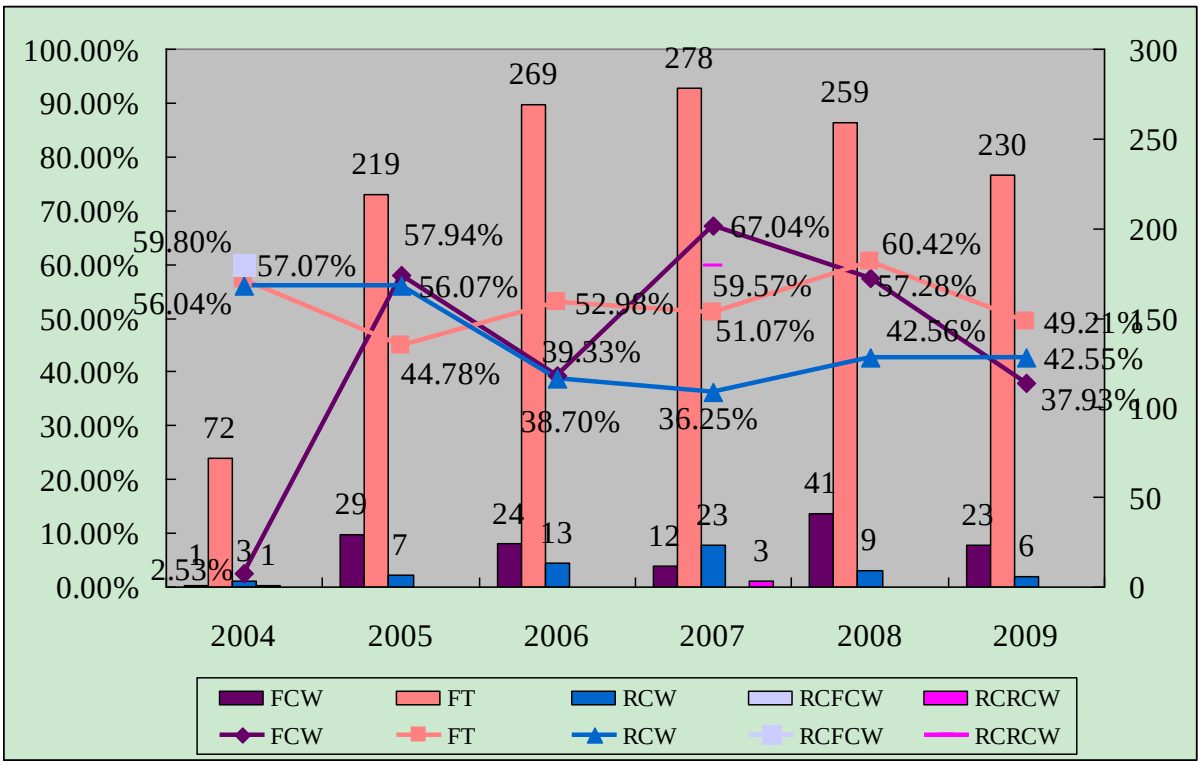

Figure 4-35 Deviation Analysis by Template for WSD Single-Item Standard Works

Chapter 5: Worksite Survey

5.1 Purposes of the Worksite Survey

As discussed in Chapter 3, the whole working period of a utility trench work is dependent on the work activities involved, their relationships, and the duration of each work activity. The duration of a work activity is determined by the scope/quantity of this activity and the production rate in carrying out this activity. The production rate is influenced by a wide range of factors, e.g., the number of labors and machines deployed, labor skills, and worksite conditions. The worksite conditions are characterized by the constraint on working time, climatic condition, hard rock condition, and site constraint. In current PPA templates, the effect of a worksite condition on the duration of a work activity is represented by the MFs. The duration of a work activity generally is determined by a number of variables including the road category, dimensions of the trench, equipment production rate, manual production rate, percentage of equipment work, and worksite conditions. The road category includes flexible carriageway, rigid carriageway, footway, road crossing of flexible carriageway, and road crossing of rigid carriageway. The trench dimensions include length, width, and depth. Regarding the worksite conditions, there are seven time constraints (A1-A7), one climatic condition (B1), four hard rock conditions (C1-C4), and two site constraints (D1 and D2).

The main purposes of the worksite survey are:

(1) To collect the actual data of the various predictor variables of the durations of the different activities associated with sample trench works in each utility trade;
(2) To collect the actual working times of the different activities associated with sample trench works in each utility trade;
(3) To conduct a comparative analysis of the survey data to those used in the current PPA templates or predicted by the PPA templates.
(4) To improve the accuracy of current PPA templates based on the results from (1) to (3).

5.2 Surveyed Worksites and Survey Periods

The work site survey started from September 27, 2010. The worksites surveyed include 1 DSD site, 2 ELE sites, 4 FTN sites, 1 GAS site and 1 WSD site. These utility works are in different trades and conducted by different UUs, use the typical programs of current PPA templates, and involve different work contents and MFs. The basic information of the plan items of the surveyed worksites is listed in Table 5-1 and the survey periods of these work plans are shown in Table 5-2.

5.3 Data Collected in the Worksite Survey

In worksite surveys, data related to the planning and construction of the utility trench works are collected. During the worksite survey, photos were taken and relevant records were made. The photos and records were submitted to HyD biweekly. The standard form of Site Survey Records is shown in Appendix 5-1. The data collected mainly include:

(1) Work plan, major work activities and their sequences
(2) Work contents and duration of each major work activity
(3) Resources (e.g., manpower, machine, material) deployed on the worksite
(4) Layout of the worksite
(5) Working hours and work idling
(6) Work restrictions on the worksite

5.4 Production Rate Analysis

5.4.1 Production Rates in Current PPA Templates

The production rates of various activities are crucial issues in determining the permit period of a trench work. Factors considered in calculating the production rates for different activities include excavation depth, resources deployed, road type, and construction method. In current PPA templates, utility works in each trade are categorized into various utility classes in terms of excavation depths and road types. For each class, the production rates of some major activities are given to trench work with a length of 10m or 50m respectively based on assumptions of resources deployed and construction method used. The working periods of these activities are calculated for trench works with the two lengths. The working periods of trench works less than 10m are the same as the working period of trench works of 10m. For trench works of with a length other than 10m and 50m, the working periods of different activities are calculated by a linear interpolation/extrapolation method. In current PPA templates, the production rates are calculated for Activities 041, 051, 071 and 072. They are described as follows:

- Activity 041: Break up road surface and remove spoil
- Activity 051: Excavate trench in soft material, install shoring and remove spoil
- Activity 071: Backfill trench and soil test
- Activity 072: Reinstatement

Table 5-1 Basic Information of Surveyed Plan Items

Plan ID	Item	Planned Duration[1]	Road Type	Length/Width/Depth (m)	Template	Multiplication Factor
DSD 562752	1	258	Footway	150/2/2	D3(e)	A7, B1, C4, D1
ELE 1023024	2	93	Footway	221.71/1/1	D3(b)	B1, D1, D2
ELE 1029365	1	60	Footway	42.16/1.2/1.2	D3(b)	B1, D1, D2
FTN 1010835	7	52	Footway	155.87/0.5/0.6	T3(a)	D1, D2
FTN 1010838	4	16	Carriageway	13.94/1/1.1	T7(a)	D1, D2
	5	26	Footway	51.45/0.5/0.6	T3(a)	D1, D2
	6	37	Footway	84.27/0.5/0.6	T3(a)	D1, D2
FTN 1019188	1	34	Footway	56.64/0.6/0.9	T3(a)	D1, D2
FTN 1020513	1	24	Footway	27.77/0.6/0.6	T3(a)	D1, D2
	2	38	Footway	105.03/0.6/0.6	T3(a)	D1, D2
	3	40	Footway	96.48/0.6/0.6	T3(a)	D1, D2
	4	34	Footway	68.87/0.6/0.6	T3(a)	D1, D2
GAS 1014498	1	161	Carriageway	125.71/1/1.5	T8(c)	D1, D2
WSD C000202[2]	N/A	593	Carriageway	N/A	N/A	N/A

Note: 1. The planned duration excludes all Sundays and public holidays.
2. WSD C000202 is a capital work that does not use the PPA template.

Table 5-2 Survey Periods of Selected Work Plans

Plan ID	Survey Period
DSD 562752	27/09/2010 – 18/12/2010
ELE 1023024	12/10/2010 – 18/12/2010
ELE 1029365	27/10/2010 – 30/10/2010
FTN 1010835	02/10/2010 – 22/11/2010
FTN 1010838	18/10/2010 – 18/12/2010
FTN 1019188	12/10/2010 – 13/10/2010
FTN 1020513	23/10/2010 – 02/12/2010
GAS 1014498	27/09/2010 – 11/12/2010
WSD C000202	15/12/2010 – 23/12/2010

5.4.2 **Production Rates based on Worksite Surveys**

The production rates of various activities are calculated for DSD (Table 5-3), ELE (Table 5-4) and FTN (Table 5-5) based on the worksite survey. The relevant trench depths, road types, construction methods, and average levels of resources deployed on site are also shown in these tables. The production rate distributions of Activity 051 for DSD work sites, Activities 041 (75mm concrete) and 051 for ELE worksites, and Activities 051 and 071 for FTN worksites are shown in Figure 5-1 to Figure 5-5. The production rates for GAS and WSD are not provided here since the collected data are too scarce to provide convincing values.

Table 5-3 Surveyed Production Rates of DSD Sites

Activity	Unit of Production Rate	DSD						
		Depth>1.2m and up to 2.5m						
		Number of Observations	Max.	Min.	Mean	Standard Deviation	Number of Machines	Number of Workers
041 Break up road surface (75mm concrete) and remove spoil	sq.m/day	13	43.2	19.44	32.63	6.71	pneumatic breaker (1)	4-5
051 Excavate trench in soft material, install shoring and remove spoil	cu.m/day	68	8.64	2	5.09	1.75	Backhoe (1)	4-5
071 Backfill trench and soil test	cu.m/day	28	18.14	3.31	7.13	3.05		4-5
072 Reinstatement (75mm concrete)	sq.m/day	3	144	118.8	128.1	13.84		4-5

Note: It is assumed that each day has 9 working hours.

Table 5-4 Surveyed Production Rates of ELE Sites

Activity	Unit of Production Rate	ELE						
		Depth up to 1.2m						
		Number of Observations	Max.	Min.	Mean	Standard Deviation	Number of Machines	Number of Workers
041 Break up road surface (75mm concrete) and remove spoil	sq.m/day	46	54	13.5	26.45	10.62	pneumatic breaker (1)	3-5
041 Remove paving block from road surface	sq.m/day	3	25.92	24	24.87	0.97		3-5
051 Excavate trench in soft material, install shoring and remove spoil	cu.m/day	50	10.8	1.23	5.59	2.33		3-5
071 Backfill trench and soil test	cu.m/day	14	27.54	4.74	16.07	7.18		3-5
072 Reinstatement (75mm concrete)	sq.m/day	3	142.94	105.3	120.64	19.76		3-5
072 Reinstatement (paving block)	sq.m/day	5	38.57	25.2	27.24	7.37		3-5

Note: It is assumed that each day has 9 working hours.

It is observed that the production rates calculated based on the survey have large deviations for most activities. This may be due to: (1) The sample size is small; (2) the workers are different from time to time and their skills are different; and (3) some works surveyed have a small scale (e.g. 1.0m × 0.6m), which is more likely to occur for Activities 041 and 051.

Table 5-5 Surveyed Production Rates of FTN Sites

Activity	Unit of Production Rate	FTN						
		Depth up to 1.2m						
		Number of Observations	Max.	Min.	Mean	Standard Deviation	Number of Machines	Number of Workers
041 Break up road surface (250mm concrete) and remove spoil	sq.m/day	4	15	10.38	12.5	1.9	pneumatic breaker (1)	7-8
041 Break up road surface (75mm concrete) and remove spoil	sq.m/day	17	103.4	18.7	64.4	26.5	pneumatic breaker (1)	7-8
041 Remove paving block from road surface	sq.m/day	7	54	27	41.81	11.19		7-8
051 Excavate trench in soft material, install shoring and remove spoil	cu.m/day	37	39.12	7.59	21.22	8.36	Backhoe (1)	7-8
071 Backfill trench and soil test	cu.m/day	37	69.43	11.43	36.7	16.67		7-8
072 Reinstatement (75mm concrete)	sq.m/day	10	186.3	91.8	138.37	33.47		7-8
072 Reinstatement (paving block)	sq.m/day	11	46.29	10.06	29	13		7-8

Note: It is assumed that each day has 9 working hours.

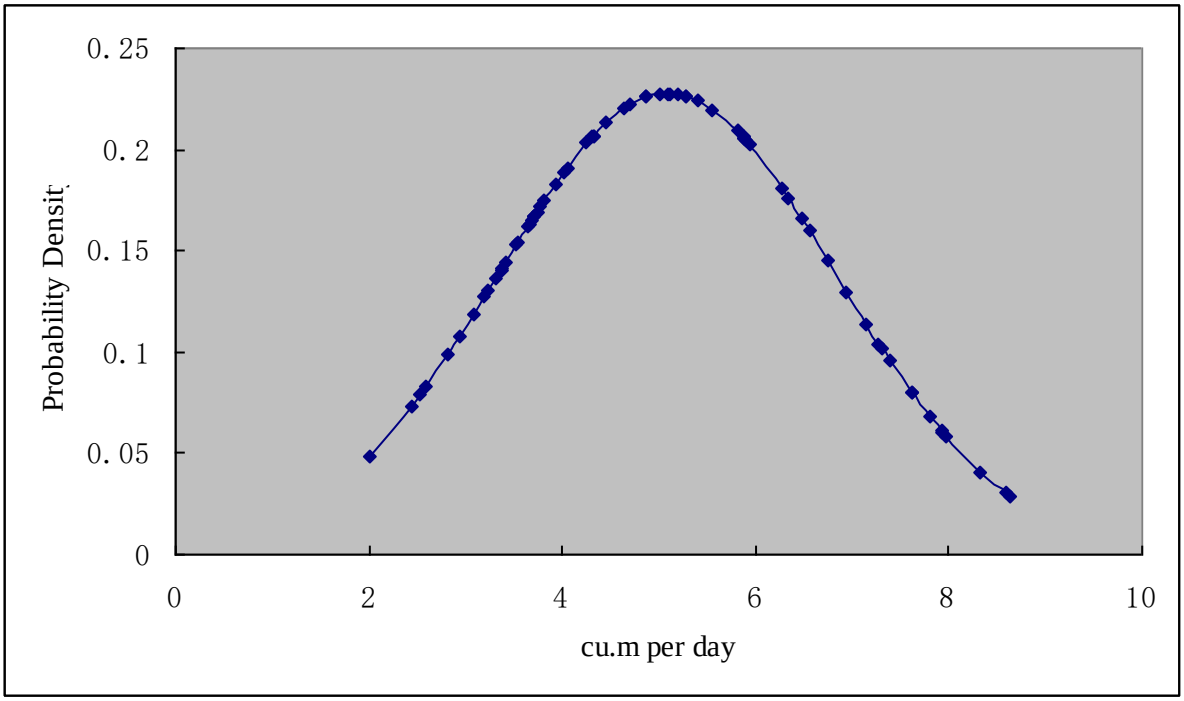

Figure 5-1 Production Rate Distribution of Activity 051 for DSD Worksites

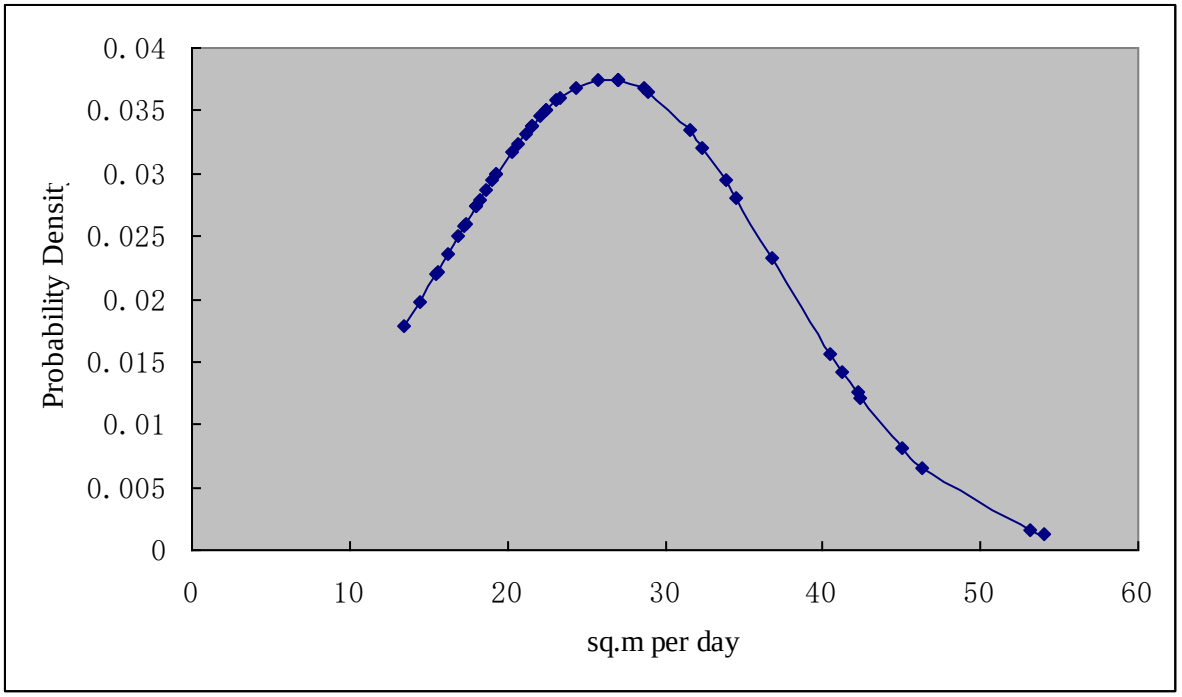

Figure 5-2 Production Rate Distribution of Activity 041 (75mm concrete) for ELE Worksites

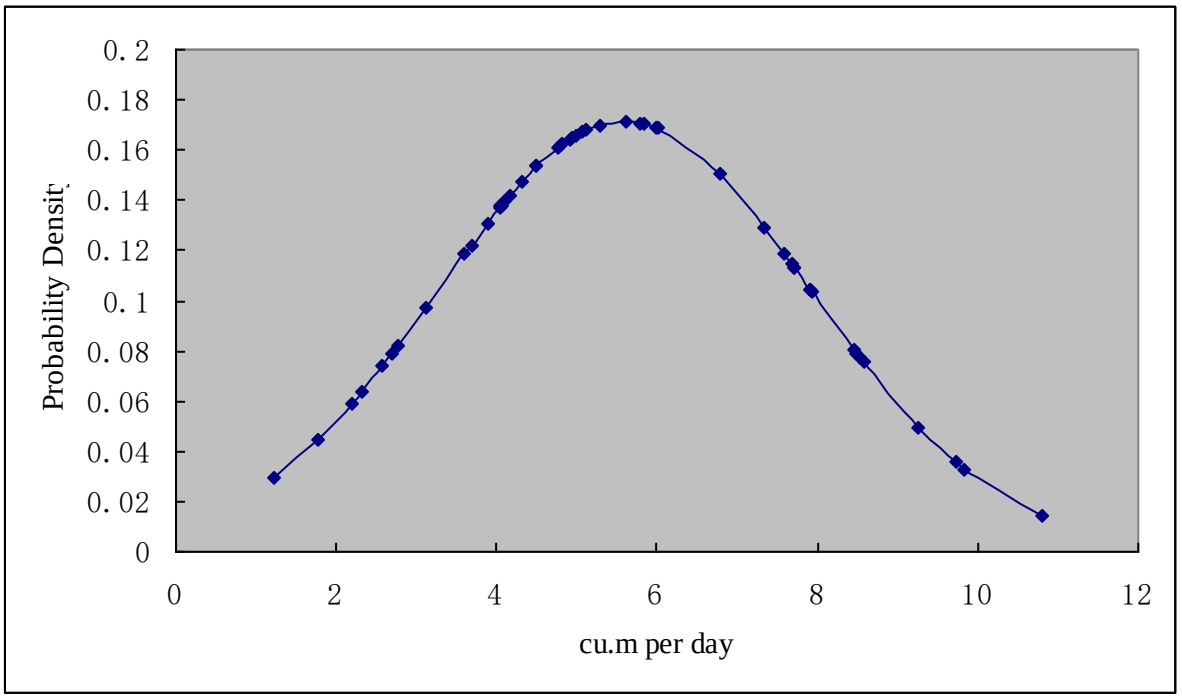

Figure 5-3 Production Rate Distribution of Activity 051 for ELE Worksites

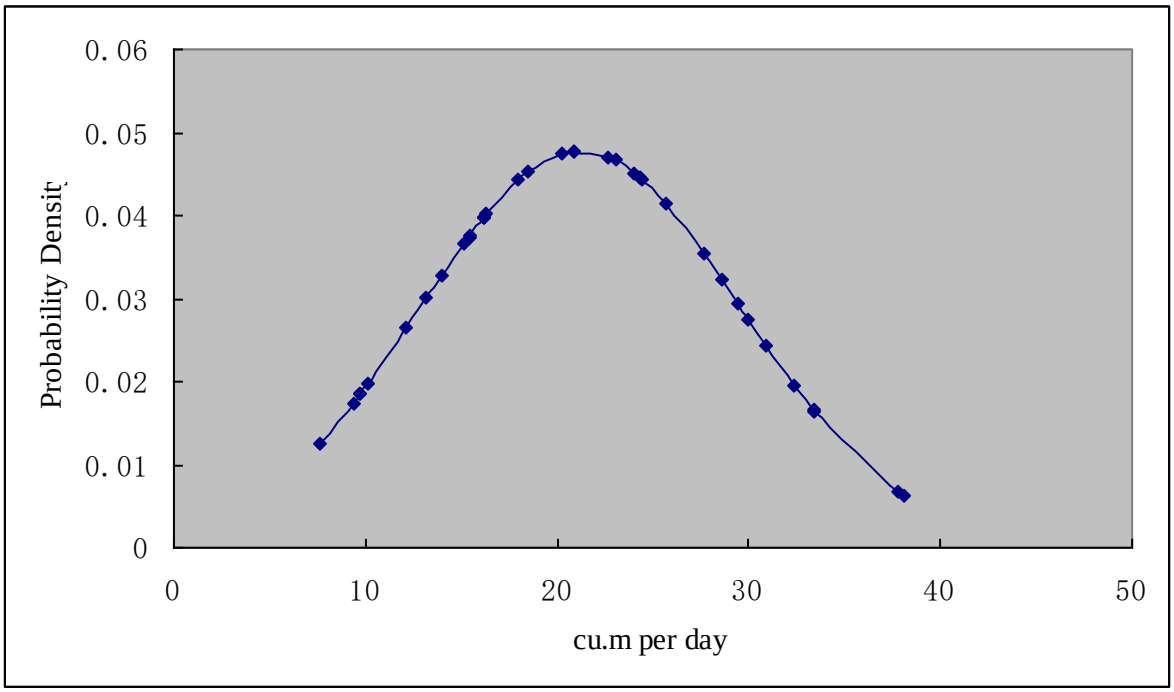

Figure 5-4 Production Rate Distribution of Activity 051 for FTN Worksites

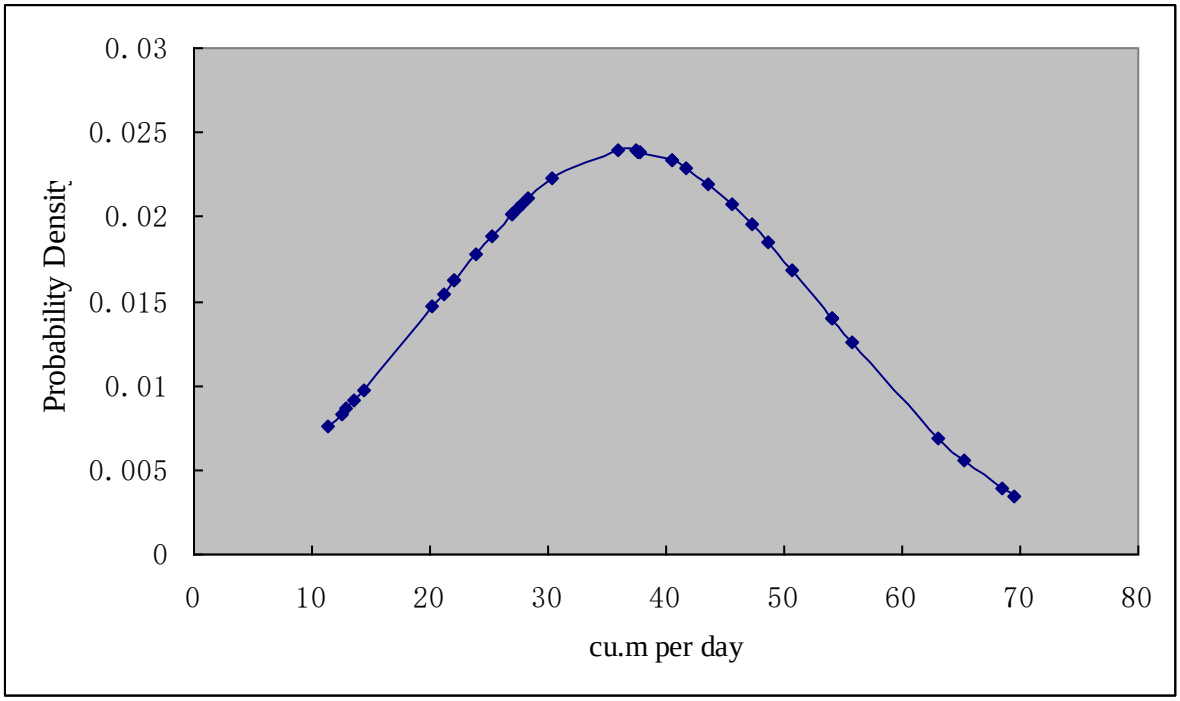

Figure 5-5 Production Rate Distribution of Activity 071 for FTN Worksites

5.4.3 Comparison of Production Rates

In the current PPA template, the production rates of various work activities for 10m and 50m work plans are given. The production rates are higher for 50m work plans than those for 10m. The working periods of these work activities for 10m and 50m work plans are calculated based on the given production rates. For working periods of work activities in work plans other than 10m and 50m, they are basically calculated by simple linear interpolation/ extrapolation based on the corresponding working periods calculated for the 10m and 50m work plans using the production rates given in the current PPA template. Therefore, for work plans with a length other than 10m and 50m, the production rates of various work activities can be reversely calculated from their working periods calculated by the interpolation/ extrapolation method. This in general assumes that the production rate of a work activity increases with the increase of the length of the work plan and that the level of resources deployed on site increases if the length of the work plan increases. However, these assumptions may not be valid. Nonetheless, it is observed in the survey that the resources deployed and the construction methods used on the worksites surveyed are similar to those assumed in the current PPA templates for 10m work plans. Table 5-6 compares the production rates calculated based on the survey to those used in the current PPA templates for 10m work plans. It is observed that the production rates based on the survey are higher than those given in the PPA templates for most activities except Activity 071 of DSD and Activity 041 of ELE.

For work activities that have higher observed production rates than those used in current PPA templates, the probable reasons are: (1) The "template" production rates in Table 5-6 are for 10m work plans. For work plans longer than 10m, the "template" production rates increase with the increase of the length. For example, the change of the production rate of Activity 041 in the PPA template as a function of the length is shown in Figure 5-6; (2) The resources deployed on the surveyed worksites are different from those assumed in the PPA templates. For example, the number of on-site workers of FTN 1010838 is two times that assumed in the PPA template; (3) The construction methods used in the surveyed worksites are different from those assumed in the PPA template. For example, an excavator was used on the worksite of FTN 1010838. However, in the calculation of the production rate in the PPA template, the use of an excavator is not assumed; and (4) In the worksite survey, the time of work preparation and waiting periods of some activities are not counted in the survey records.

Table 5-6 Comparison of Production Rates Based on Surveys to Those Used in PPA Templates

Activity	Unit	DSD		ELE		FTN	
		Survey	Template	Survey	Template	Survey	Template
041 Break up road surface (250mm concrete) and remove spoil	sqm/day	N/A	5	N/A	5	12.5	5
041 Break up road surface (75mm concrete) and remove spoil	sqm/day	32.63	30	26.45	30	64.4	30
041 Remove paving block from road surface	sqm/day	N/A	45	24.87	45	41.81	45
051 Excavate trench in soft material, install shoring and remove spoil	cum/day	5.09	4	5.59	4.5	21.22	4.5
071 Backfill trench and soil test	cum/day	7.13	8.5	16.07	8.5	36.7	8.5
072 Reinstatement (75mm concrete)	sqm/day	128.1	30	120.64	30	138.37	30
072 Reinstatement (paving block)	sqm/day	N/A	23	27.24	23	29	23

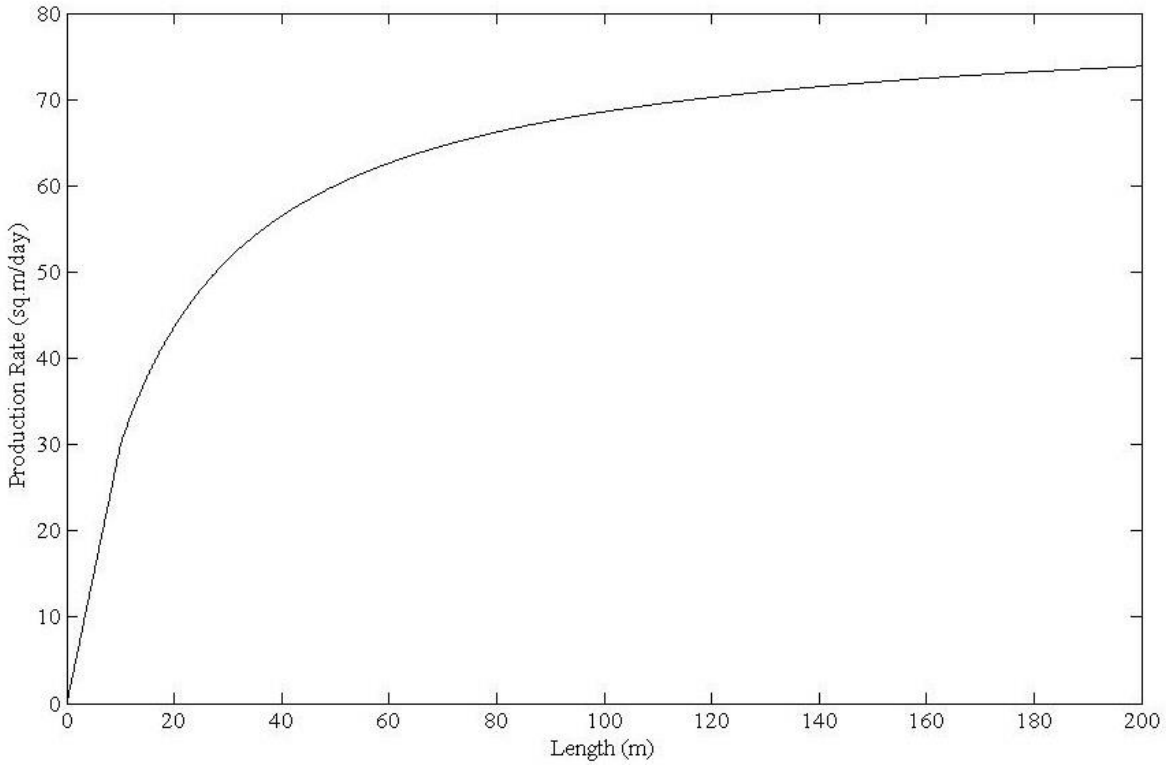

Figure 5-6 The Changes of Production Rate of Activity 041

For Activity 071 of DSD worksites and Activity 041 of ELE worksites that have smaller "survey" production rates, probable reasons are: (1) The surveyed DSD and ELE worksites are very congested; (2) Many works of the surveyed ELE worksites have small scales (e.g., 1.0m × 0.6m); and (3) The resources deployed on the surveyed ELE worksites are lower than those assumed in the PPA template. For example, the on-site workers of ELE 1023024 were three persons for most of the working periods while the template assumes 3-5 persons.

5.5 Analysis of Work Idling

A utility trench work should be completed in the shortest duration possible after its commencement. However, work activities are frequently suspended due to various reasons causing work idling. Work idling may be classified into two classes: (1) idling between two plan items; and (2) idling between two work sections/activities of a plan item. Regarding to class (1), it is common that the road surface is reinstated and opened to public after one plan item is completed. Thus, the traffic is not affected during the idling period between two plan items. For class (2), fencings or decks are usually used on the worksite such that the traffic is affected during the idling period.

In the worksite surveys, work idling periods (when there is no worker on the worksite during the working hour) are recorded. Except for time restrictions, the working hours of each working day are assumed to be 9 hours (i.e., 8:00am – 12:00pm and 1:00pm – 6:00pm). A working day is the daytime from Monday to Saturday excluding all public holidays. The idling records for different work plans are shown in Table 5-7.

A publicity board that specifies the idling reason may be provided on the worksite if the worksite has fencings or decks. The recorded reasons of work idling on the publicity board include:

- Awaiting completion of underground utilities detection;
- Awaiting completion of cables/pipes testing;
- Amid advance notification period to customers for temporary suspension of power supply before cables connection;
- Work obstructed by existing utilities plant, liaison in progress;
- Arranging temporary suspension of supply to customers for pipes connection; and
- Pressure test in progress.

Table 5-7 Records of Work Idling on the Surveyed Worksites

Plan ID	Survey Period	Survey Days[1]	Idling Period	Idling Days[1,2]	Idling belongs to Class (1)	Idling belongs to Class (2)	Fencings or Decks on Work Sites
DSD 562752	27/09/2010 – 18/12/2010	70	No	0			
ELE 1023024	12/10/2010 – 18/12/2010	58	12/10/2010 – 01/11/2010	17	√		
			13/11/2010	1		√	√
			19/11/2010 – 20/11/2010	2		√	√
			23/11/2010 – 27/11/2010	5		√	√
			30/11/2010 – 03/12/2010	4		√	√
			07/12/2010	1		√	√
			10/12/2010	1		√	√
			14/12/2010 – 18/12/2010	5		√	√
ELE 1029365	27/10/2010 – 30/10/2010	4	No	0			
FTN 1010835	02/10/2010 – 22/11/2010	43	19/10/2010 – 22/11/2010	30	√		
FTN 1010838[2]	18/10/2010 – 18/12/2010	54	24/10/2010 – 10/11/2010	15	√		√
			15/11/2010 – 22/11/2010	6	√		
			25/11/2010 – 18/12/2010	21	√		
FTN 1019188	12/10/2010 – 13/10/2010	1	No	0			
FTN 1020513	23/10/2010 – 02/12/2010	35	29/10/2010 – 01/11/2010	3		√	
			08/11/2010 – 12/11/2010	5		√	
			16/11/2010 – 02/12/2010	15	√		
GAS 1014498	27/09/2010 – 11/12/2010	64	07/10/2010 – 11/12/2010	55		√	
WSD C000202	15/12/2010 – 23/12/2010	8	18/12/2010	1		√	√

Note: 1. The survey days and idling days exclude all Sunday and public holidays.
2. The duration for concrete curing is excluded from work idling.

The survey records show that work idling is quite often in the utility trench works. The surveyed worksites are mostly located on footways and therefore the traffic impacts are mainly on the pedestrians. The traffic impacts would be more significant if the worksites are on carriageways. Besides, work idling without a publicity board is quite often. Possible reasons include poor resource planning, conflict with existing utility facilities, requirements by TD/Police/nearby shop owners, utility diversion, and inclement weather. Although the road surface is reinstated or decked in the period of work idling so that the traffic is not seriously affected, the intermittent constructions in the nearby streets within a long period may increase the public complaints.

5.6 Analysis of Working Periods

5.6.1 Comparison of the Working Periods of Activities

The working periods of Activities 041, 051, 071 and 072 are calculated for some surveyed worksites using "survey" and "template" production rates respectively and compared to the "working periods adjusted by MFs", which are the "template" working periods multiplied by the MFs. The results are shown in Table 5-8. It is observed that working periods calculated using the surveyed production rates are mostly smaller than those calculated using the production rates given in the current PPA templates. This indicates that the production rates used in the PPA templates are smaller than the real values. Moreover, when MFs are used, the difference between the working period calculated using the surveyed production rates and the working period based on the template becomes even bigger.

Table 5-8 Comparison of "Survey" "Template" and "Adjusted" Working Periods

Plan ID		**DSD 562752**	**ELE 1023024**	**FTN 1019188**	**FTN 1020513**			
Item		1	2	1	1	2	3	4
Multiplication Factor		A7, B1, C4, D1	B1, D1, D2	D1, D2	D1, D2	D1, D2	D1, D2	D1, D2
Length/Width/Depth (m)		150/2/2	221.71/1/1	56.64/ 0.6/0.9	27.77/ 0.6/0.6	105.03/ 0.6/0.6	96.48/ 0.6/0.6	68.87/ 0.6/0.6
041 (75mm)	Survey	9.1940	8.3822		0.2587	0.9785	0.8989	0.6416
	Template	5.1667	3.9797		1.5833	2.5212	2.4143	2.0692
	Adjusted	45.4670	3.9797		1.5833	2.5212	2.4143	2.0692
041 (paving block)	Survey			0.8128				
	Template			1.9163				
	Adjusted			1.9163				
051	Survey	113.4578	36.6873	1.3212	0.6478	2.4500	2.2506	1.6065
	Template	67.1210	23.3372	6.7322	4.8860	10.0856	9.4931	7.5797
	Adjusted	1683.3947	69.3115	18.1769	13.1922	27.2311	25.6314	20.4652
071	Survey	80.9958	12.7618	0.7639	0.3746	1.4166	1.3013	0.2464
	Template	35.6519	8.9229	3.5251	2.6540	5.1075	4.8279	3.9250
	Adjusted	313.73672	9.81519	3.5251	2.6540	5.1075	4.8279	3.9250
072 (75mm)	Survey	2.3419	1.8378		0.1204	0.4554	0.4184	0.2986
	Template	8.6667	9.2724		2.0833	4.8969	4.5763	3.5409
	Adjusted	76.26696	10.19964		2.0833	4.8969	4.5763	3.5409
072 (paving block)	Survey			1.1719				
	Template			3.0803				
	Adjusted			3.0803				

5.6.2 Comparison of the Working Periods of Plan Items

The working periods of the various plan items of the surveyed worksites are analyzed by comparing the proposed start date, end date and duration to the inspected actual start date, end date and duration. The results are shown in Table 5-9. The idling days during the survey period are also shown in this table.

Table 5-9 Actual Start Date, End Date and Duration of Surveyed Plan Items

Plan ID	Item	Proposed Start Date	Proposed End Date	Proposed Duration[1]	Actual Start Date	Actual End Date	Actual Duration[1]	Survey Period	Survey Days[1]	Idling Days[1]
DSD 562752	1	15/06/2010	28/04/2011	258	16/06/2010	N/A	N/A	27/09/2010 – 18/12/2010	70	0
ELE 1023024	2	06/11/2010	28/02/2011[2]	93	12/10/2010	N/A	N/A	12/10/2010 – 18/12/2010	58	36
ELE 1029365	1	06/09/2010	17/11/2010	60	09/10/2010	17/11/2010	24	27/10/2010 – 30/10/2010	4	0
FTN 1010835	7	06/09/2010	08/11/2010	52	11/10/2010	18/10/2010	6	11/10/2010 – 18/11/2010	6	0
FTN 1010838	4	25/10/2010	11/11/2010	16	11/11/2010	24/11/2010	12	11/11/2010 – 24/11/2010	12	6
	5	08/11/2010	07/12/2010	26	18/10/2010	21/10/2010	4	18/10/2010 – 21/10/2010	4	0
	6	18/10/2010	29/11/2010	37	18/10/2010	23/10/2010	6	18/10/2010 – 23/10/2010	6	1
FTN 1019188	1	20/09/2010	01/11/2010	34	11/10/2010	13/10/2010	3	12/10/2010 – 13/10/2010	2	0
FTN 1020513	1	18/10/2010	13/11/2010	24	05/11/2010	07/11/2010	3	05/11/2010 – 07/11/2010	3	0
	2	18/10/2010	30/11/2010	38	23/10/2010	16/11/2010	21	23/10/2010 – 16/11/2010	21	16
	3	18/10/2010	02/12/2010	40	02/11/2010	06/11/2010	5	02/11/2010 – 06/11/2010	5	0
	4	18/10/2010	25/11/2010	34	25/10/2010	28/10/2010	4	25/10/2010 – 28/10/2010	4	0
GAS 1014498	1	30/07/2010	12/02/2010	161	21/09/2010	N/A	N/A	27/09/2010 – 11/12/2010	64	55
WSD C000202	N/A	02/03/2009	02/03/2011	593	N/A	N/A	N/A	15/12/2010 – 23/12/2010	8	1

Note: 1. The proposed duration, actual duration, survey days and idling days exclude all Sunday and public holidays.

Table 5-9 shows that the actual working periods of the plan items are much shorter than the proposed durations. The probable reasons are summarized as follow:

(1) The working periods of the various work activities in the typical work programs calculated based on the PPA templates may not be accurate.
(2) The selection of work activities in the PPA templates may not be accordance with the actual work contents. For example, DSD 562752 only selected two work activities (052 and 063). This is obviously not realistic.
(3) The selection of MFs in the PPA templates may not be accordance with the actual work site conditions or the predefined values of the MFs in the PPA templates may not be accurate. For example, D2 [i.e., steep road (>1:10) / staircase] is a commonly selected

MF and the value of D2 is 1.8. However, it is observed that most surveyed worksites are flat and the selection of this MF is not appropriate.

(4) The resources deployed in the worksite are different from the assumptions in the PPA templates. For example, the excavator was used on the worksite of FTN 1010838. However, the calculation of the production rates in the PPA templates does not consider the use of the excavator.

Moreover, it is observed that the actual work schedules of some surveyed worksites are quite different from the work programs submitted to XPMS. Although the difference may be explained for some reasons (e.g., the restrictions of site conditions and resource planning and allocation), it may also indicate that the work programs submitted by UUs may not be the real work schedules to be carried out on the worksite.

Appendix 5-1 Site Survey Record Form

Surveyor Name: _____ Date: _____ Weather: _____

Arrival Time: _____ Leaving Time: _____

Site Survey Records

1. Work Plan Information

Plan ID (UU)	Visited Plan Item No	Road Type	Planned Duration	Item Start Date	Item Completion Date

Sheet No. of PPA Templates	Multiple Factors	Length/Width/Depth (m)	Road Name	Work Description

2. Work Site Information

Length/width of Working Sector (m)	Machine			Manpower	Working Duration
	Pick	Excavator	Frog Hammer		

3. Work Idling

Duration of Idling	Availability of Publicity Board	Reasons

Note: The reasons of idling include poor resource planning, requirement by TD/Police/nearby shop owners, utility diversion, inclement weather, etc.

4. Work Site Layout

5. Other Information

6. Activity Record

Activities	Start Time	End Time	Quantity	Manpower	Machine

Remarks:

Chapter 6: Improving Current Permit Period Assessment Templates

6.1 Overall Methodology for Improving Existing PPA Templates

One general principle in modifying existing PPA templates is to promote the efficiency of UUs in carrying out road excavation such that efficient UUs can complete their excavation works within the permit period calculated by the modified PPA templates if a reasonable level of resources is deployed on site. This modified PPA templates would also allow less efficient UUs to complete their works within the permit period if they improve work planning and scheduling, reducing work idling, and/or allocate relative more resources. In a word, the modified PPA templates would allow most of the UUs to complete their works within the permit period.

To minimize the impact on the operation of the current XPMS, it is recommended that the basic structure of the existing PPA templates will not be changed. Instead, the accuracy of existing PPA templates can be enhanced by modifying their input/predictor parameters. In this context, an overall methodology for improving existing PPA templates is shown in Figure 6-1. Basically, the following procedures will be taken to modify existing PPA templates for enhanced accuracy:

- Identifying predictor parameters in existing PPA templates;
- Determining reasonable permit period deviation (PPD) level;
- Preparing dataset for regression analysis; and
- Conducting regression analysis.

6.2 Identifying Predictor Parameters in Existing PPA Templates

In existing PPA templates, the base permit period of an excavation work is estimated based on the work activities involved, quantities of these work activities, and their logical relationships. The working period of each activity is estimated using a linear function of two predictor parameters: the slope and the intercept. For two sequential activities that have an overlap, the overlap is considered in the latter activity. Therefore, there are three parameters in predicting the working period of an activity: slope, intercept and overlap.

6.3 Determining Reasonable Permit Period Deviation Level

In view of the uncertainties of various factors that influence the working periods of various activities of an excavation work, a key issue is how to set a contingency on the working period as estimated by the PPA template. The contingency herein can be expressed as the deviation between the permit days and actual working days of an excavation work. Historical deviation levels are analyzed in order to determine reasonable PPD levels for the five trades (i.e., DSD, ELE, FTN, GAS, and WSD). Historical XPs can be classified into two categories: (1) XPs that have multiple plan items; and (2) XPs that have only a single plan item. Deviation analysis has been done for all XPs and for XPs of single plan item, respectively. As existing PPA templates were designed to estimate the permit periods of individual plan items and it is difficult to measure the overlap between different plan items, the results of deviation analysis for single-item XPs are used to determine the reasonable deviation level. In general, a reasonable deviation level should tight the permit period so as to minimize work idling and improve work efficiency and at the same time allow most of the UUs to complete their excavation works within the permit periods.

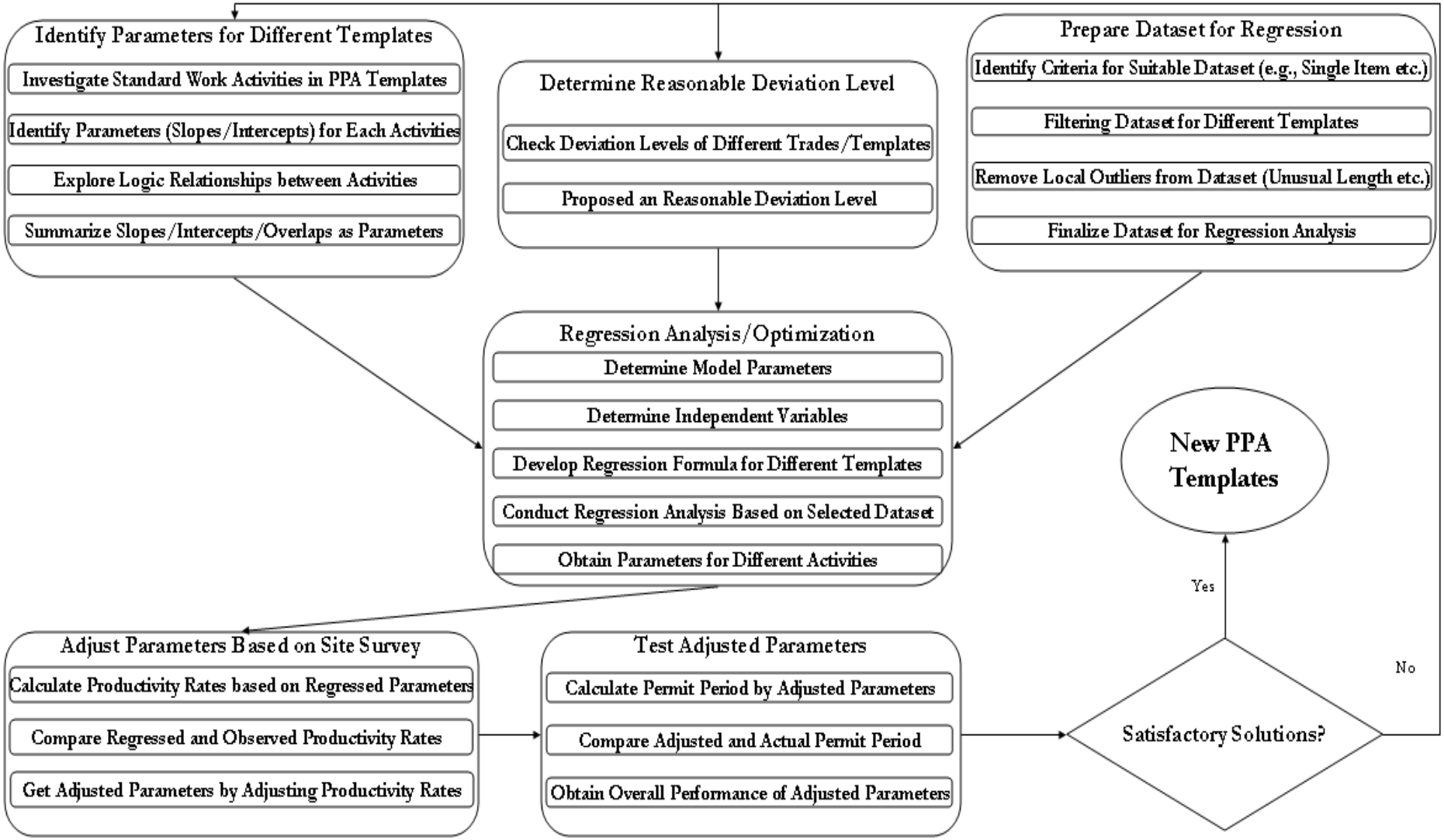

Figure 6-1 Methodology for Improving Existing PPA Templates

6.4 Preparing Dataset for Regression Analysis

To ensure data quality, the following steps are taken to prepare dataset for the regression analysis and the optimization of predictor parameters in the next stage:

(1) Identifying criteria for selecting suitable dataset;
(2) Determining the necessary information to be extracted from the database;
(3) Filtering the database to select the dataset for different PPA templates; and
(4) Removing local outliers from the remaining dataset and finalizing the dataset.

6.4.1 Identifying Criteria for Selecting Suitable Dataset

The following criteria are used to filter historical permit data:

(1) The XPs should be standard works in one single trade;
(2) The XPs should only be involved in one template type;
(3) The XPs should only have one plan item; and
(4) The XPs should have a trench length not less than 10m.

6.4.2 Determining the Necessary Information to be Extracted from the Database

The following information is extracted from the database:

(1) Permit ID;
(2) Actual working days;
(3) Permit working days;
(4) Length of trench;
(5) Trade type;
(6) Template type (footway, flexible carriageway, rigid carriageway, road crossing of flexible carriageway, and road crossing of rigid carriageway);
(7) Width/depth/material category (there are several categories for each kind of templates);
(8) Work activities used in the permit; and
(9) MFs used in the permit (working time constraints, rainy season, hard rock factor, congested underground condition, and steep road/stairs).

6.4.3 Filtering the Database to Select the Dataset for Different PPA Templates

Historical permit data are filtered using the aforementioned criteria. The remaining data are populated from the original database to form the dataset for different PPA templates.

6.4.4 Removing Local Outliers from the Remaining Dataset and Finalizing the Dataset

Outliers are removed from the remaining dataset. The remaining datasets for each template in each trade after filtering the database and removing the outliers are summarized in Table 6-1.

Table 6-1 Summary of Dataset for Regression Analysis

Template	DSD	ELE	FTN	GAS	WSD
Flexible Carriageway	8	113	48	104	130
Rigid Carriageway	11	62	18	31	61
Footway	30	5,519	3,735	877	1,327
Road Crossing of Flexible Carriageway	1	4	12	6	1
Road Crossing of Rigid Carriageway	0	0	8	2	3
Total	50	5,698	3,821	1,020	1,522

6.5 Conducting Regression Analysis

Regression analysis is a tool to measure the relationship between a dependent variable and one or more independent variables. It can indicate how the dependent variable changes when one of the independent variables is varied while others are fixed. Techniques for regression analysis can be classified into two categories: parametric and nonparametric. In a parametric

technique, the regression function is defined in terms of a finite number of unknown parameters that are estimated from the observed data. A nonparametric regression technique allows the regression function to lie in a specified set of functions, which may be infinite-dimensional. The purpose of regression analysis in this Study is to estimate the parameters (slope, intercept and overlap) that predict the working period of each work activity considered in a PPA templates. For example, as shown in Table 6-2, there are totally 31 parameters in the FTN footway template that need to be estimated by regression analysis: 7 slope parameters, 22 intercept parameters, and 2 overlap parameters. Multi-variable non-linear regression analysis technique is used in this Study.

Table 6-2 Predictor Parameters in FTN Footway Template

Activity Code	Slope	Intercept	Overlaps
011		FTNFP011B	
021		FTNFP021B	FTNFPOVLAP021
031	FTNFP031A	FTNFP031B	FTNFPOVLAP031
041	FTNFP041A	FTNFP041B	
051	FTNFP051A	FTNFP051B	
052		FTNFP052B	
053		FTNFP053B	
054		FTNFP054B	
055	FTNFP055A	FTNFP055B	
061	FTNFP061A	FTNFP061B	
062		FTNFP062B	
063		FTNFP063B	
064		FTNFP064B	
065		FTNFP065B	
066		FTNFP066B	
067		FTNFP067B	
071	FTNFP071A	FTNFP071B	
072	FTNFP072A	FTNFP072B	
073		FTNFP073B	
074		FTNFP074B	
075		FTNFP075B	
081		FTNFP081B	
Total	7	22	2

6.6 Upper and Lower Bounds of the Estimated Parameters

As discussed in previous sections, three parameters needs to be estimated (i.e., slope, intercept and overlap) for each activity considered in a PPA template. The estimated values of these parameters should be realistic. In this regard, upper and lower bounds are set up for these parameters. As these parameters are influenced by the production rate, the method to set up the upper and lower bounds are as follows:

(1) Using the mean value of the production rate observed in site survey as the maximum production rate and the production rate adopted in the existing PPA template as the minimum production rate.
(2) For an activity involving both slope and intercept, the lower and upper bounds of the two parameters are determined by comparing the values of the slope and intercept corresponding to a combination of the minimum and maximum production rates of 10m and 50 meter trench lengths.
(3) For an activity involving only the intercept but not the slope, the lower bound of the intercept is set to zero and the upper bound is set to the intercept value used in the existing PPA template.
(4) For the overlap of an activity, the lower bound is set to zero and the upper bound is set to the overlap value used in the existing PPA template.

6.7 Testing and Checking Adjusted Parameters

Once the parameters (i.e., slope, intercept and overlap) of all activities in a PPA template are estimated, these estimated values should be tested by checking the accuracy of the modified PPA template in estimating the permit period. This is done by examining the successful rate of the UUs in completing the excavation works within the permit periods as estimated by the modified PPA template if a particularly desirable PPD level is used. If the successful rate allows most of the UUs to complete their excavation works, then the modified PPA template is feasible. Otherwise, the regression analysis process will continue until a suitable set of parameter values are found.

Table 6-3 Predictor Parameters in FTN Templates

No.	Predictor Parameters	FCW	RCW	FT	RCFCW	RCRCW
1	011B	✓	✓	✓	✓	✓
2	021A	✓	✓	✓	✓	✓
3	021B	✓	✓	✓	✓	✓
4	021OVLP	✓	✓	✓	✓	✓
5	022B	✓	✓	×	✓	✓
6	031A	✓	✓	✓	✓	✓
7	031B	✓	✓	✓	✓	✓
8	031OVLP	✓	✓	✓	✓	✓
9	041A	✓	✓	✓	✓	✓
10	041B	✓	✓	✓	✓	✓
11	051A	✓	✓	✓	✓	✓
12	051B	✓	✓	✓	✓	✓
13	052B	✓	✓	✓	✓	✓
14	053B	✓	✓	✓	✓	✓
15	054B	✓	✓	✓	✓	✓
16	055A	✓	✓	✓	✓	✓
17	055B	✓	✓	✓	✓	✓
18	061A	✓	✓	✓	✓	✓
19	061B	✓	✓	✓	✓	✓
20	062B	✓	✓	✓	✓	✓
21	063B	✓	✓	✓	✓	✓
22	064B	✓	✓	✓	✓	✓
23	065B	×	×	✓	×	×
24	066B	×	×	✓	×	×
25	067B	✓	✓	✓	✓	✓
26	071A	✓	✓	✓	✓	✓
27	071B	✓	✓	✓	✓	✓
28	072A	✓	✓	✓	✓	✓
29	072B	✓	✓	✓	✓	✓
30	073B	✓	✓	✓	✓	✓
31	074B	✓	✓	✓	✓	✓
32	075B	✓	✓	✓	✓	✓
33	081B	✓	✓	✓	✓	✓

6.8 Improving the Templates in the Five Trades

Based on the above discussed methodology, the PPA templates in the five trades (i.e., DSD, ELE, FTN, GAS, and WSD) have been modified to improve their accuracy while considering the current situations of these trades and their particular requirements. Specifically, the input parameters (e.g., slopes, intercepts, and overlaps) of the PPA templates in the five trades are optimized to enhance the estimating accuracy of these templates through regression analysis of the 12,111 single-item standard XPs. Different templates of each trade, or the same type of templates of different trades may also have different parameters. For example, there are 31 and 39 parameters in the FTN and WSD footway templates, respectively, and 32 and 40

parameters in the FTN and WSD flexible carriageway templates, respectively. Table 6-3 shows the parameters of the different templates of FTN. The three numbers of each parameter, e.g., 011 of parameter 011B, indicate the work activity code, and the character following the three numbers, e.g., B of parameter 011B, indicates the type of the parameter. Parameters A, B, and OVLP mean slope, intercept, and overlap, respectively. In addition, in Table 6-3, "✓" means the regression analysis takes the corresponding work activity into consideration while "×" means the opposite.

As an example, Table 6-4 shows the values of the optimized predictor parameters of the FTN footway template. These predictor parameters are provided according to the categories of excavation works [(a) to (g)] in terms of width, depth, and number of ducts.

Table 6-4 Values of Optimized Predictor Parameters in FTN Footway Template

Predictor Parameters	**(a)**	**(b)**	**(c)**	**(d)**	**(e)**	**(f)**	**(g)**
Width	Up to 1m	Up to 1m	Up to 1m	Up to 1m	Up to 1.5m	Up to 1.5m	Up to 2m
Depth	Up to 1.2m	>1.2 - 2.5m	Up to 1.2m	>1.2 - 2.5m	Up to 1.2m	>1.2 - 2.5m	>1.2 - 2.5m
Number of Ducts	1 - 2	1 - 2	4 - 6	4 - 6	9 - 12	9 - 12	15 and above
FTNFP011B	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000
FTNFP021B	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000
FTNFPOVLP021	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000
FTNFP031A	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
FTNFP031B	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000
FTNFPOVLP031	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
FTNFP041A	0.0114	0.0114	0.0114	0.0114	0.0170	0.0170	0.0227
FTNFP041B	0.1894	0.1894	0.1894	0.1894	0.2841	0.2841	0.3788
FTNFP051A	0.0484	0.2212	0.0484	0.2212	0.0727	0.2787	0.3361
FTNFP051B	1.0156	3.0215	1.0156	3.0215	1.5234	4.0635	5.1055
FTNFP052B	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
FTNFP053B	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000
FTNFP054B	2.0000	2.0000	3.0000	3.0000	4.0000	4.0000	4.0000
FTNFP055A	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FTNFP055B	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
FTNFP061A	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
FTNFP061B	2.0000	2.0000	2.5000	2.5000	2.5000	2.5000	2.5000
FTNFT062B	5.0000	5.0000	5.0000	5.0000	5.5000	5.5000	5.5000
FTNFP063B	10.0000	10.0000	12.0000	12.0000	13.0000	13.0000	13.0000
FTNFP064B	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
FTNFP065B	2.0000	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000
FTNFP066B	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
FTNFP067B	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000
FTNFP071A	0.0021	0.0623	0.0021	0.0623	0.0281	0.1010	0.1347
FTNFP071B	1.9792	1.3773	1.9792	1.3773	1.7188	1.6840	2.2454
FTNFP072A	0.0077	0.0077	0.0077	0.0077	0.0115	0.0115	0.0153
FTNFP072B	0.1276	0.1276	0.1276	0.1276	0.1913	0.1913	0.2551
FTNFP073B	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000	1.5000
FTNFP074B	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000
FTNFP075B	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000
FTNFP081B	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

The modified PPA templates for the five trades are in Microsoft Excel spreadsheets, which are attached to the report of this Study. In the following sections, the estimating accuracy of the modified PPA templates is compared with that of current PPA templates used by HyD. In this comparison, single-item standard XPs in the five trades are used.

6.9 Deviation Analysis of Current Templates by Permit Days and Template Days

The "permit days" means the permit duration in days granted by HyD for a particular XP while the "template days" means the duration in days calculated by the corresponding existing PPA template. In this context, the "PPD" is the same as the type 2 relative PPD defined in Section 4.3. A similar definition is used to calculate the "TPD", in which the "permit days" is replaced by the "template days" (See Section 4.11.1).

There are 12,111 single-item standard XPs from 2004 to 2009 in the five trades. The overall PPDs of these XPs by permit days and template days in the five trades are shown in Table 6-5. The TPDs of current templates of different road categories are shown in Table 6-6. It is observed that:

(1) The PPD and TPD of all single-item standard XPs in the five trades are 46.57% and 56.44%, respectively. The latter is much higher than the former.
(2) For all the five trades, the TPDs are much larger than the PPDs.

Table 6-5 PPDs and TPDs of Current Templates in Each Trade

Trade	Number of XPs	Actual Working Days	Permit Days	PPD	Template Days	TPD
DSD	50	2,113	4,842	56.36%	7,047	70.02%
ELE	5,698	164,327	274,017	40.03%	324,785	49.40%
FTN	3,821	52,852	144,115	63.33%	199,831	73.55%
GAS	1,020	38,544	64,220	39.98%	75,915	49.23%
WSD	1,522	64,554	116,210	44.45%	132,561	51.30%
Total	12,111	322,390	603,404	46.57%	740,139	56.44%

Table 6-6 TPDs of Current Templates in Each Road Category

Road Category	TPD/Number of XPs				
	DSD	ELE	FTN	GAS	WSD
FCW	57.99%/8	59.12%/113	72.63%/48	56.76%/104	50.54%/130
FT	81.48%/30	48.89%/5,519	73.58%/3,735	46.85%/877	52.33%/1,327
RCW	54.41%/11	65.37%/62	78.13%/18	45.20%/31	41.27%/61
RCFCW	77.63%/1	42.86%/4	56.06%/12	-6.78%/6	59.80%/1
RCRCW	-	-	64.02%/8	28.42%/2	59.57%/3
Total	70.02%/50	49.40%/5,698	73.55%/3,821	49.23%/1,020	51.30%/1,522

6.10 Performance of the Modified Templates

Table 6-7 shows the overall performance of the modified PPA templates. In summary:

(1) The TPDs of single-item standard works of the five trades range from 37.04% (FTN) to 55.74% (DSD), with an overall PPD by template days of 38.97% for the five trades.
(2) The successful rates of single-item standard works of the five trades range from 80% (DSD and WSD) to 89% (ELE), with an overall successful rate of 86% for the five trades. Herein, the successful rate refers to the percentage of single-item standard works that can be completed within the template days.

Table 6-7 Overall Performance of the Modified Templates

Trade	Road Category	Number of Samples	Successful Cases	Successful Rate	Template Days (Modified)	Actual Working Days	TPD (Modified)
DSD	FCW	8	6	75%	669	413	38.27%
	RCW	11	9	82%	1,480	967	34.66%
	FT	29	23	79%	2,475	681	72.48%
	RCFCW	1	1	100%	71	17	76.06%
	Subtotal	**49**	**39**	**80%**	**4,695**	**2,078**	**55.74%**
ELE	FCW	113	109	96%	7,018	3,284	53.21%
	RCW	62	59	95%	4,768	1,794	62.37%
	FT	5,519	4,875	88%	255,918	159,173	37.80%
	RCFCW	4	4	100%	212	76	64.15%
	Subtotal	**5,698**	**5,047**	**89%**	**267,916**	**164,327**	**38.66%**
FTN	FCW	48	42	88%	1,251	726	41.97%
	RCW	18	17	94%	510	222	56.47%
	FT	3,735	3,145	84%	81,841	51,682	36.85%
	RCFCW	12	9	75%	193	127	34.20%
	RCRCW	8	6	75%	147	95	35.37%
	Subtotal	**3,821**	**3,219**	**84%**	**83,942**	**52,852**	**37.04%**
GAS	FCW	104	95	91%	21,593	9,321	56.83%
	RCW	31	28	90%	4,530	2,706	40.26%
	FT	877	737	84%	40,734	25,956	36.28%
	RCFCW	6	3	50%	465	425	8.60%
	RCRCW	2	1	67%	249	136	45.38%
	Subtotal	**1,020**	**864**	**85%**	**67,571**	**38,544**	**42.96%**
WSD	FCW	130	102	78%	13899	8,370	39.78%
	RCW	61	47	77%	7841	5,702	27.28%
	FT	1327	1068	80%	82127	50,384	38.65%
	RCFCW	1	1	100%	70	41	41.43%
	RCRCW	3	3	100%	130	57	56.15%
	Subtotal	**1,522**	**1,221**	**80%**	**104,067**	**64,554**	**37.97%**
Total		**12,110**	**10,390**	**86%**	**528,191**	**322,355**	**38.97%**

6.10.1 Performance of the Modified DSD Templates

The performance of the modified DSD templates is shown in Table 6-8. The deviations of some modified DSD templates are still quite high compared to other trades: FT(c) (82.85%), RCFCW(a) (76.06%), FT(e) (74.57%), FCW(g) (73.03%), and RCW(c)(68.29%). However, the template days of all modified DSD templates are smaller than those of the existing DSD templates and consequently the deviations of all modified DSD templates are smaller than those of the existing DSD templates. For example, for the existing DSD templates, the deviations of FT(c), RCFCW(a), FT(e), FCW(g) and RCW(c) are 85.92%, 77.63%, 81.77%, 80.17% and 89.68%, respectively.

It is also noted that the various DSD templates have only a small number of standard XPs. Many of them only have 1-3 standard XPs. This may be inadequate for statistical analysis. Nonetheless, the reasons of high deviations of some DSD templates are explored by using FT(c) and FT(e) as examples. FT(c) has 7 standard XPs, the details of which are presented in Table 6-9. It is observed that the template days of the modified template are close to the permit days issued by HyD based on expert experiences except for permits 4 and 5. Possible reasons for these two permits may be explained as follows:

(1) In permit 4, the UU applied MFs including time constraint, rainy season and congested underground conditions. The template days calculated by the modified template with and

without using MFs are 145 days and 55 days respectively. It is seen that the template days (55 days) calculated by the modified template without using MFs is much closer to the actual working days (19 days) and the permit days (60 days) issued by HyD than those calculated by the existing template.

(2) In permit 5, the UU applied all MFs including time constraint (A1), rainy season, hard rock factor (C3), congested underground condition, and steep road. The template days calculated by the modified template with and without using MFs are 376 days and 48 days, respectively. It is seen that the template days (48 days) calculated by the modified template without using MFs is much closer to the actual working days (47 days) and the permit days (78 days) issued by HyD than those calculated by the existing template.

(3) It may be concluded that the accuracy of the FT(c) and FT(e) templates can be further improved if MFs are not used.

Table 6-8 Performance of the Modified DSD Templates

Road Category	Template Type	Number of Samples	Successful Cases	Successful Rate	Template Days (Modified)	Actual Working Days	TPD (Modified)
FCW	(c)	3	2	67%	277	188	32.13%
	(e)	2	2	100%	91	31	65.93%
	(f)	2	1	50%	212	170	19.81%
	(g)	1	1	100%	89	24	73.03%
	Subtotal	**8**	**6**	**75%**	**669**	**413**	**38.27%**
RCW	(c)	1	1	100%	41	13	68.29%
	(e)	2	2	100%	269	126	53.16%
	(f)	7	6	86%	841	447	46.85%
	(g)	1	0	0%	329	381	-15.81%
	Subtotal	**11**	**9**	**82%**	**1480**	**967**	**34.66%**
FT	(a)	3	0	0%	65	89	-36.92%
	(c)	7	6	86%	898	154	82.85%
	(d)	2	1	50%	88	42	52.27%
	(e)	16	15	94%	1207	307	74.57%
	(f)	1	1	100%	217	89	58.99%
	Subtotal	**29**	**23**	**79%**	**2475**	**681**	**72.48%**
RCFCW	(a)	1	1	100%	71	17	76.06%
	Subtotal	**1**	**1**	**100%**	**71**	**17**	**76.06%**
Total		49	39	80%	4695	2078	55.74%

Table 6-9 Performance of the Modified DSD FT(c) Template

No.	Actual Working Days	Permit Days	PPD	Template Days (Existing)	TPD (Existing)	Template Days (Modified)	TPD (Modified)
1	5	85	94.12%	115	95.65%	90	94.44%
2	6	65	90.77%	65	90.77%	46	86.96%
3	2	30	93.33%	44	95.45%	32	93.75%
4	19	60	68.33%	180	89.44%	145	86.90%
5	47	78	39.74%	427	88.99%	376	87.50%
6	29	35	17.14%	35	17.14%	25	-16.00%
7	46	189	75.66%	228	79.82%	184	75.00%
Total	154	542	71.59%	1094	85.92%	898	82.85%

Table 6-10 shows there are 16 XPs in FT(e) template and it is easy to find that overall performance of the modified templates is better than that of the permit days issued by HyD based on expert experiences, which is much better than that of the existing PPA templates. It is observed that the template days of the modified template are closer to the actual working days than permit days issued by HyD based on expert experience except for permits 5 and 16.

Possible reasons for these two permits may be explained as follows:

(1) In permit 5, the UU applied MFs including rainy season and congested underground conditions. The template days calculated by the modified template with and without using MFs are 108 days and 80 days respectively. It is seen that the template days (80 days) calculated by the modified template without using MFs is much closer to the actual working days (65 days) and the permit days (78 days) issued by HyD than those calculated by the existing template.

(2) In permit 16, the UU applied MFs including rainy season and congested underground conditions. The template days calculated by the modified template with and without using MFs are 267 days and 44 days respectively. It is seen that the template days (44 days) calculated by the modified template without using MFs is much closer to the actual working days (50 days) and the permit days (55 days) issued by HyD than those calculated by the existing template.

Table 6-10 Performance of the Modified DSD FT(e) Template

No.	Actual Working Days	Permit Days	PPD	Template Days (Existing)	TPD (Existing)	Template Days (Modified)	TPD (Modified
1	10	74	86.49%	74	86.49%	52	80.77%
2	6	63	90.48%	63	90.48%	44	86.36%
3	8	29	72.41%	29	72.41%	17	52.94%
4	29	113	74.34%	118	75.42%	81	64.20%
5	**65**	**78**	**16.67%**	**146**	**55.48%**	**108**	**39.81%**
6	41	93	55.91%	93	55.91%	67	38.81%
7	9	80	88.75%	80	88.75%	59	84.75%
8	11	83	86.75%	83	86.75%	52	78.85%
9	17	53	67.92%	54	68.52%	38	55.26%
10	11	54	79.63%	54	79.63%	34	67.65%
11	12	78	84.62%	78	84.62%	50	76.00%
12	6	70	91.43%	70	91.43%	48	87.50%
13	4	112	96.43%	112	96.43%	83	95.18%
14	22	43	48.84%	54	59.26%	38	42.11%
15	6	218	97.25%	218	97.25%	169	96.45%
16	**50**	**55**	**9.09%**	**358**	**86.03%**	**267**	**81.27%**
Total	307	1296	76.31%	1684	81.77%	1207	74.57%

6.10.2 Performance of the Modified ELE Templates

The overall successful rate and deviation of the modified ELE templates are 89% and 38.66%, respectively. The details are shown in Table 6-11. According to Table 6-11, it is observed that:

(1) The deviations of different templates range largely, from 19.70% of RCFCW (g) to 81.43% of RCW(e).

(2) The overall deviations of the modified FCW templates (53.21%) and the modified RCW templates (62.37%) are much higher than that of the modified FT templates (37.80%). Moreover, the overall deviation of the modified RCFCW templates is 64.15%, which is the highest value among all the templates.

(3) One possible reason for large fluctuation of the overall deviations may be the small number of some specific templates. For example, there are only one XP in each of the RCFCW templates. For those templates with at least 10 XPs, the maximum and minimum deviations are 81.43% [RCW(e)] and 31.07% [FT(b)], respectively.

(4) The successful rates of all the templates are higher than 83%. For those templates with at least 10 XPs, the maximum and minimum successful rates are 83% [FCW(d)] and 100% [FCW(b), FCW(c), FCW(g), RCW(e) and RCW(g)], respectively.

Table 6-11 Performance of the Modified ELE Templates

Road Category	Template Type	Number of Samples	Successful Cases	Successful Rate	Template Days (Modified)	Actual Working Days	TPD (Modified)
FCW	(a)	4	4	100%	149	81	45.64%
	(b)	47	46	98%	2,381	1,165	51.07%
	(c)	13	13	100%	828	260	68.60%
	(d)	12	10	83%	698	397	43.12%
	(e)	17	16	94%	1,104	594	46.20%
	(f)	4	4	100%	206	85	58.74%
	(g)	16	16	100%	1,652	702	57.51%
	Subtotal	**113**	**109**	**96%**	**7,018**	**3,284**	**53.21%**
RCW	(a)	1	1	100%	22	18	18.18%
	(b)	35	32	91%	1,685	1,026	39.11%
	(d)	4	4	100%	441	103	76.64%
	(e)	11	11	100%	1,217	226	81.43%
	(f)	1	1	100%	57	24	57.89%
	(g)	10	10	100%	1,346	397	70.51%
	Subtotal	**62**	**59**	**95%**	**4,768**	**1,794**	**62.37%**
FT	(a)	893	812	91%	29,745	17,160	42.31%
	(b)	3,364	2,900	86%	142,462	98,205	31.07%
	(c)	47	42	89%	3,815	1,934	49.31%
	(d)	805	747	93%	43,680	23,188	46.91%
	(e)	188	173	92%	15,195	7,956	47.64%
	(f)	44	39	89%	2,600	1,363	47.58%
	(g)	178	162	91%	18,421	9,367	49.15%
	Subtotal	**5,519**	**4,875**	**88%**	**255,918**	**159,173**	**37.80%**
RCFCW	(b)	1	1	100%	42	4	90.48%
	(e)	1	1	100%	52	13	75.00%
	(f)	1	1	100%	52	6	88.46%
	(g)	1	1	100%	66	53	19.70%
	Subtotal	**4**	**4**	**100%**	**212**	**76**	**64.15%**
Total		**5,698**	**5,047**	**89%**	**267,916**	**164,327**	**38.66%**

6.10.3 Performance of the Modified FTN Templates

The overall successful rate and deviation of modified FTN templates are 84% and 37.04%, respectively. The details are shown in Table 6-12. It is observed that:

(1) The deviations of different modified templates range largely, from -53.42% of FCW (e) to 89.66% of RCRCW(b).

(2) The overall deviations of the modified FCW templates (41.97%), the modified FT templates (36.85%), the modified RCFCW templates (34.20%), and the modified RCRCW templates (35.37%) are quite close to each other, ranging from 34% to 42%. The overall deviation of the modified RCW templates is 56.47%.

(3) As mentioned before, one possible reason of large fluctuation may be that there are a small number of XPs applying some templates. For templates with at least 10 permits, the maximum and minimum deviations are 53.35% [RCW(a)] and 36.83% [FT(a)], respectively.

(4) The successful rates of different road categories range largely, from 75% of RCRCW and RCFCW to 94% of RCW. In particular, the successful rates of RCFCW and RCRCW are low partially due to that the maximum length of road crossing is assumed to be 3.5m.

6.10.4 Performance of the Modified GAS Templates

The overall successful rate and deviation of proposed GAS templates are 85% and 42.90%, respectively. The details are shown in Table 6-13. According to Table 6-13, it is observed that:

(1) The deviations of different modified templates range largely, from -100.00% of RCRCW(b) to 76.27% of RCFCW(e).
(2) The overall deviation ranges largely by road category, from 8.60% of RCFCW to 56.83% of FCW. Moreover, the overall deviation of FCW template (56.83%) is much higher than that of RCW template (40.26%), which is much higher than that of FT template (36.28%).
(3) As mentioned before, one possible reason of large fluctuation may be that there are a small number of XPs applying some templates. For templates with at least 10 permits, the maximum and minimum deviations are 72.34% [FCW(b)] and 20.48% [FT(c)].
(4) The successful rates of different road categories range largely, from 50% of RCFCW and RCRCW to 91% of FCW. In particular, the successful rates of RCFCW and RCRCW are low partially due to the maximum length of road crossing is assumed to be 3.5m. The successful rates of the modified FCW template (91%) and RCW template (90%) are quite close and higher than that of the modified FT template (84%).
(5) The templates FCW(b) and FCW(d) are higher than other modified templates.

Table 6-12 Performance of the Modified FTN Templates

Road Category	Template Type	Number of Samples	Successful Cases	Successful Rate	Template Days (Modified)	Actual Working Days	TPD (Modified)
FCW	(a)	43	39	91%	1,115	572	48.70%
	(b)	3	2	67%	63	42	33.33%
	(e)	2	1	50%	73	112	-53.42%
	Subtotal	**48**	**42**	**88%**	**1,251**	**726**	**41.97%**
RCW	(a)	15	14	93%	403	188	53.35%
	(b)	1	1	100%	68	14	79.41%
	(c)	2	2	100%	39	20	48.72%
	Subtotal	**18**	**17**	**94%**	**510**	**222**	**56.47%**
FT	(a)	3,685	3,106	84%	80,458	50,825	36.83%
	(b)	21	19	90%	663	346	47.81%
	(c)	5	3	60%	85	95	-11.76%
	(e)	23	17	74%	606	384	36.63%
	(g)	1	0	0%	29	32	-10.34%
	Subtotal	**3,735**	**3,145**	**84%**	**81,841**	**51,682**	**36.85%**
RCFCW	(a)	8	6	75%	134	89	33.58%
	(b)	3	3	100%	41	14	65.85%
	(c)	1	0	0%	18	24	-33.33%
	Subtotal	**12**	**9**	**75%**	**193**	**127**	**34.20%**
RCRCW	(a)	7	5	71%	118	92	22.03%
	(b)	1	1	100%	29	3	89.66%
	Subtotal	**8**	**6**	**75%**	**147**	**95**	**35.37%**
Total		**3,821**	**3,219**	**84%**	**83,942**	**52,852**	**37.04%**

Regarding FCW(d), there are 25 permits and overall deviation of the modified template is 64.10%. The detail information of 25 permits is shown in Table 6-14. It is found that the template days of three permits (4, 7, and 10) by the modified template are longer than the corresponding template days by the existing template. The possible reasons are as follows:

(1) Permit 4 used a time constraint factor A7 with which the permit period is multiplied with an arbitrary times (10 times in this permit). The template day calculated by the modified template without using this time constraint is 269 days, which is close to the actual working day (271 days) and the permit day (279 days) issued by HyD.
(2) Similarly, permit 7 used the time constraint factor A7 (9 times in this permit). The template day calculated by the modified template without using time constraint is 110 days, which is closer to the actual working day (102 days) and the permit day (129 days) issued by HyD.

Table 6-13 Performance of the Modified GAS Templates

Road Category	Template Type	Number of Samples	Successful Cases	Successful Rate	Template Days (Modified)	Actual Working Days	TPD (Modified)
FCW	(a)	5	4	80%	411	289	29.68%
	(b)	35	35	100%	4,646	1,285	72.34%
	(c)	38	32	84%	6,970	4,233	39.27%
	(d)	25	24	96%	9,498	3,410	64.1%
	(e)	1	0	0%	68	104	-52.94%
	Subtotal	**104**	**95**	**91%**	**21,593**	**9,321**	**56.83%**
RCW	(a)	4	4	100%	265	161	39.25%
	(b)	11	10	91%	590	231	60.85%
	(c)	10	9	90%	1,433	818	42.92%
	(d)	6	5	83%	2,242	1,496	33.27%
	Subtotal	**31**	**28**	**90%**	**4,530**	**2,706**	**40.26%**
FT	(a)	306	281	92%	10,612	5,345	49.63%
	(b)	462	375	81%	21,715	14,395	33.7%
	(c)	98	72	73%	6,354	5,053	20.48%
	(d)	7	5	71%	1,481	968	34.64%
	(e)	4	4	100%	572	195	65.91%
	Subtotal	**877**	**737**	**84%**	**40,734**	**25,956**	**36.28%**
RCFCW	(b)	1	0	0%	18	36	-100%
	(c)	4	2	50%	211	333	-57.82%
	(e)	1	1	100%	236	56	76.27%
	Subtotal	**6**	**3**	**50%**	**465**	**425**	**8.6%**
RCRCW	(c)	2	1	50%	249	136	45.38%
	Subtotal	**2**	**1**	**50%**	**249**	**136**	**45.38%**
Total		**1,020**	**864**	**85%**	**67,571**	**38,544**	**42.96%**

Table 6-14 Performance of the Modified GAS FCW(d) Template

No.	Actual Working Days	Permit Days	PPD	Template Days (Existing)	TPD (Existing)	Template Days (Modified)	TPD (Modified)
1	61	75	18.67%	385	84.16%	358	82.96%
2	306	340	10.00%	791	61.31%	777	60.62%
3	199	201	1.00%	256	22.27%	247	19.43%
4	**271**	**279**	**2.87%**	**324**	**16.36%**	**2065**	**86.88%**
5	160	163	1.84%	227	29.52%	211	24.17%
6	215	323	33.44%	432	50.23%	407	47.17%
7	**102**	**129**	**20.93%**	**134**	**23.88%**	**474**	**78.48%**
8	72	75	4.00%	462	84.42%	457	84.25%
9	209	212	1.42%	381	45.14%	375	44.27%
10	**71**	**91**	**21.98%**	**615**	**88.46%**	**623**	**88.60%**
11	7	16	56.25%	20	65.00%	16	56.25%
12	411	482	14.73%	582	29.38%	569	27.77%
13	65	71	8.45%	285	77.19%	269	75.84%
14	66	71	7.04%	197	66.50%	182	63.74%
15	202	203	0.49%	199	-1.51%	179	-12.85%
16	169	218	22.48%	226	25.22%	217	22.12%
17	36	216	83.33%	225	84.00%	214	83.18%
18	134	137	2.19%	462	71.00%	448	70.09%
19	228	293	22.18%	409	44.25%	406	43.84%
20	120	130	7.69%	194	38.14%	187	35.83%
21	138	363	61.98%	375	63.20%	356	61.24%
22	75	323	76.78%	341	78.01%	335	77.61%
23	48	65	26.15%	66	27.27%	51	5.88%
24	8	34	76.47%	33	75.76%	29	72.41%
25	37	37	0.00%	57	35.09%	46	19.57%
Total	3410	4547	25.01%	7678	55.59%	9498	64.10%

(3) In permit 10, the permit day (91 days) issued by HyD is close to actual working day (71 days). Permit 10 only applied one MF: hard rock factor (D3). The template day calculated by the modified template without using the MF is 388 days since the length of the trench is 450m. Thus, the reason may be a type error in the XPMS, i.e., 45m instead of 450m.

6.10.5 Performance of the Modified WSD Templates

The overall successful rate and deviation of the modified WSD templates are 80% and 38%, respectively. The details are presented in Table 6-15. It is observed that:

(1) The deviations of different templates range largely, from -81.67% of RCW(d) to 77.33% of FCW(g).
(2) The overall deviation ranges largely by road category, from 27.28% of RCW to 56.15% of RCRCW. Moreover, the overall deviations of the modified FCW templates (39.78%) and the modified FT templates (38.65%) are quite close.
(3) For the templates with at least 10 permits, the maximum and minimum deviation are 55.85% [FCW(f)] and 25.27% [RCW(c)], respectively.
(4) The successful rates of different road categories range largely, from 77% of RCW to 100% of RCFCW and RCRCW. In particular, the high successful rates of RCFCW and RCRCW may be due to the limited samples.

Table 6-15 Performance of the modified WSD Templates

Road Category	Template Type	Number of Samples	Successful Cases	Successful Rate	Template Days (Modified)	Actual Working Days	TPD (Modified)
FCW	(a)	12	8	67%	722	634	12.19%
	(b)	9	8	89%	570	280	50.88%
	(c)	69	53	77%	6,369	4,581	28.07%
	(d)	6	3	50%	850	570	32.94%
	(f)	32	29	91%	5,044	2,227	55.85%
	(g)	2	1	50%	344	78	77.33%
	Subtotal	**130**	**102**	**78%**	**13,899**	**8,370**	**39.78%**
RCW	(a)	5	2	40%	780	808	-3.59%
	(b)	3	3	100%	153	39	74.51%
	(c)	43	33	77%	4,207	3,143	25.29%
	(d)	1	0	0%	60	109	-81.67%
	(f)	9	9	100%	2,641	1,603	39.30%
	Subtotal	**61**	**47**	**77%**	**7,841**	**5,702**	**27.28%**
FT	(a)	481	379	79%	21,291	14,614	31.36%
	(b)	144	126	88%	5,736	3,432	40.17%
	(c)	602	483	80%	41,000	24,786	39.55%
	(d)	9	6	67%	810	700	13.58%
	(e)	1	1	100%	50	26	48.00%
	(f)	86	70	81%	10,979	5,731	47.80%
	(g)	4	3	75%	2,261	1,095	51.57%
	Subtotal	**1,327**	**1,068**	**80%**	**82,127**	**50,384**	**38.65%**
RCFCW	(c)	1	1	100%	70	41	41.43%
	Subtotal	**1**	**1**	**100%**	**70**	**41**	**41.43%**
RCRCW	(a)	3	3	100%	130	57	56.15%
	Subtotal	**3**	**3**	**100%**	**130**	**57**	**56.15%**
Total		**1,522**	**1,221**	**80%**	**104,067**	**64,554**	**37.97%**

Chapter 7: Recommendations for Potential Future Improvements

7.1 Potential Improvement Areas

In this Chapter, several recommendations are made to improve the permit period assessment system in the following areas:

- Review of work activities of fixed long durations in current PPA templates;
- Elimination of unnecessary work activities from current PPA templates;
- Concurrent programming of work activities;
- Potential elimination of templates for road crossing of carriageway;
- Review of the assumption of number of gangs employed in excavation works;
- Setting a length limit on excavation items; and
- Permit period estimation based on excavation area for some works.

7.2 Review of Work Activities of Fixed Long Durations in Current PPA Templates

In each existing template, there are several work activities that are assigned a fixed duration. For some activities, the assigned durations are quite long, for example, 84 days for the construction of a GAS valve chamber and 39 days for the construction of a FTN manhole. Work activities that are assigned a long fixed duration in DSD, ELE, FTN, GAS, and WSD are listed in Table 7-1, Table 7-2, Table 7-3, Table 7-4 and Table 7-5. Such assigned durations may not be reasonable and need to be further reviewed to enhance accuracy. In this context, UUs were requested to review the activities involved in different templates that are assigned fixed durations.

7.3 Elimination of Unnecessary Work Activities from Current PPA Templates

As discussed in Chapter 3, each PPA template estimates the permit period based on a number of "standard work activities" of excavation works in each trade. These templates have been in use for more than seven years. It is useful to evaluate whether the activities considered in each template are really "standard" by investigating the frequency that these activities are actually involved in historical excavation works. In this regard, a preliminary investigation has been conducted in this Study using previous excavation works that adopted standard templates. The analysis results of DSD, ELE, FTN, GAS, and WSD are presented in Table 7-6, Table 7-7, Table 7-8, Table 7-9 and Table 7-10, respectively.

In DSD, work activities that have been less frequently involved in excavation works are: "056 – Tunneling" (never been involved), "022 – Major traffic arrangement" (8.68%), "055 – Temporary decking" (9.44%), "074 – road marking and furniture" (14.86%), "053 – demolish existing manhole" (18.33%), and "073 – concrete curing" (19.20%). For activity "022", its frequency would be much higher if only consider excavation works on the carriageway since around half of the excavation works are on the footway where there is no need to make major traffic arrangement.

In ELE, the following work activities have been less frequently involved in excavation works: "056 – tunneling" (0.04%), "022 – major traffic arrangement" (0.05%), "062 – erect platform

for cable laying" (0.05%), "054 – telephone pit removal and reconstruction by other UUs" (0.08%), "074 – road marking and furniture" (0.42%), "057 – construct duct bank" (0.65%), and "053 – telephone pit removal and reconstruction by power company" (1.45%).

In FTN, the following work activities have been less frequently involved in excavation works: "054 – demolish existing manhole" (0.10%), "063 – construct manhole" (0.22%), "065 – construct/demolish kiosk/cabinet foundation" (0.70%), "066 – erect telephone pole" (0.94%), "053 – demolish existing joint box" (1.33%), "064 – modify chamber frame and cover" (2.54%), "067 – repair ducts/cables (per 10m linear duct length)" (2.78%), and "022 – major traffic arrangement" (4.55%).

In GAS, the following work activities have been less frequently involved in excavation works: "066 – construct/modify underground governor (twin stream)" (0.17%), "065 – construct/modify underground governor (single stream)" (0.25%), "064 – construct/modify above ground district governor" (0.29%), "063 – construct/modify above ground service governor" (0.36%), "022 – major traffic arrangement" (6.22%), and "068 – arrange for temporary suspensions of gas supply with customer" (8.42%).

In WSD, the following work activities have been less frequently involved in excavation works: "068 – install & construct waste diction meter chamber" (1.10%), "069 install & construct single/double air valve chamber" (1.11%), "066 – construct DN600 inspection tee chamber" (1.54%), "067 – construct washout pump pit" (1.74%), "022 – major traffic arrangement" (6.75%), "074 – road marking and furniture" (12.96%), and "055 – temporary decking" (16.07%).

7.4 Concurrent Programming of Work Activities

Due to the limitation of the current PPA templates, all fixed duration items (e.g., construction of manhole) of a trench are programmed in series, regardless these items may be carried out concurrently on site. This would result in a long permit period. To overcome this problem, further study may be done to modify the current PPA templates such that fixed duration items can be programmed concurrently.

7.5 Potential Elimination of Templates for Road Crossing of Carriageway

The difference between an excavation work on carriageway (indicated in a red line) and that on road crossing of carriageway (indicated in a blue line) is shown in Figure 7-1. In a word, an excavation on carriageway is along a carriageway and that on road crossing is along a road crossing. The standard work activities of excavation works on road crossings are exactly the same as those for excavation works on carriageways although usually the length of an excavation work on a road crossing is much shorter than that on a carriageway. The minimum length of the road crossing is assumed to be 3.5m. In the current templates, for a short-length (less than or equal to 10m) excavation work on carriageway, the permit period is assumed to be the same as that of a 10m excavation work. It is possible that the templates for excavation works on carriageway may be used for excavation works on road crossing of carriageway, and the templates for road crossing of carriageway could be eliminated.

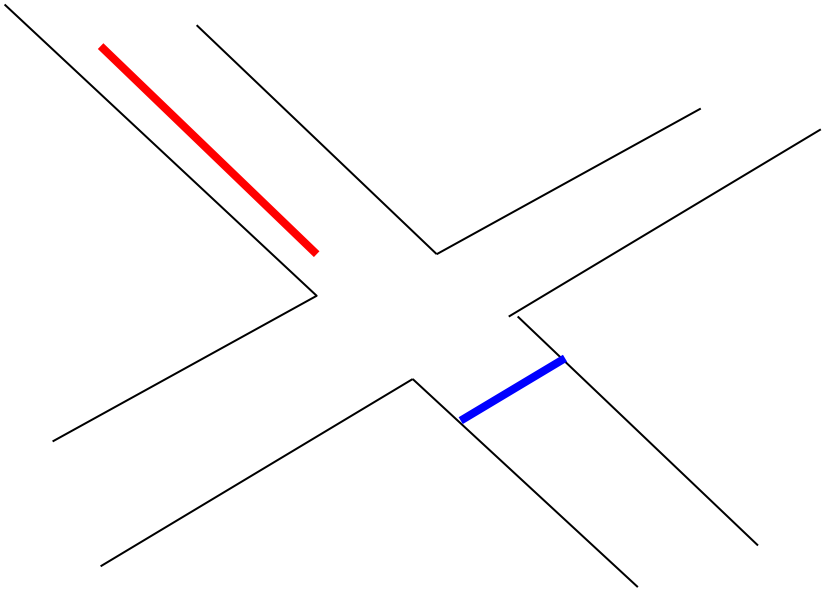

Figure 7-1 Excavation Works on Carriageway and Road Crossing of Carriageway

7.6 Review of Assumption of Number of Gangs Employed in Excavation Works

The production rates of various work activities in an excavation work depend on the resources deployed in the working site. In the current templates, it is assumed that (1) one gang (usually four people, one operating excavator, one digging and installing pipe underground, and two moving excavated spoil) is employed for manual work of 10m excavation works and (2) two gangs for manual work of 50m excavation works. This assumption is used to estimate the production rates of different work activities in current PPA templates of the five trades. However, the actual resources used in the worksite of an excavation work could be different from those assumed to be used for this excavation work. In the site survey of this Study, it was found that there were usually 4 to 5 people on DSD sites including those with a length longer than 50m and 7 to 8 people (one operating excavator, one operating breaker, four removing spoil, and two constructing joint box) on FTN sites that are frequently less than 50m in length. That the level of resources employed on site is different from that assumed in the corresponding template and consequently the difference of the actual production rate from the assumed production date could lead to the deviation of the actual working periods from the permit days approved. One example is work activity 071 (backfilling trench and soil test), a manual work which is common in both FTN and DSD. In the site survey, it is observed that the average production rate of this activity for DSD was 7.13 cu.m./day and 36.7 cu.m./day for FTN. The status of the surveyed excavation works indicates that the DSD works applied for time extensions while the FTN works finished much earlier than the template days given by the current templates. Nonetheless, such a large difference in the production rates may also be due to other factors such as different trench dimensions (depth, width, and length) and surrounding environments between DSD works and FTN works.

7.7 Setting a Length Limit on Excavation Items

In practice, a long trench has to be excavated in phases due to the limit of resources, the constraints on working site, and the need to minimize the interruption to the public. There is a need to set a limit on the maximum length of an excavation item to better reflect this real

situation. Shorter excavation items with more precise working periods would also be beneficial to case coordination among UUs. The length limits for different trades may be different to reflect their different characteristics, such as the impacts on the surrounding environment and the work efficiencies.

A statistical analysis of the lengths of previous excavation items in DSD, ELE, FTN, GAS and WSD has been conducted. Table 7-11 shows the minimum, maximum, average, and standard deviation of the lengths of excavation items in these five trades.

7.8 Permit Period Estimation Based on Excavation Area for Some Works

The quantity of an excavation work is determined by its three dimensions: length, width and depth. Current PPA templates can only cater for the excavation works with line input. This is valid for excavation works that have regular shapes, i.e., the width and depth does not change along the longitudinal direction. However, for some excavation works, the width may change greatly along the longitudinal direction. This makes it impossible to use the length to accurately estimate the quantity of the work. One possible way to improve the accuracy in estimating the working quantity is to use the area input instead of the line input. This requires the development of new or significantly modified templates for various trades.

Table 7-1 Fixed Duration of Work Activities in the Existing DSD Templates

Activity Code	Width	Up to 1.0m	> 1.0m to 1.5m	> 1.0m to 1.5m	>1.5m to 2.0m	>1.5m to 2.0m	>2.0m to 3.5m	>2.0m to 3.5m
	Depth	Up to 1.2m	Up to 1.2m	>1.2m to 2.5m	Up to 1.2m	>1.2m to 2.5m	>2.0m to 3.0m	> 3.0m to 4.0m
	Pipe size (diameter in mm)	150	225 to 300	225 to 300	375 to 525	375 to 525	600 to 1200	600 to 1200
	Description	(a)	(b)	(c)	(d)	(e)	(f)	(g)
	Flexible Carriageway							
021	Fence off site with necessary temporary traffic arrangement	3	3	3	3	3	3	3
022	Major traffic arrangement	10	10	10	10	10	10	10
052	Support and protect utilities	2	2	2	2	2	2	2
053	Demolish existing manholes	7	7	7	7	7	7	7
055	Temporary decking	4	4	4	5	5	6	6
063	Construct manholes	7	7	7	7	7	7	7
072	Reinstatement	3	3	3	3	3	3	3
	Rigid Carriageway							
056	Tunneling	21	21	21	21	21	21	21
062	Water/air testing	2	2	2	2	2	2	2
073	Concrete curing	7	7	7	7	7	7	7
	Footway							
031	Locate utilities	4	4	4	4	4	4	4
073	Concrete curing	3	3	3	3	3	3	3

Table 7-2 Fixed Duration of Work Activities in the Existing ELE Templates

Activity Code	Width	Up to 0.5m	> 0.5m to 1m	> 0.5m to 1m	>1m to 1.5m	>1m to 1.5m	>1.5m to 2m	>1.5m to 2m
	Depth	Up to 1.2m	Up to 1.2m	>1.2m to 2.5m	Up to 1.2m	>1.2m to 2.5m	Up to 1.2m	>1.2m to 2.5m
	No. of cables	1 - 3	4 - 8	4 - 8	9 - 12	9 - 12	13 - 16	13 - 16
	Description	(a)	(b)	(c)	(d)	(e)	(f)	(g)
	Flexible Carriageway							
021	Fence off site	3	3	3	3	3	3	3
022	Major traffic arrangement	10	10	10	10	10	10	10
031	Cable / gas pipe location	4	4	4	4	4	4	4
053	Telephone pit/pipe removal and reconstruction	6	6	6	6	6	6	6
055	Temporary decking	4	4	4	5	5	6	6
056	Tunneling	21	21	21	21	21	21	21
057	Construct duct bank	2	4	4	6	6	8	8
061	Lay pipes/cables	2	4	4	6	6	8	8
063	Locate cable/jointing position, arrange shutdown/outage, cable jointing and accessories installation.	11	17	17	23	23	27	27
072	Reinstatement	3	3	3	3	3	3	3
	Rigid Carriageway							
073	Concrete curing	7	7	7	7	7	7	7
	Footway							
031	Locate utilities	4	4	4	4	4	4	4
073	Concrete curing	3	3	3	3	3	3	3

Table 7-3 Fixed Duration of Work Activities in the Existing FTN Templates

Activity Code	Width	Up to 0.5m	> 0.5m to 1m	> 0.5m to 1m	>1m to 1.5m	>1m to 1.5m	>1.5m to 2m	>1.5m to 2m
	Depth	Up to 1.2m	Up to 1.2m	>1.2m to 2.5m	Up to 1.2m	>1.2m to 2.5m	Up to 1.2m	>1.2m to 2.5m
	No. of cables	1 - 3	4 - 8	4 - 8	9 - 12	9 - 12	13 - 16	13 - 16
	Description	(a)	(b)	(c)	(d)	(e)	(f)	(g)
	Flexible Carriageway							
021	Fence off site	3	3	3	3	3	3	3
022	Major traffic arrangement	10	10	10	10	10	10	10
031	Cable / gas pipe location	4	4	4	4	4	4	4
053	Demolish existing joint box	6	6	6	6	7	7	7
054	Demolish existing manhole	11	11	13	13	14	14	14
062	Construct joint box	18	18	18	18	19	19	19
063	Construct manhole	35	35	35	37	37	39	39
067	Repair ducts/cables (per 10m linear duct length)	13	13	13	13	13	13	13
072	Reinstatement	3	3	3	3	3	3	3
	Rigid Carriageway							
073	Concrete curing	7	7	7	7	7	7	7
	Footway							
053	Demolish existing Joint Box	6	6	6	6	7	7	7
054	Demolish existing Manhole	11	11	13	13	14	14	14
062	Construct Joint Box	18	18	18	18	19	19	19
063	Construct Manhole	35	35	35	37	37	39	39
067	Repair ducts/cables (per 10m linear duct length)	13	13	13	13	13	13	13
073	Concrete curing	3	3	3	3	3	3	3

Table 7-4 Fixed Duration of Work Activities in the Existing GAS Templates

Activity Code	Width	Up to 0.6m	> 0.6m to 1.0m	>0.6m to 1.0m	> 1m to 1.5m	> 1.5m to 2m
	Depth	Up to 1.2m	Up to 1.2m	>1.2m to 1.5m	>1.5m to 2.5m	>2.5m to 3.5m
	No. of pipe	1	1	1	1	1
	Pipe Size/Pipe Material	<=160mm PE	(160mm, 400mm]	PE	(250mm, 750mm]	Steel
	Assumed Pipe Size	Up to 160mm	160	315	300	750
	Description	(a)	(b)	(c)	(d)	(e)
	Flexible Carriageway					
021	Fence off site	3	3	3	3	3
022	Major traffic arrangement	10	10	10	10	10
055	Temporary decking	4	4	4	4	6
062	Construct Manhole/Pit/Valve Chamber	3	3	3	84	84
063	Construct/Modify Above Ground Service Governor	15	15	15	15	15
064	Construct/Modify Above Ground District Governor	21	21	21	21	21
065	Construct/Modify Underground Governor (Single)	28	28	28	28	28
066	Construct/Modify Underground Governor (Twin)	43	43	43	43	43
067	Soundness test (air / hydraulic)	3	3	3	56	56
068	Arrange for temp. suspension	4	4	4	4	4
069	Connect new main/service	9	10	10	14	14
072	Reinstatement	3	3	3	3	3
	Rigid Carriageway					
073	Concrete curing	7	7	7	7	7
	Footway					
062	Construct Manhole/Pit/Valve Chamber	3	3	3	84	84
063	Construct/Modify Above Ground Service Governor	15	15	15	15	15
064	Construct/Modify Above Ground District Governor	21	21	21	21	21
065	Construct/Modify Underground Governor (Single)	28	28	28	28	28
066	Construct/Modify Underground Governor (Twin)	43	43	43	43	43
067	Soundness test (air / hydraulic)	3	3	3	56	56
068	Arrange for temp. suspension	4	4	4	4	4
069	Connect new main/service to live main/service	9	10	10	14	14
073	Concrete curing	3	3	3	3	3

Table 7-5 Fixed Duration of Work Activities in the Existing WSD Templates

Activity Code	Width	Up to 0.6m	> 0.6m to 1m	> 1m to 1.5m	> 1m to 1.5m		> 1.5m to 2m	> 2m to 2.5m
	Depth	Up to 1.2m	>1.2m to 1.5m	>1.5m to 2.5m	>1.5m to 2.5m		>2.5m to 3.5m	>3.5m to 4.5m
	No. of pipe	1	1	1	1	1	1	1
	Pipe Size/Pipe Material	<150 (DI/PE)	200,250,300,400,450 (DI)		600 (DI)	600 (MS)	[700,1000] (MS)	1200,1400 (MS)
	Assumed Pipe Size	150	450	450	600	600	1000	1400
	Description	(a)	(b)	(c)	(d)	(d)	(e)	(f)
Flexible Carriageway								
021	Fence off site	3	3	3	3	3	3	3
022	Major traffic arrangement	10	10	10	10	10	10	10
031	Cable / gas pipe location	4	4	4	4	4	4	4
055	Temporary decking	4	4	4	4	4	6	6
062	Connecting new main to live main	3	5	7.5	7.5	11	15	19
063	Teeing off from new main	2	5	5	5	7	11	13
064	Construct thrust block	4	4	4	5	6	7	8
065	Install/construct valve chamber	2	20	20	24	24	42	48
066	Construct DN600 Inspection Tee Chamber	0	0	0	17	17	26	35
067	Construct Washout Pump pit	0	23	27	27	27	33	44
068	Install & construct Waste Detection Meter Chamber	16	16	18	18	18	0	0
069	Install & construct Single/Double Air Valve Chamber	2	2	3	3	3	4	5
0610	Pressure testing	5	5	5	5	5	5	5
0611	Cleaning and Sterilization	4	4	4	4	4	4	4
0612	Water sampling	7	7	7	7	7	7	7
0613	Arrange newspaper/radio announcement	5	5	5	5	5	5	5
072	Reinstatement	3	3	3	3	3	3	3
Rigid Carriageway								
073	Concrete curing	7	7	7	7	7	7	7
Footway								
062	Connecting new main to live main	3	5	7.5	7.5	11	15	19
063	Teeing off from new main	2	5	5	5	7	11	13
064	Construct thrust block	4	4	4	5	6	7	8
065	Install/construct valve chamber	2	20	20	24	24	42	48
066	Construct DN600 Inspection Tee Chamber	0	0	0	17	17	26	35
067	Construct Washout Pump pit	0	23	27	27	27	33	44
068	Install & construct Waste Detection Meter Chamber	16	16	18	18	18	0	0
069	Install & construct Single/Double Air Valve Chamber	2	2	3	3	3	4	5
0610	Pressure testing	5	5	5	5	5	5	5
0611	Cleaning and Sterilization	4	4	4	4	4	4	4
0612	Water sampling	7	7	7	7	7	7	7
0613	Arrange newspaper/radio announcement	5	5	5	5	5	5	5
072	Reinstatement	3	3	3	3	3	3	3

Table 7-6 Frequency of Work Activities Used in Different DSD Templates

Activity Code	FCW			FT			RCW			RCFCW			RCRCW			Total		
	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage
011	122	157	77.71%	259	431	60.09%	95	314	30.25%	11	11	100.00%	8	9	88.89%	495	922	53.69%
021	157	157	100.00%	309	431	71.69%	174	314	55.41%	11	11	100.00%	8	9	88.89%	659	922	71.48%
022	28	157	17.83%	9	431	2.09%	36	314	11.46%	2	11	18.18%	5	9	55.56%	80	922	8.68%
031	157	157	100.00%	413	431	95.82%	304	314	96.82%	11	11	100.00%	9	9	100.00%	894	922	96.96%
041	157	157	100.00%	420	431	97.45%	309	314	98.41%	11	11	100.00%	9	9	100.00%	906	922	98.26%
051	156	157	99.36%	425	431	98.61%	312	314	99.36%	11	11	100.00%	9	9	100.00%	913	922	99.02%
052	47	157	29.94%	102	431	23.67%	44	314	14.01%	3	11	27.27%	4	9	44.44%	200	922	21.69%
053	53	157	33.76%	72	431	16.71%	34	314	10.83%	3	11	27.27%	7	9	77.78%	169	922	18.33%
055	12	157	7.64%	53	431	12.30%	14	314	4.46%	3	11	27.27%	5	9	55.56%	87	922	9.44%
056	0	157	0.00%	0	431	0.00%	0	314	0.00%	0	11	0.00%	0	9	0.00%	0	922	0.00%
061	156	157	99.36%	417	431	96.75%	311	314	99.04%	11	11	100.00%	9	9	100.00%	904	922	98.05%
062	154	157	98.09%	407	431	94.43%	308	314	98.09%	11	11	100.00%	9	9	100.00%	889	922	96.42%
063	150	157	95.54%	390	431	90.49%	301	314	95.86%	11	11	100.00%	9	9	100.00%	861	922	93.38%
071	156	157	99.36%	409	431	94.90%	304	314	96.82%	11	11	100.00%	9	9	100.00%	889	922	96.42%
072	157	157	100.00%	428	431	99.30%	313	314	99.68%	11	11	100.00%	9	9	100.00%	918	922	99.57%
073	25	157	15.92%	92	431	21.35%	52	314	16.56%	3	11	27.27%	5	9	55.56%	177	922	19.20%
074	39	157	24.84%	48	431	11.14%	42	314	13.38%	2	11	18.18%	6	9	66.67%	137	922	14.86%
075	157	157	100.00%	307	431	71.23%	173	314	55.10%	11	11	100.00%	9	9	100.00%	657	922	71.26%
081	120	157	76.43%	268	431	62.18%	102	314	32.48%	11	11	100.00%	8	9	88.89%	509	922	55.21%

Note: FCW, FT, RCW, RCFCW, and RCRCW stand for flexible carriageway, footway, rigid carriageway, road crossing of flexible carriageway, and road crossing of rigid carriageway; NOP means the number of excavation permits involving a specific work activity.

Table 7-7 Frequency of Work Activities Used in Different ELE Templates

Activity Code	FCW			FT			RCW			RCFCW			RCRCW			Total		
	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage
011	964	1,405	68.61%	19,949	27,361	72.91%	442	649	68.10%	1,988	3,483	57.08%	618	1,483	41.67%	23,961	34,381	69.69%
021	1,187	1,405	84.48%	20,861	27,361	76.24%	539	649	83.05%	2,066	3,483	59.32%	649	1,483	43.76%	25,302	34,381	73.59%
022	10	1,405	0.71%	2	27,361	0.01%	3	649	0.46%	1	3,483	0.03%	0	1,483	0.00%	16	34,381	0.05%
031	1,396	1,405	99.36%	27,300	27,361	99.78%	642	649	98.92%	3,473	3,483	99.71%	1,477	1,483	99.60%	34,288	34,381	99.73%
041	1,403	1,405	99.86%	27,355	27,361	99.98%	648	649	99.85%	3,483	3,483	100.00%	1,483	1,483	100.00%	34,372	34,381	99.97%
051	1,400	1,405	99.64%	27,321	27,361	99.85%	643	649	99.08%	3,472	3,483	99.68%	1,477	1,483	99.60%	34,313	34,381	99.80%
052	228	1,405	16.23%	3,375	27,361	12.34%	62	649	9.55%	55	3,483	1.58%	13	1,483	0.88%	3,733	34,381	10.86%
053	18	1,405	1.28%	459	27,361	1.68%	20	649	3.08%	0	3,483	0.00%	1	1,483	0.07%	498	34,381	1.45%
054	0	1,405	0.00%	25	27,361	0.09%	0	649	0.00%	1	3,483	0.03%	0	1,483	0.00%	26	34,381	0.08%
055	723	1,405	51.46%	6,326	27,361	23.12%	279	649	42.99%	914	3,483	26.24%	82	1,483	5.53%	8,324	34,381	24.21%
056	4	1,405	0.28%	6	27,361	0.02%	1	649	0.15%	2	3,483	0.06%	2	1,483	0.13%	15	34,381	0.04%
057	12	1,405	0.85%	11	27,361	0.04%	6	649	0.92%	138	3,483	3.96%	58	1,483	3.91%	225	34,381	0.65%
061	1,330	1,405	94.66%	27,072	27,361	98.94%	608	649	93.68%	3,463	3,483	99.43%	1,471	1,483	99.19%	33,944	34,381	98.73%
062	3	1,405	0.21%	12	27,361	0.04%	2	649	0.31%	0	3,483	0.00%	0	1,483	0.00%	17	34,381	0.05%
063	1,166	1,405	82.99%	26,524	27,361	96.94%	537	649	82.74%	3,326	3,483	95.49%	1,409	1,483	95.01%	32,962	34,381	95.87%
071	1,403	1,405	99.86%	27,355	27,361	99.98%	648	649	99.85%	3,483	3,483	100.00%	1,482	1,483	99.93%	34,371	34,381	99.97%
072	1,405	1,405	100.00%	27,350	27,361	99.96%	649	649	100.00%	3,483	3,483	100.00%	1,483	1,483	100.00%	34,370	34,381	99.97%
073	57	1,405	4.06%	17,488	27,361	63.92%	523	649	80.59%	120	3,483	3.45%	1,325	1,483	89.35%	19,513	34,381	56.76%
074	70	1,405	4.98%	36	27,361	0.13%	19	649	2.93%	15	3,483	0.43%	6	1,483	0.40%	146	34,381	0.42%
075	1,161	1,405	82.63%	20,765	27,361	75.89%	526	649	81.05%	2,049	3,483	58.83%	650	1,483	43.83%	25,151	34,381	73.15%
081	993	1,405	70.68%	20,248	27,361	74.00%	451	649	69.49%	1,969	3,483	56.53%	624	1,483	42.08%	24,285	34,381	70.63%

Note: FCW, FT, RCW, RCFCW, and RCRCW stand for flexible carriageway, footway, rigid carriageway, road crossing of flexible carriageway, and road crossing of rigid carriageway; NOP means the number of excavation permits involving a specific work activity.

Table 7-8 Frequency of Work Activities Used in Different FTN Templates

Activity Code	FCW			FT			RCW			RCFCW			RCRCW			Total		
	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage
011	365	615	59.35%	9,485	14,402	65.86%	181	318	56.92%	1,098	2,702	40.64%	466	1,416	32.91%	11,595	19,453	59.61%
021	513	615	83.41%	11,990	14,402	83.25%	248	318	77.99%	2,547	2,702	94.26%	1,233	1,416	87.08%	16,531	19,453	84.98%
022	53	615	8.62%	52	14,402	0.36%	24	318	7.55%	576	2,702	21.32%	181	1,416	12.78%	886	19,453	4.55%
031	496	615	80.65%	12,012	14,402	83.41%	245	318	77.04%	2,232	2,702	82.61%	985	1,416	69.56%	15,970	19,453	82.10%
041	586	615	95.28%	13,293	14,402	92.30%	281	318	88.36%	2,586	2,702	95.71%	1,363	1,416	96.26%	18,109	19,453	93.09%
051	480	615	78.05%	10,656	14,402	73.99%	199	318	62.58%	2,178	2,702	80.61%	1,002	1,416	70.76%	14,515	19,453	74.62%
052	104	615	16.91%	1,325	14,402	9.20%	45	318	14.15%	575	2,702	21.28%	120	1,416	8.47%	2,169	19,453	11.15%
053	3	615	0.49%	251	14,402	1.74%	2	318	0.63%	2	2,702	0.07%	0	1,416	0.00%	258	19,453	1.33%
054	1	615	0.16%	19	14,402	0.13%	0	318	0.00%	0	2,702	0.00%	0	1,416	0.00%	20	19,453	0.10%
055	186	615	30.24%	3,420	14,402	23.75%	92	318	28.93%	779	2,702	28.83%	260	1,416	18.36%	4,737	19,453	24.35%
061	577	615	93.82%	13,393	14,402	92.99%	292	318	91.82%	2,652	2,702	98.15%	1,381	1,416	97.53%	18,295	19,453	94.05%
062	48	615	7.80%	2,753	14,402	19.12%	21	318	6.60%	16	2,702	0.59%	12	1,416	0.85%	2,850	19,453	14.65%
063	2	615	0.33%	40	14,402	0.28%	0	318	0.00%	0	2,702	0.00%	0	1,416	0.00%	42	19,453	0.22%
064	4	615	0.65%	489	14,402	3.40%	2	318	0.63%	0	2,702	0.00%	0	1,416	0.00%	495	19,453	2.54%
065	0	615	0.00%	137	14,402	0.95%	0	318	0.00%	0	2,702	0.00%	0	1,416	0.00%	137	19,453	0.70%
066	0	615	0.00%	182	14,402	1.26%	0	318	0.00%	0	2,702	0.00%	0	1,416	0.00%	182	19,453	0.94%
067	32	615	5.20%	468	14,402	3.25%	19	318	5.97%	5	2,702	0.19%	17	1,416	1.20%	541	19,453	2.78%
071	588	615	95.61%	13,376	14,402	92.88%	285	318	89.62%	2,617	2,702	96.85%	1,361	1,416	96.12%	18,227	19,453	93.70%
072	594	615	96.59%	13,533	14,402	93.97%	291	318	91.51%	2,663	2,702	98.56%	1,388	1,416	98.02%	18,469	19,453	94.94%
073	74	615	12.03%	3,891	14,402	27.02%	114	318	35.85%	59	2,702	2.18%	534	1,416	37.71%	4,672	19,453	24.02%
074	445	615	72.36%	6,735	14,402	46.76%	177	318	55.66%	2,241	2,702	82.94%	1,018	1,416	71.89%	10,616	19,453	54.57%
075	481	615	78.21%	11,840	14,402	82.21%	233	318	73.27%	2,285	2,702	84.57%	1,083	1,416	76.48%	15,922	19,453	81.85%
081	409	615	66.50%	9,552	14,402	66.32%	194	318	61.01%	1,281	2,702	47.41%	583	1,416	41.17%	12,019	19,453	61.78%

Note: FCW, FT, RCW, RCFCW, and RCRCW stand for flexible carriageway, footway, rigid carriageway, road crossing of flexible carriageway, and road crossing of rigid carriageway; NOP means the number of excavation permits involving a specific work activity.

Table 7-9 Frequency of Work Activities Used in Different GAS Templates

Activity Code	FCW			FT			RCW			RCFCW			RCRCW			Total		
	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage
011	868	1,484	58.49%	2,783	4,800	57.98%	334	538	62.08%	167	295	56.61%	46	96	47.92%	4,198	7,213	58.20%
021	1,088	1,484	73.32%	3,106	4,800	64.71%	414	538	76.95%	253	295	85.76%	82	96	85.42%	4,943	7,213	68.53%
022	210	1,484	14.15%	55	4,800	1.15%	82	538	15.24%	78	295	26.44%	24	96	25.00%	449	7,213	6.22%
031	1,305	1,484	87.94%	4,336	4,800	90.33%	513	538	95.35%	272	295	92.20%	93	96	96.88%	6,519	7,213	90.38%
041	1,468	1,484	98.92%	4,746	4,800	98.88%	525	538	97.58%	290	295	98.31%	95	96	98.96%	7,124	7,213	98.77%
051	1,445	1,484	97.37%	4,496	4,800	93.67%	517	538	96.10%	279	295	94.58%	94	96	97.92%	6,831	7,213	94.70%
052	1,293	1,484	87.13%	4,250	4,800	88.54%	496	538	92.19%	280	295	94.92%	88	96	91.67%	6,407	7,213	88.83%
055	788	1,484	53.10%	1,962	4,800	40.88%	249	538	46.28%	138	295	46.78%	50	96	52.08%	3,187	7,213	44.18%
061	1,431	1,484	96.43%	4,562	4,800	95.04%	509	538	94.61%	291	295	98.64%	96	96	100.00%	6,889	7,213	95.51%
062	979	1,484	65.97%	3,535	4,800	73.65%	405	538	75.28%	241	295	81.69%	70	96	72.92%	5,230	7,213	72.51%
063	0	1,484	0.00%	12	4,800	0.25%	13	538	2.42%	1	295	0.34%	0	96	0.00%	26	7,213	0.36%
064	0	1,484	0.00%	8	4,800	0.17%	13	538	2.42%	0	295	0.00%	0	96	0.00%	21	7,213	0.29%
065	0	1,484	0.00%	6	4,800	0.13%	12	538	2.23%	0	295	0.00%	0	96	0.00%	18	7,213	0.25%
066	0	1,484	0.00%	1	4,800	0.02%	11	538	2.04%	0	295	0.00%	0	96	0.00%	12	7,213	0.17%
067	1,107	1,484	74.60%	3,642	4,800	75.88%	422	538	78.44%	238	295	80.68%	80	96	83.33%	5,489	7,213	76.10%
068	92	1,484	6.20%	440	4,800	9.17%	47	538	8.74%	25	295	8.47%	3	96	3.13%	607	7,213	8.42%
069	1,036	1,484	69.81%	3,646	4,800	75.96%	419	538	77.88%	225	295	76.27%	82	96	85.42%	5,408	7,213	74.98%
071	1,461	1,484	98.45%	4,583	4,800	95.48%	491	538	91.26%	294	295	99.66%	96	96	100.00%	6,925	7,213	96.01%
072	1,430	1,484	96.36%	4,696	4,800	97.83%	507	538	94.24%	288	295	97.63%	96	96	100.00%	7,017	7,213	97.28%
073	119	1,484	8.02%	2,075	4,800	43.23%	337	538	62.64%	29	295	9.83%	83	96	86.46%	2,643	7,213	36.64%
074	1,185	1,484	79.85%	1,985	4,800	41.35%	410	538	76.21%	253	295	85.76%	71	96	73.96%	3,904	7,213	54.12%
075	842	1,484	56.74%	2,780	4,800	57.92%	349	538	64.87%	141	295	47.80%	59	96	61.46%	4,171	7,213	57.83%
081	844	1,484	56.87%	2,888	4,800	60.17%	337	538	62.64%	169	295	57.29%	58	96	60.42%	4,296	7,213	59.56%

Note: FCW, FT, RCW, RCFCW, and RCRCW stand for flexible carriageway, footway, rigid carriageway, road crossing of flexible carriageway, and road crossing of rigid carriageway; NOP means the number of excavation permits involving a specific work activity.

Table 7-10 Frequency of Work Activities Used in Different WSD Templates

Activity Code	FCW			FT			RCW			RCFCW			RCRCW			Total		
	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage	Number of Permit	Total	Percentage
011	1,700	2,332	72.90%	4,892	7,342	66.63%	707	1,255	56.33%	85	162	52.47%	117	230	50.87%	7,501	11,321	66.26%
021	1,884	2,332	80.79%	5,921	7,342	80.65%	1,050	1,255	83.67%	156	162	96.30%	228	230	99.13%	9,239	11,321	81.61%
022	450	2,332	19.30%	38	7,342	0.52%	268	1,255	21.35%	3	162	1.85%	5	230	2.17%	764	11,321	6.75%
031	2,317	2,332	99.36%	7,276	7,342	99.10%	1,231	1,255	98.09%	162	162	100.00%	226	230	98.26%	11,212	11,321	99.04%
041	2,332	2,332	100.00%	7,310	7,342	99.56%	1,252	1,255	99.76%	162	162	100.00%	229	230	99.57%	11,285	11,321	99.68%
051	2,316	2,332	99.31%	7,267	7,342	98.98%	1,237	1,255	98.57%	160	162	98.77%	229	230	99.57%	11,209	11,321	99.01%
052	946	2,332	40.57%	2,991	7,342	40.74%	605	1,255	48.21%	19	162	11.73%	29	230	12.61%	4,590	11,321	40.54%
055	255	2,332	10.93%	1,181	7,342	16.09%	346	1,255	27.57%	14	162	8.64%	23	230	10.00%	1,819	11,321	16.07%
061	2,244	2,332	96.23%	7,184	7,342	97.85%	1,214	1,255	96.73%	158	162	97.53%	230	230	100.00%	11,030	11,321	97.43%
062	2,082	2,332	89.28%	6,912	7,342	94.14%	1,177	1,255	93.78%	88	162	54.32%	225	230	97.83%	10,484	11,321	92.61%
063	882	2,332	37.82%	2,199	7,342	29.95%	484	1,255	38.57%	4	162	2.47%	10	230	4.35%	3,579	11,321	31.61%
064	2,060	2,332	88.34%	6,645	7,342	90.51%	1,100	1,255	87.65%	89	162	54.94%	215	230	93.48%	10,109	11,321	89.29%
065	777	2,332	33.32%	2,128	7,342	28.98%	554	1,255	44.14%	13	162	8.02%	12	230	5.22%	3,484	11,321	30.77%
066	69	2,332	2.96%	45	7,342	0.61%	59	1,255	4.70%	0	162	0.00%	1	230	0.43%	174	11,321	1.54%
067	56	2,332	2.40%	83	7,342	1.13%	57	1,255	4.54%	0	162	0.00%	1	230	0.43%	197	11,321	1.74%
068	20	2,332	0.86%	47	7,342	0.64%	56	1,255	4.46%	0	162	0.00%	1	230	0.43%	124	11,321	1.10%
069	46	2,332	1.97%	33	7,342	0.45%	46	1,255	3.67%	0	162	0.00%	1	230	0.43%	126	11,321	1.11%
0610	1,801	2,332	77.23%	5,934	7,342	80.82%	1,058	1,255	84.30%	73	162	45.06%	208	230	90.43%	9,074	11,321	80.15%
0611	1,795	2,332	76.97%	5,930	7,342	80.77%	1,052	1,255	83.82%	71	162	43.83%	201	230	87.39%	9,049	11,321	79.93%
0612	1,756	2,332	75.30%	5,898	7,342	80.33%	1,049	1,255	83.59%	72	162	44.44%	200	230	86.96%	8,975	11,321	79.28%
0613	1,665	2,332	71.40%	5,764	7,342	78.51%	802	1,255	63.90%	60	162	37.04%	196	230	85.22%	8,487	11,321	74.97%
0614	2,052	2,332	87.99%	6,796	7,342	92.56%	1,157	1,255	92.19%	86	162	53.09%	219	230	95.22%	10,310	11,321	91.07%
071	2,310	2,332	99.06%	7,273	7,342	99.06%	1,233	1,255	98.25%	158	162	97.53%	229	230	99.57%	11,203	11,321	98.96%
072	2,324	2,332	99.66%	7,249	7,342	98.73%	1,250	1,255	99.60%	162	162	100.00%	230	230	100.00%	11,215	11,321	99.06%
073	1,774	2,332	76.07%	6,921	7,342	94.27%	1,237	1,255	98.57%	93	162	57.41%	230	230	100.00%	10,255	11,321	90.58%
074	727	2,332	31.17%	159	7,342	2.17%	550	1,255	43.82%	10	162	6.17%	21	230	9.13%	1,467	11,321	12.96%
075	1,906	2,332	81.73%	6,246	7,342	85.07%	1,117	1,255	89.00%	162	162	100.00%	226	230	98.26%	9,657	11,321	85.30%
081	1,529	2,332	65.57%	4,582	7,342	62.41%	635	1,255	50.60%	82	162	50.62%	124	230	53.91%	6,952	11,321	61.41%

Note: FCW, FT, RCW, RCFCW, and RCRCW stand for flexible carriageway, footway, rigid carriageway, road crossing of flexible carriageway, and road crossing of rigid carriageway; NOP means the number of excavation permits involving a specific work activity.

Table 7-11 Statistical Analysis Results of All Standard Plan Items in the Five Trades

Trade	Minimum Length	Maximum Length	Average Length	Standard Deviation	Number of Plan Items
DSD	1.00	500.00	39.64	54.31	476
ELE	0.50	715.00	38.39	54.60	31,830
FTN	0.40	700.00	67.82	89.74	13,457
GAS	0.60	930.00	64.79	101.87	5,265
WSD	0.50	700.00	45.25	71.13	9,237
Total	0.40	930.00	47.31	71.21	60,265

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COLLABORATION STUDY OF PERMIT PERIOD ASSESSMENT METHOD FOR EXCAVATION WORKS OTHER THAN UTILITY TRENCH WORKS

FINAL REPORT

Report for R&D Division, Highways Department, HKSAR

Prepared by Road Research Group

Hong Kong Road Research Laboratory

Department of Civil and Structural Engineering

The Hong Kong Polytechnic University

Project No.: Hy(S)Q/044/2011

Date: August 2013

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Chapter 1 Introduction

1.1 Background

To date, Hong Kong had about 2,000 km long roads with over 70,000 km utilities deployed beneath the road surfaces. In other words, an average of about 35 km long utilities such as electric wires, water pipes and gas mains were laid in every kilometer road. Due to continuous developments and requests of utility stakeholders on having routine maintenance and new installations for increasing demands of the society, substantial amount of road opening works throughout the city had been undertaken [2].

Such extensive road opening works had thus drawn great attentions from the public. They were concerned about nuisances aroused from frequent and repeated road openings. Highways Department (HyD), as the excavation permit (XP) issuing authority, was also concerned about having fair coordination in giving approval of XPs [2]. In some occasions, public complaints about noise produced by construction activities or work sites that took unacceptably long period to finish the works were aroused. The latter issue, in particular, was more sensitive to the public as site idling could be easily observed by citizens especially when the sites were taken place on busy roads where people passed by every day. It was indeed understandable that the public demanded works to be completed in an early schedule, and the respective nuisances aroused from works could hence be minimized [5].

Computer systems, the Internet Interface for the Utility Management System (IIUMS) and subsequently the Excavation Permit Processing System (XPMS), were introduced in year 2004 and 2009 respectively. Sets of standard templates, which aimed to facilitate permit application process for common road opening works, were established. In case the works were not covered by the standard templates, applicant(s) had to apply non-standard works XP with proposed work items and schedules as well as supporting documents to substantiate the application [4].

At the initial stage under the operation of the IIUMS, some non-standard works with short duration were not covered by any standard templates due to the diversified work nature. In view of this, XP for short duration works (i.e. less than or equal to 14

days) but not under the scope of standard work was introduced, aiming to provide a new channel to applicants for having a direct and simple application process, as well as to reduce the workload of authority in processing XP applications [5].

A review on approved permit period and actual working period between years 2005 and 2007 was also undertaken. As shown in Figure 1-1, there were noticeable discrepancies between granted average permit period and actual working period recorded. It was also revealed in Figure 1-2 that the permit period of XPs granted to government departments including HyD had relatively large deviations to those granted to private utility stakeholders [5].

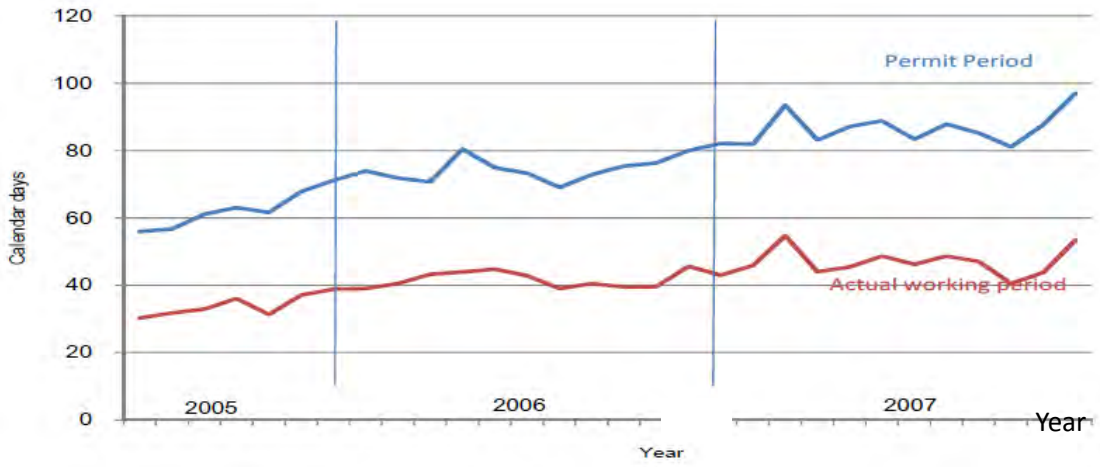


Figure 1-1 Comparison of average permit period and actual working period (Jan 2005 – Dec 2007)

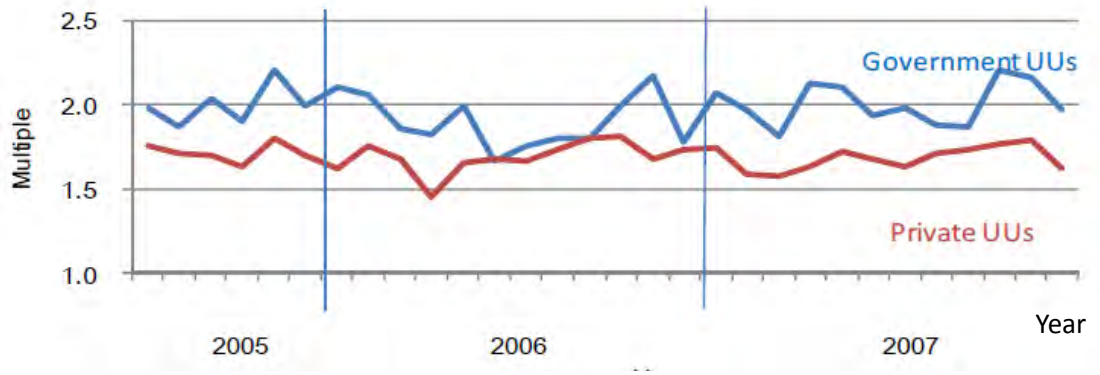


Figure 1-2 Index on the difference between permit period and actual working period (Jan 2005 – Dec 2007)

To address the issues of road opening works on site, HyD initiated a study to review the existing Permit Period Assessment (PPA) method for utility trench works in 2010.

It intended to obtain a more accurate and realistic approach for determining permit periods [1].

In that study, road opening management practice in Hong Kong, Australia, Singapore, the United Kingdom and the Mainland was reviewed. It was noticed that legislations, regulations, codes of practice, procedures and requirements of road work applications were the common measures adopted to facilitate road opening work in various aspects. Legislations, for instance, were established to master the process of permit application, approval, variation and extension. Regulations were deployed to provide guidance for road opening works to minimize disturbances incurred by proposed construction activities on sites. Codes of practice were published as for maintaining work quality and standardizing requirement for common works. Procedures and requirements of road work applications were also given to facilitate the application process through application systems [1].

XP data for utility trench work under five utility trades including Drainage Services Department, Water Services Department, electricity and fixed telecommunication network, as well as gas services, were analysed in that study. Deviations between the approved permit periods and actual working times on site were analyzed in various aspects. From years 2004 to 2009, an overall 16% decrease in permit period deviation was found when considering all XPs of the five trades [1].

Site surveillances were also conducted to collect information relating to productivities of common works with considerations of work natures, constraints of work site, as well as resources related to labor and machine. Several conclusions were reached: (1) Permit periods obtained from the current set of standard template might not be accurate in estimating the actual requirements; in which, the approved permit periods were generally slightly longer than actual needs on site; (2) Standard template(s) selected was not complied with actual construction activities conducted on site; (3) Multiplication Factor(s) selected might not be appropriate to describe the site constraints well; (4) Resources deployed on site differed from assumptions made in standard template(s); Most importantly, (5) actual work schedules on site were not consistent with those registered in the application system [1].

As a result of the findings, the PPA method and PPA templates were refined. Recommendations were given onto seven aspects for improvements: (1) Revision of fixed duration work items, which might not be reasonable in some cases if using a single value for all plans; (2) Elimination of work items that found to be unnecessary to the current practices especially those had seldom been adopted in the past few years; (3) Programme concurrence - it was questioned that if trench work could be done concurrently on site, as in the current standard templates, the work was assumed to be undertaken in series resulting in relatively long permit periods; (4) Elimination of standard templates for road opening work on carriageway, as in the past practice, two templates were adopted to describe work that was along and across the road; (5) Assumption of human resources made in standard templates was required to update based on site surveys; (6) Imposing limitation onto trench work length was needed to reflect real situations on site because lengthy trench was normally conducted in phases; (7) In some cases, road openings were in irregular shape. Polygon model, hence, was more preferable than line model when illustrating work areas under the application system, and so better facilitation of XPs [1].

Subsequent to previous study for utility trench work, this Study for excavation works other than utility trench works was carried out to complete the review for the remaining trades of works.

1.2 Objective

The main objective of the current study was to review and improve the current PPA method for excavation works other than utility trench works. The existing standard PPA templates adopted by these parties were reviewed and revised. New standard PPA templates were proposed to cater for some new but common standard works nowadays.

1.3 Approach

There were five major elements in achieving the research objective of developing improved PPA methods for excavation works other than utility trench works:

1. Reviewing literature and documents
2. Reviewing standard PPA templates
3. Data analysis

4. Interviews with XP applicants and administrators
5. Site surveillance

Figure 1-3 shows the relationship between these elements. As shown in the figure, review of literature and standard PPA templates, and analysis of data collected since 1 April 2004 were carried out to obtain knowledge and understanding relating to existing information. New information was obtained from interview with PPA practitioners and designers (i.e. practising engineers and administrators) and site surveillance on working excavation works.

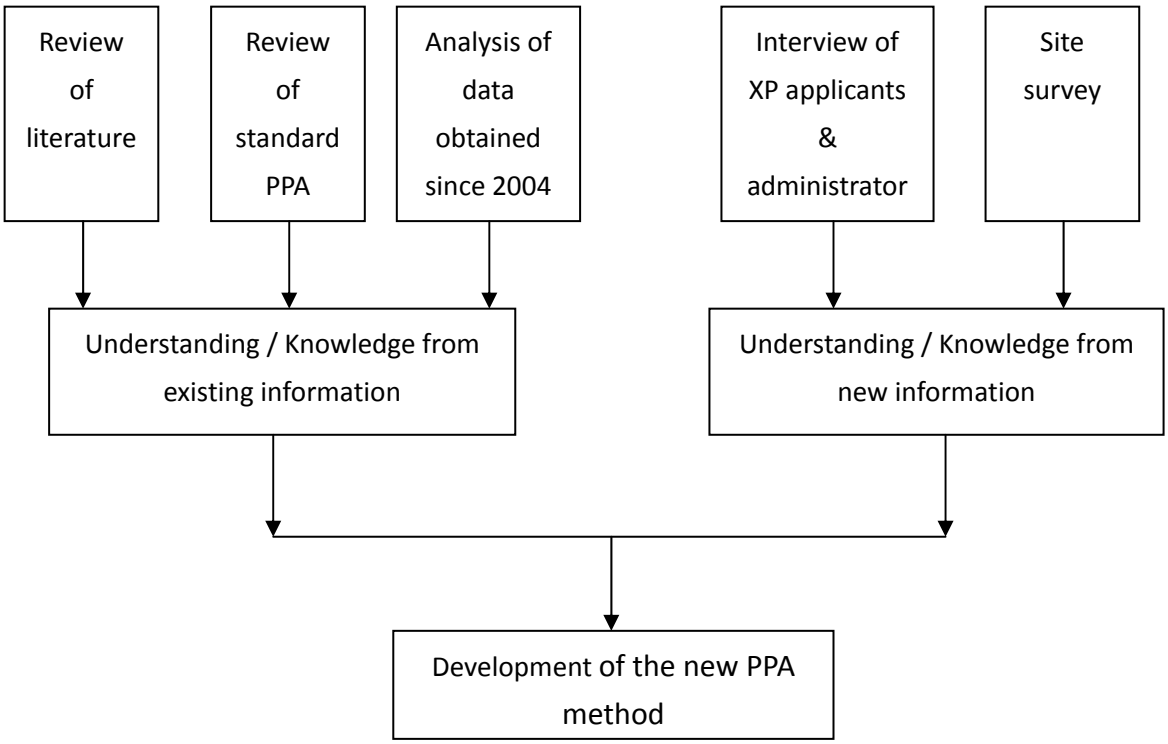


Figure 1-3 Approach for formulation of new PPA method

1.4 Report Structure

There are in total seven chapters in this report, in Chapter 1, relevant literature/records/documents of HyD and other parties associated with excavation permit application are reviewed. Particularly, the "Study of Permit Period Assessment Method for Utility Trench Works" is discussed.

To start with, an analysis on historic XP records for excavation works other than utility trench works is conducted in Chapter 2. This aims to reveal the past and current situations of the IIUMS and XPMS, respectively, figuring out attributes that influence accuracy of the current PPA method.

From the other perspective, the current standard PPA templates for excavation works other than utility trench works under Architectural Services Department (ASD), Civil Engineering and Development Department (CEDD), Housing Department (HSD), Hong Kong Tramways Limited (HTL) and HyD are reviewed. Means to enhance typical work programmes are discussed in Chapter 3.

In Chapter 4, records obtained from full-time surveillance on selected work sites that had been conducted for 17 weeks between February and June 2012 are presented. This survey intends to collect information on real practices of road opening works, in which the information is expected to help when formulating the new PPA model and suggesting means to improve the current practice.

Furthermore, in Chapter 5, comments and advices from the interviews and meetings with XP applicants under ASD, CEDD, HSD, HTL and HyD, and the Excavation Permit Processing Team (XPPT) are summarized. Their views are addressed and further actions are proposed where the contents fit for this study scope.

Having conducted analyses, revisions, inspections and discussions in four different perspectives, recommendations on improving the PPA method are given in Chapter 6.

Finally, the user guide of the new PPA method is presented in Chapter 7 of this report.

Chapter 2 Analysis on Historic XP Records

This chapter presents the results of analysis on XP data from IIUMS and XPMS. The analytical methods, parameters and assumptions applied in the analysis are described in Section 2.2. Section 2.3 moves onto examining permit period consistency from various aspects to figure out the discrepancies if any. Sections 2.4 and 2.5 are split into two parts, focusing on the attributions from late start and early completion of work. Lastly, permit extension, standard template and user-defined template usages are reviewed in Sections 2.6 and 2.7.

2.1 Scope of analysis

XPs registered under the five utility stakeholders, i.e. ASD, CED, HSD, HTL and HyD, were considered. With the exception of short duration work records, total of 24,425 normal XPs that were registered and completed between 1 April 2004 and 24 August 2009 under the IIUMS, and 6,413 XPs that were registered and completed between 25 August 2009 and 31 December 2011 under the XPMS were studied in the following sections. Table 2-1 shows a summary of the approved permit period and the actual working period of these XPs.

Table 2-1 Summary of XPs under the IIUMS and the XPMS

	Approved permit period	**Actual working period**
IIUMS	*Mean = 94.9 days*	*Mean = 51.3 days*
N = 24,425	*Std = 107.2 days*	*Std =92.2 days*
XPMS	*Mean = 106.5 days*	*Mean = 62.2 days*
N = 6,413	*Std = 104.2 days*	*Std = 95.3 days*

2.2 Analytical method

2.2.1 Permit Period Deviation (PPD)

To find out whether there were any discrepancies between approved and actual working periods of XPs, two parameters namely Absolute Permit Period Deviation (PPD) and Relative PPD were deployed. They were used to quantify the discrepancies in days and in percentage with respect to permit approval period. Their definitions were:

Absolute PPD = Permit approval period – Actual working period [in day(s)]

and,

Relative PPD = (Absolute PPD / Permit approval period) [in percentage]

The higher the values of Absolute and Relative PPDs, the greater the discrepancies between permit approval period and actual working period were on site.

2.2.2 Assumptions and Removal of Outliers

In this analysis, it was assumed that the Absolute PPD values obtained from each of the two systems followed a Normal distribution. The Anderson-Darling test was thus adopted to verify the assumption with the null and alternative hypotheses as follows:

H_0: the Absolute PPD values follow a Normal distribution

H_1: the Absolute PPD values do not follow a Normal distribution

The test results shown in Table 2-2 indicate that the null hypotheses are rejected at 0.5% significance level, i.e. the Absolute PPD values obtained from the two systems do not follow Normal distribution as was assumed.

Table 2-2 Anderson-Darling test results for the Absolute PPD values of the two systems

	Absolute PPD	**AD Test Statistics**	**P-value**
IIUMS	*Mean = 47.72*	*1665.55*	*<0.005*
*N = 22,901**	*Std = 60.29*		
XPMS	*Mean = 47.26*	*337.32*	*<0.005*
*N = 6,099**	*Std = 55.87*		

*1,524 and 314 XPs with permit extension under the IIUMS and the XPMS, respectively, were excluded in the test, as they lie outside the scope in this section. Histograms of Absolute PPD records of the two systems are shown in Figure 2-1 and Figure 2-2 as for reference.

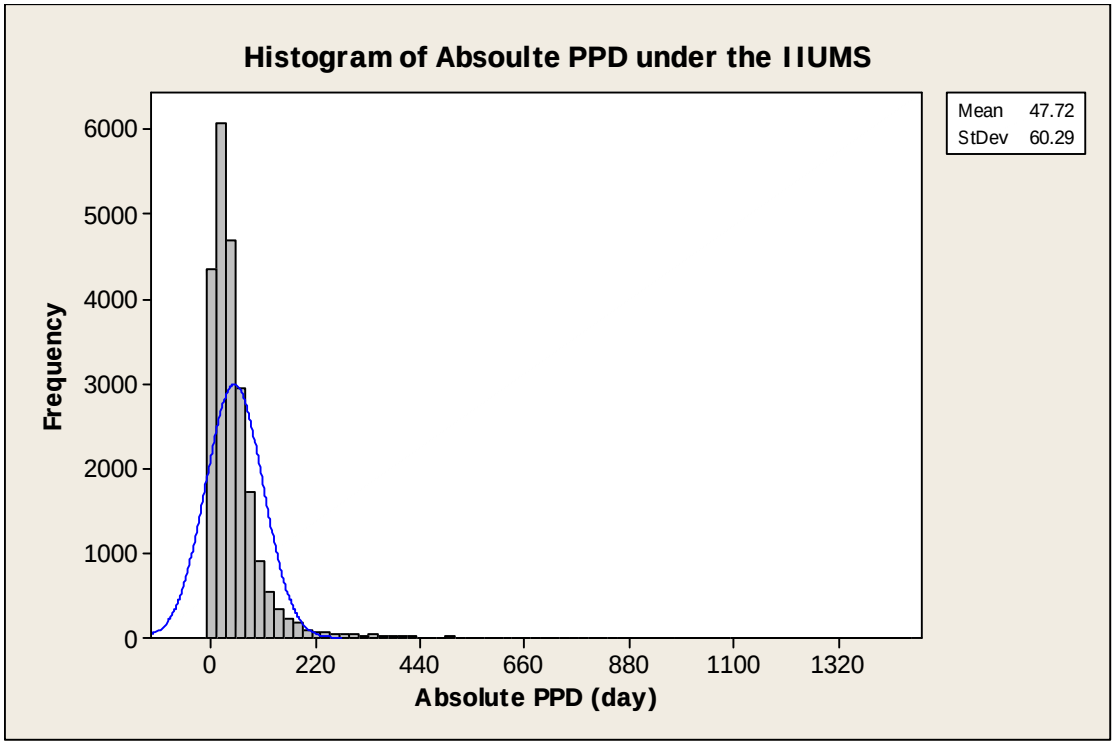


Figure 2-1 Histogram of Absolute PPD (with Normal distribution curve) under the IIUMS

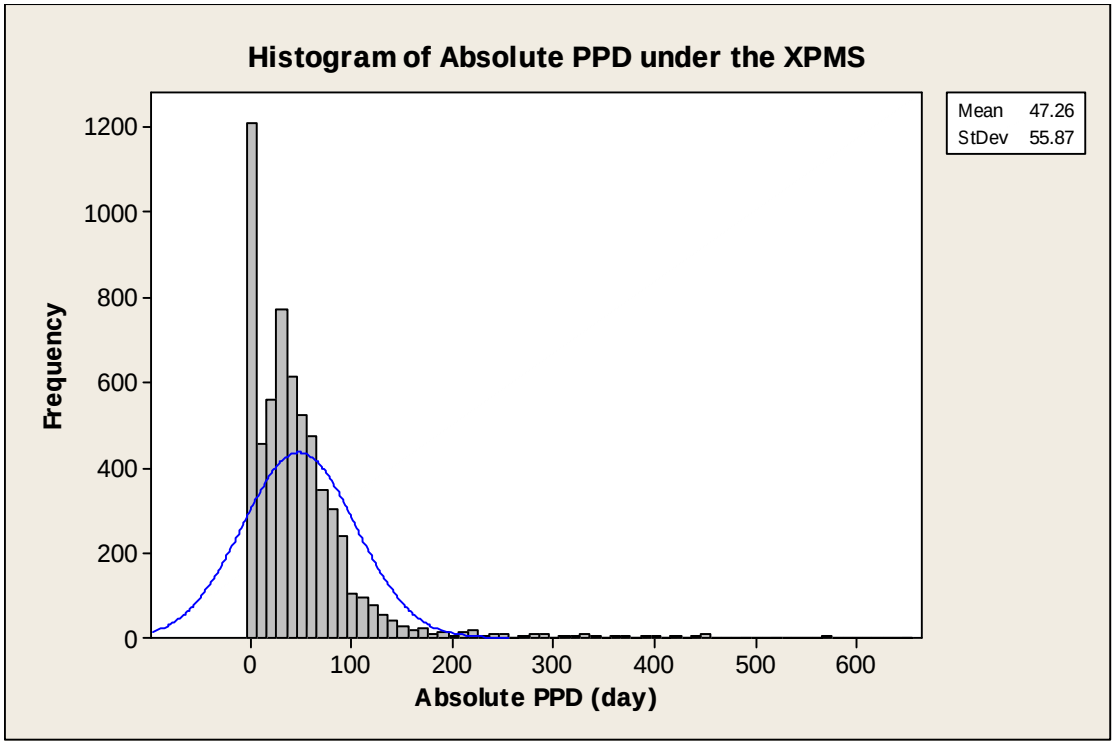


Figure 2-2 Histogram of Absolute PPD (with Normal distribution curve) under the XPMS

In this case, outliers could not be removed based on three standard deviations rule as governed by Normal distribution. A descriptive statistics indicator with 95 percentile as outlier cut-off was adopted in the current analysis. After that, total of 21,454 and 5,794 XPs under the IIUMS and the XPMS, respectively, remained. Table 2-3 shows the distributions of XPs under the five utility stakeholders of the two systems before and after the removal process; and a descriptive summary of the (qualified) XPs after the removal process is shown in Table 2-4.

Table 2-3 Distributions of XPs under the five utility stakeholders of the two application systems before and after the removal process

		All XPs	**All XPs – Extension**	**All XPs – Extension – Outliers**
IIUMS	*ASD*	*858 / 3.5%*	*662 / 2.9%*	*582 / 2.7%*
	CEDD	*1,990 / 8.1%*	*1,736 / 7.6%*	*1,384 / 6.5%*
	*HSD**	-	-	-
	HTL	*147 / 0.6%*	*146 / 0.6%*	*132 / 0.6%*
	HyD	*21,430 / 87.7%*	*20,357 / 88.9%*	*19,356 / 90.2%*
Grand total		*24,425*	*22,901*	*21,454*
XPMS	*ASD*	*250 / 3.9%*	*134 / 2.2%*	*131 / 2.3%*
	CEDD	*1,455 / 22.7%*	*1,391 / 22.8%*	*1,239 / 21.4%*
	HSD	*113 / 1.8%*	*77 / 1.3%*	*76 / 1.3%*
	HTL	*29 / 0.5%*	*29 / 0.5%*	*29 / 0.5%*
	HyD	*4,566 / 71.2%*	*4,468 / 73.3%*	*4,319 / 74.5%*
Grand total		*6,413*	*6,099*	*5,794*

* No XPs were found under HSD in the IIUMS.

Table 2-4 Descriptive summary of the (qualified) XPs of the two application systems after the removal process

	Approved permit period	**Actual working period**	**Absolute PPD**	**Relative PPD**
IIUMS	*Mean*	*Mean*	*Mean*	*Mean*
N = 21,454	*= 82.3 days*	*= 44.7 days*	*= 37.7 days*	*= 56.7 %*
	Median	*Median*	*Median*	*Median*
	= 61.0 days	*= 19.0 days*	*= 30.0 days*	*= 64.7 %*
	25th percentile	*25th percentile*	*25th percentile*	*25th percentile*
	= 37.0 days	*= 5.0 days*	*= 13.0 days*	*= 25.0 %*
	75th percentile	*75th percentile*	*75th percentile*	*75th percentile*
	= 92.0 days	*= 50.0 days*	*= 55.0 days*	*= 88.9 %*
XPMS	*Mean*	*Mean*	*Mean*	*Mean*
N = 5,794	*= 95.0 days*	*= 57.2 days*	*= 37.9 days*	*= 50.3 %*
	Median	*Median*	*Median*	*Median*
	= 79.0 days	*= 31.0 days*	*= 33.0 days*	*= 54.5 %*
	25th percentile	*25th percentile*	*25th percentile*	*25th percentile*
	= 52.0 days	*= 9.0 days*	*= 10.0 days*	*= 12.5 %*
	75th percentile	*75th percentile*	*75th percentile*	*75th percentile*
	= 106.0 days	*= 71.0 days*	*= 58.0 days*	*= 84.6 %*

It could be seen that the mean, median, 25th and 75th percentiles of Relative PPD decreased slightly after the introduction of the XPMS. These indicated that permit period discrepancies had been gently improved under the operation of the XPMS. Nevertheless, further improvements should be achieved; as there were half of the XPs with over 50% permit time remained after completion.

2.3 Multidimensional analysis

To identify attributes of permit period discrepancies, a multidimensional analysis was conducted onto all the qualified XPs under the following aspects.

a) by utility stakeholder, i.e. ASD, CEDD, HSD, HTL and HyD;
b) by region, i.e. Hong Kong, Kowloon and New Territories;
c) by work type, i.e. Standard work and Non-standard work;
d) by Multiplication Factor (MF);

e) by carriageway and footpath;

f) by standard template usage; and

g) by single/multiple item permit.

Distributions of the qualified XPs of the two systems were shown in Table 2-5 and Table 2-6. In the IIUMS, the majority of works were registered in New Territories as non-standard work permits. MFs or standard templates were not used to determine the permit period. These permits included single work item and works were taken place on footpath. In the XPMS, the majority of works were also registered in New Territories as non-standard work permits. These applications did not adopt MFs, but standard templates were used for part of the plan items to determine permit period. There permits included multiple work items and works were undertaken on footpath.

Table 2-5 Distribution of the qualified XPs by category under the IIUMS

	Region			***Work type***		***Multiplication Factor***		***Single/Multiple item permit***	
	HK	*KL*	*NT*	*Standard*	*Non-standard*	*Yes*	*No*	*Single*	*Multiple*
ASD	*154 / 26.5%*	*150 / 25.8%*	*278 / 47.8%*	*153 / 26.3%*	*429 / 73.7%*	*156 / 26.8%*	*426 / 73.2%*	*283 / 48.6%*	*299 / 51.4%*
CEDD	*462 / 33.4%*	*347 / 25.1%*	*575 / 41.5%*	*167 / 12.1%*	*1,217 / 87.9%*	*167 / 12.1%*	*1,217 / 87.9%*	*521 / 37.6%*	*863 / 62.4%*
HSD	-	-	-	-	-	-	-	-	-
HTL	*132 / 100%*	-	-	-	*132 / 100%*	-	*132 / 100%*	*64 / 48.5%*	*68 / 51.5%*
HyD	*5,365 / 26.2%*	*4,454 / 21.4%*	*10,931 / 52.4%*	*5,131 / 26.5%*	*14,225 / 73.5%*	*5,148 / 26.6%*	*14,208 / 73.4%*	*10,415 / 53.8%*	*8,941 / 46.2%*
Sub total	*5,959*	*4,951*	*11,784*	*5,451*	*16,003*	*5,471*	*15,983*	*11,283*	*10,171*

	Standard template usage			***Road type***				***Sub total***
	All Standard	*All Non-standard*	*Mixed*	*Carriageway*	*Footpath*	*Both*	*Neither*	
ASD	*153 / 26.3%*	*429 / 73.7%*	-	*72 / 12.4%*	*344 / 59.1%*	*130 / 22.3%*	*36 / 6.2%*	*582*
CEDD	*167 / 12.1%*	*1,217 / 87.9%*	-	*100 / 7.2%*	*625 / 45.2%*	*103 / 7.4%*	*556 / 40.2%*	*1,384*
HSD	-	-	-	-	-	-	-	*0*
HTL	-	*132 / 100%*	-	*44 / 33.3%*	*68 / 51.5%*	*19 / 14.4%*	*1 / 0.8%*	*132*
HyD	*5,131 / 26.5%*	*14,218 / 73.5%*	*7 / 0.1%*	*5,352 / 27.6%*	*9,017 / 46.6%*	*1,784 / 9.2%*	*3,203 / 16.5%*	*19,356*
Sub total	*5,583*	*15,864*	*7*	*5,568*	*10,054*	*2,036*	*3,796*	

Note: number of XPs / percentage with respect to the total number of XPs *Grand total = 21,454*

Table 2-6 Distribution of the qualified XPs by category under the XPMS

	Region			***Work type***		***Multiplication Factor***		***Single/Multiple item permit***	
	HK	*KL*	*NT*	*Standard*	*Non-standard*	*Yes*	*No*	*Single*	*Multiple*
ASD	*29 / 22.1%*	*31 / 23.7%*	*71 / 54.2%*	*19 / 14.5%*	*112 / 85.5%*	*-*	*131 100%*	*-*	*131 / 100%*
CEDD	*371 / 29.9%*	*712 / 57.5%*	*156 / 12.6%*	*619 / 50.0%*	*620 / 50.0%*	*-*	*1,239 / 100%*	*-*	*1,239 / 100%*
HSD	*2 / 2.6%*	*45 / 59.2%*	*29 / 38.2%*	*3 / 3.9%*	*73 / 96.0%*	*-*	*76 / 100%*	*-*	*76 / 100%*
HTL	*29 / 100%*	*-*	*-*	*5 / 17.2%*	*24 / 82.8%*	*5 / 17.2%*	*24 / 82.8%*	*-*	*29 / 100%*
HyD	*859 / 19.9%*	*815 / 18.9%*	*2,645 / 61.2%*	*1,598 / 37.0%*	*2,721 / 63.0%*	*-*	*4,319 / 100%*	*1 / 0.1%*	*4,318 / 99.9%*
Sub total	*1,290*	*1,603*	*2,901*	*2,244*	*3,550*	*5*	*5,789*	*1*	*5,793*

	Standard template usage			***Road type***				***Sub total***
	All Standard	*All Non-standard*	*Mixed*	*Carriageway*	*Footpath*	*Both*	*Neither*	
ASD	*19 / 14.5%*	*7 / 5.3%*	*105 / 80.2%*	*27 / 20.6%*	*65 / 49.6%*	*38 / 29.0%*	*1 / 0.8%*	*131*
CEDD	*619 / 50.0%*	*31 / 2.5%*	*589 / 47.5%*	*20 / 1.6%*	*1,090/ 88.0%*	*98 / 7.9%*	*31 / 2.5%*	*1,239*
HSD	*3 / 3.9%*	*2 / 2.6%*	*71 / 93.4%*	*5 / 6.6%*	*47 / 61.8%*	*24 / 31.6%*	*-*	*76*
HTL	*5 / 17.2%*	*1 / 3.4%*	*23 / 79.3%*	*7 / 24.1%*	*15 / 51.8%*	*7 / 24.1%*	*-*	*29*
HyD	*1,598 / 37.0%*	*119 / 2.8%*	*2,602 / 60.2%*	*1,238 / 28.7%*	*1,988 / 46.0%*	*1,049 / 24.3%*	*44 / 1.0%*	*4,319*
Sub total	*2,244*	*160*	*3,390*	*1,297*	*3,205*	*1,216*	*76*	

Note: number of XPs / percentage with respect to the total number of XPs

Grand total = 5,794

2.3.1 Permit Period Deviation (PPD) by utility stakeholder

i. XPs under the IIUMS

Of the 21,454 XPs, 2.7%, 6.5 %, 0.6% and 90.2% were registered under ASD, CED, HTL and HyD, respectively. No XP record was found under HSD in this system. The means and medians of the Relative PPD of the four utility stakeholders were 38.4% and 34.0%, 33.3% and 26.6%, 42.7% and 46.0%, as well as 59.0% and 68.2%.

The boxplot[1] shown in Figure 2-3 reveals that XPs under HyD had higher discrepancy between the approved permit period and the actual working time on site. There was at least 68.2% permit time remained in half of the XPs. In contrast, CED had the least discrepancy between the two periods; half of them used up 73.4% approval time for their work. However, it should be noticed that there were merely 1,384 XPs out of 21,454 under CED in this system. Its high consistency might be due to such low permit usage, as HyD dominated the system with 19,356 numbers of XP, i.e. over 90% XPs were registered between years 2004 and 2009.

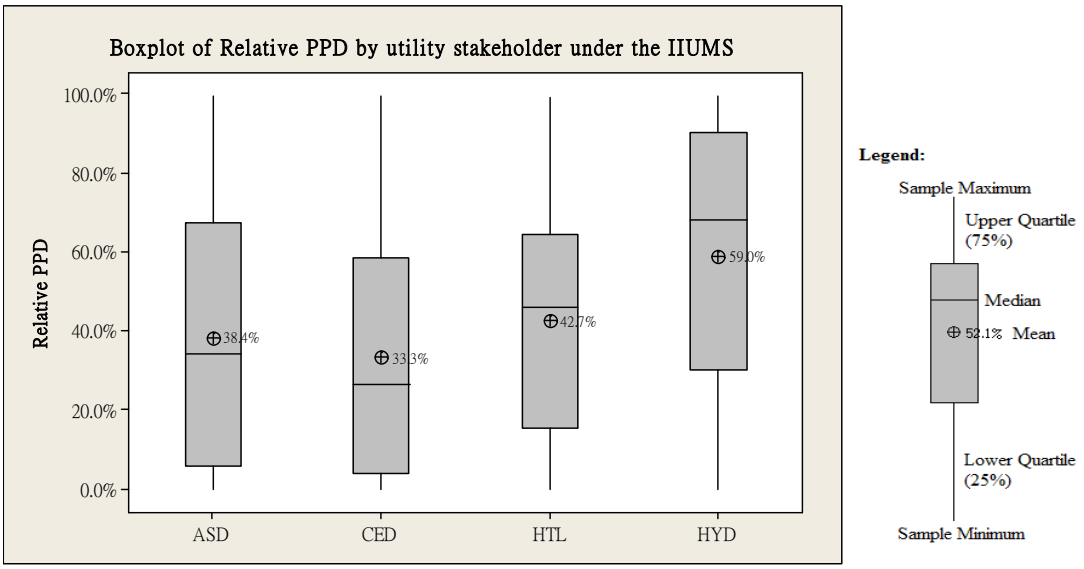


Figure 2-3 Boxplot of Relative PPD by utility stakeholder under the IIUMS

[1] Boxplot is a tool to depict groups of numerical data graphically through its five-number summaries: sample minimum, lower quartile (25%), median, mean, upper quartile (75%), and sample maximum.

ii. XPs under the XPMS

Of the 5,794 XPs, 2.3%, 21.4%, 1.3%, 0.5% and 74.5% were under ASD, CEDD, HSD, HTL and HyD, respectively. Their means and medians of the Relative PPD were 36.2% and 24.7%, 32.3% and 14.8%, 32.6% and 22.4%, 52.1% and 61.1%, as well as 56.1% and 62.4%.

Similar to the phenomenon reported under the IIUMS, the boxplot shown in Figure 2-4 revealed that HyD and HTL had higher discrepancies between the approved permit period and the actual working time on site. There was at least 60% time remained in half of the XPs after completion. While, discrepancy of CEDD was the least in among the five utility stakeholders; half of the permittees used up 84.5% approval time for their work on site.

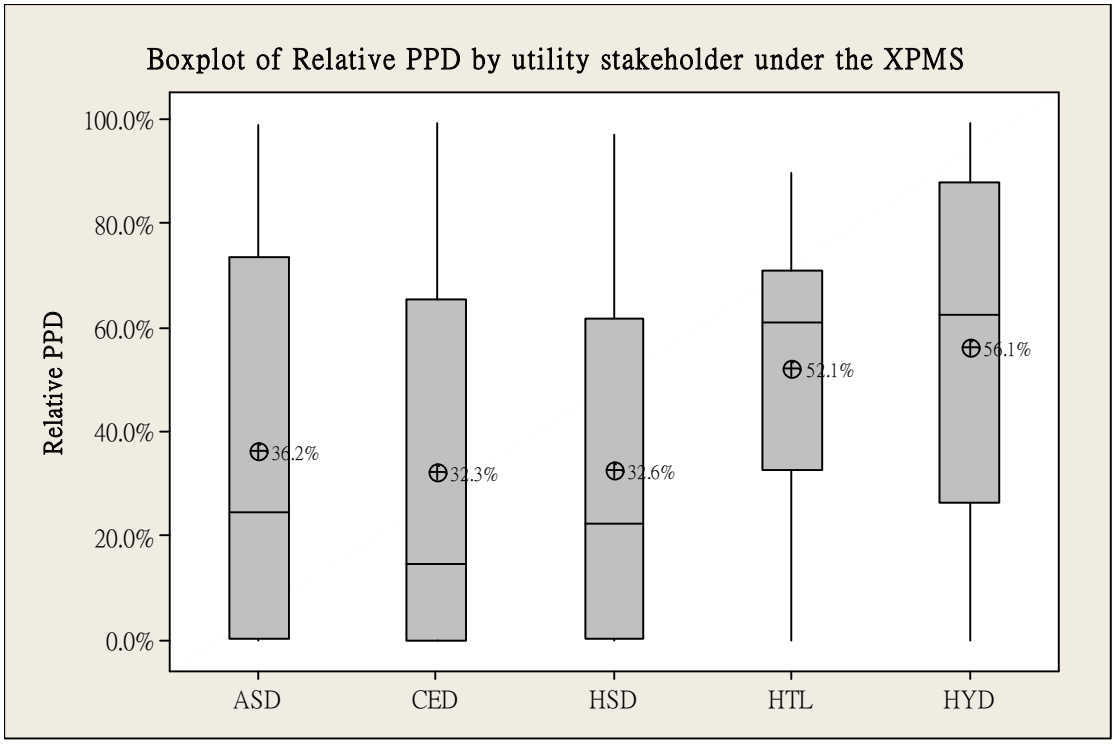


Figure 2-4 Boxplot of Relative PPD by utility stakeholder under the XPMS

2.3.2 Permit Period Deviation (PPD) by region

i. XPs under the IIUMS

Of the 21,454 XPs, 28.5%, 20.7% and 50.8% were undertaken in Hong Kong, Kowloon and New Territories, respectively. Their means and medians of the Relative PPD were 61.5% and 71.7%, 53.4% and 59.2%, as well as 55.3% and 62.8%.

The boxplot shown in Figure 2-5 reveals that the discrepancy in Hong Kong was larger than the other two regions; there was at least 71.7% time remained in half of the XPs. The discrepancy in Kowloon was the least among the three regions; half of the permittees used up 40.8% permit time after completion; where the works in New Territories used up 37.2% permit time only.

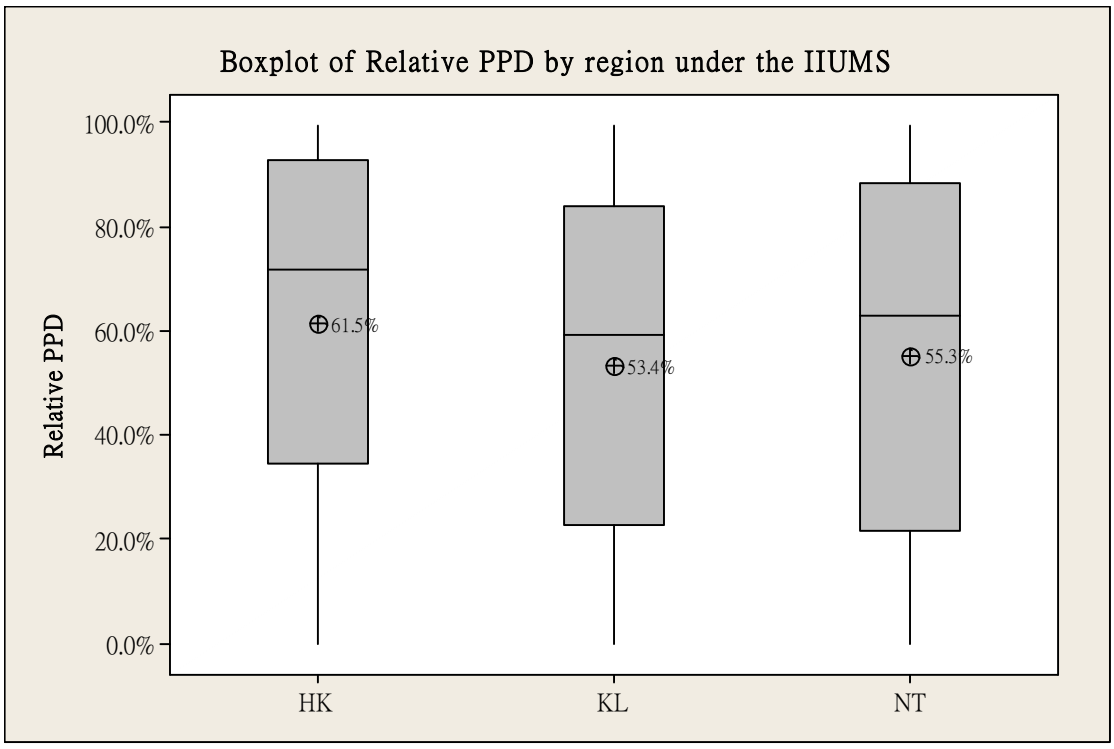


Figure 2-5 Boxplot of Relative PPD by region under the IIUMS

ii. XPs under the XPMS

Of the 5,794 XPs, 22.3%, 27.7% and 50.1% were undertaken in Hong Kong, Kowloon and New Territories, respectively. The means and medians of the Relative PPD of the three regions were 42.6% and 38.6%, 44.8% and 46.0%, as well as 56.7% and 63.9%.

Unlike the situation revealed by the IIUMS's data, the boxplot shown in Figure 2-6 revealed that the PPD for New Territories was higher than the other two regions. There was at least 63.9% approval time left in half of the cases. The discrepancies in Hong Kong and Kowloon areas were much better, and half of them with over 38% permit time remained after completion. In fact, situations in Hong Kong and Kowloon had been improved significantly after the use of the XPMS.

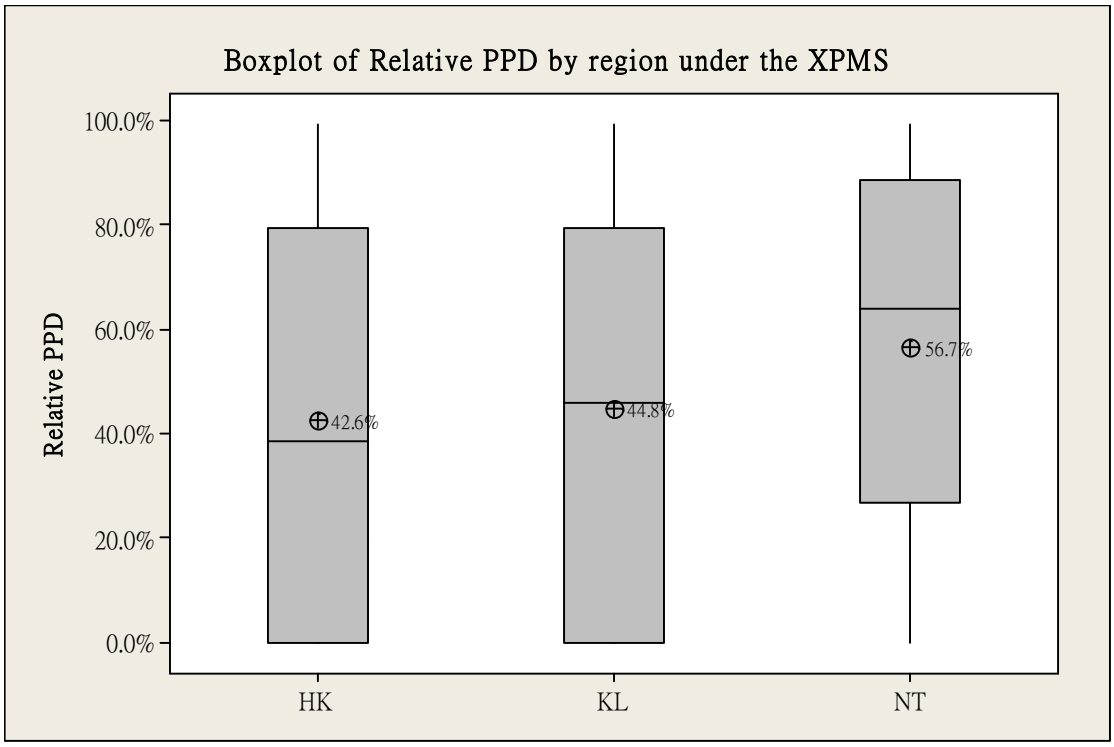


Figure 2-6 Boxplot of Relative PPD by region under the XPMS

2.3.3 Permit Period Deviation (PPD) by work type

i. XPs under the IIUMS

Of the 21,454 XPs, 25.4% and 74.6% of them were standard work and non-standard work permits, respectively. Their means and medians of the Relative PPD are 62.4% and 73.6%, and 54.7% and 60.7%.

Figure 2-7 showed that XPs registered as standard works had larger discrepancy than those of non-standard work, in which half of them with over 73.6% permit time left after completion. In contrast, XPs that were registered as non-standard work had less discrepancy.

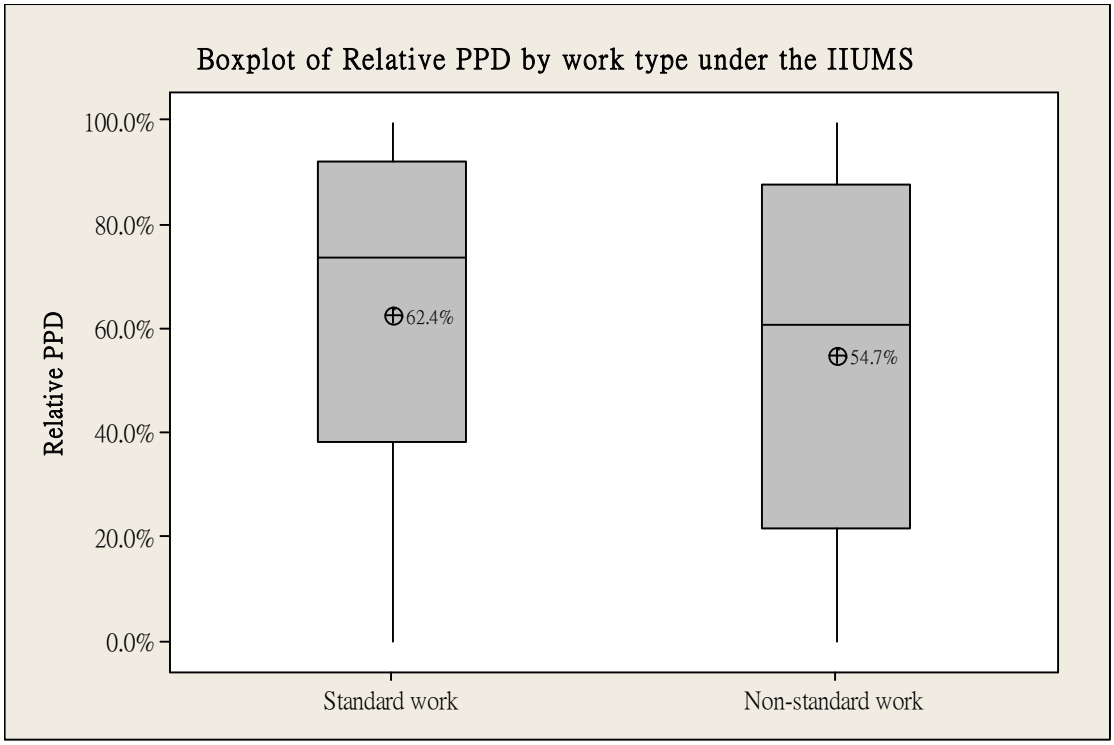


Figure 2-7 Boxplot of Relative PPD by work type under the IIUMS

ii. XPs under the XPMS

Of the 5,794 XPs, 38.7% and 61.3% of them were standard work and non-standard work permits, respectively. Their means and medians of the Relative PPD were 51.5% and 57.6%, as well as 49.5% and 53.3%.

Figure 2-8 revealed that XPs registered as standard work had higher consistency between the permit approval period and actual working time on site. Relative PPD was found since the introduction of the XPMS; while for plans related to non-standard work, 7% decrease was noted. Albeit there was an overall improvement under the XPMS, further efforts in enhancing permit period consistency should be exerted since there were 57.6% and 53.3% time remained in half of the XPs in standard work and non-standard work respectively.

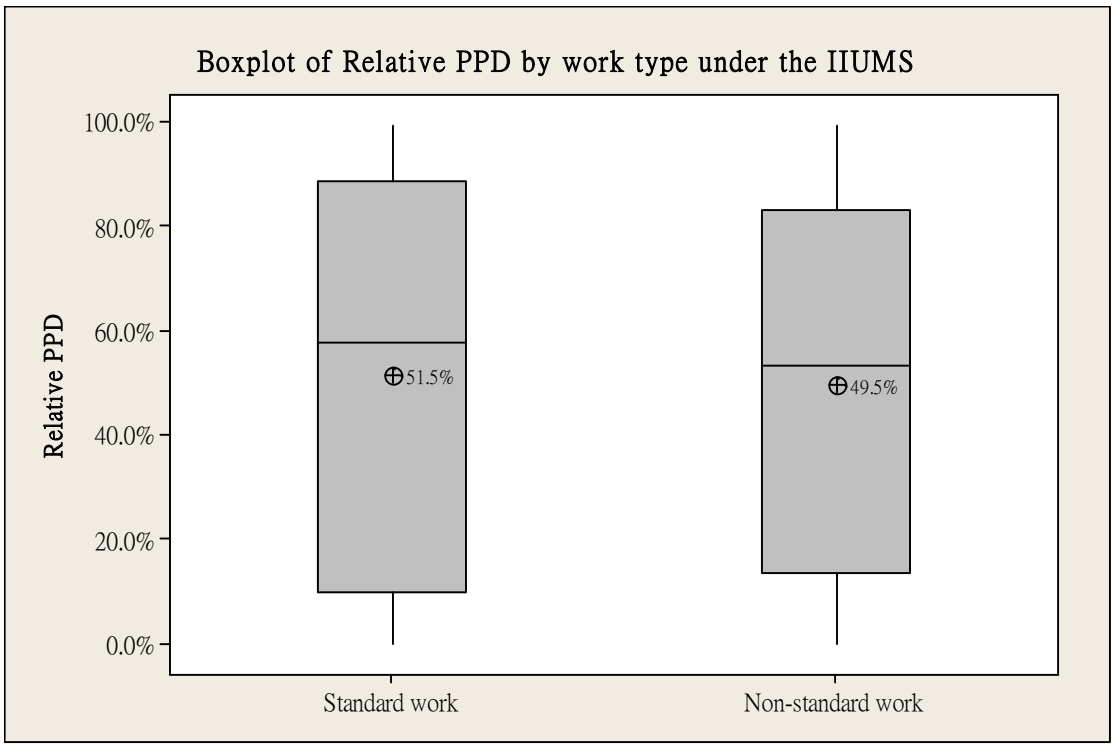


Figure 2-8 Boxplot of Relative PPD by work type under the XPMS

2.3.4 Permit Period Deviation (PPD) by Multiplication Factor (MF)

i. XPs under the IIUMS

Of the 21,454 XPs, 25.5% and 74.5% adopted and not adopted MF in the applications respectively. Their means and medians of the Relative PPD were 62.4% and 73.5%, as well as 54.7% and 60.7%, respectively.

Figure 2-9 revealed that XPs with MF(s) in determining permit time had higher Relative PPD; 73.5% time remained in half of the XPs after completion. More importantly, a noticeable deviation between XPs using and not using MF to determine permit periods was found. The use of the MFs might simply multiply durations of permit periods by factors making those even longer than usual, but not actually enhancing the accuracy of the estimations. The deficiency of MF usage would probably due to lacking knowledge on its application, which applicants did not know how the factors were derived and hence, had no idea on how to make use of them properly.

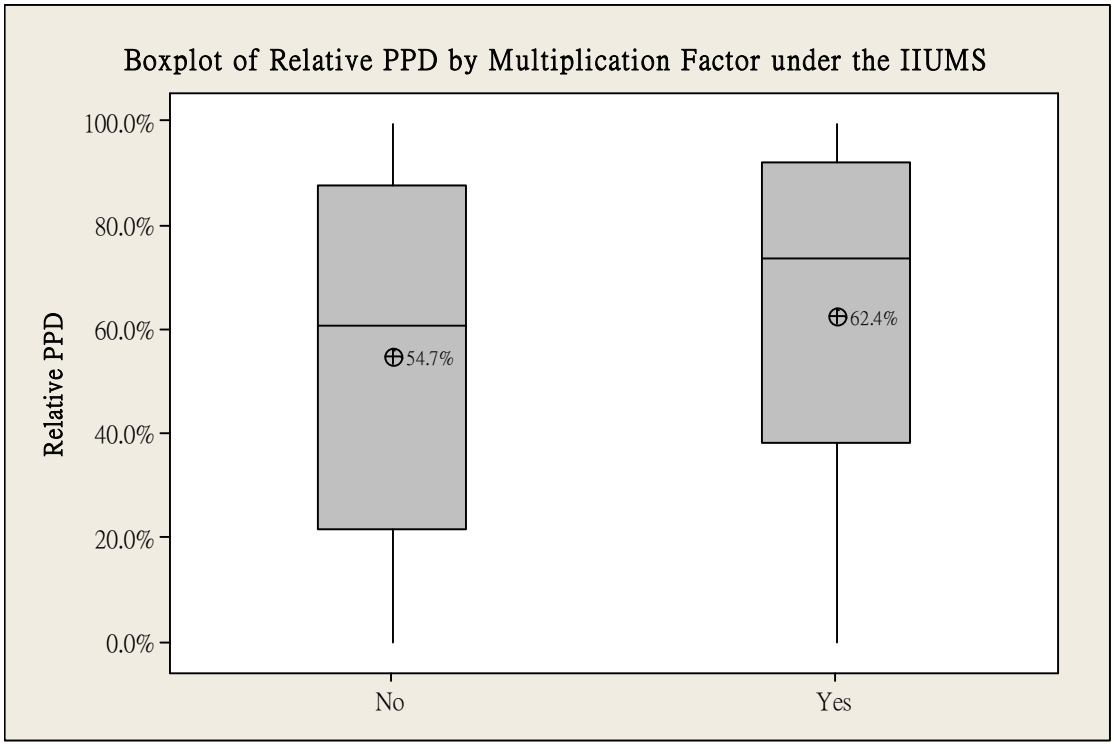


Figure 2-9 Boxplot of Relative PPD by Multiplication Factor under the IIUMS

ii. Records under the XPMS

Of the 5,794 XPs, all but five did not adopt MF in the permit applications. The means and medians of the Relative PPD of XPs using and not using MF were 49.2% and 61.1%, and 50.3% and 54.5%, respectively.

Compared to the situation as found under the IIUMS, the deviation between using MF and not using MF was less as shown in Figure 2-10. In the XPMS, the cases without MF had less discrepancies in the past few years, but, yet, there was insufficient evidence to make sound conclusion on that as the sample size of plans with MF was noticeably small, which was five in total.

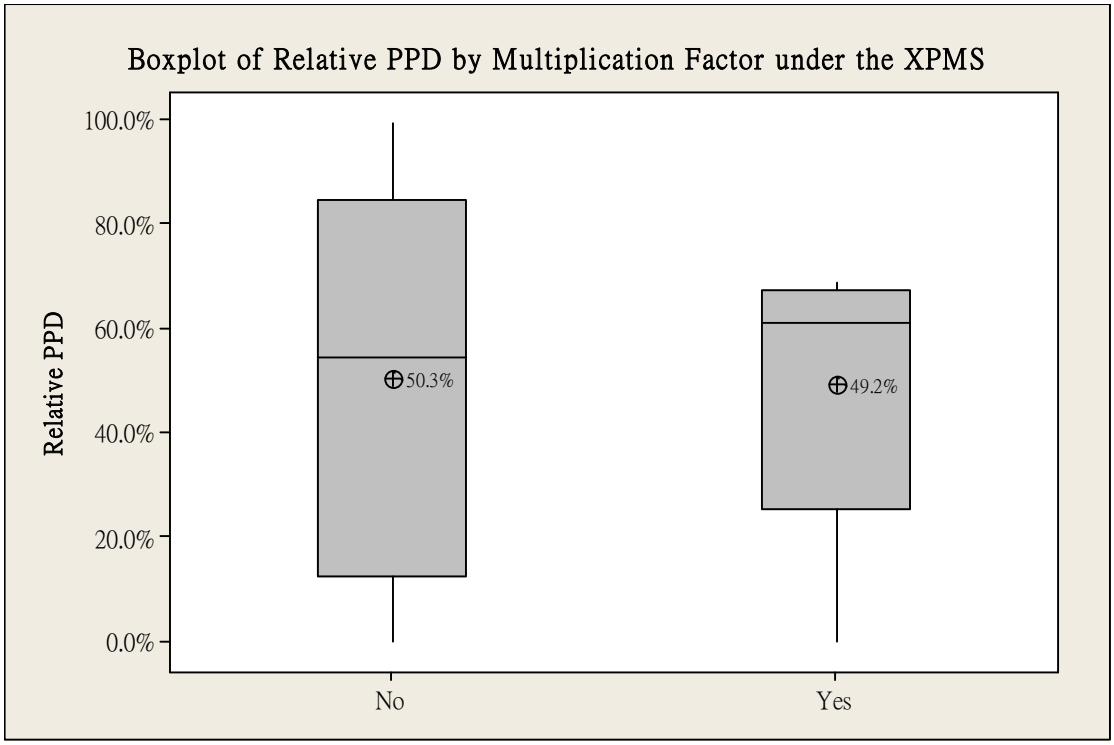


Figure 2-10 Boxplot of Relative PPD by Multiplication Factor under the XPMS

2.3.5 Permit Period Deviation (PPD) by carriageway and footpath

i. XPs under the IIUMS

Of the 21,454 XPs, 9.5%, 26.0%, 46.9% and 17.7% were undertaken on footpath and carriageway, carriageway, footpath, and neither of these two road types, respectively. Their means and medians of the Relative PPD were 47.5% and 50.6%, 63.1% and 74.5%, 61.1% and 71.4%, and 40.5% and 36.4%.

Figure 2-11 revealed that XPs on carriageway and on footpath were of higher discrepancies between the permit approval period and actual working time on site. There was at least 70% time left in half of the XPs. In contrast, works undertaken on neither of these two road types had the least discrepancy, of which half of them remained 36.4% permit time or less after completion.

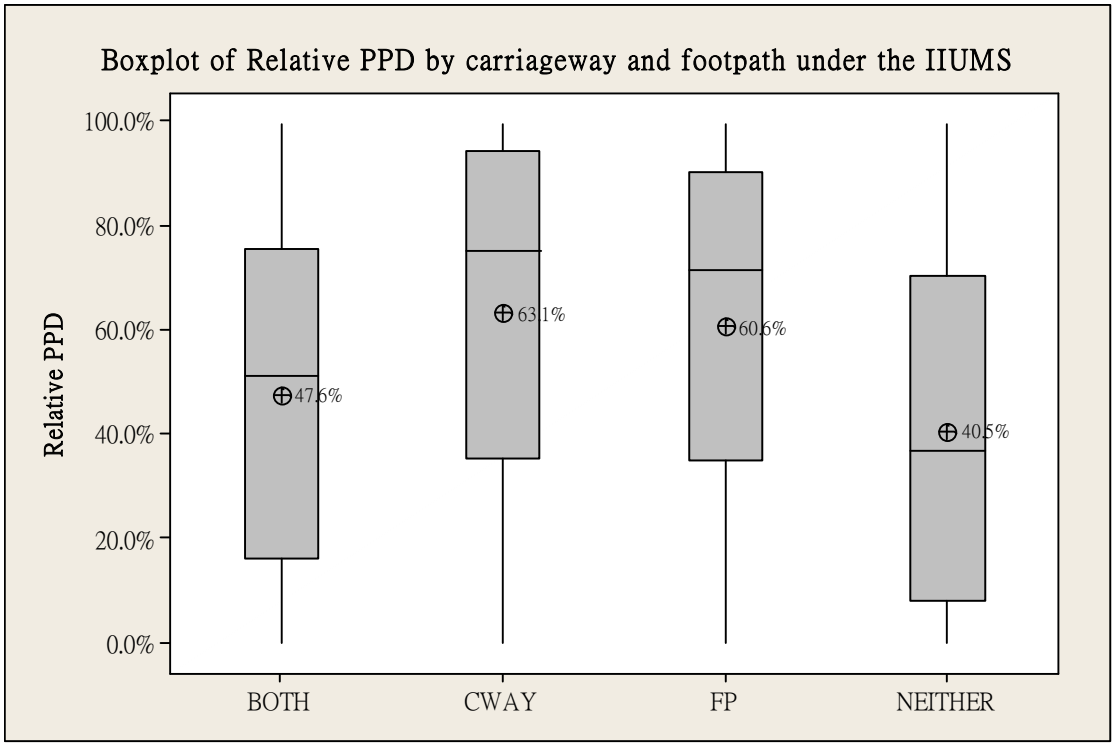


Figure 2-11 Boxplot of Relative PPD by footpath and carriageway under the IIUMS

ii. Records under the XPMS

Of the 5,794 XPs, 21.0%, 22.4%, 55.3% and 1.3% were undertaken on footpath and carriageway, carriageway, footpath and neither of these two road types, respectively. Their means and medians of the Relative PPD were 44.6% and 44.4%, 60.2% and 70.6%, 48.3% and 51.7%, and 53.8% and 57.0%.

In the XPMS, discrepancies of work undertaken on carriageway remained, but the situation as on footpath had been significantly improved. There was 51.7% time left in half of the XPs as shown in Figure 2-12. More importantly, work undertaken on footpath and carriageway was slightly improved under the new system except that on neither of these two road types. Its inconsistencies were even increased by 20% in half of the cases.

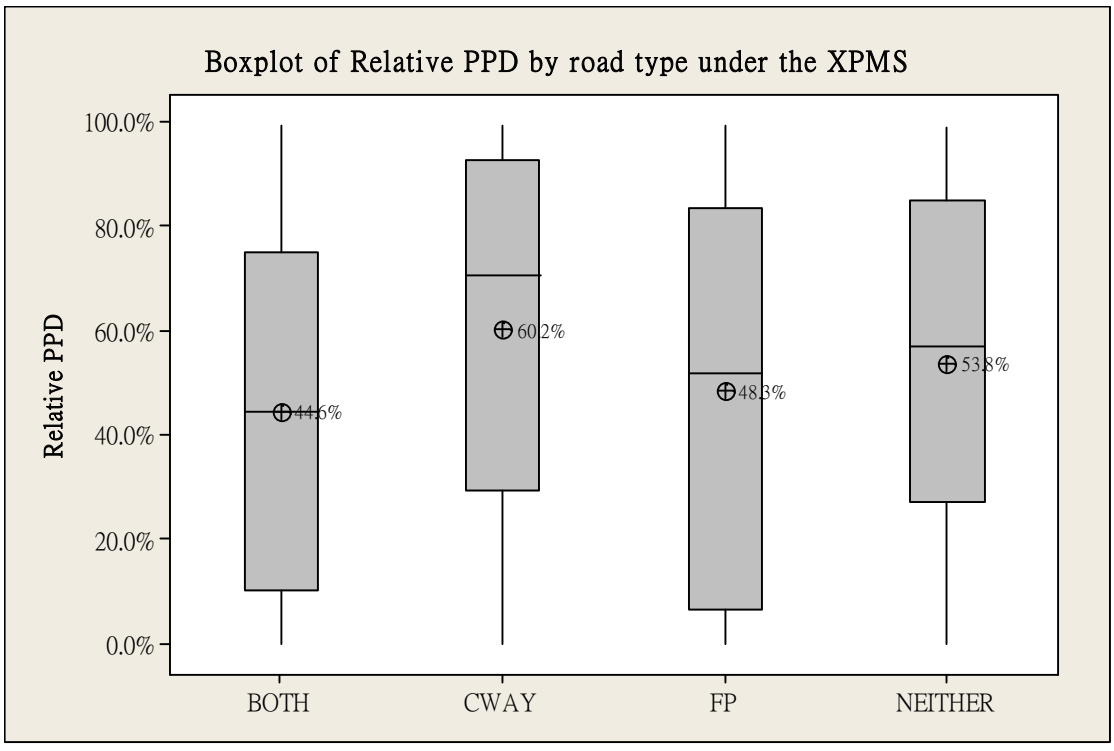


Figure 2-12 Boxplot of Relative PPD by footpath and carriageway under the XPMS

2.3.6 Permit Period Deviation (PPD) by usage of standard template

i. XPs under the IIUMS

Of the 21,454 XPs, 0.1%, 74.6% and 25.4% were recorded as mixture of standard and non-standard work, purely non-standard work and purely standard work respectively. The means and medians of Relative PPD of these three categories were 59.9% and 51.7%, 54.7% and 60.7%, and 62.4% and 73.6%, respectively.

Figure 2-13 showed that XPs with permit periods determined by standard templates had higher discrepancies between the approved permit period and actual working time on site. There was at least 73% time left in half of the XPs. For those did not use standard template(s) to determine permit periods, time remained after completion reduced to about 61% in half of the cases. In contrast, discrepancies for XPs with both standard and non-standard work items and their spreads were lesser. In this regard, there seemed to be rooms for improvement on the standard template(s) in assessing required working periods for the proposed excavation work.

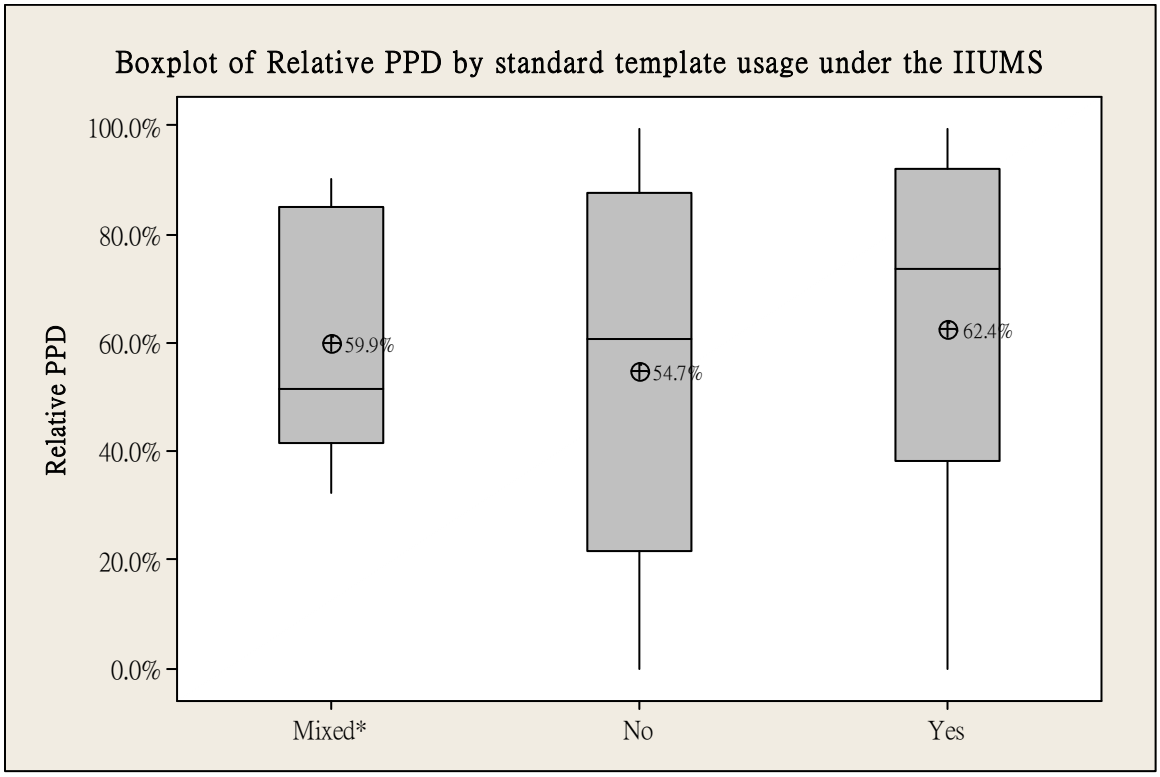


Figure 2-13 Boxplot of Relative PPD by standard template usage under the IIUMS

**Mixed*: permit duration of a work plan was determined by both standard template(s) and user self-substantiated work programme.

ii. XPs under the XPMS

Of the 5,794 XPs, 58.5%, 2.8% and 38.7% were recorded as mixture of standard and non-standard work, purely non-standard work and purely standard work. The means and medians of Relative PPD of these three categories were 49.4% and 53.2%, 51.7% and 54.4%, and 51.5% and 57.6%, respectively.

Figure 2-14 showed that the discrepancies of XPs with approved permit periods determined and not determined by standard template(s) were similar. Half of these cases were with approximately 50% permit times left. Nevertheless, there had been an overall improvement after introduction of XPMS; for instance, it dropped from the median value of Relative PPD of 73% under standard work in the IIUMS to 57% in this system.

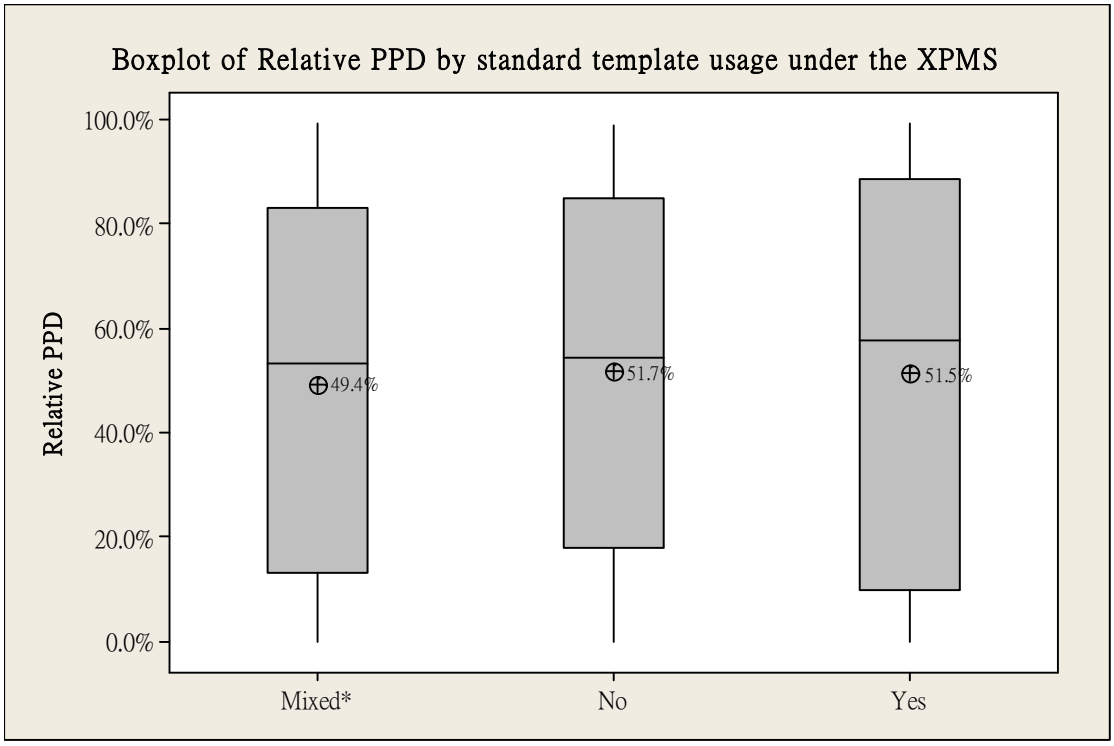


Figure 2-14 Boxplot of Relative PPD by standard template usage under the XPMS

**Mixed*: permit duration of a work plan was determined by both Standard template(s) and user self-substantiated work programme.

2.3.7 Permit Period Deviation (PPD) by single and multiple item permit

i. XPs under the IIUMS

Of the 21,454 XPs, 47.4% and 52.6% were multiple items permits, i.e. XPs with more than one work item, and single item permits, respectively. Their means and medians of the Relative PPD were 51.7% and 56.3%, and 61.2% and 72.9%.

Figure 2-15 revealed that XPs registered with single work item had higher discrepancies between the approved permit period and actual working time on site. There was 72.9% time remained in half of the XPs after completion. For multiple items permits, the discrepancies were lesser; permittees used up about 43% time for half of their work on site and that the median permit period inconsistency was 21% lower than those with single work item, i.e. the use of multiple work items might reflect the site works better.

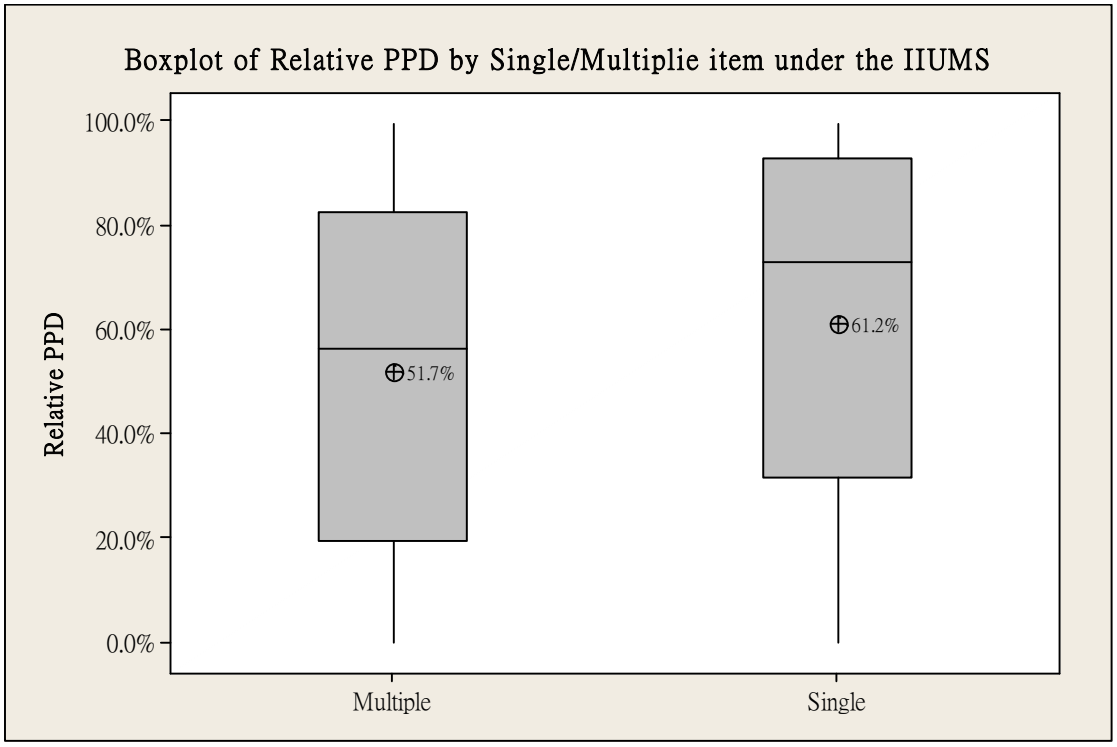


Figure 2-15 Boxplot of Relative PPD by single-multiple item permit under the IIUMS

ii. XPs under the XPMS

Of the 5,794 XPs, all but one was multiple items permits. Its mean and median of the Relative PPD were 50.3% and 54.5%.

As there was only one single item permit found in the application system, the result shown in Figure 2-16 could not bring any conclusions onto the discrepancy issue. For multiple items permits, the situation was similar to that under the IIUMS; about 55% permit times remained in half of the cases.

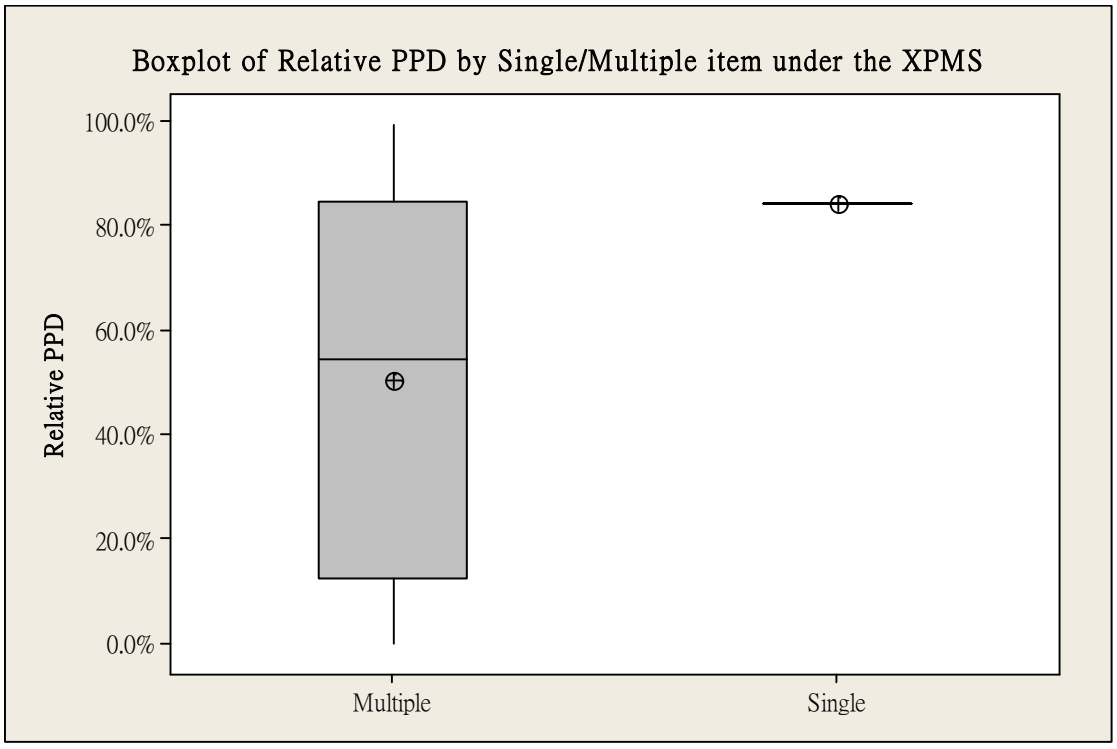


Figure 2-16 Boxplot of Relative PPD by single-multiple item permit under the XPMS

In summary, there were slight improvements in assessing permit period from the IIUMS to XPMS. However, the discrepancies between approved permit period and actual working time on site were still excessive. An enhancement to the current PPA practice was considered necessary as there was generally 65% permit time left in the IIUMS and 55% left in the XPMS in half of the cases. Permittees of HyD, in particular, which were the dominant users of the two application systems, had 69% and 63% time left in half of the work plans, respectively.

2.4 Late start of work

There was an observation that the excavation work on site was generally begun later than the permit start date approved by the authority. Except HTL, on average, work started 2 to 4 weeks after permit start date. This situation for the two application systems were summarized in Table 2-7 and Table 2-8.

Table 2-7 Summary of late start day of work under the IIUMS

Utility stakeholder	Count	Mean	Median	25th, 75th percentiles
ASD	*564*	*25.8*	*5.0*	*0.0, 16.0*
CEDD	*1,327*	*26.7*	*19.0*	*9.0, 35.0*
HSD	-	-	-	-
HTL	*132*	*5.0*	*0.0*	*0.0, 4.0*
HyD	*19,017*	*17.5*	*12.0*	*3.0, 25.0*
Overall	*21,040*	*18.2*	*12.0*	*3.0, 25.0*

Table 2-8 Summary of late start day of work under the XPMS

Utility stakeholder	Count	Mean	Median	25th, 75th percentiles
ASD	*130*	*15.9*	*6.5*	*0.0, 21.3*
CEDD	*978*	*28.7*	*21.0*	*4.0, 46.5*
HSD	*73*	*14.7*	*8.0*	*1.0, 22.0*
HTL	*28*	*7.8*	*3.0*	*0.0, 7.0*
HyD	*4,301*	*23.2*	*18.0*	*6.0, 35.0*
Overall	*5,510*	*23.8*	*18.0*	*5.0, 36.0*

Note: Only XPs with advance notice and/or completion notice updated by permittees are shown in these tables. Late start of work is defined as the actual start date on site minus the permit approval start date, and that is in day(s).

Such observation might lead to a new direction to resolve the discrepancy problem in permit period. Probably, the permittees / nominated permittees should be alerted to arrange their resources before actual commencement of work on site to exclude any non-construction activities incurred by road opening work from the permit period, for instance, discussions on Temporary Traffic Arrangement (TTA) with Road Management Office of the HKPF or TD beforehand.

2.5 Early completion of work

Apart from reporting Advance Notification (AN), permittees had to notify the authority for the completion of site work by reporting Completion Notification (CN) as soon as practical after completion. However, as this step was not a mandatory process, there was a possibility that permittees would ignore it and CN would automatically be reported by the system after the permit period is expired.

Due to the current practice, some inconsistencies between approved permit period and actual working time on site cannot be confirmed. This was because the computer system itself could not know the exact date the work on site was completed; it could only refer to CN reported by the permittees or the approved permit end date as recorded. Therefore, this part was to analyze all the XPs with CN manually reported by permittees, aiming to figure out the attribution to discrepancy if work was completed in an earlier schedule.

To figure out how much discrepancy would be produced if the CN was submitted immediately after completion, summaries of early completion records of the two application systems were shown in Table 2-9 and Table 2-10.

Table 2-9 Summary of early completion day of work under the IIUMS

Utility stakeholder	**Count**	**Mean**	**Median**	**25th, 75th percentiles**
ASD	*564*	*12.2*	*3.0*	*0.0, 16.0*
CEDD	*1,327*	*23.2*	*10.0*	*0.0, 36.0*
HSD	-	-	-	-
HTL	*132*	*22.9*	*11.0*	*1.0, 31.5*
HyD	*19,017*	*23.2*	*14.0*	*2.0, 35.0*
Overall	*21,040*	*22.9*	*13.0*	*1.0, 35.0*

Table 2-10 Summary of early completion day of work under the XPMS

Utility stakeholder	Count	Mean	Median	25th, 75th percentiles
ASD	*130*	*11.5*	*1.0*	*0.0, 16.3*
CEDD	*978*	*12.1*	*0.0*	*0.0, 13.0*
HSD	*73*	*10.6*	*2.0*	*0.0, 20.0*
HTL	*28*	*31.3*	*22.0*	*8.0, 51.0*
HyD	*4,301*	*21.6*	*12.0*	*0.0, 34.0*
Overall	*5,510*	*19.6*	*8.0*	*0.0, 31.0*

Note: Only XPs with advance notice and/or completion notice updated by those permittees are shown in these tables. Early completion of work in day(s) is defined as the actual completion date on site minus the permit approval end date.

Analogous to the situation as found in the previous section, there were, on average, 2 to 4 weeks early completion in the five utility stakeholders. This indicated that there might be a need for every permittee to submit CN so as to collect better information and road opening work management to the authority. Such amelioration would help in collecting reliable information over time; in particular, information regarding production rates of common work on sites, which could then be used to continuously enhance the permit period assessment method.

2.6 Permit extension

In the previous sections, severe permit period discrepancies were found in the two systems; but indeed, there were some XPs with approved permit periods lesser than the actual needs on sites. Under the IIUMS and the XPMS, total of 1,524 and 314 XPs, respectively, underestimated the required working time on sites. Summaries of these records were shown in Table 2-11 and Table 2-12.

In the IIUMS, there were 1,524 numbers of XPs (equivalent to 6.2% of total XPs) applied with permit period extension to cater for the actual requirement on site. Of which, 12.9%, 16.7%, 0.1% and 70.4% were from ASD, CEDD, HTL and HyD, respectively. According to the figures shown in Table 2-11, the majority plans were undertaken in New Territories; were non-standard work; did not adopt MF or did not use standard template(s) in the applications for determining permit periods; were multiple items permits and were undertaken neither on carriageway nor footpath.

In the XPMS, there were 314 numbers of XPs (equivalent to 4.9% of total XPs) applied with permit period extension to cater for the actual requirement on site. Of which, 36.9%, 20.4%, 11.5% and 31.2% were from ASD, CEDD, HSD and HyD, respectively. Period permit extension usage from HyD, in particular, had dropped significantly after the introduction of the XPMS, from 70.4% to 31.2% with respect to the total applications. According to the figures shown in Table 2-12, the majority plans were undertaken in New Territories; were Non-standard work; did not adopt MF but used standard template(s) in the applications in some of the work items for determining permit periods; were multiple items permit and undertaken on footpath.

Of the 1,524 and 314 numbers of permit extension records under the IIUMS and XPMS, respectively, seven common reasons were adopted by permittees for applying permit extension through the computer system as shown in Table 2-13. It could be seen that two of the common reasons: adverse weather and unforeseeable underground conditions were currently covered by Multiplication Factors, but the rest of the reasons did not. This led to the consideration to the need of giving allowances in permit period if plan(s) is like to encounter these kinds of situations on site. In particular, requests on additional work and conflicts with / awaiting approvals from other parties would generally by outside permittees' control and were hard to plan in advance and hence, resulting in permit extension finally.

Notwithstanding, after the introduction of XPMS, an overall decreasing usage of permit extension, from 6.2% to 4.9% with respect to the total numbers of XPs was found. In which, some XPs were of relatively large numbers of permit extension application such as XPs under ASD, CEDD and HyD, and XPs registered as non-standard work.

Table 2-11 Summary of XPs with permit period extension by category under the IIUMS

	Region			***Work type***		***Multiplication Factor***		***Single/Multiple item permit***	
	HK	*KL*	*NT*	*Standard*	*Non-standard*	*Yes*	*No*	*Single*	*Multiple*
ASD	*49 / 25.0%*	*72 / 36.7%*	*75 / 38.3%*	*51 / 26.0%*	*145 / 74.0%*	*53 / 27.0%*	*143 / 73.0%*	*101 / 51.5%*	*95 / 48.5%*
CED	*94 / 37.0%*	*31 / 12.2%*	*129 / 50.8%*	*6 / 2.4%*	*248 / 97.6%*	*6 / 2.4%*	*248 / 97.6%*	*91 / 35.8%*	*163 / 64.2%*
HSD	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
HTL	*1 / 100%*	*-*	*-*	*-*	*1 / 100%*	*-*	*1 / 100%*	*-*	*1 / 100%*
HyD	*199 / 18.5%*	*201 / 18.7%*	*673 / 62.7%*	*80 / 7.5%*	*993 / 92.5%*	*81 / 7.5%*	*992 / 92.5%*	*422 / 39.3%*	*651 / 60.7%*
Sub total	*343*	*304*	*877*	*137*	*1,387*	*140*	*1,384*	*614*	*910*

	Standard template usage			***Road type***				***Sub total***
	All standard	*All non-standard*	*Mixed*	*Carriageway*	*Footpath*	*Both*	*Neither*	
ASD	*51 / 26.0%*	*144 / 73.5%*	*1 / 0.5%*	*12 / 6.1%*	*116 / 59.2%*	*63 / 32.1%*	*5 / 2.6%*	*196 / 12.9%*
CED	*6 / 2.4%*	*248 / 97.6%*	*-*	*26 / 10.2%*	*94 / 37.0%*	*29 / 11.4%*	*105 / 41.3%*	*254 / 16.7%*
HSD	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*0 / 0%*
HTL	*-*	*1 / 100%*	*-*	*1 / 100%*	*-*	*-*	*-*	*1 / 0.1%*
HyD	*80 / 7.5%*	*992 / 92.5%*	*1 / 0.1%*	*52 / 4.8%*	*396 / 36.9%*	*115 / 10.7%*	*510 / 47.5%*	*1,073 / 70.4%*
Sub total	*137*	*1,522*	*2*	*91*	*606*	*207*	*620*	

Note: number of XPs / percentage with respect to the total number of XPs *Grand total = 1,524*

Table 2-12 Summary of XPs with permit period extension by category under the XPMS

	Region			***Work type***		***Multiplication Factor***		***Single/Multiple item permit***	
	HK	*KL*	*NT*	*Standard*	*Non-standard*	*Yes*	*No*	*Single*	*Multiple*
ASD	*29 / 25.0%*	*34 / 29.3%*	*53 / 45.7%*	*14 / 12.1%*	*102 / 87.9%*	*-*	*116 / 100%*	*-*	*116 / 100%*
CED	*15 / 23.4%*	*5 / 7.8%*	*44 / 68.8%*	*3 / 4.7%*	*61 / 95.3%*	*-*	*64 / 100%*	*-*	*64 / 100%*
HSD	*-*	*24 / 66.7%*	*12 / 33.3%*	*-*	*36 / 100%*	*-*	*36 / 100%*	*-*	*36 / 100%*
HTL	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*-*
HyD	*10 / 10.2%*	*31 / 31.6%*	*57 / 58.2%*	*13 / 13.3%*	*85 / 86.7%*	*-*	*98 / 100%*	*-*	*98 / 100%*
Sub total	*78*	*96*	*142*	*29*	*284*	*0*	*316*	*0*	*314*

	Standard template usage			***Road type***				***Sub total***
	All standard	*All non-standard*	*Mixed*	*Carriageway*	*Footpath*	*Both*	*Neither*	
ASD	*14 / 12.1%*	*7 / 6.0%*	*95 / 81.9%*	*14 / 12.1%*	*58 / 50.0%*	*44 / 37.9%*	*-*	*116 / 36.9%*
CED	*3 / 4.7%*	*6 / 9.4%*	*55 / 85.9%*	*6 / 9.4%*	*36 / 56.3%*	*8 / 12.5%*	*14 / 21.9%*	*64 / 20.4%*
HSD	*-*	*-*	*36 / 100%*	*-*	*9 / 25.0%*	*27 / 75.0%*	*-*	*36 / 11.5%*
HTL	*-*	*-*	*-*	*-*	*-*	*-*	*-*	*0 / 0%*
HyD	*13 / 13.3%*	*4 / 4.1%*	*81 / 82.7%*	*14 / 14.3%*	*69 / 70.4%*	*13 / 13.3%*	*2 / 2.0%*	*98 / 31.2%*
Sub total	*30*	*17*	*267*	*34*	*172*	*92*	*16*	

Note: number of XPs / percentage with respect to the total number of XPs *Grand total = 314*

Table 2-13 Common reasons of permittees in applying permit extension in the IIUMS and XPMS

	IIUMS						XPMS					
Reason	**ASD**	**CEDD**	**HSD**	**HTL**	**HyD**	**Total**	**ASD**	**CEDD**	**HSD**	**HTL**	**HyD**	**Total**
Adverse weather condition (e.g. no work was conducted on site due to heavy rain or storm)	69	72	-	-	451	592	44	6	-	-	21	71
Conflicts with / Awaiting approvals from other parties (e.g. works cannot be commenced due to conflicts with nearby work site(s) or existing properties owned by other parties)	27	31	-	-	233	291	29	20	12	-	29	90
Late start / Slow progress of work (e.g. seeking approval for temporary traffic arrangement from RMO or works was completed behind schedule due to low productivity)	41	47	-	-	167	255	24	22	2	-	24	72
Requests on additional work (e.g. work item(s) was added after the XP approved, the respective permit period thus could not cover the time for the newly added work items)	9	64	-	-	167	240	11	15	2	-	5	33
Unforeseeable underground conditions (e.g. hard-rock condition or congested underground utility situation)	42	60	-	-	111	213	28	9	8	-	14	59
Outstanding work (e.g. works were finished but rejected by Inspector of work (IOW) as they did not complied with requirements)	3	7	-	-	115	125	2	-	-	-	1	3

Note: There were some cases that two or more reasons listed in the above table were used when applying permit extension in the IIUMS and XPMS.

2.7 Usages of standard and user-defined templates

In the following sections, all XPs, i.e. total of 24,425 and 6,413 numbers of plans under the IIUMS and the XPMS were considered. There were no considerations on whether the XPs were outlier cases or with permit extension due to unforeseeable delay.

2.7.1 Standard template usage under the IIUMS

i. ASD

In ASD, most of the typical work programmes were used by permit applicants, albeit some of them like 4b and 3a were used in less than 5 times as shown in Table 2-14. In total, 908 standard work items out of 1,553 were adopted in 858 numbers of XPs, i.e. almost 60% usage in this stakeholder.

Table 2-14 Standard template usage of ASD under the IIUMS

Name of Standard Template	Count	Percentage
3b - Typical Works Programme for Rigid Carriageway-Cable Connection Work	162	10.43%
1b - Typical Works Programme for Rigid Carriageway-Drainage Pipe Connection Work	130	8.37%
1c - Typical Works Programme for Concrete/Paving Block Footway-Drainage Pipe Connection Work	120	7.73%
6 - Typical Works Programme for Construction or Removal of Hoarding Footings	107	6.89%
5 - Typical Works Programme for Run-in Construction	106	6.83%
8 - Typical Works Programme for Ground Investigation Trial Pit on Footway (not exceeding 1.5mx1.5m width and 3m in depth)	92	5.92%

Name of Standard Template	Count	Percentage
2c - Typical Works Programme for Concrete/Paving Block Footway-Drainage Pipe Connection Work	43	2.77%
2b - Typical Works Programme for Rigid Carriageway-Water Pipe Connection Work	40	2.58%
1a - Typical Works Programme for Flexible Carriageway-Drainage Pipe Connection Work	37	2.38%
7 - Typical Works Programme for Ground Investigation at Footway (not exceeding 30m in depth)	23	1.48%
3c - Typical Works Programme for Concrete/Paving Block Footway-Cable Connection Work	20	1.29%
2a - Typical Works Programme for Flexible Carriageway-Water Pipe Connection Work	17	1.09%
4b - Typical Works Programme for Rigid Carriageway- Gas Piping Connection Work	6	0.39%
4c - Typical Works Programme for Concrete/Paving Block Footway- Gas Piping Connection Work	3	0.19%
3a - Typical Works Programme for Flexible Carriageway-Cable Connection Work	2	0.13%

Grand total = 908 standard templates adopted out of 1,553 work items in 858 numbers of XP

ii. CEDD

Unlike the popularity of standard templates found under ASD, as shown in Table 2-15, only typical works programme D1 was frequently used by permittees within the study period. It dominated 64% of the registered work items; in total, 3,354 standard work items out of 5,206 were adopted in 2,101 numbers of XPs. For the rest of the typical works programmes like D3b and D3c, only 36 records were found. Hence, subsequent efforts onto identifying reasons of low usage of the rest of works programmes and means to improve the current template design were required to achieve a better utilization of the standard templates.

Table 2-15 Standard template usage of CEDD under the IIUMS

Name of Standard Template	Count	Percentage
D1 - Typical works Programme for Ground Investigation	3318	63.73%
D3c - Typical Works Programme for Repairing Crash Cushion or New Crash Cushion	28	0.54%
D3b - Typical Works Programme for Repairing Railing or New Railing	8	0.15%

Grand total = 3,354 standard templates adopted out of 5,206 work items in 2,101 numbers of XP

iii. HSD

No XPs were found to use standard templates for XP application under this utility stakeholder in the IIUMS and so there was no standard template usage record.

iv. HTL

No standard templates were adopted out of 147 numbers of XP, the situation was even worse than that of CED. Efforts to improve the current template design and encourage applicants to adopt standard template(s) are thus required for HTL.

v. HyD

Table 2-16 shows the past usage of standard templates under HyD. Typical works programmes such as D1, D17 and D2a were used by permit applicants in more than ten thousand times between years 2004 and 2009. The high usage showed that permittees found these typical works programmes were useful in describing the proposed works on site. However, even though some of the works programmes were popular in the past five years, some others like D10, D9b, D14a, D14b and D11b were still under-used. There were less than a hundred in total out of 27,185 registered work items in the system using them.

Table 2-16 Standard template usage of HyD under the IIUMS

Name of Standard Template	Count	Percentage
D1 - Typical Works Programme for Concrete/Paving Block Footway Construction	5064	14.08%
D17 - Typical Works Programme for Public Lighting Installation	3884	10.80%
D2a - Typical Works Programme for Flexible Carriageway Construction	3259	9.06%
D3b - Typical Works Programme for Repairing Railing or New Railing	1034	2.88%
D18 - Typical Works Programme for Replacement of Rusty Public Lighting Column (4 No.)	1029	2.86%
D3a - Typical Works Programme for Repairing Safety Fence or New Safety Fence	940	2.61%
D2b - Typical Works Programme for Rigid Carriageway Construction	833	2.32%
D3c - Typical Works Programme for Repairing Crash Cushion or New Crash Cushion	736	2.05%
D4f - Typical Works Programme for Surface Channel	419	1.17%
D19 - Typical Works Programme for Installation or Relocation of Public Lighting Controller (1 no.)	361	1.00%
D6 - Typical Works Programme for Run-in Construction	355	0.99%
D12 - Typical Works Programme for Typical Works Programme for Directional Sign (Installation)	339	0.94%
D15 - Typical Works Programme for Central Refuge Construction on Carriageway	307	0.85%
D8a - Typical Works Programme for Cross Road Duct Laying in Flexible Carriageway (per lane)	257	0.71%
D8b - Typical Works Programme for Cross Road Duct Laying in Rigid Carriageway (per lane)	237	0.66%
D7 - Typical Works Programme for Demolition, Extension or Repair of Central Divider	204	0.57%
D4a - Typical Works Programme for Road Crossing of Flexible Carriageway (per lane) - Roadside Gully with 5m pipe Connection/Construction Work	202	0.56%
D5 - Typical Works Programme for Roadside Slope Maintenance	158	0.44%
D9c - Typical Works Programme for Ducting/Drawpit Construction on Footway	119	0.33%

Name of Standard Template	Count	Percentage
D4b - Typical Works Programme for Road Crossing of Rigid Carriageway (per lane) - Roadside Gully with 5m pipe Connection/Construction Work	108	0.30%
D9a - Typical Works Programme for Ducting/Drawpit Construction on Flexible Carriageway	50	0.14%
D4d - Typical Works Programme for Rigid Carriageway-Drainage Pipe Installation	42	0.12%
D4c - Typical Works Programme for Flexible Carriageway-Drainage Pipe Installation	39	0.11%
D4e - Typical Works Programme for Concrete/Paving Block Footway-Drainage Pipe Installation	35	0.10%
D13 - Typical Works Programme for Footing of Gantry Sign	26	0.07%
D10 - Typical Works Programme for Construction of Taxi Shelter	19	0.05%
D9b - Typical Works Programme for Ducting/Drawpit Construction on Rigid Carriageway	16	0.04%
D14a - Typical Works Programme for Construction of a Signalized Junction (without kerb realignment)	15	0.04%
D14b - Typical Works Programme for Construction of a Signalized Junction (with addition of a traffic lane/kerb realignment)	2	0.01%
D11b - Typical Works Programme for construction of Tram Shelter with Service Duct in Rigid Carriageway	1	0.00%

Grand total = 20,090 standard templates adopted out of 35,964 work items in 21,430 numbers of XP

2.7.2 Standard template usage under the XPMS

i. ASD

The majority typical works programmes used by ASD between years 2009 and 2011 were shown in Table 2-17. The overall popularity of works programmes seemed to slightly drop when comparing to the old system, but the usage of typical works programme No.6 was

doubled under the XPMS and the top three works programmes were dominating in 148 work items in 250 numbers of XPs. Nevertheless, the usage levels were still incomparable to non-standard items, which were in total 781. Therefore, the authority may need to identify reasons of low usage and means to promote typical works programmes as to achieve a better utilization of the standard templates and higher consistency between the approved permit periods and the actual working times on sites.

Table 2-17 Standard template usage of ASD under the XPMS

Name of Standard Template	**Count**	**Percentage**	**Past usage***
6 - Typical Works Programme for Construction or Removal of Hoarding Footings	100	12.06%	6.89%
7 - Typical Works Programme for Ground Investigation at Footway (not exceeding 30m in depth)	11	1.33%	1.48%
8 - Typical Works Programme for Ground Investigation Trial Pit on Footway (not exceeding 1.5mx1.5m width and 3m in depth)	11	1.33%	5.92%
5 - Typical Works Programme for Run-in Construction	10	1.21%	6.83%
1b - Typical Works Programme for Rigid Carriageway-Drainage Pipe Connection Work	4	0.48%	8.37%
1a - Typical Works Programme for Flexible Carriageway-Drainage Pipe Connection Work	4	0.48%	2.38%
2b - Typical Works Programme for Rigid Carriageway-Water Pipe Connection Work	3	0.36%	2.58%
1c - Typical Works Programme for Concrete/Paving Block Footway-Drainage Pipe Connection Work	2	0.24%	7.73%
3a - Typical Works Programme for Flexible Carriageway- Cable Connection Work	2	0.24%	0.13%
3c - Typical Works Programme for Concrete/Paving Block Footway-Cable Connection Work	1	0.12%	1.29%

Grand total = 148 standard templates out of 829 work items in 250 numbers of XP

* For the past usage of standard templates under the IIUMS, the numbers are referred to Table 2- as for comparison purpose.

ii. CEDD

For CEDD, as shown in 2-18, only typical works programme D1 was frequently used. There were in total 3,144 standard works item out of 8,423 in 1,455 numbers of XPs. Efforts onto identifying contributories of such low usage and means to promote and enhance current standard template design are thus required. Starting from IIUMS, typical works programme D1 had been the top choice adopted by permit applicants and remained popular after system migration, hence D1 should be maintained in the current set of standard templates. Nevertheless, it seemed that the rest work items registered in the system could not make use of the other standard templates due to their work nature. Hence, standard template(s) were rarely adopted in permit applications in the past 3 years.

Table 2-18 Standard template usage of CEDD under the XPMS

Name of Standard Template	**Count**	**Percentage**	**Past usage***
D1 - Typical Works Programme for Ground Investigation	3,144	100%	63.73%

Grand total = 3,144 standard templates out of 8,423 work items in 1,455 numbers of XP

* For the past usage of standard templates under the IIUMS, the numbers are referred to Table 2- as for comparison purpose.

iii. HSD

Similar to ASD and CEDD, standard templates were under-used in the XPMS; only the typical work programme No.8 was taken by permittees in 6 times out of 378 work items in 119 numbers of XP. Albeit permittees under HSD were not frequent permit users, efforts to improve the current template design as for achieving a better utilization of standard templates and higher consistency in permit periods were considered necessary.

Table 2-19 Standard template usage of HSD under the XPMS

Name of Standard Template	Count	Percentage	Past usage*
8 - Typical Works Programme for Ground Investigation Trial Pit on Footway (not exceeding 1.5m x 1.5m width and 3m in depth)	6	1.3%	0%

Grand total = 6 standard templates out of 454 work items in 113 numbers of XP

* For the past usage of standard templates under the IIUMS, the numbers are referred to *Section 2.7.1 (iii)* as for comparison purpose.

iv. HTL

As shown in Table 2-20, only the typical works programme T3 was used in 6 times out of 72 work items in 29 numbers of XP. Alike the situation of HSD, though permittees under HTL were not frequent applicants, efforts to enhance and promote the usage of current typical works programmes would also be required. In fact, starting from the use of XPMS, standard template usage had been slightly raised as there were no templates adopted in the old system, i.e. the IIUMS.

Table 2-20 Standard template usage of HTL under the XPMS

Name of Standard Template	Count	Percentage	Past usage*
T3 - Typical Works Programme for 50m Footway - Ducts/Cables Laying Work	6	8.3%	0%

Grand total = 6 standard templates out of 72 work items in 29 numbers of XP

* For the past usage of standard templates under the IIUMS, the numbers are referred to *Section 2.7.1 (iv)* as for comparison purpose.

v. HyD

Analogous to the IIUMS, most of the typical works programmes were adopted by permit applicants; though the popularity had however slightly dropped. From IIUMS to XPMS, overall usage of typical works programmes dropped from 56% to 38%. This drop pulled against the expectation from the authority that the XPMS was aimed to promote typical works programme usage, anticipating enhancing permit period assessment practice and hence more accurate permit periods for excavation work. As such, efforts to figure out why typical works programme usage had dropped and to explore whether there is demand for new templates for new works were needed.

Table 2-21 Standard template usage of HyD under the XPMS

Name of Standard Template	**Count**	**Percentage**	**Past usage***
D1 - Typical Works Programme for Concrete/Paving Block Footway Construction	1430	10.75%	14.08%
D17 - Typical Works Programme for Public Lighting Installation	680	5.11%	10.80%
D3b - Typical Works Programme for Repairing Railing or New Railing	430	3.23%	2.88%
D9c - Typical Works Programme for Ducting/Drawpit Construction on Footway	390	2.93%	0.33%
D9a - Typical Works Programme for Ducting/Drawpit Construction on Flexible Carriageway	267	2.01%	0.14%
D6 - Typical Works Programme for Run-in Construction	256	1.92%	0.99%
D3a - Typical Works Programme for Repairing Safety Fence or New Safety Fence	210	1.58%	2.61%
D15 - Typical Works Programme for Central Refuge Construction on Carriageway	208	1.56%	0.85%
D2b - Typical Works Programme for Rigid Carriageway Construction	200	1.50%	2.32%
D7 - Typical Works Programme for Demolition, Extension or Repair of Central Divider	166	1.25%	0.57%
D2a - Typical Works Programme for Flexible Carriageway Construction	145	1.09%	9.06%
D4f - Typical Works Programme for Surface Channel	111	0.83%	1.17%

Name of Standard Template	Count	Percentage	Past usage*
D8b - Typical Works Programme for Cross Road Duct Laying in Rigid Carriageway (per lane)	107	0.80%	0.66%
D12 - Typical Works Programme for Typical Works Programme for Directional Sign (Installation)	92	0.69%	0.94%
D13 - Typical Works Programme for Footing of Gantry Sign	76	0.57%	0.07%
D8a - Typical Works Programme for Cross Road Duct Laying in Flexible Carriageway (per lane)	73	0.55%	0.71%
D3c - Typical Works Programme for Repairing Crash Cushion or New Crash Cushion	73	0.55%	2.05%
D14a - Typical Works Programme for Construction of a Signalized Junction (without kerb realignment)	43	0.32%	0.04%
D4c - Typical Works Programme for Flexible Carriageway-Drainage Pipe Installation	33	0.25%	0.11%
D9b - Typical Works Programme for Ducting/Drawpit Construction on Rigid Carriageway	32	0.24%	0.04%
D14b - Typical Works Programme for Construction of a Signalized Junction (with addition of a traffic lane/kerb realignment)	28	0.21%	0.01%
D5 - Typical Works Programme for Roadside Slope Maintenance	23	0.17%	0.44%
D4d - Typical Works Programme for Rigid Carriageway-Drainage Pipe Installation	16	0.12%	0.12%
D4b - Typical Works Programme for Road Crossing of Rigid Carriageway (per lane) - Roadside Gully with 5m pipe Connection/Construction Work	9	0.07%	0.30%
D4e - Typical Works Programme for Concrete/Paving Block Footway-Drainage Pipe Installation	6	0.05%	0.10%
D4a - Typical Works Programme for Road Crossing of Flexible Carriageway (per lane) - Roadside Gully with 5m pipe Connection/Construction Work	5	0.04%	0.56%
D10 - Typical Works Programme for Construction of Taxi Shelter	3	0.02%	0.05%

Grand total = 5,112 standard templates out of 13,301 work items in 4,566 numbers of XP

* For the past usage of standard templates under the IIUMS, the numbers are referred to Table 2- as for comparison purpose.

2.7.3 User-defined template usage under the XPMS

Besides the typical works programmes provided in the application system, it was noticed that some users defined and saved their own programmes as templates for permit applications. Table 2-22 shows the frequently adopted user-defined programmes, which would probably provide an insight into the need of establishing new templates for common works that have been currently treated as non-standard. As there was no user-defined work programmes registered under the IIUMS, only the records from the XPMS are shown in the table.

It was found that some user-defined works programmes had been frequently used by applicants in more than hundred times like the top three template records found under HyD. Similarly, permittees under ASD, CEDD, HSD and HTL attempted to use their own programmes in the applications so as to illustrate their work schedules on site. Albeit the number of registered work items was incomparable to the total items found from the system, this phenomenon suggested that there were common work items requiring standardization to achieve a better utilization of standard templates. In addition, there was a need to figure out the reasons why applicants turn into using their own-developed templates instead of those standard ones provided in the system. The understanding would help to improve the current and the future template designs.

Table 2-22 User-defined template usage of the five utility stakeholders under the XPMS

	Name of user-defined template	**Count**
ASD	Reinstate pavement	34
132 work items out of 880 in	Installation of settlement marker	28
264 numbers of XP	Connection of manhole	23
	Construction of fence	21
	Pavement rectification	15
	Drainage connection	11
CEDD	Greening works	112
277 work items out of 4,844 in	Planting works	30
1,470 numbers of XP	Landslip Preventive Measure (LPM) works	49
	Install slope registration plate	51
	Ground investigation works	14
	Tree pit	11
HSD	Paving resurface works	21
38 work items out of 385 in	Inspection pit	17
119 numbers of XP		
HTL	Tram pole erection	18
50 work items out of 67 in 29	Tram track renewal	18
numbers of XP	Tram pole erection (with removal)	11
	Island/Kerb removal	3

	Name of user-defined template	Count
HyD	Cold milling and resurfacing Work	253
597 work items out of 12,096	Reconstruction of footpath	189
in 4,700 numbers of XP	Construction/Resurfacing of carriageway	117
	Installation of railing	25
	Repair damaged cycle track	13

2.8 Summary

From the above review, discrepancy between approved permit period and actual working time on site was revealed. This situation seemed to be common which indeed required immediate efforts to improve. The analyses by utility stakeholder, region, work type, MF, carriageway and footpath, usage of standard template, as well as single or multiple item(s) permit would probably lead to a new direction onto resolving the problem.

It was also found that the discrepancies in approved permit period and actual working time were not only due to faster production rates of work on site, but also due to waiting time for coordination with conflicting parties. This issue required significant effort to deal with to relieve the discrepancies.

Of the thirty thousand records of XP extracted from the IIUMS and XPMS, there were minor proportions that required permit extension for the actual needs on site. The delays were usually derived from the five reasons including adverse weather conditions, conflicts with/waiting approval from other parties, late start/slow progress of work, requests on additional work, unforeseeable underground conditions, and outstanding works. Parts of the delays could actually be dealt with the use of MF(s) in the applications. There was a need to find out whether applicants know how to make proper use of MF(s) or merely because of unforeseeable constraints, resulting in extensions finally.

Lastly, usages of standard templates and self-defined templates were discussed. It revealed the changes of popularity of work types from the IIUMS to XPMS. The information helped to decide the standard templates to retain; furthermore, the records of user-defined templates help on making a list of new templates that were in high demand recently.

Chapter 3 Review of Existing Standard PPA Templates

This chapter discusses the existing standard PPA templates of the five stakeholders, i.e. ASD, CEDD, HSD, HTL and HyD.

To facilitate application process of XPs for excavation work on roads, sets of standard PPA templates were deployed for each of the utility stakeholder based on its work nature and road surface type. In this regard, permit period was determined by lists of standard construction activities and Multiplication Factors (MFs), which were embedded in the PPA templates, providing logical rules for the authority to manage.

Suitability of the current PPA templates in terms of work nature, construction sequence, road surface type and work site condition were reviewed. Formulations for determining XP period, applicability and coverage of MFs were assessed. These steps aimed to find out whether there was insufficiency or redundancy of the current standard PPA templates.

3.1 Characteristics of the PPA templates

Table 3-1 to Table 3-5 list all the standard PPA templates (a total of 74 numbers) that were currently established for the five stakeholders. The standard templates for applicants under ASD/HSD, CEDD, HyD and HTL were 17, 1, 9 and 47, respectively.

The PPA templates were designed mainly based on work nature and road surface type. Of which HyD had the largest number of standard templates for a wide variety of construction and maintenance work on carriageway and footway.

Table 3-1 Current PPA templates adopted by ASD/HSD

Works Description		**Template No.**
Drainage Connection Work	a. On flexible carriageway	1a
	b. On rigid carriageway	1b
	c. On footway	1c
Water Connection Work	a. On flexible carriageway	2a
	b. On rigid carriageway	2b
	c. On footway	2c
Power/Telephone/Communication Cables Connection Work	a. On flexible carriageway	3a
	b. On rigid carriageway	3b
	c. On footway	3c
Gas Piping Connection Work	a. On flexible carriageway	4a
	b. On rigid carriageway	4b
	c. On footway	4c
Run-in Construction	a. Concrete b. Paving block	5
Construction or Removal of Hoarding Footings		6
Ground Investigation at Footway		7
Ground Investigation Trial Pit on Footway		8

Table 3-2 Current PPA templates adopted by CEDD

Works Description	**Template No.**
Ground Investigation	D1

Table 3-3 Current PPA templates adopted by HLT

Works Description		**Template No.**
Renewal of Tram Track		TT1
Ducts/Cables Laying Works	a. 50m flexible carriageway	T1
	b. 50m rigid carriageway	T2
	c. 50m footway	T3
Ducts/Cables Laying Works	a. 10m flexible carriageway	T4
	b. 10m rigid carriageway	T5
	c. 10m footway	T6
Ducts/Cables Laying Works	a. road crossing of flexible carriageway (per lane)	T7
	b. road crossing of rigid carriageway (per lane)	T8

Table 3-4 Current PPA templates adopted by HyD

Works Description			**Template No.**
Footway/Service Lane Repair		a. Concrete / paving block b. Paving block	D1
Construction of Carriageway		a. Flexible	D2a
		b. Rigid	D2b
Safety Fence/Railing/Crash Cushion		a. Repair or install safety fence	D3a
		b. Repair or install railing	D3b
		c. Repair or install crash cushion	D3c
Drainage	Construction of Gully with 5m Connection Pipe	a. On flexible carriageway	D4a
		b. On rigid carriageway	D4b
	Drainage Pipe Installation	a. On flexible carriageway	D4c
		b. On rigid carriageway	D4d
		c. On footway	D4e
	Surface Channel		D4f
Roadside Slope Maintenance		a. Spray concrete b. Soil nail and rock dowel c. Surface stripping d. Installation of raking drain e. Planter wall construction f. Simple retaining wall	D5

	g. Construction of U channel h. Installation of rock mesh i. Mulching for planting j. Greening involving drilling k. Tree planting	
Run-in Construction	a. Concrete b. Paving block	D6
Central Divider	a. Demolition b. Extension c. Repair	D7
Cross Road Duct Laying	a. On flexible carriageway b. On rigid carriageway	D8a D8b
Ducting/Drawpit Construction	a. On flexible carriageway b. On rigid carriageway c. On footway	D9a D9b D9c
Taxi Shelter		D10
Tram Shelter	a. On flexible carriageway b. On rigid carriageway	D11a D11b
Directional Sign (Installation)		D12
Footing of Gantry Sign		D13
Signalized Junction	a. Without kerb realignment b. With addition of a traffic lane	D14a D14b
Central Refuge Construction		D15
Construction of New Layby*		D16
Public Lighting Installation on Footway		D17
Replacement of Rusty Public Lighting Column		D18
Public Lighting Controller	a. Installation b. Relocation	D19a D19b

* Pending submission from NT Region

For ASD, their standard PPA templates were mainly for construction of public utilities such as drainage, water, gas and telecommunication cable connections. Templates for HTL focused on tram track renewal and ducts/cables laying work; and CEDD had only one template, which was for ground investigation.

Albeit every trade had its own set of PPA templates to calculate required permit period, there were quite a few standard templates that were similar in work nature amongst

them. For instance, individual templates were deployed for HyD and ASD for work related to drainage connection and run-in construction, and HyD and HTL for work related to ducts/cables laying work.

There was room for improvement on the current sets of PPA template by integrating those identical templates set across the five utility stakeholders if applicable or combining work items of similar nature to simplify the system.

3.2 Work activities in the PPA template

In the current practice, calculations of permit period were based on selected work items, work coverage and sequences stated in the standard PPA templates. Work duration of each activity was estimated based on the production rate with the assumptions on labor, tools and machines, as well as factors that were likely to influence work process including adverse weather, hard rock and work time constraint conditions.

Table 3-5 lists all activities currently adopted in the PPA templates of the five studied stakeholders. There were in total 78 work activities; they were taken to form standard templates based on work nature and work site requirements. These standard templates were expected to provide the logical rules for permit period estimations and achieving high consistency between the approved permit period and actual working time on site. Furthermore, each standard template also allowed unsuitable work items to be deselected by permit applicants where necessary as to illustrate the actual situations of work on site and for better determination of permit periods.

As shown in the table, an item number was assigned to each of the work activity for representation. 7 identical item numbers were however of different descriptions under the five stakeholders. For instance, item 061 is for describing “lay pipes/cables” works under HLT and HyD, whilst was written as “geological logging by geologist” under ASD and HSD. Item 063a was to represent “erect hoarding post and construct concrete footings” under ASD and HSD, but is to represent “installation and fixing the alignment of tram track” under HTL.

This numbering system was confusing and should be improved to have a better and clear description of the work activities. A new set of item number should be introduced, and each item number should be used to represent one activity only.

Table 3-5 Work activities established in the standard PPA templates

Item	*Work activity*	*ASD/HSD*	*CEDD*	*HLT*	*HyD*
011	Take over site	✓	✓	✓	✓
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc.)	✓	✓	✓	✓
022	Major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway)	✓	✓	✓	✓
031	Locate utilities (gas pipe / cable location)	✓		✓	✓
032a	Erect scaffolding for spray concrete				✓
032b	Erect scaffolding for other works				✓
033a	Erect working platform for surface stripping				✓
033b	Erect working platform for soil nail and rock dowel				✓
041	Break up road surface and remove spoil	✓		✓	✓
041a	Break up road surface and remove spoil				✓
041b	Removal of paving block from road surface				✓
042	Construct inspection pit	✓			
042	Break up and remove defective slope surface				✓
042a	Demolish central divider				✓

Item	*Work activity*	*ASD/HSD*	*CEDD*	*HLT*	*HyD*
042b	Extend central divider				✓
042c	Repair central divider				✓
043	Surface stripping				✓
045a	Drill hole (up to 30m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement		✓		
045b	Drill hole (> 30m to 60m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement		✓		
045c	Drill hole (> 60m to 90m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement		✓		
045d	Drill hole (> 90m to 150m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement		✓		
046a	Trial pit (1.5m x 1.5m, up to 3m deep) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement		✓		
046b	Trial pit (1.5m x 1.5m, > 3m to 5m deep) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement		✓		
047a	Trial trench (1.5m wide, 3m deep, >1.5m to 3m long) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement		✓		
047b	Trial trench (1.5m wide, 3m deep, >3m to 5m long) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement		✓		
048a	Slope stripping (0.5m wide, 0.3m deep, < 15m long) - Erect access ladder, excavate, in-situ testing & sampling, logging, backfill,		✓		

Item	*Work activity*	*ASD/HSD*	*CEDD*	*HLT*	*HyD*
	reinstatement				
048b	Slope stripping (0.5m wide, 0.3m deep, > 15m to 30m long) - Erect access ladder, excavate, in-situ testing & sampling, logging, backfill, reinstatement		✓		
049	Instrumentation		✓		
051	Excavate trench in soft material, install shoring and remove spoil	✓		✓	✓
051	Drilling operation	✓			
052	Support and protect utilities / Drill and install soil nail	✓		✓	✓
052	In-situ tests	✓			
052	Conduct other in-situ testing	✓			
052	Conduct in-situ density CBR testing	✓			
053	Construction of M/H (upto type 'D') / Drill and install rock dowel / Construction of Tubular Steel Framed Passenger Shelter / Construction of drawpit	Conduct other in-situ testing			✓
053a	Install rock mesh				✓
054	Construct raking drain				✓
055	Temporary decking	✓		✓	✓

Item	*Work activity*	*ASD/HSD*	*CEDD*	*HLT*	*HyD*
056	Tunneling (e.g. under tram track per carriageway lane) / Form weep holes				✓
057	Concreting for binding layer / Spray concrete (include BRC fixing, curing and coring for checking)				✓
058	Construction of surface channel (including formworking and concreting) / Remove scaffolding for spray concrete				✓
058a	Remove working platform for surface stripping / Remove scaffolding for spray concrete				✓
058b	Remove working platform for soil nail and rock dowel / Remove scaffolding for other works				✓
059	Construct planter wall of length				✓
060a	Construct simple retaining structure up to 2m high				✓
060b	Construct simple retaining structure > 2m and up to 3m high				✓
061	Lay pipes / cables	Geological logging by Geologist		✓	✓
061a	Construct U-channel of size up to 300mm			Removal and disposal of track	✓
061b	Construct U-channel of size > 300mm up to 450mm				✓
062	Construct drawpits	Geological logging by Geologist			✓
062a	Construction of new manhole	✓		Drilling and installation	

Item	*Work activity*	*ASD/HSD*	*CEDD*	*HLT*	*HyD*
				of holding down bolts	
062b	Connection to existing manhole	✓			
063	Site inspection, testing and commissioning (CCTV record) / Water test and water connection / Cable connection including testing and commissioning	✓			
063a	Erect hoarding post and construct concrete footings	✓		Installation and fixing the alignment of tram track	
063b	Dismantle concrete footings	✓			
064	Lay drop kerb	✓			✓
064a	Rail joint welding and grinding	✓		✓	
065	Construct run-in	✓			
065a	Construct paving block run-in			Track level	✓
065b	Construct concrete run-in				✓
066	Excavate trench in soft material, install shoring and remove spoil				✓
071	Backfilling with cement / bentonite grout	✓			

Item	*Work activity*	*ASD/HSD*	*CEDD*	*HLT*	*HyD*
071	Backfill trench and soil test	✓		✓	✓
072	Reinstatement	✓		✓	✓
073	Concrete curing	✓		✓	✓
074	Road marking and furniture	✓		✓	✓
075	Demobilization (site clearance)	✓	✓	✓	✓
076	Laying kerb				✓
081	Check reinstatement quality and report completion of road opening works	✓	✓	✓	✓
C001	Construct central refuge				✓
F051	Footing				✓
F052	Anchor block				✓
F053	Safety fence				✓
F054a	Railing on straight road				✓
F054b	Railing at junction bend				✓
F071	Construction of footing				✓

Item	*Work activity*	*ASD/HSD*	*CEDD*	*HLT*	*HyD*
P001	Preparation of Pole Hole				✓
P002	Power disconnection & removal of existing columns				✓
P003	Pole erection, lantern installation and internal wiring				✓
S001	Construction of traffic signal post				✓
S002	Connecting cable for traffic signal by EMSD				✓
S003	Connecting power supply by CLP / HEC				✓
S74a	Fabrication and erection of Directional Sign Support & Frame				✓
T051	Erection of tram shelter				✓

Some activities, however, were designated for specific work types and were mutually taken across the five stakeholders. Of the 78 work items, items 011, 021, 022, 075 and 081 were co-existed in all the standard PPA templates, as they are essential for all excavation work on site. For instance, work sites had to be taken over at the beginning of work and/or demolished at the end. Temporary Traffic Arrangement (TTA) had to be made, if work areas were partly or entirely taken place on carriageway to avoid traffic disorder or accidents. Furthermore, items 031, 041, 051, 052, 055, 071, 072, 073 and 074, which were common activities used for describing trench work including excavation, duct laying and reinstatement etc., were adopted in the PPA templates under ASD, HSD, HTL and HyD.

Nevertheless, the PPA templates under CEDD did not have many common items as which the work of CEDD focuses on hole drilling, trenching and trial pits. These kinds of

work were dissimilar to those adopted by the rest stakeholders (e.g. items 045a, 045b, 045c, 045d, 046a, 046b, 047a, 047b, 048a and 048b).

It was also noticed that there were some work items describing similar activities such as item 064 (lay drop kerb) and item 076 (laying kerb), and item 065 (construct paving block run-in) and item 065a (construct concrete run-in). There would be rooms for improvement on the current PPA templates by combining these kinds of work items that were similar in nature and required more or less the same working time on site.

3.3 Similarities of the PPA templates

Each of the utility stakeholders might involve some work that was similar in nature with the others. For instance, works under HyD and ASD involved construction of run-in, drainage connections and pipe installations; and works under ASD, HSD and CEDD involved ground investigation. Their standard PPA templates could be combined as one where feasible, making the typical programme list less bulky and easing applicants and the system while processing.

In the following sections, similarities of the PPA templates of the five stakeholders were discussed. This aimed to search for feasibility of combining current PPA templates, which appeared to be a possible way to improve applicability and user-friendliness of the current system.

3.3.1 Comparison of templates for run-in construction under HyD and ASD

For carrying out run-in construction work, ASD and HyD had to adopt corresponding PPA templates for the applications of XP, in which their templates, by items and work descriptions, were similar to each other. The activity description for item 041 “break up road surface and remove spoil”, in particular, was identical. However, it should be highlighted that no information was provided as if the activity was conducted on rigid surface or flexible surface.

3.3.2 Comparison of templates for drainage connection works under HyD and ASD

In addition, ASD and HyD had to apply XPs for carrying out drainage connection works on flexible/rigid carriageway and paving block footway. In these pre-set PPA templates,

work activities, in general, were similar to each other as presented under the description. The template of ASD, for instance, contained item 062a and b, which were for construction of new manhole; while template of HyD contains item 053, which was for construction of manhole as well. Further investigations onto the need of having two items for construction of manhole would be required.

3.3.3 Comparison of templates for drainage/water/cable/gas connection works under ASD/HSD

In ASD, parts of the XP were applied for carrying out connection works of drainage, water, cable and gas, and there were currently four PPA templates designated for them. At the beginning of work, all of them adopt the same work procedures on site, e.g. item 011 take over site; 021 fence off work area; and 022 major traffic management, followed by item 061 pipe laying and 062 construction of drawpit, valve pit or manhole. The work was then ended by items 071, 072 and 075 for backfilling, reinstatement and demobilization. However, for plans related to water connection works, there is an additional work activity, item 063 for connection and testing activity work on site, differing from the rest of the three templates.

3.3.4 Comparison of templates for ground investigation under ASD, HSD and CEDD

For ground investigation works, ASD, HSD and CEDD, though were slightly different in their roles, were of certain demand on carrying out underground investigation work. XPs and so corresponding PPA templates were thus required for their applications. Regarding the PPA template content, CEDD, for instance, had more detail descriptions on works related to drill hole activity on site. It had items 045a, b, c and d, 046a and b, 047a and b, as well as 048a and b for illustrating the entire process stage by stage; while ASD/HSD adopts items 042, 051, 052 to represent the major activities for drill hole, testing and ground investigation. From these two sets of templates, a questionable issue was raised as to whether work items listed in the templates should be as simple/detail as possible to enhance the estimation accuracy of permit period and so better facilitation of road opening work.

3.4 Attributes influencing efficiency of the PPA model

Since the establishment of the standard templates, fixed production rates were

deployed in work items to estimate required durations for work on site. Such the values however may introduce variations in permit period across XP applications, even though the work was identical in amount and similar in site conditions. Attributes that could affect such the variations were listed as follows: (1) structure of the PPA templates; (2) assumptions made in production rate, e.g. by manual (i.e. labor with hand tools) or machine; and (3) MFs usage. Concern of production rate, in particular, was the main issue in this section.

Table 3-6 to Table 3-8 summarize the production rates of common activities of the five stakeholders by manual and machine. Of the 78 activities as listed in the tables, some of them were directly related to work quantity, for instance, 041 break up road surface and remove spoil; 051 excavate and dispose of soft material to provide formation level; 052 support and protect utilities; 071 backfill soil to provide formation level and soil test; and 072 reinstatement.

On top of work quantity, production rates were dependent on types of machine adopted on work site. In addition, as more labor was expected to be employed for works that are larger in scale, two sets of production rate are made for that consideration. Different values were given for work length of 10 and 50m respectively.

Road surface type was the other consideration when giving production rates for common work activities on site. This was because contractors should deploy appropriate and respective equipment for work on different road surface types and that the choice of equipment affects production rate most – for instance, using backhoe on carriageway covered with rigid or flexible pavement and electric breaker on footway for breaking up the road surface of work site. In fact, production rates across stakeholders shown in the tables were currently sensitive to machine and road surface types, and that the rate should be adjusted if machine(s) was used instead of labor.

Table 3-6 Production rates of activities in PPA templates for ASD and HSD

Item	Activities	Dimension/ Template	1a	1b	1c	2a	2b	2c	3a	3b	3c	4a	4b	4c	5	6	8
041	Break up road surface and remove spoil (sq.m/day)	10 m (pneumatic)	9	5	30	9	5	30	9	5	30	9	5	30	30	30	30
		50 m (pneumatic)	18	10	60	18	10	60	18	10	60	18	10	60			
		50 m (backhoe)	30	16		30	16		30	16		30	16				
051	Excavate and dispose of soft material to provide formation level (cu.m/day)	Length 10 m, Depth 1.2 m, Manual	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5			
		Length 50 m, Depth 1.2 m, Manual	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0			
		Length 50 m, Depth 1.2 m, Backhoe	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0			
		Length 10 m, Depth 2.5 m, Manual	4	4	4	4	4	4	4	4	4	4	4	4			
		Length 50 m, Depth 2.5 m, Manual	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0			
		Length 50 m, Depth 2.5 m, Backhoe	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0			
		Depth 2.5-3.5 m, Manual															2
		Depth 2.5 m , m shoring/day	5	5	5	5	5	5	5	5	5	5	5	5			
		Depth 2.5-3.5 m, m shoring/day															3
052	Support and protect utilities	Length 50 m, Depth 1.2 m, Manual	9	9	9	9	9	9	9	9	9	9	9	9			
		Length 50 m, Depth 1.2 m, Backhoe	18	18	18	18	18	18	18	18	18	18	18	18			
		Length 50 m, Depth 2.5 m, Manual	8	8	8	8	8	8	8	8	8	8	8	8			
		Length 50 m, Depth 2.5 m, Backhoe	16	16	16	16	16	16	16	16	16	16	16	16			
		Length 50 m, Depth 2.5 m , m shoring/day	8	8	8	8	8	8	8	8	8	8	8	8			

Item	Activities	Dimension/ Template	1a	1b	1c	2a	2b	2c	3a	3b	3c	4a	4b	4c	5	6	8
071	Backfill to provide formation level and soil test (cu.m/day)	10 m	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5			
		50 m	17	17	17	17	17	17	17	17	17	17	17	17			
072	Reinstatement (sq.m/day)	10 m	60	30	30	60	30	30	60	30	30	60	30	30			
		50 m	120	60	60	120	60	60	120	60	60	120	60	60			

Table 3-7 Production rates of activities in PPA templates for HyD

Item	Activities	Dimension/ Template	D1	D2a	D2b	D4a	D4b	D4c	D4d	D4e	D6	D8a	D8b
041	Break up road surface and remove spoil (sq.m/day)	10 m (pneumatic)		9	5	9	5	9	5	30	30	9	5
		50 m (pneumatic)		18	10			18	10	60			
		50 m (backhoe)		30	16			30	16				
041a	Break up road surface and remove spoil (sq.m/day)	10 m	30										
		50 m	60										
041b	Removal of paving block from road surface (sq.m/day)	10 m	45										
		50 m	90										
051	Excavate and dispose of soft material to provide formation level (cu.m/day)	Length 10 m, Depth 1.2 m, Manual	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5
		Length 50 m, Depth 1.2 m, Manual	9	9	9			9	9	9			
		Length 50 m, Depth 1.2 m, Backhoe	18	18	18								
		Length 10 m, Depth 2.5 m, Manual				4	4	4	4	4			
		Length 50 m, Depth 2.5 m, Manual											
		Length 50 m, Depth 2.5 m, Backhoe											
		Depth 2.5 m , m shoring/day				5	5	5	5	5			

Item	Activities	Dimension/ Template	D1	D2a	D2b	D4a	D4b	D4c	D4d	D4e	D6	D8a	D8b
071	Backfill to provide formation level and soil test (cu.m/day)	10 m	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5		8.5	8.5
		50 m	17	17	17			17	17	17			
076	Laying kerb (m/ day, Min. 2 days)		15										
072	Reinstatement (sq.m/day)	10 m	30	60	30	60	30	60	30	30		60	30
		50 m	60	120	60			120	60	60			

(Cont'd)

Item	Activities	Dimension/ Template	D9a	D9b	D9c	D10	D11a	D11b	D14a	D14b	D17	D18	D9a
041	Break up road surface and remove spoil (sq.m/day)	10 m (pneumatic)	9	9	30	30	9	5	9	9	30		9
		50 m (pneumatic)	18	18	60	60	18	10					18
		50 m (backhoe)	30	30			30	16					30
041a	Break up road surface and remove spoil (sq.m/day)	10 m											
		50 m											
041b	Removal of paving block from road surface (sq.m/day)	10 m											
		50 m											
051	Excavate and dispose of soft material to provide formation level (cu.m/day)	Length 10 m, Depth 1.2 m, Manual	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5
		Length 50 m, Depth 1.2 m, Manual	9	9	9		9	9			9		9
		Length 50 m, Depth 1.2 m, Backhoe	18	18	18		18	18			18		18
		Length 10 m, Depth 2.5 m, Manual					4	4					
		Length 50 m, Depth 2.5 m, Manual					8	8					
		Length 50 m, Depth 2.5 m, Backhoe					16	16					

Item	Activities	Dimension/ Template	D9a	D9b	D9c	D10	D11a	D11b	D14a	D14b	D17	D18	D9a
		Depth 2.5 m , m shoring/day					5	5					
071	Backfill to provide formation level and soil test (cu.m/day)	10 m	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5		8.5
		50 m	17	17	17	17	17	17				8.5	17
076	Laying kerb (m/ day, Min. 2 days)												
072	Reinstatement (sq.m/day)	10 m	60	30	30	30	60	30			30		60
		50 m	120	60	60	60	120	60				30	120

Table 3-8 Production rates of activities in PPA templates for HTL

Item	Activities	Dimension/ Template	TT1	T1	T2	T3	T4	T5	T6	T7	T8
041	Break up road surface and remove spoil (sq.m/day)	Manual	5			60					
		Pneumatic		18	10		9	5	30	9	5
		Backhoe		30	16						
051	Excavate and dispose of soft material to provide formation level (cu.m/day)	Manual		9	9	9	4.5	4.5	4.5	4.5	4.5
		Backhoe		18	18	18					
052	Support and protect utilities	Manual		8	8	8	4	4	4	4	4
		Backhoe		16	16	16					
		m shoring/day		8	8	8	5	5	5	5	5
055	Temporary decking	Manual		4	4	4	2	2	2	2	2
		Backhoe		12	12	12	6	6	6	6	6
		m shoring/day		6	6	6	3	3	3	3	3
061A	Removal and disposal of track (m/day)		36								

Item	Activities	Dimension/ Template	TT1	T1	T2	T3	T4	T5	T6	T7	T8
062A	Drilling and installation of holding down bolts (m/day)		36								
063A	Installation and fixing the alignment of tram track (m/day)		36								
064A	Rail joint welding and grinding (m/day)		36								
065A	Track level (m/day)		36								
071	Backfill to provide formation level and soil test (cu.m/day)			17	17	17	8.5	8.5	8.5	8.5	8.5
072	Reinstatement (sq.m/day)		30	120	60	60	60	30	30	60	30

3.5 Calculation of permit period

As defined in the current method, approved permit period was calculated from summation of number of day required to complete work activities selected in standard template(s). For instance, if 3 work items from a PPA template were adopted in a work plan, item 041 for 2 days, item 051 for 3 days and item 072 for 1 day, the total permit period required for this work plan is 2 + 3 + 1 = 6 days.

3.5.1 Duration of work activity

Number of day required to complete an activity was determined by production rates that pre-set in the current PPA templates. As there were two sets of production rates for work with alignment length 10m and 50m, numbers of day required for completing the work for these two alignment lengths are as follows:

$$y_{10} = \text{Area of the work site (base on 10m length)} / r_{10}$$

Or

$$Y_{50} = \text{Area of the work site (base on 50m length)} / r_{50}$$

where

y_{10} and y_{50} is the number of day requires to complete the work with alignment length 10m and 50m, respectively.

r_{10} and r_{50} is the production rate for work with alignment length 10m and 50m, respectively.

To standardize calculations and durations of permit periods, alignment width was set to be default according to the work natures instead of using actual dimensions of the work site. For instance, default width of Templates D1, D6 and D8 is 3m, 5m and 1m respectively. These default widths were for different work natures such as constructions of footway, run-in as well as cross road ducts. Since the width of work site was set to default by the XPMS, it implied that applicant(s) might not be able to obtain required permit periods that based on actual dimensions of work site. This was expected to have a considerable impact on the accuracy of permit period estimations.

In the existing PPA templates, duration for work with less than 10m alignment length was assumed to be the same as of the work with length equal to 10m. For work with

length more than 10m but less than 50m, work duration was obtained by approximation, which was the linear interpolation technique. Figure 3-1 illustrates calculation of work duration with alignment length between 10m and 50m.

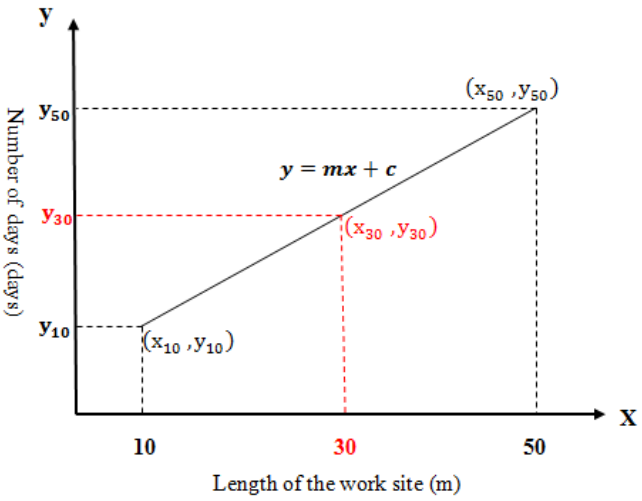


Figure 3-1 Illustration of linear interpolation method

As defined in the linear interpolation method, slope, *m*, i.e. the production rate of work activity and total duration required for completing this activity, *y*, were given by:

$$y = mx + C$$

where

m is the production rate of the work activity

y is the total duration required for completing the work activity on site

x is the length of the work site with minimum of 10m

C is the y-intercept

Furthermore, in case MF(s) is applied in work plans for determining work item duration, the total duration required for completing the activity on site, *y*, had to be multiplied by the corresponding value set in MF(s) as follow:

$$y = (mx + C) * MF$$

3.5.2 Multiplication factors

As aforementioned, MF(s) was one of the variables for determining work activity duration and permit period. Applicants might select suitable MF(s) in their applications so as to reflect special situations on site, especially site constraints. In the current PPA practice, the five utility stakeholders shared the same table of MF(s) in the system.

MFs were categorized into four groups as shown in Table 3-9: Group A, time constraint; Group B, climatic conditions; Group C, hard rock factor; and Group D, site constraints (physical). In each of these groups, individual factor(s) could be assigned for illustrating site constraints or limitations by degree of influences. For instance, 7 individual factors were adopted in Group A to specify various approved working hours on work sites. In addition, in Group C, 4 individual factors were used to describe percentages of hard rock conditions on work site. As in the calculation of PPA model, larger the value of the MFs, greater the influences on the required duration for work.

Table 3-9 Multiplication Factors (MFs) adopted in the standard PPA templates

Group	Item	Description	MF
A - Time constraint	A1	10:00-16:00 only (Police / customer restriction)	2
	A2	2.5 hours * 2 per day (e.g. 09:00 - 11:30 & 14:30 - 17:00 for restaurants, schools or busy shopping areas)	2.4
	A3	3 working hours per day (e.g. 13-16 at Kam Wah St. market)	4
	A4	CNP - 19:00 to 23:00 only	3
	A5	CNP - 21:00 to 23:00 only	6
	A6	CNP - Night (19:00 to 23:00) and Sunday/holidays (10:00 to 17:00)	2.3
	A7	Others	
B - Climatic conditions	B1	Rainy season (April to September with % days lost > 10%) - necessity for additional preventive measures such as water pumping, erection of bund walls etc.	1.1
C - Hard rock factor	C1	Hard rock > 80% *	6.5
	C2	Hard rock > 50% & < = 80% *	5.2
	C3	Hard rock > 30% & < = 50% *	3.2
	C4	Hard rock > 10% & < = 30% *	1.9
D - Site constraints (physical)	D1	Congested underground installations (e.g. footpath of urban area or footpath of <3.5m width in rural area)	1.5
	D2	Steep road (> 1 : 10) / staircase	1.8

3.6 Summary

Having reviewed the existing standard PPA templates, there were numbers of issues that might require further actions, so as to achieve a better utilization of standard PPA templates. The issues and corresponding recommendations were listed as follows:

i. To combine the existing PPA templates where work activities were similar in nature. For instance, connection work of drainage, water, cables and gas pipe (Templates 1-4 of ASD and HSD.
ii. To unify or re-estimate the production rates of each activity in the PPA templates by comparing to the rates obtained from site surveillance and data analysis.
iii. To simplify the establishment of different production rates for work activities, which were with alignment length less than 10m, between 10m and 50m, and beyond 50m whenever it is feasible.
iv. To investigate the feasibility of using polygon model in the standard PPA templates, as work alignment length in 10m to 50m with width 3m to 3.5m adopted in the current practice might not be able to cater for diversified needs of work, especially for work on carriageway.
v. To review the suitability of some standard PPA templates for the determination of permit period, as in the current practice, permit periods were determined based on default width of work. This setting would affect accuracy of permit duration estimations.

Chapter 4 Site Surveillance

To have a better understanding on the applicability of the existing PPA templates and to collect practical information for updating them, surveillance on selected work sites had been conducted from 1st February to 31st May 2012. Details of selected work sites and findings from surveillances are summarized in this chapter.

Firstly, basic information of the selected work sites such as plan ID, location, survey date, road category (carriageway, footpath, both of these two, and neither of them), as well as work site status (on-going, completed prior to or within the inspection period, and delay) was summarized. Characteristics of proposed works, for instance, job nature, work type (Standard and Non-standard), and dates for describing the status of the approved XP were presented.

Secondly, records obtained from site surveillance were reported. Site work operations and sequences, and production rates obtained from site inspections with the consideration of number of machine and labor were discussed. Lastly, recommendations for improving the existing PPA templates based on the above discussions were given.

4.1 Characteristics of work site

The site surveys intended to obtain a more comprehensive idea of the current operations of excavation work on site and their relationships with the existing PPA templates. To maximize the use of site inspection, permit type, standard template usage, utility stakeholder, and work nature were treated as main consideration during selecting. Other factors such as work site location and road surface type were taken as secondary consideration where necessary.

Figure 4-1 shows the distribution of work site locations of the 49 selected work sites. It could be seen from the figure that 10 of them were located in Hong Kong Island, mainly in Wan Chai and Central Districts. 8 of them were located in Kwun Tong District and 6 were located in Shatin and Yau Tsim Mong (mainly in Tsim Sha Tsui and Mong Kok in Kowloon) District, respectively. The rests of the sites were located in Wong Tai Sin, Sham Shui Po, Kwai Chung, Tuen Mum, Tsuen Wan and Tai Po Districts.

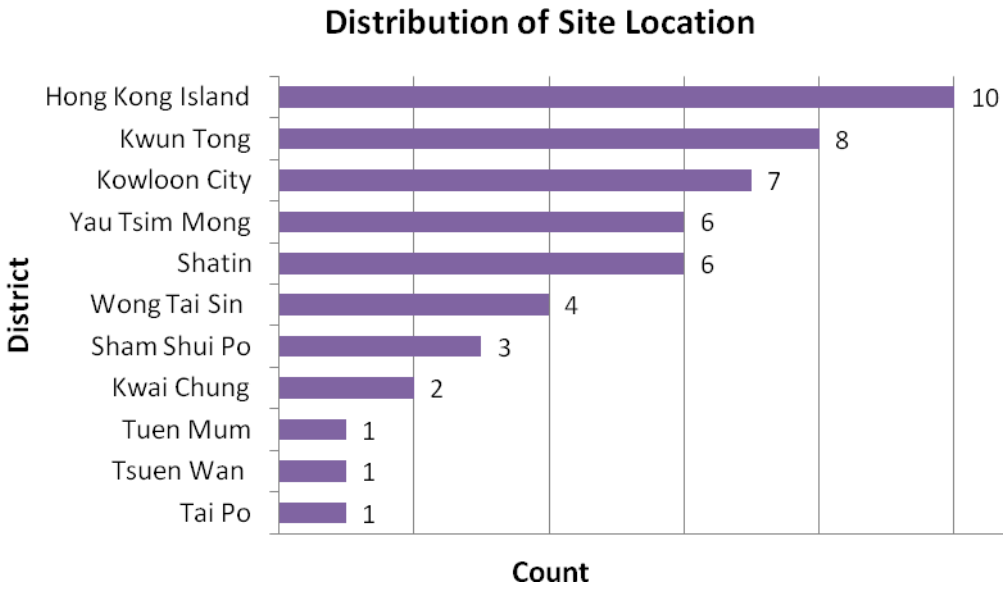


Figure 4-1 Distribution of selected work sites

Of the 49 selected work sites, as shown in Table 4-1, 35 were granted under HyD, 4 were granted under CEDD/HSD, and 3 are granted under ASD/HTL. The high number of work sites selected from HyD indicates that the department had been responsible for substantial amount of excavation work in Hong Kong and that had involved a wide variety of work type - for instance, construction of carriageway/footway, cold milling and resurfacing, as well as construction of signalized junctions.

Table 4-1 Numbers of selected work site by utility stakeholder

Utility stakeholder	Count
Architectural Service Department (ASD)	3
Civil Engineering and Development Department (CEDD)	4
Housing Department (HSD)	4
Hong Kong Tramways Limited (HTL)	3
Highways Department (HyD)	35
Total	**49**

To complete work orders initiated by HyD, contractors were appointed under term contracts, which were signed as for agreeing maintenance work within certain amount of areas and period. For instance, the contractor China Road & Bridge Corporation and Welcome Construction Company Limited Joint Venture (CRBC-WCCL JV) was responsible for most of the maintenance work in Yau Tsim Mong District as observed during survey. In some cases, work contracts were signed with specialist contactors like Vibro (HK) Ltd for ground investigation work. Table 4-2 lists the 14 contractors involved

in the 49 work sites selected in this survey. CRBC-WCCL JV and San Fook Kong (SFK) involved most among them.

Table 4-2 Contractors involved in the selected work sites

Contractor	Count
China State Construction Eng (HK) Ltd	2
China Road & Bridge Corporation and Welcome Construction Company Limited Joint Venture (CRBC-WCCL JV)	14
Gammon Construction Ltd	6
Harvest Civil Engineering Co. Ltd	1
Hip Hing Construction Co. Ltd	1
Kim Shing (K.F) Construction Co. Ltd	1
Leader Civil- Richwell Joint venture	1
Mak Hang Kei (HK) Construction Ltd	1
San Fook Kong (SFK)	11
Shui On Building Contractors Ltd	2
Shui Wing Engineering Company Ltd	3
Shun Yuen Construction Co Ltd	2
Vibro (HK) Ltd	3
Wai Kee (Zens) Construction & Transportation Co. Ltd	1
Total	**49**

Table 4-3 summarizes the status of the 49 selected work sites as were inspected from 1st February 2012 to 31st May 2012. As shown in the table, 17 work sites were found completed during the first visit; whilst 23 work sites were completed within the surveillance period and 7 work sites were carrying on even after the site inspection period. An XP of work on Johnston Road had been cancelled due to traffic issue and hence, the planned work could not be undertaken. Status of Hennessy Road was unknown, as CN was not submitted to the system or no activities were observed on work site.

Table 4-3 Status of the selected work sites

Status	Count
Cancelled	1
Completed before the site inspection period	17
Completed within the site inspection period	23
On-going	7
Unknown	1
Total	**49**

4.2 Characteristics of Excavation Permits (XPs)

To commence excavation work on carriageway and/or footpath, XPs should be applied to get a consent from the authority (i.e. HyD for coordination with site works nearby and permit period assessment, TD and RMO for traffic arrangements at areas where being affected by the work and EPD for construction noise permit).

In Hong Kong, there was a wide variety of excavation work undertaken on roads every day, construction of carriageway and footway, installation of hand railings, improvement of signalized pedestrian facilities, lighting works, slope works, tunneling works as well as pipes/ducts connection and ground investigation. Table 4-4 lists the work nature of the selected sites and their total counts taken in the site survey.

Table 4-4 Distribution of work nature in the selected sites

Works Nature	Count
Associate works for provision of lift	1
Circuit improvement	1
Cold milling & resurfacing	7
Construction of carriageway	3
Construction of carriageway & footpath	4
Construction of fence wall	1
Construction of footpath	3
Construction of railings	3
Construction of run in	1
Construction of site office	1
Footpath widening	2
Ground investigation	3
Replacement of existing paving blocks at footpath	1
Improvement of pedestrian facilities	1
Junction modification	1

Light installation		1
Removal of traffic island		1
Repairing of damaged underground drain		1
Replacement floor tiles		2
Signalized pedestrian crossing		4
Storm water works		1
Trial pit works		2
Tram track renewal		3
Water main works		1
	Total	**49**

Of the 49 work sites, most of them were for construction or re-construction of carriageway and footpath; there were in total 10 records, accounting for 20% of the total work sites. There was about 14% of work on cold milling and resurfacing, 8% on work on construction of signalized pedestrian crossing, and 6% on tram track renewal and construction of hand railings. The rest were work on ground investigation, footpath widening, etc.

Figure 4-2 classifies the work sites in terms of road category. As shown in the figure, most of the works were conducted on footpath, which had 17 in total; followed by those on carriageway, accounting for 16 in total. In addition, 13 of them were carried out on both carriageway and footpath, and 3 of them were undertaken on tram track.

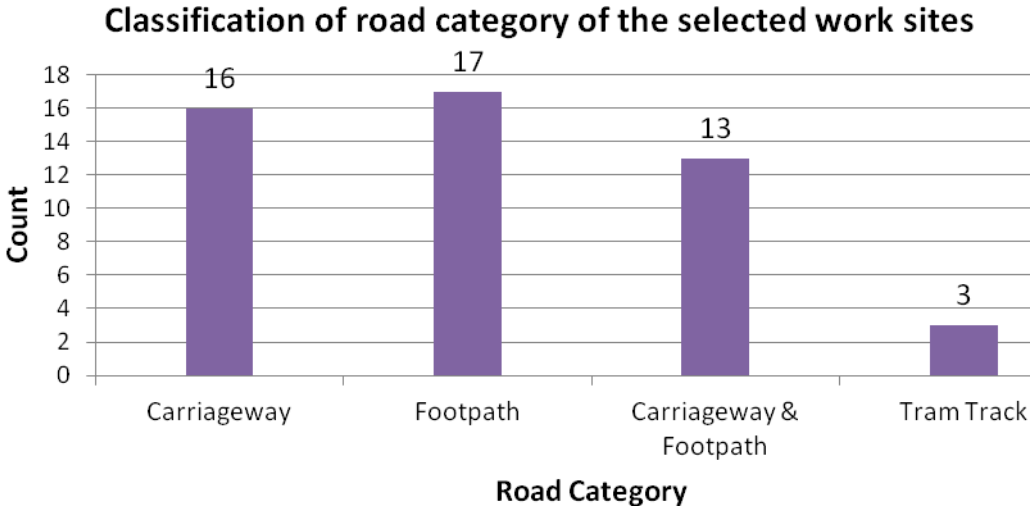


Figure 4-2 Classification of road category of the selected work sites

To standardize permit period of each type of work and simplify application process, standard templates were designed for the use of corresponding stakeholders. In these

templates, work activities and sequences as well as production rates were defaulted; hence, permit durations were unified avoiding variations on approved periods of the same types of work. When work site conditions cannot be generalized by these templates, Non-standard Work applications provide flexibility on outlining the work programme and work duration that permittees require. Table 4-5 shows the number of standard and non-standard Work of the selected work sites in the current study. It could be seen that numbers of standard and non-standard work undertaken were about equal.

Table 4-5 Number of Standard and Non-standard Work of the selected work sites

Works type	**Count**
Standard Work	24
Non-standard Work	25
Total	**49**

Though there were numbers of standard templates for excavation work on roads for both the carriageway and footpath, some permittees turned to adopt non-standard work application as line model in standard templates limited the illustration of work extent on site. In addition, there was a lack of standard template for some frequent maintenance work like cold milling and resurfacing.

Table 4-6 lists the 49 selected work sites by standard and non-standard work as well as their respective standard template(s). As shown in the table, Template D1 “Footway/ Service Lane Repair” was the top adopted; followed by Templates D15 “Central Refuge Construction”, D17 “Public Lighting Installation on Footway” and D9C “Ducting/Drawpit Construction on Footway”.

Table 4-6 Standard templates involved in the selected sites

Plan ID	Road Name	Dept.	Standard Templates														
			D1	D2a	D2b	D3a	D3b	D3c	D4a	D4b	D4c	D4d	D4e	D4f	D5	D6	D7
1062928	Argyle Street	HyD							Non-Standard								
1058948	Canton Road	HyD	✓														
1049499	Caroline Hill Road	HyD							Non-Standard								
1053470	Choi Hung Bus Terminal	HyD	✓		✓		✓										
1064210	Chun Wah Road	HyD							✓	✓							
1053611	Concorde Road	CED							Non-Standard								
1069288	Connaught Road Central	HTL							Non-Standard								
1057247	Des Voeux Road Central	HTL							Non-Standard								
1061388	Fat Kwong Street	HyD											✓	✓			
1064939	Fuk Wa Street	HyD									✓		✓				
1052767	Granville Road	HyD	✓			✓	✓					✓					
1056193	Gloucester Road	HyD							Non-Standard								
1051512	Hennessy Road	HyD															
1061070	Hing Fat Street	ASD							Non-Standard								
1053078	Hip Wo Street (section 1)	HyD	✓				✓										
1060859	Hip Wo Street (section 2)	HyD	✓														
1068134	Hoi Bun Road (section 1)	HyD															
1073348	Hoi Bun Road (section 2)	ASD							Non-Standard								
1057381	Hollywood Road	HyD							Non-Standard								
1061386	Hung Hom Road	HyD												✓			

Plan ID	Road Name	Dept.	Standard Templates													
			D1	D2a	D2b	D3a	D3b	D3c	D4a	D4b	D4c	D4d	D4e	D4f	D5	D6	D7
1064827	Hong Chong Road	HyD							Non-Standard								
1047428	Johnston Road	CED							Non-Standard								
1064016	Kau Pui Lung Street	CED	✓														
1074101	Kwai Shing Court	HSD							Non-Standard								
1061750	Leighton Road	HyD							Non-Standard								
1060970	Leung Wan Street	HyD												✓			
1049871	Lockhart Road	HyD							Non-Standard								
1056977	Lung Cheung Road	HyD				✓											
1066089	Man Lai Road	HyD															
1067289	Mong Kok Road	HyD							Non-Standard								
1041914	Ning Tai Road	HyD														✓	
1071000	Po Nga Road	HSD							Non-Standard								
1070506	Salisbury Road	HyD							Non-Standard								
1062007	Sha Ma Tau Street	CED	✓														
1073897	Shek Pai Street	HSD							Non-Standard								
1060722	Shing Mum Tunnel Road	HyD							Non-Standard								
1062008	South of Sha Ma Tau Street	CED	✓														
1053583	Tai Po Road (Shatin)	HyD							Non-Standard								
1068636	Tai Wan Road	HSD							Non-Standard								
1064743	Tate's Crain Highway	HyD							Non-Standard								

Plan ID	Road Name	Dept.	Standard Templates														
			D1	D2a	D2b	D3a	D3b	D3c	D4a	D4b	D4c	D4d	D4e	D4f	D5	D6	D7
1066380	Tolo Highway	HyD							Non-Standard								
1076578	Tsuen Wan Pier	HyD					✓										
1064891	Tsui Ping Road (section 1)	ASD							Non-Standard								
1057566	Tsui Ping Road (section 2)	HyD			✓		✓										
1017874	Tsz Wan Shan Road (section 1)	HyD	✓														
1030066	Tsz Wan Shan Road (section 2)	HyD	✓	✓	✓												
1057057	Yen Chow Street (section 1)	HyD							Non-Standard								
1049114	Yen Chow Street (section 2)	HyD															
1048691	Wylie Road	HyD															

Plan ID	Road Name	Dept.	Standard Templates														
			D8a	D8b	D9a	D9b	D9c	D10	D11a	D11b	D12	D13	D14a	D14b	D15	D17	D18
1062928	Argyle Street	HyD							Non-Standard								
1058948	Canton Road	HyD		✓			✓										
1049499	Caroline Hill Road	HyD							Non-Standard								
1053470	Choi Hung Bus Terminal	HyD															
1064210	Chun Wah Road	HyD															
1053611	Concorde Road	CED							Non-Standard								
1069288	Connaught Road Central	HTL							Non-Standard								
1057247	Des Voeux Road Central	HTL							Non-Standard								
1061388	Fat Kwong Street	HyD															

Plan ID	Road Name	Dept.	Standard Templates														
			D8a	D8b	D9a	D9b	D9c	D10	D11a	D11b	D12	D13	D14a	D14b	D15	D17	D18
1064939	Fuk Wa Street	HyD															
1052767	Granville Road	HyD															
1056193	Gloucester Road	HyD							Non-Standard								
1051512	Hennessy Road	HyD														✓	
1061070	Hing Fat Street	ASD							Non-Standard								
1053078	Hip Wo Street (section 1)	HyD					✓								✓		
1060859	Hip Wo Street (section 2)	HyD															
1068134	Hoi Bun Road (section 1)	HyD	✓		✓		✓								✓		
1073348	Hoi Bun Road (section 2)	ASD							Non-Standard								
1057381	Hollywood Road	HyD							Non-Standard								
1061386	Hung Hom Road	HyD															
1064827	Hong Chong Road	HyD							Non-Standard								
1047428	Johnston Road	CED							Non-Standard								
1064016	Kau Pui Lung Street	CED															
1074101	Kwai Shing Court	HSD							Non-Standard								
1061750	Leighton Road	HyD							Non-Standard								
1060970	Leung Wan Street	HyD															
1049871	Lockhart Road	HyD							Non-Standard								
1056977	Lung Cheung Road	HyD															
1066089	Man Lai Road	HyD														✓	

Plan ID	Road Name	Dept.	Standard Templates														
			D8a	D8b	D9a	D9b	D9c	D10	D11a	D11b	D12	D13	D14a	D14b	D15	D17	D18
1067289	Mong Kok Road	HyD							Non-Standard								
1041914	Ning Tai Road	HyD															
1071000	Po Nga Road	HSD							Non-Standard								
1070506	Salisbury Road	HyD							Non-Standard								
1062007	Sha Ma Tau Street	CED															
1073897	Shek Pai Street	HSD							Non-Standard								
1060722	Shing Mum Tunnel Road	HyD							Non-Standard								
1062008	South of Sha Ma Tau Street	CED															
1053583	Tai Po Road (Shatin)	HyD							Non-Standard								
1068636	Tai Wan Road	HSD							Non-Standard								
1064743	Tate's Crain Highway	HyD							Non-Standard								
1066380	Tolo Highway	HyD							Non-Standard								
1076578	Tsuen Wan Pier	HyD															
1064891	Tsui Ping Road (section 1)	ASD							Non-Standard								
1057566	Tsui Ping Road (section 2)	HyD	✓				✓								✓		
1017874	Tsz Wan Shan Road (section 1)	HyD															
1030066	Tsz Wan Shan Road (section 2)	HyD	✓														
1057057	Yen Chow Street (section 1)	HyD							Non-Standard								
1049114	Yen Chow Street (section 2)	HyD			✓											✓	
1048691	Wylie Road	HyD											✓		✓		

4.3 Observations on work site

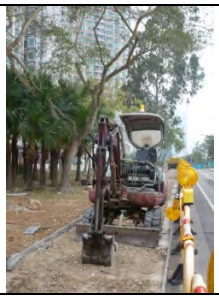
During the site survey period, details such as types of construction activities and sequences on work site, usage of machines, labor allocation, production rates by machine or labor as well as site idling reasons were recorded.

During the 120 days site survey from February to May 2012, several common activities were found in most of the surveyed work sites. They were excavation/trenching, breaking up road surface, construction of hand railings, light poles and drawpits, ducts laying, backfilling, as well as reinstating road surface by paving blocks.

It was noticed that most work sites employed 3 workers in the majority of time. In some occasions, more workers were employed, particularly, when the scale of work site was relatively large, such as the site on Ning Tai Road in Ma On Shan and the cold milling and resurfacing work on Tate's Crain Highway and Tai Po Road (Shatin). In addition, there were special cases that required more workers to finish the work in short time period like crossroad work where major traffic arrangement on site was needed. For instance, the work site on Wylie road required temporary traffic arrangement when conducting crossroad work and 10 workers were engaged for completing the activities within the time allowed by RMO; and the tram track renewal work under HTL required to be completed within one day that demanded intensive resources to maintain the progress of site work as well as normal operation of trams and nearby traffic.

Apart from labor, plants were the other major recourses that often deployed in work sites to enhance productivity. Commonly adopted plants included electric hand breaker, hydraulic breaker, plate compactor, backhoe, mobile crane, grinding wheel and hand tools likes hammer as illustrated in
Figure 4-3.

Figure 4-3 Illustration of common activities and machines deployed on work site

Electric/Pneumatic Hand Breaker	Hydraulic Breaker	Plate Compressor
		
Backhoe	**Mobile Crane**	**Grinding wheel**
		

4.3.1 Key dates of Excavation Permits (XPs)

In an XP, there were 7 major status representing work and permit status. Approved permit start and end dates indicate the permit period approved by HyD that the work was allowed to carry out in-situ. When it was ready to commence the site work, permittee shall submit an Advance Notification (AN) to the system to notify start and end dates to the authority for managing and coordinating purposes. After the work was completed, applicants shall submit Completion Notification (CN) to report actual start and end dates to the system.

Table 4-7 revealed these key dates and status of an XP, as well as the differences between the approval and actual working dates of the sites surveyed. It was evident that there were gaps between the approved start date and the AN start date, the gaps ranged from 1 to 156 days. Most of them were between 20 and 40 days. These gaps were even longer when the approved start date and the actual start date were compared. In general, there were 30 to 40 days greater than the actual need. Discussion with the staff of contractors on site revealed that the gap was mainly used for the approval seeking process of Transport Department (TD), and Hong Kong Police Force (HKPF), as well as resources arrangement and mobilization.

Table 4-7 Key dates and status of the selected work sites

Plan ID	Road name	Dept.	Approved permit period	Difference between approved start and AN start date	Difference between approved end and AN end date	Actual working period
1062928	Argyle Street	HyD	268	57	-	-
1058948	Canton Road	HyD	184	42	39	105
1049499	Caroline Hill Road	HyD	229	10	117	-
1053470	Choi Hung Bus Terminal	HyD	361	22	109	232
1064210	Chun Wah Road	HyD	27	1	-	-
1053611	Concorde Road	CED	731	18	-	-
1069288	Connaught Road Central	HTL	94	6	5	85
1057247	Des Voeux Road Central	HTL	155	2	57	98
1061388	Fat Kwong Street	HyD	86	20	43	25
1064939	Fuk Wa Street	HyD	87	8	-	-
1052767	Granville Road	HyD	91	21	6	66
1056193	Gloucester Road	HyD	232	8	113	113
1051512	Hennessy Road	HyD	106	23	-17	102
1061070	Hing Fat Street	ASD	154	1	-	-
1053078	Hip Wo Street (section 1)	HyD	153	44	1	110
1060859	Hip Wo Street (section 2)	HyD	103	1	10	11
1068134	Hoi Bun Road (section 1)	HyD	114	1	-	-
1073348	Hoi Bun Road (section 2)	ASD	78	10	-	-
1057381	Hollywood Road	HyD	160	12	-	-

Plan ID	Road name	Dept.	Approved permit period	Difference between approved start and AN start date	Difference between approved end and AN end date	Actual working period
1061386	Hung Hom Road	HyD	87	30	34	25
1064827	Hong Chong Road	HyD	95	6	89	2
1047428	Johnston Road	CED	177	156	-	-
1064016	Kau Pui Lung Street	CED	90	19	34	39
1074101	Kwai Shing Court	HSD	83	4	61	23
1061750	Leighton Road	HyD	765	59	-	-
1060970	Leung Wan Street	HyD	55	1	40	15
1049871	Lockhart Road	HyD	252	12	106	1
1056977	Lung Cheung Road	HyD	114	39	14	63
1066089	Man Lai Road	HyD	206	21	110	77
1067289	Mong Kok Road	HyD	159	3	40	118
1041914	Ning Tai Road	HyD	172	86	1	87
1071000	Po Nga Road	HSD	20	6	7	9
1070506	Salisbury Road	HyD	40	2	12	34
1062007	Sha Ma Tau Street	CED	145	10	99	38
1073897	Shek Pai Street	HSD	16	1	6	11
1060722	Shing Mum Tunnel Road	HyD	101	4	-	-
1062008	South of Sha Ma Tau Street	CED	91	9	53	31
1053583	Tai Po Road (Shatin)	HyD	95	21	-	-
1068636	Tai Wan Road	HSD	23	1	1	23

Plan ID	Road name	Dept.	Approved permit period	Difference between approved start and AN start date	Difference between approved end and AN end date	Actual working period
1064743	Tate's Crain Highway	HyD	53	1	8	35
1066380	Tolo Highway	HyD	145	8	86	53
1076578	Tsuen Wan Pier	HyD	93	1	-	-
1064891	Tsui Ping Road (section 1)	ASD	75	1	7	69
1057566	Tsui Ping Road (section 2)	HyD	184	92	-	-
1017874	Tsz Wan Shan Road (section 1)	HyD	120	7	89	26
1030066	Tsz Wan Shan Road (section 2)	HyD	169	23	1	147
1057057	Yen Chow Street (section 1)	HyD	92	3	61	30
1049114	Yen Chow Street (section 2)	HyD	85	7	51	29
1048691	Wylie Road	HyD	104	22	6	56

4.3.2 Work alignments and sequences

Of the work sites selected, most of the contractors followed the work alignment that they stated during the application process. However, there was an exceptional case that Choi Hung Bus Terminal with permit ID 1053470 partly followed the work alignments as submitted in its work plan, as in the XPMS. It was noticed that the applicant defined its work area by lines while the actual shapes and sizes were different on work site.

Such difference might be due to the limitation of line method in describing area that the applicants applied for a longer work alignment as to make sure sufficient permit period to compensate for the time required for the extended width.

In addition, as observed on work site, it seemed that sometimes it was hard for contractors to follow the work plans and the detail procedures as stated in the templates. Possible reasons of having inconsistency between the actual situation and ideal work schedule on site are listed as follows:

i. Time gap often existed between the approved and the actual start dates, which seemed to indicate that there were rooms for improvement in the overall management process, in particular, at the beginning of the work.
ii. Detail working procedures on sites were very much dependent on work site environment and experiences of workers. Detail work procedures generally could not be finalized until contractors reach the site.
iii. Allocation of resources such as raw materials, plants and workers, sometimes, would noticeably affected site operations too.
iv. Contractors were likely to change the sequence of work plan items if crossroad work was involved. This was because it required certain time (say about 10 days etc.) to get the approval from relevant parties particularly for special traffic arrangement. Building in flexibility in work sequence could optimize the overall production effectiveness.
v. Contractors had to put particular efforts for coordination to maintain daily operation of the existing facilities. For instance, the work in Choi Hung Bus Terminal was closely correlated to KMB Company Ltd., the contractor had an additional duty to give ample notification time for passengers about the relocation of bus platform.

4.3.3 Production rates

Every work site would include some common activities and some unique activities that were specific for particular nature of work. Duration of permit period was much dependent on the production rates of them.

As observed on work sites and by comparing the records with standard templates, the common work items of the sites selected generally included item 011 (take over site), item 021 (fence off site with necessary traffic arrangement), item 022 (major traffic arrangement), item 075 (demobilization), and item 081 (check reinstatement quality and report completion of road opening works). Their approved durations, as stated in standard templates, were extracted and listed in Table 4-8. It appeared that their durations were not dependent on human / machine resources adopted on site.

Table 4-8 Essential activities for excavation works on site

Item no.	Activity	Duration (days)
011	Take over site	1
021	Fence off site with necessary traffic arrangement	1-3
022	Major traffic arrangement	10
075	Demobilization (site clearance)	1
081	Check reinstatement quality and report completion of road opening works	2

Unlike the fixed duration work items as in Table 4-8, most of the unique activities of the site selected were based on deployment of labor and/or machine for determining their productivity rates. For instance, item 041 (break up road surface and remove spoil), 051 (excavate and dispose of soft material to provide formation level), 052 (support and protect utilities), 064 (lay drop kerb), 071 (backfill to provide formation level and soil test), and 072 (reinstatement) were activities that had taken numbers of labor and machines into account while determining the corresponding durations. Table 4-9 lists the activities that their production rates were dependent on recourse of labor and machine, together with their corresponding production rates as recorded from the current site survey.

As shown in the table, the numbers of labor on work site ranged from 2 to 13. In normal cases, there were 3 to 5 workers, where additional 1-2 workers were deployed for operating machines if they were adopted. Items 061A (remove existing tram track) and 063A (install new tram track) involved greater amount of labor (about 11 to 13) and machines to cope with the tight schedule for replacing tram track.

Table 4-9 Production rates of site activities

Item no.	Activity	Resource / Machine	No. of samples	Average human resources	Average daily production rate	Max.	Min.	S.D
041	Break up road surface and remove spoil - Rigid surface (sq. m/day)	Manual	2	4	9.9	15.4	4.5	7.7
		Electric hand breaker	4	3	25.3	48.0	6.2	17.6
		Hydraulic breaker	8	5	24.7	81.0	7.2	24.5
041	Break up road surface and remove spoil - Flexible surface (sq. m/day)	Electric hand breaker	4	2	24.0	36.0	0.8	16.4
041	Break up road surface and remove spoil - Rigid surface (sq. m/day) HTL	Hydraulic breaker	3	9	55.7	80.0	23.0	29.4
041b	Break up road surface and remove spoil - Paving blocks (sq. m/day)	Manual	4	3	60.8	125.0	20.0	45.2
051	Excavate trench in soft material, install shoring and remove spoil (cu. m/day)	Manual	11	3	18.4	64.0	0.9	19.5
		Hydraulic breaker	6	5	15.8	41.1	3.7	13.6
052	Support and protect utilities (cu. m/day)	Manual	4	3	5.3	10.0	0.9	3.9
061	Lay pipe (m/day)	Manual	6	3	36.8	93.3	5.1	39.5
061A	Remove existing tram track (m/day)	Manual	1	11	80.0	80.0	80.0	45.3
063A	Install new tram track (m/day)	Manual	1	13	10.7	10.7	10.7	-
064	Lay drop kerb (m/day)	Manual	9	3	58.4	112.0	9.6	26.9
071	Backfill trench and soil test (cu. m/day)	Plate compactor	17	4	32.1	80.0	5.1	20.8
072	Reinstatement (paving block) (sq. m/day)	Manual	16	3	53.9	426.7	2.6	108.6

Item no.	Activity	Resource / Machine	No. of samples	Average human resources	Average daily production rate	Max.	Min.	S.D
072	Reinstatement (concrete) (sq. m/day)	Plate compactor	4	7	292.4	448.0	36.0	179.0
073	Concrete curing (sq. m/day)	Manual	8	2	55.7	170.7	12.0	65.6
C001	Building a central refuge (sq. m/day)	Manual	1	3	18.7	18.7	18.7	-
F054A	Railing on straight road (m/day)	Manual	1	2	160.0	160.0	160.0	-

Table 4-9 also presented the average production rates obtained from the site survey. It could be seen from the table that productivities of 15 work activities were dependent on the type of resource or machine. Since 11 of them, as shown in Table 4-10, were adopted in the existing PPA templates in the XPMS, comparison between the actual rates on site and these as stated in the templates could be made. It was found that the rates collected from the site survey were generally faster than those of the existing templates. The site survey rates were about 1.5 to 5 times of the existing ones.

Table 4-10 Comparison of production rates between existing templates and site survey records

Item no.	Activity	Resource / Machine	Site survey*	Existing template		
				ASD/ HSD	HTL	HyD
041	Break up road surface and remove spoil -Rigid surface (sq. m /day)	Manual	9.9	-	-	-
		Electric hand breaker	25.3	5.0	-	5.0
		Hydraulic breaker	24.7	16.0	-	16.0
041	Break up road surface and remove spoil - Flexible surface (sq. m /day)	Electric hand breaker	24.0	9.0	-	9.0
		Hydraulic breaker	-	30.0	-	30.0
041	Break up road surface and remove spoil -Rigid surface (sq. m /day)	Manual	-	-	5.0	-
		Hydraulic breaker	55.7	-	-	-
041b	Break up road surface and remove spoil - Paving blocks (sq. m /day)	Manual	60.8	-	-	45.0
051	Excavate trench in soft material, install shoring and remove spoil (cu. m /day)	Manual	18.4	4.5	9.0	4.5
		Hydraulic breaker	15.8	-	18.0	18.0
052	Support and protect utilities (cu. m /day)	Manual	5.3	9.0	8.0	-
061	Lay pipe (m /day)	Manual	36.8	-	-	-
061A	Remove existing tram track (m /day)	Manual	80.0	-	36.0	-
063A	Install new tram track (m /day)	Manual	10.7	-	36	-
064	Lay drop kerb (m/day)	Manual	58.4	-		15.0
071	Backfill trench and soil test (cu. m /day)	Plate compactor	32.1	8.5	17.0	8.5
072	Reinstatement (paving block) (sq. m /day)	Manual	53.9	-		-
072	Reinstatement (concrete) (sq. m /day)	Plate compactor	292.4	30.0	30.0	30.0

* Average

It was also noticed that, in the existing templates, the rate in item 072 (reinstatement) was not related to material type or method that adopted in this activity, although it classified the road surface type into flexible pavement, rigid pavement and footpath. However, materials and methods adopted were likely to influence the production rate of activity. It was thus suggested to revise the production rate of item 072 as to be dependent on material type. The observed rate of reinstatement using concrete was about 10 times of the current rate.

4.3.4 Site idling

Within the permit periods, site idling sometimes occurred and no activities were carried out on site. Permittees shall show their reasons for idling on site for public references when they had activities as follows: concrete curing, waiting for major traffic management etc. However, work site might be idle due to uncommon reasons; permittees in this case, might not be able to show the corresponding reasons as in the above cases. This might result in complaint from the public if idling time was unreasonable long as from point of view of the public.

Durations and reasons for site idling depended on the work natures and operations in the work sites; where coordination between parties often contributed to that. As in the site survey conducted between February and May, some of the selected work sites were idle for relatively long time. Information regarding site idling durations and reasons are presented in Table 4-11. The common reason for site idling as observed on the sites was awaiting for finalization of temporary traffic diversion for next stage of works. Such high usage suggests that coordination between parties could noticeably occupy working time on site.

In addition, although adverse weather condition was not a standard reason for site idling, work sites were normally idle when weather was bad and no work was carried out as observed in most cases. In the work site on Canton Road, for instance, work progress had been affected by rain for 3 days in mid-April as recorded from the site survey.

Table 4-11 Idling time in the selected sites

Site	Date	Duration (days)	Idling Reasons
Argyle Street	10/5/2012 11/5/2012	2	Concrete curing
Canton Road	1/3/2012 to 15/3/2012	19	Awaiting finalization of temporary traffic diversion for next stage of works
	5/4/2012 17/4/2012 19/4/2012 20/4/2012		Bad weather condition
Choi Hung Bus Terminal	1/2/2012 20/2/2012	9	No site idling reason was shown
	6/3/2012 to 12/3/2012		Awaiting finalization of temporary traffic diversion for next stage of works
Chun Wah Road	27/3/2012 to 29/3/2012	3	Awaiting finalization of temporary traffic diversion for next stage of works
Des Voeux Road Central	17/4/2012	6	Bad weather condition
	23/4/2012 to 27/4/2012		Concrete curing
Hoi Bun Road (section 2)	23/5/2012	1	No site idling reason was shown

Site	Date	Duration (days)	Idling Reasons
Man Lai Road	28/3/2012 2/4/2012 to 12/4/2012	12	Awaiting completion of cable testing
Ning Tai Road	24/2/2012 28/2/2012 16/3/2012	24	No site idling reason was shown
	20/3/2012 to 26/3/2012		Awaiting finalization of temporary traffic diversion for next stage of works
	16/4/2012 to 30/4/2012		Awaiting finalization of temporary traffic diversion for next stage of works
Tsui Ping Road (section 1)	19/3/2012 to 31/3/2012 3/4/2012 to 30/4/2012	41	Awaiting engineers' instruction for further ground investigation
Tsui Ping Road (section 2)	9/5/2012 11/5/2012 14/5/2012	14	No site idling reason was shown
	17/5/2012 to 26/5/2012		Awaiting finalization of temporary traffic diversion for next stage of works
	23/5/2012		No site idling reason was shown

Site	Date	Duration (days)	Idling Reasons
Wylie Road	6/2/2012	1.5 hrs	Bad weather condition
	17/2/2012	1.5 hrs	Awaiting for the materials
	22/2/2012		Bad weather condition
	7/3/2012	3	Awaiting for machine & Concrete curing
	23/3/2012		

4.3.5 Other observations

On top of information regarding work activities, sequences and productivities obtained from site survey, there were other on-site observations, which might offer good references.

i. Coordination between private/governmental parties could affect efficiency of site work. For instance, work productivity in Wylie Road was slowed down to prevent site idling when it was awaiting approval for temporary traffic arrangement from RMO.

ii. In some cases, actual work on site was different from the templates submitted by the permittees. Work plan for Ning Tai Road did not involve light pole relocations, but the work actually did.

iii. The work in Wylie Road (Plan ID: 1048691) was a good example in demonstrating the activities and procedures of constructing a central refuge. Workers started to build the central refuge from 7th March 2012 and finished on 23rd March 2012, which indicated that they required about 17 days to construct a unit of central refuge with averagely 3 to 4 workers per day plus adoption of machine like hydraulic vibrator, mobile crane and rotary cutter. Of these 17 days, they took 2 to 3 days to finish item 041, 2 to 3 days for item 051, 1 day for item 061, 3 to 4 days for item 062, as well as 4 to7 days for items 064, 071 and 072.

iv. Lighting work was undertaken on Man Lai Road (Plan ID: 1066089). As from verbal discussion with the workers, they normally took 3 working days to install a light pole on footpath, and the following trench excavation and paving block reinstatement, which leaded to the next light pole. Common procedures for installing a light pole as observed were items 041, 051, 052, 061, 062, P001, 064, 071 and 072.

v. Although an average production rate of item 061 (pipes laying) obtained from site survey was about 36.8 m/day, the rate might however impractical to quantify. This was because the pipe laying work often conducted in associated with activities such as excavation and breaking up road surface, in which laying work took relatively short duration to complete.

vi. Referring to item 062 (construction of drawpits), it took about 2 to 3 days to construct a drawpit with dimension 0.8m (L) X 0.8m (W) X 0.8m (D).

vii. In April, there were 2 work sites for tram track renewal work. To avoid significant impacts on traffic, the work was conducted during the Easter holiday and specific method was adopted for item 041. Furthermore, tram track replacement work had to be conducted during non-operating hours, i.e. the work was conducted at late night.

viii. Common procedures to renew a pair of tram tracks included break up road surface

and remove spoil (041), remove existing tram track (061A), install new tram tracks (063A), reinstatement with concrete (071) and concrete curing (073). According to workers of HTL, 4 welding joints could be completed per each night work.

ix. Major activities of excavation work on site based on site surveys were summarized as follows:

a) Provide temporary traffic arrangement
b) Mark trenching areas with detail dimensions as for breaking up
c) Break up road surface and remove spoils
d) Excavate to the required formation levels
e) Lay pipes or ducts
f) Construct drawpits or install light poles
g) Backfill trench
h) Reinstate pavement surface
i) Cure concrete if reinstated by concrete
j) Provide road marking

There were a total of 10 major activities observed compared to 15 work items of the exiting templates (for instance, Template D1 as shown below). It implied that the numbers of items in the existing templates are comprehensive.

a) 011 Take over site
b) 021 Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)
c) 022 Major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway)
d) 031 Cable / gas pipe location (statutory requirement by EMSD);
e) 041 Break up road surface and remove spoil
f) 051 Excavate trench in soft material, install shoring and remove spoil
g) 052 Support and protect utilities
h) 055 Temporary decking
i) 056 Tunneling (e.g. under tram track per carriageway lane)
j) 061 Construction of cable ducts
k) 071 Backfill trench and soil test
l) 072 Reinstatement
m) 074 Road marking and furniture
n) 075 Demobilization (site clearance)

o) 081 Check reinstatement quality and report completion of road opening works

4.4 Case study - cold milling and resurfacing

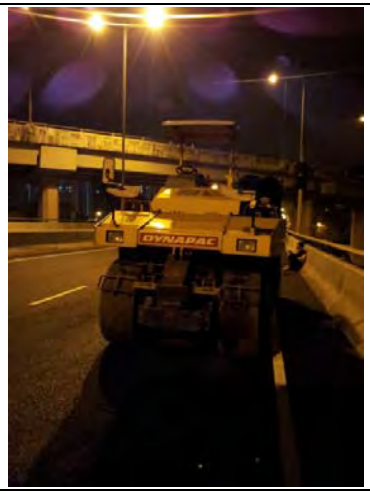
On 29th March 2012 and 29th May 2012, 2 resurfacing work sites located at Tate's Crain Highway and Tai Po Road (Shatin) were surveyed to obtain a better understanding on this kind of work in terms of procedures and activities conducted on the site. Contractor, Gammon Construction Limited, was responsible for these two work orders. The corresponding resurfacing areas of the captioned locations were about 105m X 4m = 420 m^2 and 125 X 3.5 = 438 m^2. In these two work sites, 10 workers were engaged working on various items; the machines adopted were tandem roller and road paver, with hand tools such as electric hand breaker as shown in Figure 4-4.

As observed, work activities and sequences of the two work sites were the same, and the durations for each activity did not have great differences. Table 4-12 records the general procedures of "Cold Milling and Resurfacing" work on Tate's Crain Highway and Tai Po Road (Shatin). It took about 8 hours to finish the work with areas around 420m^2 to 430m^2.

Table 4-12 Procedures adopted for "Cold Milling and Resurfacing" work

Time	Duration (hr)	Activities
21:00- 22:00	1	Set up Closure
22:00-24:00	2	Cold milling
23:30-00:30	1	Clean up the road surface
00:00-00:45	0.75	Resting
00:45-01:00	0.25	Dimension measurement
		Applying tack coat
01:00-01:15	0.25	Laying 1st layer - base course
01:15-02:35	1.25	Laying 2nd layer - wearing
02:30-02:35	0.08	Taking core samples
03:00-03:25	0.4	Road marking etc.
03:45-04:00	0.25	Void test
		Remove closure
		Leave site
Total	**7.23**	

Figure 4-4 Photos of cold milling and resurfacing

Cold milling machine	Cleaner	Road Paver
		
Tandem roller	**Tandem roller**	**Road paver paving the layer**
		

4.5 Summary

The existing XPMS and standard PPA templates provided a platform for applicants and corresponding parties to apply for permission of excavation works on roadways and footways. The diversified PPA templates targeted to provide comprehensive coverage for different natures of work and facilitate application process of XPs. There is still room for improvement in order to enhance system efficiency and standard PPA templates.

Firstly, there was often a time gap, on average 20 to 30 days, between approved start and actual start dates. It was believed that the overall management process affects commencement of work on sites. In addition, allocation of resources such as raw materials, labor and machines did have influences on it as well.

Secondly, detail work procedures were affected by actual work site environments or experiences of the workers. Priority of work plan items might need re-arranging, as the rotation/changing of work areas might take about 10 days to get approval from relevant parties, e.g. RMO/TD. Hence, the self-initiated re-arrangement practices seemed to optimize production rates and keep site idling to minimum.

Thirdly, some actual working areas (e.g. at the site in Choi Hung Bus Terminal) did not comply with the work alignments as submitted to the XPMS. Area items were sometimes registered as line(s) while the actual situation should be polygon(s). As the XPMS did not allow applicants to use polygon if they are taking standard work permit, applicants would thus extend the alignment length as of original plan to obtain a longer permit period to reduce the risk of over-run.

It should also be highlighted that productivity rates collected on sites were generally 1.5 to 5 times faster than the rates currently adopted in PPA templates.

At last, there was currently much non-standard work. For instance, cold milling and resurfacing had been frequently adopted by permittees. There was a need to develop new standard templates for work measured in area.

Chapter 5 Interview on Users' Hands-On Experiences of the XPMS

Having conducted review on XP data and the existing PPA templates, and site surveillance on targeted work sites, interviews were undertaken with applicants of the five utility stakeholders and Excavation Permit Processing Team (XPPT) of HyD to obtain hands-on experiences of processing XPs in the XPMS.

There were in total 6 interview sections conducted with the XPPT and applicants under ASD, CEDD, HSD, HTL and HyD. Each of the interviews was with a tailor-made questionnaire for facilitating the meeting progress and discussion flow. The 6 sets of questionnaire were presented in the Interim Report. Their key comments and suggestions on the current PPA practice are summarized in the following sections.

5.1 Key points from the interview with Excavation Permit Processing Team of HyD

i. Review of Multiplication Factor (MF) values was suggested. This might help to obtain a better understanding of the past ideas in providing flexibilities in the determination of permit periods.
ii. Justifications for taking MF(s) in permit applications, such as, reports on ground investigation for hard-rock condition and congested underground utility situation might be required in the due course.
iii. Interviewees questioned that applicants were fear of being rejected in applications due to lacking justification, resulting in low usage of MF(s) in the XPMS.
iv. Adding standard template(s) for works related to road openings on Part-Time Pedestrian Street was suggested.
v. Unavailability of polygon model in standard template was considered as the main reason of high non-standard permit usage.
vi. Imposing upper bound in length for resurfacing works might be impractical, it might be better to simply follow comments and advices given by TD and/or HKPF (RMO).
vii. Tailor-made work programme(s) and new standard template(s) for illustrating discontinuous work day pattern for Cold Milling and Resurfacing work would be required.
viii. Revision of repeating opening restriction would be required.
ix. For referencing purposes, it was suggested that work items that are currently established in typical works programs could be shown in the system interface while assessing non-standard Work applications. For simplicity, only work items that were similar in nature to those proposed in non-standard applications were needed (e.g. trench work with 2m depth (standard) could

be shown as reference for trench work with 3m depth). In fact, such arrangement setting was previously adopted in the IIUMS but was cancelled in the XPMS.

x. Polygon model for illustrating work areas in standard work permit would be required. For instance, Landslip Preventive Measures (LPM) and slope works like soil nailing would be benefited by polygon model.

xi. Provision of detail master programmes for work plan together with the use of critical path in the form of gantt chart was suggested as to ease the assessment process.

xii. A balance should strike between imposing restriction and giving flexibility in permit periods owing to various constraints and uncertainty of work on sites.

5.2 Key points from the interview with permit applicants of ASD

i. Interviewees expressed they were not familiar with the application system and choices (e.g. MFs and typical work programmes) they could pick in the interface.

ii. They expressed that standard templates were good for illustrating activities and work procedures, but they were uncertain if the standard templates could suitably determine the required permit periods. Interviewees and their colleagues tended to use non-standard templates during XP applications.

iii. Adding standard template(s) for work related to Ground Investigation, Run-in Construction, and Construction of Hoarding would be required.

iv. Interviewees admitted that site work was generally started 2-3 weeks after the approval start date, and it could be even longer if the work is undertaken on carriageway, requiring approval from RMO before the work starts.

v. Interviewees expressed they would like to have some allowance on work area (i.e. a slightly larger space than the actual area of excavation) for dealing with unforeseeable site constraints.

vi. Coordination with other stakeholders and parties could result in delay on work leading to possible permit extension. The delay derived from coordination with other parties, however, might not be foreseeable.

vii. Emphases on applicants' awareness and user-familiarity with the application system were made. It was also suggested that HyD might consider offering training sessions through the web or by training kits for users as for better understanding of the XPMS and future systems if any.

5.3 Key points from the interview with permit applicants of CED

i. Adding standard templates for water mains/gas pipes/ducts replacing work as well as slope nailing, greening work, slope surface protection, natural terrain, boulder barrier, trench work and trial pit was suggested.

ii. Interviewees expressed that the existing PPA templates were not applicable in describing their work on site in most cases. They tended to substantiate permit applications using self-defined work programmes.

iii. In their permit applications, polygon model was commonly adopted to illustrate the work areas. Line model with trench width 2m, generally, was not applicable for their work. They look forward to the implementation of polygon model in standard templates.

iv. Interviewees admitted that their work often started some days behind the approved start date, in particular, for work located at sensitive areas like the Peak. It was also necessary for them to get an approved XP before discussions with RMO and TD for work areas which were partly/entirely on carriageway.

v. Interviewees said that they seldom propose work areas that were significantly larger than actual needs, but they admitted having intentions to apply slightly bigger work areas as for contingency and practical concern. Such consideration was mainly due to past experiences on common site constraints and flexibility of work.

vi. It was suggested adding more items for different work natures, and allowing the use of polygon model in standard work permits. It was also suggested standardizing non-standard work programmes that had been commonly used in the past few years.

vii. In CED, majority of work has been granted under capital work contracts. The existing standard templates, however, were not capable to cover those; more standard templates would be required.

viii. One reason of not using standard template(s) was that permit periods obtained by standard PPA templates were often considered insufficient comparing to contractors' request. Hence, applicants preferred using non-standard templates afterwards.

5.4 Key points from the interview with permit applicants of HSD

i. Interviewees said, in general, their XPs involved many work natures and incurred many parties. They seldom used standard template(s) in application, since the current templates could not cover their needs.

ii. Their colleagues sometimes would like to initiate work programmes and save with special names on the system for their own use, but these self-initiated

work programmes merely benefits the initiators. Other colleagues are not able to make use of these templates as they did not know the content of them. Such practice has made the list of the system very bulky and would not help with facilitating the application process of the whole department.

iii. They said that they even did not know there were eight standard templates set exclusively for HSD. They were not quite familiar with the system, in particular, the use of standard templates.

iv. From time to time, they directly adopted their self-initiated templates in the system for substantiating their applications. The existing standard templates, which they might not aware of, might serve as references.

v. Albeit MF(s) was rarely used in permit applications, they inherently adopted some flexibility in work plans; for instance, they usually registered work items with slightly longer alignment than actual need. Such tactics is their common practice.

vi. In HSD, new works and maintenance works were the two main divisions. There were variations in work complexity demanding different working periods under the two divisions. For instance, utility replacement work was always harder especially in old public housing estates like Sau Mau Ping Estate because replacement work involved provision of temporary services, which required an extra set of utility to maintain normal operation before the permanent one was completed.

vii. It was suggested adding standard template(s) for drainage laying work - work procedures might refer to current templates under DSD, as the work was very similar.

viii. Polygon model for describing work areas in the applications was welcome.

ix. Suggestion on using line and polygon models together in standard template(s) was made as the interviewees considered the use of combined model in a single template might enhance the flexibility during application.

x. Interviewees expressed that the current processing time for an XP was uncertain. It was hard to plan for that in advance and it influenced their work schedules most.

xi. Interviewees looked for more flexibility in typical works programmes that if sequence of work items and permit duration obtained by standard templates could be freely adjusted when sound evidence(s) was provided. They also looked for interface improvement on bar chart and on work programmes, e.g. color code for different natures of work.

5.5 Key points from the interview with permit applicants of HTL

i. Plans were usually registered by using non-standard templates. Installation of pole for overhead lines fixing, underground power cable, and tram track renewal were the three main work types. Applying non-standard templates in most cases was because there are often discrepancies in permit periods obtained by standard template(s) and their own-defined work programmes. Nevertheless, the use of polygon model was the other reason of not substantiating standard work permit in their applications.

ii. Adding standard template(s) for light pole construction was suggested. Procedures could refer to user-defined programme(s), which had been adopted recently.

iii. Polygon model was better in registering work areas in the system; in particular, tram track renewal was of width 2.5m per lane.

iv. There was sometimes uncertainty at the start of work, e.g. RMO might suddenly stop their work due to parade or traffic issues. In addition, they often faced restrictions of work on some days or they were even not allowed to work, e.g. holidays, sensitive days like horseracing in Happy Valley.

v. As for the time between approved start and actual start, there were often uncertainties while seeking approval from TD, RMO and EPD on the CNP issue, so work had to be always well planned. Even so, they did encounter problems when RMO suddenly stopped their work and asked them to work in the following public holidays. This might then trigger repeat opening problem. They look for some special arrangements on this issue.

5.6 Key points from the interview with permit applicants of HyD

i. Interviewees expressed that they had greater concerns on the sufficiency of permit periods than detail work plans made in the XPMS.

ii. Some applicants would like to suggest longer permit periods to allow for preparation work like material ordering before the actual site work. They also suggested that the time before the actual start of site work could be used for handling administrative procedures required by TD and HKPF.

iii. In general, XP applications were submitted 3 months before their commencement date. However, approval process of some applications finally took up 6 months. The extra 3 months could use up the entire proposed working period, leading to invalid application and double-handling the administrative work for applying a new XP thereafter.

iv. The current PPA practice might not be well-developed in general, they found hard to adopt standard template(s) to illustrate their work schedules on site. They looked for improvements in due course.

v. It was suggested that ad-hoc changes of the approved permit period in the middle of work would be allowed when permittees encounter unforeseen constraints on site with supporting evidences, for instance, ground investigation reports for justifying hard rock conditions or photos showing congested utility situation on site.

vi. It was suggested that MF(s) could be automatically applied to XP(s) in case the condition(s) was met that includes work sites on sensitive routes and Red/Pink routes, and work during rainy season and at sensitive areas like the new government office, schools and theater etc.

vii. Adding standard template(s) for lift construction on existing footbridges was proposed.

viii. Enhancement in map function in the XPMS was suggested. These might include addition of automatic full lane width for line model, key-in function for width and length, and polygon model in standard template.

ix. Interviewees said they focused on whether they could obtain the permit periods that they required. If the standard templates could not reflect their needs, they would substantiate their application through non-standard permits.

x. The interviewees said that the tentative permit periods were generally proposed by contractors; and that were in fact very much dependent on their productivities and the available resources. For instance, skillful workers during the peak construction periods were scarce resource, especially, now the ten mega infrastructure projects in Hong Kong were on-going which further deprived the availability of labor.

5.7 Summary

After having conducted interviews with the XPPT under HyD and applicants of the five utility stakeholders, constructive comments/suggestions on the current PPA method in terms of coverage, applicability, accuracy, user-friendliness, and flexibility were summarized as follows:

i Coverage

Lack of some suitable template(s) was one of the reasons that non-standard Work permits had been used. Works required establishing new standard template(s) were proposed as follows:

- ASD: new standard template(s) for ground investigation and installation of settlement marker;
- CEDD: new standard template(s) for soil nailing, slope surface protection,

natural terrain, greening work, boulder barrier;

- HSD: new standard template(s) for water mains/gas pipes/ducts connection work;
- HTL: new standard template(s) for construction of tram pole; and
- HyD: new standard template(s) for work on pedestrian zone with paving block, cold milling and resurfacing, construction of lift and installation of soil nail.

ii Applicability

The existing standard template(s) were commented as only being able to partly describing their works on site owing to diversified work natures and complexity of individual sites. The applicants tended to substantiate the applications using self-defined work programmes. Furthermore, implementing polygon model in standard template(s) was a pressing issue, in which the current study would try to address this issue as feasible.

iii Accuracy

Interviewees, in general, found that the existing standard templates were good at illustrating site activities and the respective sequence on site.

A revision of Multiplication Factor (MF) values would be required. This was expected to obtain a better understanding of the past ideas in providing flexibilities in the calculation process and hence higher accuracy in the approved permit periods. In addition, it was noted that MF had been rarely used by the five utility stakeholders.

There was often that site work started 2 to 3 weeks behind approval start date, and that the delay was mainly due to time required by the administrative process of TD and RMO for temporary traffic arrangement, and by mobilization requirement of contractors.

iv User-friendliness

Interviewees from ASD and HSD concerned about their unfamiliarity with the application system and choices they could pick in the interface regarding MFs and typical work programmes. They thus suggested having training sessions, probably through either the Internet or training kits, for their colleagues.

There were also suggestions on applying MF(s) automatically onto permit period calculation when the condition(s) was met. For instance, auto-MF could be

applied to work sites on sensitive routes and Red/Pink routes, approved permit period within rainy season, and sites at sensitive areas like schools, examination centers etc.

v Flexibility

Most importantly, a balance should strike between imposing restriction and giving flexibility in permit periods owing to various constraints and uncertainty of work on sites.

Permittees reported that their works were generally started 2 to 3 weeks after the approval start date, and the delay could be even longer if the work was undertaken on carriageway. Coordinations with site work nearby, stakeholders, TD and RMO were the common reason for the time required.

For HTL, they had some unique situations that could increase the uncertainty of permit period estimation, e.g. RMO might suddenly stop their work due to parade or traffic issues. In addition, they faced restrictions of work during some days or they were even not allowed to work, e.g. activity day like horseracing in Happy Valley. Sometimes, work was only allowed to be conducted in long public holidays (i.e. Easter and/or Christmas). Special arrangement and more flexibility on permit time could be considered.

Chapter 6 Proposed New PPA Method

6.1 Introduction

This chapter aimed to derive solutions that were anticipated to bring improvements to the current PPA method. In addition, newly defined or modified standard templates describing common excavation work were also developed. Firstly, recommendations were given to deal with the start delay issue revealed from the past and current XP data in the two databases. Secondly, issue related to site idling was discussed. Time-gap between plan items for road opening works was also discussed. Thirdly, the focus was moved onto discussing the mechanism of the current PPA method addressing issues noted during the template analyses and comments made by permit applicants in the interviews. Fourthly, following the logical work flow on site, measures for reflecting early finish of work were discussed and improvement on general issues of the XPMS other than the PPA method were raised. Lastly, a framework for excavation permit application training in the XPMS was given.

6.2 Before commencement of site activities

In the following sections, the result of the analyses on the past and existing XP records of the IIUMS and XPMS and six interviews with permit applications and XPPT were summarized, that forms the basis to support the respective recommendations which were considered applicable to address the captioned issue.

6.2.1 Findings from the analyses on the IIUMS and XPMS

With reference to the descriptive statistics indicator “Median”:, as presented in Chapter 2, an overall 12 and 18 days unused permit period before commencement of site activities were revealed from the IIUMS and XPMS respectively. It was questionable that why permittees did not maximize the use of their approved permit periods for the excavation work on site; or in other words, why the approved permit periods estimated by the PPA method could still cater the unused permit period. It probably indicates that the existing PPA method might not properly illustrate some of the work procedures as well as estimating the required work time on site.

6.2.2 Current practice of permittees

The number itself obtained from the analysis, however, might not help to bring clear

explanations of the existence of the unused permit periods. Therefore, interviews were set to consult the permit applicants of the five utility stakeholders about the real practices on site.

According to the responses of the utility stakeholders, there was generally 2-3 weeks start delay of works on site. The reason was that before the site work starts, roadwork consent had to be sought from the Road Management Office (RMO) of Hong Kong Police Force or Construction Noise Permit (CNP) had to be obtained from Environmental Protection Department (EPD).

It was then questioned that how the times for handling the administrative procedures were absorbed in the permit periods as no work item was specifically set for the catering of such time in existing templates. In other words, if permit periods were accurately estimated, the approved times were likely insufficient for permittees to finish their works on site and so permit extension was likely required. This, however, was not the case they had as only minor proportions of work were found to have permit extension.

Nevertheless, as the interview went on, some clues were drawn from the question below:

- *"As required by XPPM manual, if the actual excavated alignment(s) are significantly shorter/smaller than the approved plan alignment(s), the permittee should submit a sketch/sketches showing the actual excavated alignment(s) within 14 working days after the permit expiry date to the respective HyD Regional Office for their reference in order to avoid unnecessary argument on the quality and extent of reinstatement area(s). What percentage (e.g. 20%, 50% or 70%) is normally considered as "significantly"? What are the common reasons for the actual excavated length deviated significantly from the original plan?"*

And the interviewees' responses were as follows:

- *ASD: "They would prepare some allowances on site, so the applied work areas would be a bit larger than their actual needs for dealing with unforeseen site conditions."*

- *CEDD: "They seldom applied work areas that were significantly larger than their actual needs. However, they would commonly apply slightly larger work areas for contingency and practical concern with reference to past experiences of site constraints and flexibility of work."*
- *HSD: "They usually registered work areas slightly larger than their actual needs in the applications."*
- *HTL: "They usually registered exact work areas in XPMS."*
- *HyD: "There were discrepancies sometimes but the percentage was minor."*

It could be observed that, in general, permittees would register work areas slightly larger than the actual needs on site. They explained such an arrangement was to allow flexibility for works. In fact, according to records obtained from site surveys undergone between February and June 2012, a similar start delay situation of work was found in the majority work sites as shown in Table 6-1.

In summary, the responses from the interviews indicated that the administrative procedures before commencement of site activities were essential for excavation works on roads, in particular for plans partly or entirely located on carriageways. A question on how the period of time for these administrative procedures would be catered in the work programmes to better reflect progresses on site was then raised.

Table 6-1 Start dates of the selected work sites inspected between February and June 2012

Plan ID	Road name	Dept.	Approved permit period day(s)	Start delay day(s)
1062928	Argyle Street	HyD	268	57
1058948	Canton Road	HyD	184	42
1049499	Caroline Hill Road	HyD	229	10
1053470	Choi Hung Bus Terminal	HyD	361	22
1064210	Chun Wah Road	HyD	27	1
1053611	Concorde Road	CEDD	731	18
1069288	Connaught Road Central	HTL	94	6
1057247	Des Voeux Road Central	HTL	155	2
1061388	Fat Kwong Street	HyD	86	20
1064939	Fuk Wa Street	HyD	87	8
1052767	Granville Road	HyD	91	21

Plan ID	Road name	Dept.	Approved permit period day(s)	Start delay day(s)
1056193	Gloucester Road	HyD	232	8
1051512	Hennessy Road	HyD	106	23
1061070	Hing Fat Street	ASD	154	1
1053078	Hip Wo Street (section 1)	HyD	153	44
1060859	Hip Wo Street (section 2)	HyD	103	1
1068134	Hoi Bun Road (section 1)	HyD	114	1
1073348	Hoi Bun Road (section 2)	ASD	78	10
1057381	Hollywood Road	HyD	160	12
1061386	Hung Hom Road	HyD	87	30
1064827	Hong Chong Road	HyD	95	6
1047428	Johnston Road	CEDD	177	156
1064016	Kau Pui Lung Street	CEDD	90	19
1074101	Kwai Shing Court	HSD	83	4
1061750	Leighton Road	HyD	765	59
1060970	Leung Wan Street	HyD	55	1
1049871	Lockhart Road	HyD	252	12
1056977	Lung Cheung Road	HyD	114	39
1066089	Man Lai Road	HyD	206	21
1067289	Mong Kok Road	HyD	159	3
1041914	Ning Tai Road	HyD	172	86
1071000	Po Nga Road	HSD	20	6
1070506	Salisbury Road	HyD	40	2
1062007	Sha Ma Tau Street	CEDD	145	10
1073897	Shek Pai Street	HSD	16	1
1060722	Shing Mum Tunnel Road	HyD	101	4
1062008	South of Sha Ma Tau Street	CEDD	91	9
1053583	Tai Po Road (Shatin)	HyD	95	21
1068636	Tai Wan Road	HSD	23	1
1064743	Tate's Crain Highway	HyD	53	1
1066380	Tolo Highway	HyD	145	8
1076578	Tsuen Wan Pier	HyD	93	1
1064891	Tsui Ping Road (section 1)	ASD	75	1
1057566	Tsui Ping Road (section 2)	HyD	184	92
1017874	Tsz Wan Shan Road (section 1)	HyD	120	7
1030066	Tsz Wan Shan Road (section 2)	HyD	169	23

Plan ID	Road name	Dept.	Approved permit period day(s)	Start delay day(s)
1057057	Yen Chow Street (section 1)	HyD	92	3
1049114	Yen Chow Street (section 2)	HyD	85	7
1048691	Wylie Road	HyD	104	22

6.2.3 Recommendations

From the analytical results of the past and current XP data of the two systems and applicant responses to the interview questions, there was delay on commencement of site works due to time for handling administrative procedures. The period of time due to the delay should be excluded from the permit periods which no excavation was involved. In addition, as currently established in the PPA guideline, there were a maximum of 120 days for applicants to offset their administrative time required from the issue day of their XPs. Applicants were expected to make use of this 120-day period to undertake any of the administrative procedures before the commencement of site works.

The exclusion of the time for administrative procedures from the permit period would probably lead to some benefits to permittees, HyD, and the society as follows:

- Permittees: The time for handling administrative procedures would not needed to be absorbed by other “plan items”. In addition, a more realistic and accurate estimation of permit periods could be achieved which allowed efficient co-ordination between utility stakeholders during the application process. These improvements on efficiency could eventually help to reduce human resources in the use of the XPMS.
- HyD: From the managing point of view, it would have a better reflection from the system on the number of active excavation sites and the number of permits in the process of handling administrative procedures within a specified time frame. This might also ease the work planning nearby the excavated sites as lesser numbers of conflicting works are expected within the area.
- Society: As more efficient co-ordination would be expected thereafter, utility maintenance was expected to be undertaken in a less obstructed situation in terms of planning, handling of XPs and in-situ site works. Having an enhanced

productivity of site work, less nuisances would be caused to the general public which would finally be beneficial to them.

6.3 Time-gaps between work items

Under some work sites particular for those located on carriageways, there were sometimes restrictions to follow and co-ordinations with other parties as well as trial runs were required from time to time. Because of these, activities on site would have to stop and the site would be idled for a certain period of time.

6.3.1 Foreseeable site idling situations

Currently, a list of standard reasons for site idling was established and shown in the Excavation Permit Process Manual by HyD [7]. These reasons were set for permittees to notify the public in case site idling would be happened. Some of the work sites, however, might be idle due to uncommon reasons and hence permittees should not use the standard idling reasons as stated in the manual. Under some circumstances, however, complaints from the public might be resulted if the idling time was unreasonable long as from the public's point of view. Table 6-2 lists the twenty four standard reasons for site idling written in the manual.

Table 6-2 Standard reasons for site idling

No.	Standard Reasons	Remarks
1	Awaiting completion of concrete curing	
2	Awaiting completion of cables / pipes testing	1. Cables / pipes should be properly connected and found inside the trench when this reason was used. But, cables / pipes testing might be carried out on existing services only without new connection.
3	Awaiting completion of cables / pipes connection [by UU's name]	1. Cables / pipes should be laid and found inside the trench when this reason was used. But, cables / pipes connection might be in-between existing cables / pipes.

No.	Standard Reasons	Remarks
4	Awaiting completion of underground utilities detection	1. Usually, the site was fenced off and excavation had not yet commenced, but there were also cases that excavation was required to facilitate the detection work.
5	Underground pipeworks / cabling works in progress for trenchless work	1. The display board was usually erected at the inlet shafts. 2. Works were carried out underground which was not easily seen by public.
6	Awaiting completion of leakage detection works	1. This reason was commonly used by WSD and HKCG. 2. Pipes should be properly connected and found inside the trench when this reason was used.
7	Awaiting soil compaction test result before subsequent backfilling and reinstatement works	1. Usually, soil sample would be taken for testing after completion of soil compaction. A compacted and relative even soil formation should be found inside the trench when this reason was used.
8	Awaiting completion of water main sterilization and water quality test	1. Completed water main should be found inside the trench when this reason was used.
9	Awaiting completion of dewatering of water main	1. Water pump / drainage system should be found inside the trench and / or the soil inside the trench was too wet for works when this reason was used.
10	Awaiting completion of tailor-made pipe fittings at workshop to accommodate site obstructions	1. Tailor-made fittings were used at connection point of water main. 2. Usually, sections of water main should be laid inside the trench when this reason was used. 3. Tailor-made fittings were used in the presence of obstructions during gas pipe installation and sections of associated gas pipes might not be laid inside the trench.

No.	Standard Reasons	Remarks
11	Amid advance notification period to customers for temporary suspension of water / power supply before pipes / cables connection	1. Usually, UUs would serve advance notification to the affected customers to facilitate their subsequent works. 2. Cables / pipes should be laid and found inside the trench for subsequent connection when this reason was used. But, cables / pipes connection might be in-between existing cables / pipes.
12	Amid advance notification period to customers for temporary suspension of gas supply before pipes connection	
13	Awaiting completion of underground utilities / obstruction / [description of works] diversion by [UU's name]	1. Other UU's utilities would be exposed or readily observable and would be in conflict with or required to be relocated for the proposed work.
14	Awaiting finalization of temporary traffic diversion for next stage of works	1. Usually, the reinstatement of trench had been completed and TTM of next stage of works would be set up for HKPF's agreement.
15	Temporary traffic diversion on trial	1. Usually, excavation for that stage of work had not commenced.
16	Affected by inclement weather	
17	Pending completion of other sections for cables / pipes / [description of works] installation by [UU's name]	1. Usually, the installation of utilities inside the trench by the Permittee should be suspended when this reason was used. Besides, other's work should be found at the interface of different permits or at other sections of the same permit.
18	Works at night time only	1. Agreed with UUs as per UTLC Paper No. 2/2009. Normally, majority of the excavated trench / pit would be covered up or decked during daytime to facilitate daily public activities and the idling site was mainly for fencing off the construction materials / plant with display board for the road works at night.

No.	Standard Reasons	Remarks
19	Works on Saturday, Sunday or General Holiday only	1. Agreed with UUs as per UTLC Paper No. 2/2009. Normally, majority of the excavated trench / pit would be covered up or decked during weekdays to facilitate daily public activities and the idling site was mainly for fencing off the construction materials / plant with display board for the road works on Saturday, Sunday or General Holiday.
20	No works within traffic rush hours	1. Works were carried out at non rush hours. The site should virtually be active on that day.
21	Suspension of works due to occasional activities / events nearby	1. Handwriting was allowed for urgent cases.
22	Suspension of works * Accident investigation in progress * Suspended by [Government department] due to [reason]	
23	No works on Saturdays	1. This standard reason was implemented on 1.7.2010. UUs expressed that works were unlikely to be carried out at night, Sundays and Public Holidays, and they suggested reviewing the original wordings. 2. This reason was mainly used by Home Affairs Department to suit their contract requirement.
24	Awaiting Engineer's instruction for further ground investigation works	1. This standard reason was commonly used by ground investigation works.

The XP issuing authority, HyD, had a clear idea on road opening work practices in Hong Kong as revealed in the coverage of wide variety of works in the XPMS. In spite of this, there was no work item set in the work programme specifically for the illustration of the idling issues as listed in the standard reasons of site idling. For instance, waiting time was required for finalization of temporary traffic diversion for next stage of work as mentioned by the permittees interviewed.

6.3.2 Observation from site survey

As observed from the site surveys conducted between February and June, some of the selected sites were idle for relatively long period of time. Summaries on information regarding the site idle durations and respective idling reasons had been presented in Chapter 4. The common reason for site idling observed was “waiting for finalization of temporary traffic diversion for next stage of works”. The time ranged from 3 to 22 days and was dependent on road types, work natures and locations.

6.3.3 Supports from previous literature

In a previous study on Permit Period Assessment Method for Utility Trench Works, site idling due to practical needs and particularly time-to-time co-ordinations with other parties was observed. Due to this, corresponding measure had been recommended; it was set to allow reasonable time periods for permittees to co-ordinate with other parties when required.

Section 5.4 of the Guideline on Permit Period Assessment for Utility Trench Works 2012 [17] gives the provision, allowing permittees in placing administrative time gaps between excavation items in work programme:

“*For excavations affect carriageways, administrative time gaps of not more than 14 days can be introduced between excavation items to cater for necessary administrative preparation works. Typical administrative preparation works include application for roadwork advice, parking meter suspension and gazette for road closure, etc. The applicant shall state clearly the reasons of introducing the time gaps. HyD may require the applicant to provide substantiation to justify the duration of time gap introduced. During the excavation stage, the applicant shall start the administrative preparation works before the completion of the preceding excavation item as early as practical to avoid unnecessary delay.”*

6.3.4 Recommendations

With the support from literature and site survey observation as well as the concern on standardization of work practice amongst utility stakeholders, it was suggested to unify the same practice for all the permittees under the PPA practice.

The rule as in Section 5.4 of the Guideline on Permit Period Assessment for Utility Trench Works could be directly adopted for the five utility stakeholders considered in this study, or minor amendments could be made where appropriate [17].

Having introduced this new measure, some benefits to permittees, the authority, i.e. HyD, and the society would be expected as follows:

- Permittees: The times for handling administrative procedures would not needed to be absorbed by other "plan items". In addition, a more realistic estimation of permit periods would be expected. Accurate estimation of permit periods allows efficient co-ordination between utility stakeholder during the application process. These improvements on efficiency could eventually help to reduce human resources in the use of the XPMS.
- HyD: From the managing point of view, it would have a better reflection from the system on the actual progress of works on site. And it is a more realistic approach in estimating permit period after introduction of the time-gap in plans where necessary.
- Society: After the refinement of the PPA method, sufficient permit period would be granted to applicants and roads under the jurisdiction of HyD would be occupied for excavation according to actual need. The overall society cost due to the excavation works could be minimized.

6.4 Mechanism of permit period assessment (PPA) method

The analyses conducted on the XP data from year 2004 to 2012 revealed that 50% of the approved permit period was remained after excavation works completed on site in half of the cases. The figures led to the need to review and adjust the current PPA method in order to determine a more reasonable XP period for applicants to carry out excavation work on site.

6.4.1 Areas of concern

Areas that would improve the current PPA method were discussed in the following sections with reference to the analyses on XPs from the two systems, the site surveys conducted between February and June 2012, and the six interviews with XPPT and applicants of the five utility stakeholders.

6.4.1.1 Estimation in production rates

In the site surveys conducted between February and June, production rates of work on sites were recorded. They were compared with the rates stated in the existing standard templates. The comparison revealed that the rates were generally inconsistent with the existing ones. For instance, production rate for using "electric hand breaker on flexible surface" of item 041 in standard templates was 9.0 sq.m/day amongst different utility trades, whilst an average value of 24.0 sq.m/day was observed on sites. It should also be noted in Table 6-3 that the rates set in the existing templates were dependent on the numbers of labor and types of machine deployed on site. In case that the assumptions made for the rates stated in existing standard templates did not follow the actual site situations, there was likely to be discrepancies on the time required for a contractor to undertake the excavation works.

During the interviews with applicants of the five utility stakeholders, they expressed concerns about the accuracy of permit period estimated by the current PPA method:

- *ASD: "Standard templates were helpful in illustrating work procedures and work items, but not able to totally reflect the actual site conditions to determine the required permit periods."*
- *CEDD: "Discrepancies between permit periods estimated from the current PPA templates and working periods requested by contractors were generally found. Hence, the CEDD users tended to use non-standard templates for applications in order to obtain the necessary permit period."*
- *HTL: "Non-standard templates were adopted in most cases because of the discrepancies in permit periods obtained by standard template(s) and their own-defined work programmes."*
- *HyD: "Applying non-standard templates with substantiation for cases because the permit periods given by standard templates were not appropriate for the site situations and actual needs."*

In fact, permit period calculation was mainly based on production rates assumed for each activity. However, the rates were found to be inconsistent when comparing to site surveys. As such, revisions would be required for the current PPA templates so as to improve the accuracy and consistency of permit period estimation.

Table 6-3 Production rates of existing templates and site survey records

Item No.	Activity	Resource / Machine	Site survey*	Existing template				
				ASD	CED	HSD	HTL	HyD
041	Break up road surface and remove spoil - Rigid surface (sq. m / day)	Manual	9.9	-	-	-	-	-
		Electric hand breaker	25.3	5.0	-	5.0	5.0	5.0
		Hydraulic breaker	24.7	16.0	-	16.0	-	16.0
041	Break up road surface and remove spoil - Flexible surface (sq. m / day)	Electric hand breaker	24.0	9.0	9.0	9.0	-	9.0
		Hydraulic breaker	-	30.0	30.0	30.0	-	30.0
041	Break up road surface and remove spoil - Footway (sq. m / day)	Manual	60.8	-	-	-	-	45.0
051	Excavate trench in soft material, install shoring and remove spoil (cu. m / day)	Manual	18.4	4.5	-	4.5	9.0	4.5
		Hydraulic breaker	15.8	-	-	-	18.0	18.0
052	Support and protect utilities (cu. m / day)	Manual	5.3	9.0	9.0	9.0	8.0	-
061	Lay pipe (no. / day)	Manual	3	2.0	-	2.0	4.0	2.0
061A	Remove existing tram track (m / day)	Manual	80.0	-	-	-	36.0	-
063A	Install new tram track (m / day)	Manual	10.7	-	-	-	36	-
071	Backfill trench and soil test (cu. m / day)	Plate compactor	32.1	8.5	-	8.5	17.0	8.5

* Average value obtained in site surveys

Item No.	Activity	Resource / Machine	Site survey*	Existing template				
				ASD	CED	HSD	HTL	HyD
072	Reinstatement (paving block) (sq. m / day)	Manual	53.9	-	-	-	-	-
072	Reinstatement (concrete) (sq. m / day)	Plate compactor	292.4	30.0	-	30.0	30.0	30.0
073	Concrete curing (sq. m / day)	Manual	55.7	3	-	3	7	3
C001	Building a central refuge (sq. m / day)	Manual	18.7	-	-	-	-	3
F054A	Railing on straight road (m / day)	Manual	160.0	-	-	-	-	50

* Average value obtained in site surveys

6.4.1.2 Repeated use of item numbers

In the standard templates, calculations of permit period were based on selected work items, work coverage and sequence. An item number was assigned to each of these activities for representation as shown in Table 6-4; eight identical item numbers were however found to have different descriptions under the five utility stakeholders being studied. For instance, item 061 was describing "lay pipe/cable work" under HLT and HyD, whilst was described as "geological logging by geologist" under ASD and HSD. Item 063a was representing "erect hoarding post and construct concrete footings" under ASD and HSD, but was used to represent "installation and fixing the alignment of tram track" under HTL.

Table 6-4 Work activities with identical item number in the current standard templates

No.	Work activity	ASD/HSD	CEDD	HLT	HyD
053	Construction of M/H (up to type 'D') / Drill and install rock dowel / Construction of Tubular Steel Framed Passenger Shelter / Construction of drawpit	Conduct other in-situ testing			✓
061	Lay pipes / cables	Geological logging by Geologist		✓	✓
061a	Construct U-channel of size up to 300mm			Removal and disposal of track	✓
062	Construct drawpits	Geological logging by Geologist			✓
062a	Construction of new manhole	✓		Drilling and installation of holding down bolts	

Note: Only the work items with identical number but different descriptions of work between utility stakeholders are shown in the above table. There are in total 78 work items adopted in the original set of standard templates.

No.	Work activity	ASD/HSD	CEDD	HLT	HyD
063a	Erect hoarding post and construct concrete footings	✓		Installation and fixing the alignment of tram track	
064a	Rail joint welding and grinding	✓		✓	
065a	Construct paving block run-in			Track level	✓

Note: Only the work items with identical number but different descriptions of work between utility stakeholders are shown in the above table. There are in total 78 work items adopted in the original set of standard templates.

6.4.1.3 Idle/infrequently used templates

Some existing standard templates were found to be idle or infrequently used. The standard templates of low usage rate under ASD, HSD, HyD and HTL are shown in Table 6-4. It should be noted that CEDD had only one standard template, and their works were usually not fully covered by that templates in the system. This issue for CEDD would be further discussed in *Section 6.4.1.5.*

Table 6-4 Infrequently used standard templates under the five utility stakholders

Name of Standard Template	Count
Under ASD	
1a - Typical Works Programme for Flexible Carriageway - Drainage Pipe Connection Work	4
1b - Typical Works Programme for Rigid Carriageway - Drainage Pipe Connection Work	4
2b - Typical Works Programme for Rigid Carriageway - Water Pipe Connection Work	3
1c - Typical Works Programme for Concrete/Paving Block Footway - Drainage Pipe Connection Work	2
3a - Typical Works Programme for Flexible Carriageway - Cable Connection Work	2
3c - Typical Works Programme for Concrete/Paving Block Footway - Cable Connection Work	1

Note: standard template(s) used for less than 5 times in the XPMS is shown in the above table.

Name of Standard Template	Count
Under ASD	
2a - Typical Works Programme for Flexible Carriageway - Water Connection Work	0
2c - Typical Works Programme for Footway - Water Connection Work	0
3b - Typical Works Programme for Rigid Carriageway - Water Connection Work	0
4a - Typical Works Programme for Flexible Carriageway - Gas Piping Connection Work	0
4b - Typical Works Programme for Rigid Carriageway - Gas Piping Connection Work	0
4c - Typical Works Programme for Footway - Gas Piping Connection Work	0
Under HSD	
1a - Typical Works Programme for Flexible Carriageway - Drainage Pipe Connection Work	0
1b - Typical Works Programme for Rigid Carriageway - Drainage Pipe Connection Work	0
1c - Typical Works Programme for Footway - Drainage Pipe Connection Work	0
2a - Typical Works Programme for Flexible Carriageway - Water Connection Work	0
2b - Typical Works Programme for Rigid Carriageway - Water Pipe Connection Work	0
3a - Typical Works Programme for Flexible Carriageway - Cable Connection Work	0
3b - Typical Works Programme for Rigid Carriageway - Water Connection Work	0
3c - Typical Works Programme for Concrete/Paving Block Footway - Cable Connection Work	0
4a - Typical Works Programme for Flexible Carriageway - Gas Piping Connection Work	0
4b - Typical Works Programme for Rigid Carriageway - Gas Piping Connection Work	0
4c - Typical Works Programme for Footway - Gas Piping Connection Work	0
5 - Typical Works Programme for Run-in Construction	0
6 - Typical Works Programme for Construction or Removal of Hoarding Footings	0
7 - Typical Works Programme for Ground Investigation at Footway (not exceeding 30m in depth)	0
Under HTL	
TT1 - Typical Works Programme for Renewal of Tram Track	0
T1 - Typical Works Programme for 50m Flexible Carriageway - Ducts/Cables Laying Works	0
T2 - Typical Works Programme for 50m Rigid Carriageway - Ducts/Cables Laying Works	0
T4 - Typical Works Programme for 10m Flexible Carriageway - Ducts/Cables Laying Works	0
T5 - Typical Works Programme for 10m Rigid Carriageway - Ducts/Cables Laying Works	0

Note: standard template(s) used for less than 5 times in the XPMS is shown in the above table.

Name of Standard Template	Count
Under HTL	
T6 - Typical Works Programme for 10m Footway - Ducts/Cables Laying Works	0
T7 - Typical Works Programme for Road Crossing of Flexible Carriageway (per lane) - Ducts/Cables Laying Works	0
T8 - Typical Works Programme for Road Crossing of Rigid Carriageway (per lane) - Ducts/Cables Laying Works	0
Under HyD	
D10 - Typical Works Programme for Construction of Taxi Shelter	3
D11a - Typical Works Programme for Flexible Carriageway - Tram Shelter	0
D11b - Typical Works Programme for Rigid Carriageway - Tram Shelter	0
D16 - Typical Works Programme for Construction of New Layby	0
D19a - Typical Works Programme for Installation of Public Lighting Controller	0
D19b - Typical Works Programme for relocation of Public Lighting Controller	0

Note: standard template(s) used for less than 5 times in the XPMS is shown in the above table.

6.4.1.4 Adequacy of work items

Apart from analysis on XP data of the two systems, the six interviews with the XPPT and permit applicants of the five utility trades also provided ideas to the improvement areas of the existing PPA method. Specific comments on applicability of work items in standard templates given by the interviewees are as follows:

- *CEDD: "The existing standard templates were not applicable in describing their works on site; hence they tended to apply excavation permits by self-defined work programmes with substantiations."*
- *CEDD: "Addition of work items for different natures of work, and to allow the use of polygon model for standard templates would be required."*
- *HSD: "It was suggested that if some work items in standard templates could be combined for simplification."*
- *HyD: "The current standard templates might not be applicable to illustrate the work schedules on site."*
- *XPPT: "Standard template(s) for works related to road openings on Part-Time Pedestrian Street should be added."*

6.4.1.5 Coverage of standard templates

Interviewees expressed their concerns on the coverage of standard templates during the six meetings as follows:

- *ASD: "Standard templates for works related to run-in construction, hoarding and ground investigation would be required."*
- *CEDD: "Addition of standard templates for soil nailing, greening work, slope surface protection, boulder barrier, trench work and trial pit was suggested."*
- *HTL: "XPs were usually registered with non-standard templates. Tram Track renewal, installation of pole for overhead lines fixing and underground power cable were their three main work types. Non-standard templates were adopted in most cases as there were discrepancies in permit periods obtained by standard template(s) and their own-defined work programmes."*
- *HTL: "Standard template for light pole construction would be required. A user-defined template was being adopted recently."*
- *HyD: "Standard template(s) for lift/ramp retrofitting works would be required."*
- *XPPT: "Standard template(s) for works related to road openings on Part-Time Pedestrian Street should be added."*
- *XPPT: "Standard templates for illustrating discontinuous work day pattern of cold milling and resurfacing work would be required."*
- *XPPT: "Polygon model in illustrating work areas in standard templates would be required for Landslip Preventive Measure (LPM) work and slope works like soil nailing."*

6.4.1.6 Provision of polygon model in standard templates

The availability of polygon model in standard template was also discussed in the interviews with the XPPT and applicants of the five utility stakeholders. Currently, standard templates could only allow work item(s) to be represented by line model (with trenching width not greater than 2m).

In real practices, however, there was often excavation work with trench width greater than the 2m or in area form. Applicants would therefore need to register their work items in plans by polygon model, which had less restriction on the dimensions. During the interviews, some interviewees commented that polygon model was not available for inputting their plans, and that was also one of the reasons for the rare use of standard templates in some utility stakeholders in the past eight years. Overall usages of standard templates in the IIUMS and XPMS were 25.4% and 38.7% respectively.

Comments on the availability of polygon model and relevant issues are as follows:

- *ASD: "If polygon model was adopted in standard templates, ASD's users would be benefited in their permit application processes as their works usually involved areas in nature."*
- *CEDD: "In their applications, polygon model was commonly adopted to illustrate the work areas. Line model with trench width of 2m was generally not applicable for their work and therefore they welcomed adoption of polygon model in standard templates."*
- *HSD: "Polygon model would be more preferable when describing work areas in permit applications."*
- *HSD: "An enhancement of using both line and polygon models in standard templates would be favorable for the ease of applications."*
- *HTL: "Non-standard templates were applied in most of the cases as there have been discrepancies between permit periods obtained by standard template(s) and own-defined work programmes. The absence of polygon model was the other reason."*
- *HTL: "Polygon model was better in marking work areas in particular for works such as tram track renewal which was of width 2.5m per lane."*
- *HyD: "An enhancement of map function in the XPMS was considered to be necessary, for instance, automatic full lane width for line model, key in width and length values, as well as the implementation of polygon model in standard template."*
- *XPPT: "Unavailability of polygon model might be one of the main reasons of high usage of non-standard templates."*
- *XPPT: "Polygon model in illustrating work areas in standard templates would be required, For instance, Landslip Preventive Measure (LPM) work and slope works like soil nailing were in this category."*

6.4.2 Recommendations

Measures were proposed in the following sections aiming to address the comments given by interviewees in the meetings and the findings of the analysis results of XP data.

6.4.2.1 *Update on production rates for work items*

Under the current PPA method, the permit period was estimated based on calculations of total time required for completing the tasks registered in work plan. Time of fixed duration activities and more importantly, time for activities that were dependent on plan item length both contributed to the outcome.

To achieve greater estimation accuracy, the parameters for calculating approved permit period in standard templates were reviewed. The process was carried out with reference to the single work item permits extracted from the IIUMS only as few records could be extracted from the XPMS. The procedures adopted in the review process were as follows:

1. *Exclude cases with permit duration shorter than 14 days.*
2. *Arrange standard templates in descending order by its sample size.*
3. *Exclude templates from further analysis if the sample size was less than 30.*
4. *Examine the formulation of each standard template according to the order obtained in step (2).*
5. *Actual working days for each of the cases were calculated.*
6. *Classify work items by length dependent and length independent items.*
7. *Calculate the duration of each item with the consideration of Multiplication Factors (MFs).*
8. *Exclude cases with negative values on the subtraction of actual working period and total duration of length independent items.*
9. *After exclusion, sort the templates in descending order by sample size, and conduct analysis beginning from the template with the largest sample size.*
10. *Regression model was built for the template with consideration of length dependent items only. The rates adopted in existing template and from site surveys were used as the lower and upper boundaries for the calibration.*
11. *Slightly adjust and round up the coefficients with practical considerations.*
12. *The coefficients were used for calculating the new permit periods and checked against the actual working periods. The coefficient became the new rate when 85% of the cases with the estimated permit periods being longer than the actual working periods.*
13. *Repeat steps (10) to (12) for the next largest sample-sized template.*
14. *In case the work item(s) was previously analyzed, its value was directly adopted and fixed during the calibration for the following template(s).*

Having considered the production rates obtained from site surveys and the results

derived from the calibration, new rates for work items, as shown in Table 6-5, in standard templates for the new PPA method were recommended.

After the review, production rates of item 051 by machine and manual were increased by 33%. The rates of items 071 and 072 were increased by 41%, and the rate of item 041 was slightly increased by 11%. These changes were in line with the observations from site survey that production rates were generally faster than the existing one in the standard templates.

Furthermore, wordings of the activities were harmonized to rationalize the descriptions. For instance, description of items 024a, 024d and 024e was modified as “Mobilize material and plant”, “Drill hole for soil nail” and “Conduct grouting to soil nail”, respectively. Item 064b was modified as “Install and fix track alignment”; and Item P002 was modified as “Disconnect power and remove existing column”. The revised wordings aimed for clearer illustrations of site work for both the applicants and the authority.

Table 6-5 New production rates for all work items in standard templates

No.	Activity	Original (O) / New (N) / Modified (M) item	Unit	Machine	Site survey	ASD a,b (c, d)	CEDD a,b (c, d)	HSD a,b (c, d)	HTL a,b (c, d)	HyD a,b (c, d)	Remarks
011	Take over site	O	day	Manual	-	1, 1 (1, 1)	1, 1 (1, 1)	1, 1 (1, 1)	1, 1 (1, 1)	1, 1 (1, 1)	Existing rate is retained
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	O	day	Manual	-	2, 3 (2, 3)	2, 3 (2, 3)	2, 3 (2, 3)	2, 3 (2, 3)	2, 3 (2, 3)	Existing rate is retained. The rate for polygon model is fixed at 3 days.
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	N	day	Manual	-	10, 10 (3, 3)	10, 10 (3, 3)	10, 10 (3, 3)	10, 10 (3, 3)	10, 10 (3, 3)	The rate is modified after the meeting with the applicants, and the database analysis.
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	N	day	Manual	-	10, 10 (7, 7)	10, 10 (7, 7)	10, 10 (7, 7)	10, 10 (7, 7)	10, 10 (7, 7)	
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	N	day	Manual	-	10, 10 (10, 10)	10, 10 (10, 10)	10, 10 (10, 10)	10, 10 (10, 10)	10, 10 (10, 10)	
023aP	Conduct clearance to new site	N	day / 100 sq. m	Manual	-	-	- (1.2)	-	-	-	New rate is suggested by the respective utility stakeholder.
023bP	Conduct initial survey on existing slope	N	day / 100 sq. m	Manual	-	-	- (0.2)	-	-	-	New rate is suggested by the respective utility stakeholder.
023cP	Conduct surface stripping on existing slope	N	day / 100 sq. m	Machine	-	-	- (10)	-	-	-	New rate is suggested by the respective utility stakeholder.
024aP	Mobilize material and plant	N	day	Both	-	-	- (7)	-	-	-	New rate is suggested by the respective utility stakeholder.
024bP	Set out soil nail position	N	day / soil nail	Manual	-	-	- (20)	-	-	- (20)	New rate is from similar items or user templates.
024cP	Erect hoarding	N	sq. m / day	Manual	-	-	-	-	-	-, - (15, 15)	New rate is from similar items or user templates.
024dP	Drill hole for soil nail	N	day / soil nail	Machine	-	-	- (10)	-	-	- (10)	New rate is from similar items or user templates.
024eP	Conduct grouting to soil nail	N	day / soil nail	Machine	-	-	- (10)	-	-	- (10)	New rate is from similar items or user templates.
024fP	Conduct pull out test	N	day	Machine	-	-	- (2)	-	-	- (2)	New rate is from similar items or user templates.
024gP	Construct soil nail head	N	day / soil nail	Machine	-	-	- (10)	-	-	- (10)	New rate is from similar items or user templates.
024hP	Construct drainage system	N	day / 10 m	Manual	-	-	-	-	-	- (10)	New rate is suggested by the respective utility stakeholder.
024iP	Construct staircase on slope	N	day / 10 m	Manual	-	-	-	-	-	- (12)	New rate is suggested by the respective utility stakeholder.
024jP	Fix erosion control mat	N	day / 100 sq. m	Manual	-	-	- (6)	-	-	- (6)	New rate is suggested by the respective utility stakeholder.
024kP	Conduct hydroseeding to slope	N	day / 100 sq. m	Manual	-	-	- (4)	-	-	- (4)	New rate is suggested by the respective utility stakeholder.
024lP	Stabilize rock slope (as mesh protection)	N	day / 100 sq. m	Manual	-	-	- (7)	-	-	-	New rate is suggested by the respective utility stakeholder.
024mP	Conduct landscaping work (as hydroseeding)	N	day / 100 sq. m	Manual	-	-	- (0.2)	-	-	-	New rate is suggested by the respective utility stakeholder.
024nP	Conduct hard rock slope surfacing work	N	day / 100 sq. m	Manual	-	-	- (10)	-	-	-	New rate is suggested by the respective utility stakeholder.
024pP	Conduct rock scaling and remove boulders (only rock scaling)	N	day / 100 sq. m	Machine	-	-	- (3)	-	-	-	New rate is suggested by the respective utility stakeholder.
024qP	Construct granite stone facing	N	day / 100 sq. m	Manual	-	-	- (6.7)	-	-	-	New rate is suggested by the respective utility stakeholder.
024rP	Construct skin wall (for 500mm thick)	N	day / 100 sq. m	Machine	-	-	- (120)	-	-	-	New rate is suggested by the respective utility stakeholder.
024sP	Erect fence and gate	N	day / 10 m	Manual	-	-	- (1)	-	-	-	New rate is suggested by the respective utility stakeholder.
024tP	Install railing on slope	N	day / 10 m	Manual	-	-	- (2)	-	-	-	New rate is suggested by the respective utility stakeholder.
024uP	Carry out tree protection and preservation work	N	day / 100 sq. m	Manual	-	-	- (0.5)	-	-	-	New rate is suggested by the respective utility stakeholder.
024vP	Conduct tree survey	N	day / 100 sq. m	Manual	-	-	- (0.2)	-	-	-	New rate is suggested by the respective utility stakeholder.
024xP	Construct staircase on slope (for 1m wide single handrailing)	N	day / 10 m	Manual	-	-	- (5)	-	-	-	New rate is suggested by the respective utility stakeholder.
024yP	Construct drainage system (as 300mm U-channel with masnory apron	N	day / 10 m	Manual	-	-	- (2)	-	-	-	New rate is suggested by the respective utility stakeholder.
024zP	Erect hoarding for LPM	N	day / 10 m	Manual	-	-	- (3.33)	-	-	-	New rate is suggested by the respective utility stakeholder.
025	Dismantle hoarding	N	day / 10 m	Manual	-	-	-	-	-	- (4)	New rate is suggested by the respective utility stakeholder.
025cP	Dismantle hoarding (as Type A hoarding)	N	day / 10 m	Manual	-	-	- (1.5)	-	-	-	New rate is suggested by the respective utility stakeholder.
026	Conduct site clearance for lift construction	N	day	Manual	-	-	-	-	-	- (20)	New rate is suggested by the respective utility stakeholder.
031	Locate utilities (gas pipe / cable location)	O	day	Manual	-	2, 4 (2, 4)	2, 4 (2, 4)	2, 4 (2, 4)	2, 4 (2, 4)	2, 4 (2, 4)	Existing rate is retained. The rate for polygon model is fixed at 3 days.
032a	Erect scaffolding for spray concrete	O	day / 1200 sq. m	Manual	-	-	-	-	-	2 (2)	Existing rate is retained.
032b	Erect scaffolding for other work	O	day / 100 sq. m	Manual	-	-	-	-	-	1 (1)	Existing rate is retained.
033a	Erect working platform for surface stripping	O	day / 2 no.	Manual	-	-	-	-	-	1 (1)	Existing rate is retained.
033b	Erect working platform for soil nail and rock dowel	M	day / no.	Manual	-	-	- (1)	-	-	1 (1)	Existing rate is retained.
041a	Break up road surface and remove spoil - Rigid surface	M	sq. m / day	Manual	9.9	-	-	-	-	-	
		M	sq. m / day	Machine[1]	25.3	5, 10 (8, 16)	5, 10 (8, 16)	5, 10 (8, 16)	5, 10 (8, 16)	5, 10 (8, 16)	New rate is modified after database analysis and site survey.
		M	sq. m / day	Machine[2]	24.7	16, 16 (25, 25)	16, 16 (25, 25)	16, 16 (25, 25)	16, 16 (25, 25)	16, 16 (25, 25)	
041b	Break up road surface and remove spoil - Flexible surface	M	sq. m / day	Machine[1]	24.0	9, 18 (10, 20)	9, 18 (10, 20)	9, 18 (10, 20)	9, 18 (10, 20)	9, 18 (10, 20)	New rate is modified after database analysis and site survey.

Note: a, b (c, d) = "old rate for 10m, old rate for 50m (new rate for 10m, new rate for 50m)", except item "F071" "old rate for 2m, old rate for >2m (new rate for 2m, new rate for >2m)

1 (1) = old rate (new rate)

Superscripts *1* and *2* denote electric hand / pneumatic breaker and hydraulic breaker, respectively

No.	Activity	Original (O) / New (N) / Modified (M) item	Unit	Machine	Site survey	ASD a,b (c, d)	CEDD a,b (c, d)	HSD a,b (c, d)	HTL a,b (c, d)	HyD a,b (c, d)	Remarks
		M	sq. m / day	Machine[2]	-	30, 30 (35, 35)	30, 30 (35, 35)	30, 30 (35, 35)	30, 30 (35, 35)	30, 30 (35, 35)	New rate is modified after database analysis and site survey.
041c	Break up road surface and remove spoil - Footway	M	sq. m / day	Manual	60.8	-, - (45, 90)	-	-	30, 60 (45, 90)	45, 90 (45, 90)	Existing rate is retained.
041d	Cover walkway	N	day	Manual	-	-	-	- (4)	-	-	New rate is suggested by the respective utility stakeholder.
042	Break up and remove defective slope surface	O	day / 1200 sq. m	Manual	-	-	-	-	-	4 (4)	Existing rate is retained.
042a	Demolish central divider	O	day	Both	-	-	-	-	-	8, 16 (8, 16)	Existing rate is retained.
042b	Extend central divider	O	day	Manual	-	-	-	-	-	13, 26 (13, 26)	Existing rate is retained.
042c	Repair central divider	O	day	Manual	-	-	-	-	-	13, 26 (13, 26)	Existing rate is retained.
043	Strip surface	O	day / 2 no.	Manual	-	-	-	-	-	1 (1)	Existing rate is retained.
044	Excavate plant hole	O	day / 100 sq. m	Manual	-	-	-	-	-	6 (6)	New rate makes reference to HyD template.
044a	Conduct greening work (with drilling)	O	day / 100 sq. m	Both	-	-	-	-	-	3 (3)	Existing rate is retained.
045	Conduct ground investigation for lift construction	N	day	Manual	-	-	-	-	-	- (30)	New rate is suggested by the respective utility stakeholder.
045a	Drill hole (up to 30m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement	O	day / no.	Machine	-	-	14 (14)	-	-	-	Existing rate is retained.
045b	Drill hole (> 30m to 60m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement	O	day / no.	Machine	-	-	19 (19)	-	-	-	Existing rate is retained.
045c	Drill hole (> 60m to 90m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement	O	day / no.	Machine	-	-	26 (26)	-	-	-	Existing rate is retained.
045d	Drill hole (> 90m to 150m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement	O	day / no.	Machine	-	-	32 (32)	-	-	-	Existing rate is retained.
045e	Drill core hole	N	day / 10 no.	Machine	-	-	- (10)	-	-	-	New rate is suggested by the respective utility stakeholder.
045f	Drill inclined hole	N	day / 10 no.	Machine	-	-	- (10)	-	-	-	New rate is suggested by the respective utility stakeholder.
046a	Conduct trial pit work (1.5m x 1.5m, up to 3m deep) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement	O	day / no.	Machine	-	-	13 (13)	-	-	-	Existing rate is retained.
046b	Conduct trial pit work (1.5m x 1.5m, > 3m to 5m deep) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement	O	day / no.	Machine	-	-	18 (18)	-	-	-	Existing rate is retained.
047a	Conduct trial trench work (1.5m wide, 3m deep, >1.5m to 3m long) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement	O	day / no.	Machine	-	-	16 (16)	-	-	-	Existing rate is retained.
047b	Conduct trial trench work (1.5m wide, 3m deep, >3m to 5m long) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement	O	day / no.	Machine	-	-	21 (21)	-	-	-	Existing rate is retained.
048a	Conduct slope stripping work (0.5m wide, 0.3m deep, up to 15m long) - Erect access ladder, excavate, in-situ testing & sampling, logging, backfill, reinstatement	O	day / no.	Machine	-	-	12 (12)	-	-	-	Existing rate is retained.
048b	Conduct slope stripping work (0.5m wide, 0.3m deep, > 15m to 30m long) - Erect access ladder, excavate, in-situ testing & sampling, logging, backfill, reinstatement	O	day / no.	Machine	-	-	18 (18)	-	-	-	Existing rate is retained.
049	Provide instrumentation	O	day / no.	Both	-	-	10 (10)	-	-	-	Existing rate is retained.
050	Install settlement marker	N	day	Manual	-	- (1)	-	-	-	-	New rate is suggested by the respective utility stakeholder
051	Excavate trench / pit in soft material, install shoring and remove spoil	M	cu. m / day	Manual	18.4	4.5, - (6, 12)	-, - (6, 12)	4.5, - (6, 12)	4.5, 9 (6, 12)	4.5, 9 (6, 12)	New rate is modified after database analysis and site survey.
				Machine[2]	15.8	-, - (24, 24)	-, - (24, 24)	-, - (24, 24)	18, - (24, 24)	18, - (24, 24)	
051al	Excavate trench / pit in soft material, install shoring and remove spoil for lift construction	N	day	Both	-	-	-	-	-	-, - (20, 30)	New rate is suggested by the respective utility stakeholder.
052	Support and protect utilities	O	day	Manual	-	2 (2)	-	2 (2)	2 (2)	2 (2)	Existing rate is retained.
053	Drill and install rock dowel	M	day / 20 no.	Machine	-	-	- (7)	-	-	7 (7)	Existing rate is retained.
053a	Install rock / wire mesh	M	day / 100 sq. m	Machine	-	-	-	-	-	3 (3)	Existing rate is retained.
053b	Construct tubular steel framed passenger shelter	M	day	Machine						38, 76 (38, 76)	Existing rate is retained.
054	Construct raking drain	O	day / 10 m	Machine	-	-	-	-	-	2 (2)	Existing rate is retained.

Note: a, b (c, d) = "old rate for 10m, old rate for 50m (new rate for 10m, new rate for 50m)", except item "F071" "old rate for 2m, old rate for >2m (new rate for 2m, new rate for >2m)

1 (1) = old rate (new rate)

Superscripts *1* and *2* denote electric hand breaker and hydraulic breaker, respectively

No.	Activity	Original (O) / New (N) / Modified (M) item	Unit	Machine	Site survey	ASD a,b (c, d)	CEDD a,b (c, d)	HSD a,b (c, d)	HTL a,b (c, d)	HyD a,b (c, d)	Remarks
055	Provide temporary decking	M	day	N/A	-	2, 3 (2, 3)	-, - (2, 3)	2, 3 (2, 3)	2, 4 (2, 3)	2, 4 (2, 3)	New rate makes reference to the rates of ASD and HSD. The rate for polygon model is fixed at 3 days.
055a	Remove working platform for surface stripping	O	day / 2 no.	N/A						1 (1)	Existing rate is retained.
055b	Remove working platform for soil nail and rock dowel	O	day / 20 no.	N/A				2 (2)		2 (2)	Existing rate is retained.
056	Conduct tunneling work (e.g. under tram track per carriageway lane)	O	day	Machine	-	-	-	-	-	21 (21)	Existing rate is retained.
056a	Form weep holes	O	day	Machine		-	-	-	-	1 (1)	Existing rate is retained.
057	Provide concrete for binding layer	O	day	Both	-	-	-	-	-	1 (1)	Existing rate is retained.
057a	Spray concrete (include BRC fixing, curing and coring for checking)	O	day / 1200 sq. m	Both		-	-	-	-	12 (12)	Existing rate is retained.
058	Construct surface channel (including formworking and concreting) / Remove scaffolding for spray concrete	O	day	Manual	-	-	-	-	-	2, 4 (2, 4)	Existing rate is retained.
058a	Remove scaffolding for spray concrete	M	day	Manual	-	-	-	-	-	1 (1)	Existing rate is retained.
058b	Remove scaffolding for typical work	M	day	Manual	-	- (1)	- (1)	-	-	1 (1)	Existing rate is retained.
059	Construct planter wall	O	day / m	Manual	-	-	-	-	-	5 (5)	Existing rate is retained.
060a	Construct simple retaining structure up to 2m high	O	day / 10 m	Manual	-	-	-	-	-	8 (8)	Existing rate is retained.
060b	Construct simple retaining structure > 2m and up to 3m high	O	day / 10 m	Manual	-	-	-	-	-	13 (13)	Existing rate is retained.
061	Lay pipe / cable	O	no. / day	Manual	3.0	2, - (2, 4)	2, - (2, 4)	2, - (2, 4)	2, - (2, 4)	2, 4 (2, 4)	Existing rate is retained.
061a	Construct U-channel of size up to 300mm	O	day / 10 m	Manual	-	-	-	-	-	1 (1)	Existing rate is retained.
061b	Construct U-channel of size > 300mm and up to 450mm	O	day / 10 m	Manual	-	-	-	-	-	1 (1)	Existing rate is retained.
061c	Adjust existing utility / manhole covers	N	day	Manual	-	- (7)	-	- (7)	-	-	New rate is suggested by the respective utility stakeholder.
061d	Lower existing underground utilities	N	day / 10 m	Manual	-	- (30)	-	- (30)	-	-	New rate is suggested by the respective utility stakeholder.
061e	Diverse existing underground utilities	N	day / 10 m	Manual	-	- (30)	-	- (30)	-	-	New rate is suggested by the respective utility stakeholder.
061f	Remove abandoned pipe and backfilling	N	day / 10 m	Manual	-	- (3)	-	- (3)	-	-	New rate is suggested by the respective utility stakeholder.
061g	Conduct utility diversion for lift construction	N	day	Manual	-	-	-	-	-	-, - (90, 105)	New rate is suggested by the respective utility stakeholder.
062a	Construct drawpit / manhole / valve pit	O	day / no	Manual	-	7 (7)	-	-	- (7)	7 (7)	Existing rate is retained.
062b	Connect existing manhole	O	day	Manual	-	2 (2)	-	-	-	-	Existing rate is retained.
063	Conduct site inspection, testing and commissioning (CCTV record) / Water test and water connection / Cable connection including testing and commissioning	O	day	Manual	-	7 (7)	-	-	-	-	Existing rate is retained.
063a	Erect hoarding post and construct concrete footing	O	m / day	Manual	-	4, 9 (4, 9)	-, - (4, 9)	4, 9 (4, 9)	-	-	Existing rate is retained.
063b	Dismantle hoarding footing	O	day	Manual	-	4, 8 (4, 8)	-, - (4, 8)	4, 8 (4, 8)	-	-	Existing rate is retained.
064	Lay drop kerb	O	day	Manual	2.0	1, 2 (1, 2)	- (1, 2)	-	- (1, 2)	1, 2 (1, 2)	New rate makes reference to HyD template.
064aP	Remove and dispose of tram track	M	m / day	Manual	80.0	-	-	-	36 (58)	-	New rate is modified after site survey.
064bP	Install and fix track alignment	M	m / day	Manual	10.7	-	-	-	36 (23)	-	New rate is modified after site survey.
064cP	Conduct rail joint welding and grinding	O	m / day	Manual	-	-	-	-	36 (36)	-	Existing rate is retained.
064dP	Level track	O	m / day	Manual	-	-	-	-	36 (36)	-	Existing rate is retained.
064eP	Drill and install of holding down bolt	O	m / day	Manual	-	-	-	-	36 (36)	-	Existing rate is retained.
064f	Remove tram pole	N	day / pole	Manual	-	-	-	-	- (3)	-	New rate is suggested by the respective utility stakeholder.
064g	Erect tram pole	N	day / pole	Manual	-	-	-	-	- (3)	-	New rate is suggested by the respective utility stakeholder.
065a	Construct paving block run-in	O	day	Manual	-	3, 5 (3, 5)	-	3, 5 (3, 5)	-	3, 5 (3, 5)	Existing rate is retained.
065b	Construct concrete run-in	O	day	Manual	-	2, 3 (2, 3)	-	2, 3 (2, 3)	-	2, 3 (2, 3)	Existing rate is retained.
066a	Remove existing staircase	N	day	Manual	-	-	-	-	-	- (20)	New rate is suggested by the respective utility stakeholder.
066b	Construct new staircase foundation	N	day / no.	Manual	-	-	-	-	-	- (30)	New rate is suggested by the respective utility stakeholder.
066c	Construct new staircase	N	day / no.	Manual	-	-	-	-	-	- (50)	New rate is suggested by the respective utility stakeholder.
066d	Remove existing ramp for lift construction	N	day / no.	Manual	-	-	-	-	-	-, - (45, 60)	New rate is suggested by the respective utility stakeholder.
067a	Construct link bridge foundation and columns	N	day / no.	Machine	-	-	-	-	-	- (60)	New rate is suggested by the respective utility stakeholder.
067b	Construct link bridge	N	day / no.	Machine	-	-	-	-	-	- (30)	New rate is suggested by the respective utility stakeholder.
067c	Construct pre-bored H-piles	N	day / no.	Machine	-	-	-	-	-	- (60)	New rate is suggested by the respective utility stakeholder.
067d	Construct mini piles	N	day / no.	Machine	-	-	-	-	-	- (60)	New rate is suggested by the respective utility stakeholder.
067e	Construct lift foundation	N	day / no.	Both	-	-	-	-	-	- (50)	New rate is suggested by the respective utility stakeholder.
067f	Construct lift tower	N	day / no.	Manual	-	-	-	-	-	- (60)	New rate is suggested by the respective utility stakeholder.
067g	Construct lift shaft	N	day / no.	Manual	-	-	-	-	-	-, - (60, 75)	New rate is suggested by the respective utility stakeholder.
067h	Provide finishing	N	day / no.	Manual	-	-	-	-	-	- (30)	New rate is suggested by the respective utility stakeholder.
067i	Conduct electric room	N	day / no.	Manual	-	-	-	-	-	- (20)	New rate is suggested by the respective utility stakeholder.

Note: a, b (c, d) = "old rate for 10m, old rate for 50m (new rate for 10m, new rate for 50m)", except item "F071" "old rate for 2m, old rate for >2m (new rate for 2m, new rate for >2m)

1 (1) = old rate (new rate)

Superscripts *1* and *2* denote electric / pneumatic hand breaker and hydraulic breaker, respectively

No.	Activity	Original (O) / New (N) / Modified (M) item	Unit	Machine	Site survey	ASD a,b (c, d)	CEDD a,b (c, d)	HSD a,b (c, d)	HTL a,b (c, d)	HyD a,b (c, d)	Remarks
067j	Install glass canopy	N	day / no.	Manual	-	-	-	-	-	- (15)	New rate is suggested by the respective utility stakeholder.
067k	Install E&M, testing and commissioning	N	day / no.	Manual	-	-	-	-	-	- (50)	New rate is suggested by the respective utility stakeholder.
067l	Install untensioned beam barrier, railing and signage	N	day / no.	Manual	-	-	-	-	-	- (10)	New rate is suggested by the respective utility stakeholder.
067m	Conduct backfilling & reinstate after lift construction	N	day	Manual	-	-	-	-	-	-, - (20,30)	New rate is suggested by the respective utility stakeholder.
068P	Conduct cold milling after fence off site with approved TTM, strength local area, adjust manhole cover, spray tack coat, conduct resurfacing, curing, conduct testing, provide road marking and furniture, clear site	N	sq. m / day	Machine	424.0	-	-	-	-	400	New rate is from site survey.
069f	Conduct planting work	N	day / 100 sq. m	Manual	-	-	-	-	-	- (0.2)	New rate is suggested by the respective utility stakeholder.
069zP	Conduct planting work (as hydroseeding)	N	day / 100 sq. m	Manual	-	-	- (0.2)	-	-	-	New rate is suggested by the respective utility stakeholder.
070aP	Conduct boulder stabilisation work	N	day / 10 cu. m	Manual	-	-	-	-	-	- (20)	New rate is suggested by the respective utility stakeholder.
070bP	Construct foundation for flexible barrier	N	day / 10 cu. m	Manual	-	-	-	-	-	- (30)	New rate is suggested by the respective utility stakeholder.
070cP	Erect flexible barrier	N	day / 100 sq. m	Manual	-	-	-	-	-	- (30)	New rate is suggested by the respective utility stakeholder.
071	Conduct backfilling and soil test	M	cu. m / day	Both	32.1	8.5, 17 (12, 24)	-, - (12, 24)	8.5, 17 (12, 24)	-, - (12, 24)	8.5, 17 (12, 24)	New rate is modified after database analysis and site survey.
072a	Reinstate (concrete / asphalt)	M	sq. m / day	Machine	292.4	30, 60 (45, 90)	30, 60 (45, 90)	30, 60 (45, 90)	30, 60 (45, 90)	30, 60 (45, 90)	New rate is modified after database analysis and site survey.
072b	Reinstate (paving block)	N	sq. m / day	Manual	53.9	-, - (45, 45)	-, - (45, 45)	-, - (45, 45)	-, - (45, 45)	-, - (45, 45)	New rate is modified after database analysis and site survey.
072c	Reinstate (concrete / asphalt) after lift construction	N	day	Machine	-	-	-	-	-	-, - (4, 10)	New rate is suggested by the respective utility stakeholder.
072d	Reinstate (paving block) after lift construction	N	day	Manual	-	-	-	-	-	-, - (7, 14)	New rate is suggested by the respective utility stakeholder.
073	Provide curing to freshly laid concrete (3 days)	M	day	Manual	-	3 (3)	-	3 (3)	3 (3)	3 (3)	Existing rate is retained.
073a	Provide curing to freshly laid concrete (7 days)	O	day	Manual	-	7 (7)	-	7 (7)	7 (7)	7 (7)	Existing rate is retained.
074	Provide road marking and furniture	O	day	Manual	-	1 (1)	- (1)	1 (1)	1 (1)	1 (1)	Existing rate is retained.
075	Conduct site clearance (demobilisation)	O	day	Manual	-	1 (1)	- (1)	1 (1)	1 (1)	1 (1)	Existing rate is retained.
075al	Conduct site clearance (demobilisation) after lift construction	N	day	Manual	-	-	-	-	-	- (2)	New rate is suggested by the respective utility stakeholder.
076	Lay kerb	O	m / day(2 days min)	Manual	-	-	-	-	- (15)	15 (15)	Existing rate is retained.
076a	Lay kerb (for central refuge)	N	day	Manual	-	-	-	-	- (2)	- (2)	New rate makes reference to HyD template.
077	Conduct geological logging by geologist	O	day	Manual	-	2 (2)	-	2 (2)	-	-	Existing rate is retained.
078P	Excavate and provide temporary shoring	N	day / 10 cu. m	Both	-	-	-	-	-	- (6)	New rate is suggested by the respective utility stakeholder.
079P	Erect formwork	N	day / 10 cu. m	Manual	-	-	-	-	-	- (5)	New rate is suggested by the respective utility stakeholder.
080P	Conduct R.C work	N	day / 100 sq. m	Both	-	-	-	-	-	- (2)	New rate is suggested by the respective utility stakeholder.
081	Check reinstatement quality and report completion of road opening work	O	day	Manual	-	2 (2)	2 (2)	2 (2)	2 (2)	2 (2)	Existing rate is retained.
C001	Build central refuge	O	day	Manual	3.0	-	-	-	- (3)	3 (3)	Existing rate is retained.
C002	Prepare concrete foundation	M	day / 1 no.	Manual	-	-	-	-	-	5 (5)	Existing rate is retained.
C003	Install controller and internal wiring	M	day / 1 no.	Manual	-	-	-	-	-	2 (2)	Existing rate is retained.
C004	Remove existing controller	M	day / 1 no.	Manual	-	-	-	-	-	1(1)	Existing rate is retained.
F051	Construct footing	M	m / day	Manual	-	-	-	-	-	5 (7)	New rate is modified after database analysis and site survey.
F052	Place anchor block	M	m / day	Machine	-	-	-	-	-	2 (6)	New rate is modified after database analysis and site survey.
F053	Install safety fence	M	m / day	Manual	-	-	-	-	-	10 (16)	New rate is modified after database analysis and site survey.
F054a	Install railing on straight road	M	m / day	Manual	0.1	- (30)	- (30)	-	-	10 (30)	New rate is modified after database analysis and site survey.
F054b	Install railing at junction bend	M	m / day	Manual	-	-	-	-	-	5 (8)	New rate is modified after database analysis and site survey.
F055	Install crash cushion	M	day / no.	Manual	-	-	-	-	-	7 (3)	New rate is modified after database analysis and site survey.
F071	Construct directional sign footing	M	day	Both	-	-	-	-	-	8, 12 (8, 12)	Existing rate is retained.
F071a	Construct gantry sign footing	O	day	Both	-	-	-	-	-	8 (8)	Existing rate is retained.
P001	Prepare pole hole	O	no. / day	Manual	-	-	-	-	- (1)	1 (1)	Existing rate is retained.
P002	Disconnect power and remove existing column	O	day	Manual	-	-	-	-	- (2)	2 (2)	Existing rate is retained.
P003	Erect pole, install lantern and internal wiring	O	no. / day	Both	-	-	-	-	- (2)	2 (2)	Existing rate is retained.
S001	Erect traffic signal post	O	day	Both	-	-	-	-	-	7 (7)	Existing rate is retained.
S002	Connect cable for traffic signal by EMSD	O	day	Manual	-	-	-	-	-	21 (21)	Existing rate is retained.
S003	Connect power supply by CLP / HEC	O	day	Manual	-	-	-	-	-	7 (7)	Existing rate is retained.
S74a	Fabricate and erect directional sign support & frame	O	day	Both	-	-	-	-	-	8 (8)	Existing rate is retained.
T051	Erect tram shelter	O	day	Manual	-	-	-	-	-	53 (53)	Existing rate is retained.

Note: a, b (c, d) = "old rate for 10m, old rate for 50m (new rate for 10m, new rate for 50m)", except item "F071" "old rate for 2m, old rate for >2m (new rate for 2m, new rate for >2m)

1 (1) = old rate (new rate)

Superscripts *1* and *2* denote electric / pneumatic hand breaker and hydraulic breaker, respectively

6.4.2.2 Harmonization of item numbers

As the numbering system appeared to be confusing to the users. Hence, an improvement for having clearer description of work items would be beneficial. Item numbers, which were found to be identical but having inconsistent descriptions across different utility stakeholders, were re-arranged. The latest numbering system proposed for the new PPA method with markup on the changes made with respect to the old system is shown in Table 6-6.

In the table, a sub-coding system has been proposed for classifying work items with similar work nature but different scale (e.g. excavation work in different lengths, widths or depths), working day, or road surface material. For instance, the time for conducting major traffic arrangement in various districts could take 3, 7 or 10 days. Item 022 in the old system was thus split into three as items 022a, b and c as to allow extra flexibility to permittees, catering their needs on sites in different areas.

In addition, the new coding system provided logical flow of excavation work on sites with respect to numerical and alphabetical orders set in each of the work item. For instance, items 024a to 024z were set to describe Landslip Preventive Measures (LPM) work for CEDD and soil nailing and natural terrain works for HyD. The ascending order of work item indicated the common flow on work site. Items 045a to 048b were set to describe the ground investigation works under ASD and CEDD; similarly, the ascending order of work items indicated the common work flows on site. Same idea was applied to items 32, 33, 41, 42, 55, 58, 60 to 73, 75 and 76 with sub-coding starting from *a* up to *p*.

Table 6-6 New set of work items in standard templates

No.	Work activity	ASD	CEDD	HSD	HTL	HyD	Remarks
011	Take over site	✓	✓	✓	✓	✓	
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	✓	✓	✓	✓	✓	
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	✓	✓	✓	✓	✓	
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	✓	✓	✓	✓	✓	
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	✓	✓	✓	✓	✓	
023aP	Conduct clearance to new site		✓				
023bP	Conduct initial survey on existing slope		✓				These are new items used only in polygon model for CEDD on LPM work.
023cP	Conduct surface stripping on existing slope		✓				
024aP	Mobilize material and plant		✓			✓	These are new items used only in polygon model for CEDD on LPM work and HyD on soil nailing and natural terrain works.
024bP	Set out soil nail position		✓			✓	
024cP	Erect hoarding					✓	This is a new item used only in polygon model for HyD on soil nailing and natuarl terrain works.
024dP	Drill hole for soil nail		✓			✓	
024eP	Conduct grouting to soil nail		✓			✓	These are new items used only in polygon model for CEDD on LPM work and HyD on soil nailing and natural terrain works.
024fP	Conduct pull out test		✓			✓	
024gP	Construct soil nail head		✓			✓	
024hP	Construct drainage system					✓	This is a new item used only in polygon model for HyD on soil nailing and natuarl terrain works.
024iP	Construct staircase on slope					✓	
024jP	Fix erosion control mat		✓			✓	These are new items used only in polygon model for CEDD on LPM work and HyD on soil nailing and natural terrain works.
024kP	Conduct hydroseeding to slope		✓			✓	
024lP	Stabilize rock slope (as mesh protection)		✓				"Dismantle hoarding" is moved to "025". This is an item used only in polygon model.
024mP	Conduct landscaping work (as hydroseeding)		✓				These are new items used only in polygon model for CEDD on LPM work.
024nP	Conduct hard rock slope surfacing work		✓				
024pP	Conduct rock scaling and remove boulders (only rock scaling)		✓				
024qP	Construct granite stone facing		✓				
024rP	Construct skin wall (for 500mm thick)		✓				
024sP	Erect fence and gate		✓				
024tP	Install railing on slope		✓				
024uP	Carry out tree protection and preservation work		✓				
024vP	Conduct tree survey		✓				
024xP	Construct staircase on slope (for 1m wide with single handrailing)		✓				
024yP	Construct drainage system (as 300mm U - channel with masnory apron)		✓				
024zP	Erect hoarding for LPM		✓				
025	Dismantle hoarding					✓	This is an item moved from "024l".
025cP	Dismantle hoarding (as Type A hoarding)		✓				This is a new item used only in polygon model for CEDD on LPM work.
026	Conduct site clearance for lift construction					✓	This is a new item for HyD on lift construction.
031	Locate utilities (gas pipe / cable location)	✓	✓	✓	✓	✓	
032a	Erect scaffolding for spray concrete					✓	
032b	Erect scaffolding for other work					✓	
033a	Erect working platform for surface stripping					✓	
033b	Erect working platform for soil nail and rock dowel		✓			✓	
041a	Break up road surface and remove spoil - Rigid surface	✓	✓	✓	✓	✓	
041b	Break up road surface and remove spoil - Flexible surface	✓	✓	✓	✓	✓	
041c	Break up road surface and remove spoil - Footway	✓			✓	✓	
041d	Cover walkway			✓			This is a new item for HSD on construction of run-in.
042	Break up and remove defective slope surface					✓	

No.	Work activity	ASD	CEDD	HSD	HTL	HyD	Remarks
042a	Demolish central divider					✓	
042b	Extend central divider					✓	
042c	Repair central divider					✓	
043	Strip surface					✓	
044	Excavate plant hole					✓	
044a	Conduct greening work (with drilling)					✓	
045	Conduct ground investigation for lift construction					✓	This is a new item for HyD on lift construction.
045a	Drill hole (up to 30m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement		✓				
045b	Drill hole (> 30m to 60m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement		✓				
045c	Drill hole (> 60m to 90m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement		✓				
045d	Drill hole (> 90m to 150m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement		✓				
045e	Drill core hole		✓				
045f	Drill inclined hole		✓				
046a	Conduct trial pit work (1.5m x 1.5m, up to 3m deep) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement		✓				
046b	Conduct trial pit work (1.5m x 1.5m, > 3m to 5m deep) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement		✓				
047a	Conduct trial trench work (1.5m wide, 3m deep, >1.5m to 3m long) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement		✓				
047b	Conduct trial trench work (1.5m wide, 3m deep, >3m to 5m long) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement		✓				
048a	Conduct slope stripping work (0.5m wide, 0.3m deep, up to 15m long) - Erect access ladder, excavate, in-situ testing & sampling, logging, backfill, reinstatement		✓				
048b	Conduct slope stripping work (0.5m wide, 0.3m deep, > 15m to 30m long) - Erect access ladder, excavate, in-situ testing & sampling, logging, backfill, reinstatement		✓				
049	Provide instrumentation		✓				
050	Install settlement marker	✓					This is a new item for ASD's settlement marker.
051	Excavate trench / pit in soft material, install shoring and remove spoil	✓	✓	✓	✓	✓	Description of "051" is modified.
051al	Excavate trench / pit in soft material, install shoring and remove spoil for lift construction					✓	This is a new item for HyD on lift construction.
052	Support and protect utilities / Drill and install soil nail (HyD) / Insitu tests / Conduct other in-situ testing (ASD)	✓		✓	✓	✓	
053	Drill and install rock dowel		✓			✓	"Construction of MH (upto type 'D') and construction of drawpit" are moved to "062". "Conduct in-situ testing" for ASD is grouped into "052". "Construct tubular steel framed passenger shelter" is moved to "053b".
053a	Install rock / wire mesh					✓	
053b	Construct tubular steel framed passenger shelter					✓	This is an item moved from "053".
054	Construct raking drain					✓	
055	Provide temporary decking	✓	✓	✓	✓	✓	
055a	Remove working platform for surface stripping					✓	
055b	Remove working platform for soil nail and rock dowel		✓			✓	
056	Conduct tunneling work (e.g. under tram track per carriageway lane)					✓	"Form weep holes" is moved to "056a".

No.	Work activity	ASD	CEDD	HSD	HTL	HyD	Remarks
056a	Form weep holes					✓	This is an item moved from "056".
057	Provide concrete for binding layer					✓	"Spray concrete (include BRC fixing, curing and coring for checking)" is moved to "057a".
057a	Spray concrete (include BRC fixing, curing and coring for checking)					✓	This is an item moved from "057".
058	Construct surface channel (including formworking and concreting) / Remove scaffolding for spray concrete					✓	
058a	Remove scaffolding for spray concrete					✓	"Remove working platform for surface stripping" is moved to "055a".
058b	Remove scaffolding for typical work	✓	✓			✓	"Remove working platform for soil nail and rock dowel" is moved to "055b".
059	Construct planter wall					✓	
060a	Construct simple retaining structure up to 2m high					✓	
060b	Construct simple retaining structure > 2m and up to 3m high					✓	
061	Lay pipe / cable	✓	✓	✓	✓	✓	"Geological logging by Geologist" of ASD is moved to "077".
061a	Construct U-channel of size up to 300mm					✓	"Removal and disposal of track" of HTL is moved to "064a".
061b	Construct U-channel of size > 300mm up to 450mm					✓	
061c	Adjust existing utility / manhole covers	✓		✓			These are new items for HSD on run-in construction.
061d	Lower existing underground utilities	✓		✓			
061e	Diverse existing underground utilities	✓		✓			
061f	Remove abandoned pipe and backfilling	✓		✓			This is a new item for hoarding of HSD.
061g	Conduct utility diversion for lift construction					✓	This is a new item for HYD on lift construction.
062a	Construct drawpit / manhole / valve pit	✓			✓	✓	"Drilling and installation of holding down bolts" of HTL is moved to "064e".
062b	Connect existing manhole	✓					Description for "062b" is revised.
063	Conduct site inspection, testing and commissioning (CCTV record) / Water test and water connection / Cable connection including testing and commissioning	✓					
063a	Erect hoarding post and construct concrete footing	✓	✓	✓			"Install and fix track alignment" of HTL is moved to "064b".
063b	Dismantle hoarding footing	✓	✓	✓			
064	Lay drop kerb	✓	✓		✓	✓	"Cable laying and jointingt" of Template D17 of HyD is moved to "061".
064aP	Remove and dispose of tram track				✓		This is an item moved from "061a". It is used only in polygon model for "Remove and dispose of track".
064bP	Install and fix track alignment				✓		This is an item moved from "063a". It is used only in polygon model for "Install and fix the alignment of tram track"
064cP	Conduct rail joint welding and grinding				✓		This is an item moved from "064a". It is used in polygon model for "Conduct rail joint welding and grinding".
064dP	Level track				✓		This is an item moved from "065a". It is used in polygon model for "Level track".
064eP	Drill and install of holding down bolt				✓		This is an item moved from "062a". It is used in polygon model for "Drill and install of holding down bolts".
064f	Remove tram pole				✓		This is a new item for "Remove tram pole".
064g	Erect tram pole				✓		This is a new item for "Erect tram pole".
065a	Construct paving block run-in	✓		✓		✓	"Track level" is moved to "064dP".
065b	Construct concrete run-in	✓		✓		✓	
066a	Remove existing staircase					✓	
066b	Construct temporary staircase foundation					✓	
066c	Construct temporary staircase on footbridge					✓	
066d	Remove existing ramp for lift construction					✓	
067a	Construct link bridge foundation and columns					✓	
067b	Construct link bridge					✓	
067c	Construct pre-bored H-piles					✓	These are the new items for lift installation.
067d	Construct mini piles					✓	
067e	Construct lift foundation					✓	
067f	Construct lift tower					✓	
067g	Construct lift shaft					✓	
067h	Provide finishing					✓	
067i	Conduct electric room					✓	

No.	Work activity	ASD	CEDD	HSD	HTL	HyD	Remarks
067j	Install glass canopy					✓	These are the new items for lift installation.
067k	Install E&M, testing & commissioning					✓	
067l	Install untensioned beam barrier, railing and signage					✓	
067m	Backfilling & Reinstatement after lift construction					✓	
068P	Conduct cold milling after fence off site with approved TTM, strength local area, adjust manhole cover, spray tack coat, conduct resurfacing, curing, conduct testing, provide road marking and furniture, clear site					✓	This is a new item used only in polygon model for HyD on cold milling.
069f	Conduct planting work					✓	This is a new item for HyD's Roadside Slope Maintenance Work.
069zP	Conduct planting work (as hydroseeding)		✓				This is a new item used only in polygon model for LPM work of CEDD.
070aP	Conduct boulder stabilisation work					✓	These are new items used only in polygon model for HyD's natural terrain and soil nailing works.
070bP	Construct foundation for flexible barrier					✓	
070cP	Erect flexible barrier					✓	
071	Conduct backfilling and soil test	✓	✓	✓	✓	✓	
072a	Reinstate (concrete / asphalt)	✓	✓	✓	✓	✓	These are new items to replace "072" in order to clarify the method / material used.
072b	Reinstate (paving block)	✓	✓	✓	✓	✓	
072c	Reinstate (concrete / asphalt) after lift construction					✓	These are new items for lift installation.
072d	Reinstate (paving block) after lift construction					✓	
073	Provide curing to freshly laid concrete (3 days)	✓		✓	✓	✓	
073a	Provide curing to freshly laid concrete (7 days)	✓		✓	✓	✓	
074	Provide road marking and furniture	✓	✓	✓	✓	✓	
075	Conduct site clearance (demobilisation)	✓	✓	✓	✓	✓	The item is merged with "064" because both "064" and "076" have similar meaning.
075al	Conduct site clearance (demobilisation) after lift construction					✓	This is a new item for lift installation.
076	Lay kerb				✓	✓	
076a	Lay kerb (for central refuge)				✓	✓	This is a new item for construction central refuge of HTL and HyD.
077	Conduct geological logging by geologist	✓		✓			This is a new item for geological logging moved from "061 & 062".
078P	Excavate and provide temporary shoring					✓	These are new items used only in polygon model for HyD's natural terrain and soil nailing works.
079P	Erect formwork					✓	
080P	Conduct R.C work					✓	
081	Check reinstatement quality and report completion of road opening work	✓	✓	✓	✓	✓	
C001	Build central refuge				✓	✓	"Prepare concrete foundation" is moved to "C002".
C002	Prepare concrete foundation					✓	"Install controller and internal wiring" is moved to "C003".
C003	Install controller and internal wiring					✓	"Remove existing controller" is moved to "C004".
C004	Remove existing controller					✓	This is a new item for "Remove existing controller".
F051	Construct footing					✓	
F052	Place anchor block					✓	
F053	Install safety fence					✓	
F054a	Install railing on straight road	✓	✓			✓	
F054b	Install railing at junction bend					✓	This is a new item for CEDD's slope work.
F055	Install crash cushion					✓	
F071	Construct directional sign footing					✓	
F071a	Construct gantry sign footing					✓	
P001	Prepare pole hole				✓	✓	
P002	Disconnect power and remove existing column				✓	✓	
P003	Erect pole, install lantern and internal wiring				✓	✓	
S001	Erect traffic signal post					✓	
S002	Connect cable for traffic signal by EMSD					✓	
S003	Connect power supply by CLP / HEC					✓	
S74a	Fabricate and erect directional sign support & frame					✓	
T051	Erect tram shelter					✓	

6.4.2.3 Removal of templates

After considering comments of the five utility stakeholders, decisions on removing standard templates from the existing system were as follows:

ASD and HSD

It was found during the interviews that users were not familiar with the system and choices that could be made for their work plans, e.g. the availability of Multiplication Factors and typical work programmes. It was also found that the users had no idea which templates were standard or user-defined, making the applicants hard to follow and adopt. Applicants of HSD did not even know there are standard templates for their application.

Hence, it was suggested to retain all the existing infrequently used standard templates in the system as the problem did not relate to the applicability issue. Instead, more focus could be put on the user-friendliness of the standard templates. The authority may consider arrange more trainings and monitoring if applicants of ASD and HSD are familiar with the standard templates after that.

CEDD

In CEDD, there was only one standard template for use by the applicants and requests for adding more standard templates for suiting their needs were made. No standard template was suggested to be removed.

HTL

Similarly, the low usage rate of standard templates might not be due to their applicability but the availability of polygon model and inaccurate estimation in permit periods according to comments gathered from the interview. Albeit many of the templates were being used for only a few times or even not being used, no standard template was suggested to be removed. Furthermore, similar to the advice for ASD and HSD, monitoring on the usage of standard templates in future applications would be needed.

HyD

Albeit a number of standard templates being infrequently used or idle in the past 8

years were found, views against removing these standard templates from the system were raised during the discussion forums. The supporting reason was that the templates might be used in future work plans. Hence, it may be beneficial to make no changes.

6.4.2.4 Work item modifications

In response to the comments given in the interviews, respective changes to the existing work item in standard templates were made. Furthermore, extra work items would be added to the proposed templates to cater for the needs of work natures; those modifications were shown in Table 4-4. There were in total 170 work items in the new set of standard templates. Of which, 27 work items were modified, 77 were newly added and 66 work items were retained, denoted by *M*, *N* and *O*, respectively, in the third column of the table.

After modifications, some work items were split; Item 022, for instance, was split into three components as Item 022a, b and c. The division was aimed to allow flexibility for the applicants in choosing 3, 7 and 10 days for handling major traffic arrangements as requested by the Police. Else, Item 041 became Item 041a, b and c so as to provide a clear breakdown for work on rigid pavement, flexible pavement and footway; and Item 072 becomes Item 072a and b as for better illustration of reinstatement work on carriageway by concrete/asphalt and on footway by paving block.

6.4.2.5 Addition of new templates

Having proposed clear breakdown of work items in various site conditions, some existing standard templates were merged and listed as new templates. For instance, Templates 1a, 1b, 1c, 2a, 2b, 2c, 3a, 3b, 3c, 4a, 4b, and 4c were suggested to be replaced by Templates N1a, N1b, and N1c.

In addition, to provide a wider coverage of common excavation works, a number of new standard templates were proposed. The template list was based on the requests raised by the interviewees of the five trades. Their details were partly referring to existing user-defined programmes found in the systems and comments given in the interviews. A summary of the new standard templates for the five utility stakeholders was shown in Table 6-7. Of which 5, 4, 4, 3, and 6 numbers of new templates are

proposed for ASD, CEDD, HSD, HTL, and HyD, respectively. Table 6-8 to Table 6-23 illustrates the new set of standard templates with detail work items, production rates and work time required for various lengths and site constraints.

Furthermore, the template developed for the cold milling and resurfacing allowed the applicants to apply XP in discrete manners. This was a single permit with discrete schedule that the XP period only counts the actual working days involved with appropriate insertion of time gap of not more than 28 calendar days. All discrete days of the resurfacing works were submitted at the initial stage of the application process. Different from the typical continuous schedule, this type of XP did not include the non-operation time on site. It reflected the actual excavation working days on site and improves on the accuracy of the system.

Another discrete model having been considered was a broad permit type with discrete schedule. Under this type of schedule, the broad permit includes more than one typical XP. Each typical XP was designed to cover a section of resurfacing work that could be completed in one working day/night. Again, the broad permit was able to reflect the actual working time of the works and improve on the accuracy of the system. However, there were some disadvantages arising from the broad permit. Applicants had to activate each individual XP under another set of new procedures to cover all resurfacing work sections in a broad permit, which meaned that the management process could be complicated and might involve more time in processing. Therefore, this proposed method had finally been declined.

Table 6-7 List of new standard templates for the five utility stakeholders

Table	*Status*	*New Template Number*	*Template Name*
			Under ASD
6-8	N	0010a	N1a - Typical Works Programme for Connection Work on Flexible Carriageway
6-9	N	0010b	N1b - Typical Works Programme for Connection Work on Rigid Carriageway
6-10	N	0010c	N1c - Typical Works Programme for Connection Work on Paving Block Footway
6-11	N	0050	N2 - Typical Works Programme for Ground Investigation on Footway (not exceeding 30m in depth)
6-12	N	0060	N3 - Typical Works Programme for Installation of Settlement Marker (1 No.)
-	M	0020	5 - Typical Works Programme for Run-in Construction
-	M	0030	6 - Typical Works Programme for Construction or Removal of Hoarding Footing
-	M	0040	8 - Typical Works Programme for Ground Investigation with Trial Pit on Footway (not exceeding 1.5mx1.5m width and 3m in depth)
			Under CEDD
-	N	*	N4 - Typical Works Programme for Greening Work
-	N	*	N5 - Typical Works Programme for Planting Work
6-13	N	0080	N6 - Typical Works Programme for Landslip Preventive Measures (LPM) Work
-	N	*	N7 - Typical Works Programme for Installation of Slope Registration Plate
-	M	0070	D1 - Typical Works Programme for Ground Investigation

Note: Modified (M) / New (N). Templates without table number are not shown in this report. Refer to a separate submission in MS Excel file for details.

*These templates were not created due to insufficient information from CEDD.

Table	*Status*	*New Template Number*	*Template Name*
			Under HSD
6-8	N	0010a	N1a - Typical Works Programme for Connection Work on Flexible Carriageway
6-9	N	0010b	N1b - Typical Works Programme for Connection Work on Rigid Carriageway
6-10	N	0010c	N1c - Typical Works Programme for Connection Work on Paving Block Footway
6-11	N	0050	N2 - Typical Works Programme for Ground Investigation on Footway (not exceeding 30m in depth)
6-14	N	0090	N8 - Typical Works Programme for Construction of Draw Pit / Manhole / Value Pit
-	M	0020	5 - Typical Works Programme for Run-in Construction
-	M	0030	6 - Typical Works Programme for Construction or Removal of Hoarding Footing
-	M	0040	8 - Typical Works Programme for Ground Investigation with Trial Pit on Footway (not exceeding 1.5mx1.5m width and 3m in depth)
			Under HTL
6-15	N	0190	N9 - Typical Works Programme for Tram Pole Erection Work
6-16	N	0200	N10 - Typical Works Programme for Construction of Central Refuge Construction on Carriageway (1 No.)
6-17	N	0210	N11 - Typical Works Programme for Light Pole Erection Work (1 No. of Light Pole with 40m Cable)
-	M	0100	TT1 - Typical Works Programme for Renewal of Tram Track
-	M	0110	T1 - Typical Works Programme for Ducts/Cables Laying Work on 50 m Flexible Carriageway
-	M	0120	T2 - Typical Works Programme for Ducts/Cables Laying Work on 50 m Rigid Carriageway
-	M	0130	T3 - Typical Works Programme for Ducts/Cables Laying Work on 50 m Footway
-	M	0140	T4 - Typical Works Programme for Ducts/Cables Laying Work on 10 m Flexible Carriageway

Note: Modified (M) / New (N). Templates without table number are not shown in this report. Refer to a separate submission in MS Excel file for details.

Table	*Status*	*New Template Number*	*Template Name*
			Under HTL
-	M	0150	T5 - Typical Works Programme for Ducts/Cables Laying Work on 10m Rigid Carriageway
-	M	0160	T6 - Typical Works Programme for Ducts/Cables Laying Work on 10 m Footway
-	M	0170	T7 - Typical Works Programme for Ducts/Cables Laying Work on Road Crossing of Flexible Carriageway (per lane)
-	M	0180	T8 - Typical Works Programme for Ducts/Cables Laying Work on Road Crossing of Rigid Carriageway (per lane)
			Under HyD
6-18	N	0390	N12 - Typical Works Programme for Construction of Pedestrian Zone with Paving Block
6-19	N	0400	N13 - Typical Works Programme for Construction of Lift
6-20	N	0410	N14 - Typical Works Programme for Cold Milling and Resurfacing Work (Intermittent Permit Period)
6-21	N	0420	N15 - Typical Works Programme for Installation of Soil Nail
6-22	N	0430	N16 - Typical Works Programme for Natural Terrain Work
6-23	N	0440	N17 - Typical Works Programme for Boulder Stabilisation Work
-	M	0220	D1 - Typical Works Programme for Concrete/Paving Block Footway Construction
-	M	0230a	D2a - Typical Works Programme for Construction of Carriageway on Flexible Carriageway
-	M	0230b	D2b - Typical Works Programme for Construction of Carriageway on Rigid Carriageway
-	M	0240a	D3a - Typical Works Programme for Repairing Safety Fence or New Safety Fence
-	M	0240b	D3b - Typical Works Programme for Repairing Railing or New Railing

Note: Modified (M) / New (N). Templates without table number are not shown in this report. Refer to a separate submission in MS Excel file for details.

Table	*Status*	*New Template Number*	*Template Name*
			Under HyD
-	M	0240c	D3c - Typical Works Programme for Repairing Crash Cushion or New Crash Cushion
-	M	0250a	D4a - Typical Works Programme for Road Crossing Work of Flexible Carriageway (per lane) - Roadside Gully with 5m Pipe Connection/Construction Work
-	M	0250b	D4b - Typical Works Programme for Road Crossing Work of Rigid Carriageway (per lane) - Roadside Gully with 5m pipe Connection/Construction Work
-	M	0250c	D4c - Typical Works Programme for Flexible Carriageway-Drainage Pipe Installation
-	M	0250d	D4d - Typical Works Programme for Rigid Carriageway-Drainage Pipe Installation
-	M	0250e	D4e - Typical Works Programme for Concrete/Paving Block Footway-Drainage Pipe Installation
-	M	0250f	D4f - Typical Works Programme for Surface Channel Work
-	M	0260	D5 - Typical Works Programme for Roadside Slope Maintenance Work
-	M	0270	D6 - Typical Works Programme for Run-in Construction
-	M	0280	D7 - Typical Works Programme for Demolition, Extension or Repair of Central Divider
-	M	0290a	D8a - Typical Works Programme for Cross Road Duct Laying on Flexible Carriageway (per lane)
-	M	0290b	D8b - Typical Works Programme for Cross Road Duct Laying on Rigid Carriageway (per lane)
-	M	0300a	D9a - Typical Works Programme for Ducting/Drawpit Construction on Flexible Carriageway
-	M	0300b	D9b - Typical Works Programme for Ducting/Drawpit Construction on Rigid Carriageway
-	M	0300c	D9c - Typical Works Programme for Ducting/Drawpit Construction on Footway

Note: Modified (M) / New (N). Templates without table number are not shown in this report. Refer to a separate submission in MS Excel file for details.

Table	*Status*	*New Template Number*	*Template Name*
			Under HyD
-	M	0310	D10 - Typical Works Programme for Construction of Taxi Shelter
-	M	0320a	D11a - Typical Works Programme for Construction of Tram Shelter with Service Duct on Flexible Carriageway
-	M	0320b	D11b - Typical Works Programme for Construction of Tram Shelter with Service Duct on Rigid Carriageway
-	M	0330	D12 - Typical Works Programme for Directional Sign (Installation)
-	M	0340	D13 - Typical Works Programme for Construction of Footing of Gantry Sign (1 No.)
-	M	0350a	D14a - Typical Works Programme for Construction of Signalized Junction (without Kerb Realignment)
-	M	0350b	D14b - Typical Works Programme for Construction of Signalized Junction (with Addition of a Traffic Lane/Kerb Realignment)
-	M	0200	D15 - Typical Works Programme for Central Refuge Construction on Carriageway (1 No.)
-	M	0360	D17 - Typical Works Programme for Public Lighting Installation (1 No. Lighting with 40m Cable) on Footway
-	M	0370	D18 - Typical Works Programme for Replacement of Rusty Public Lighting Column (4 No.)
-	M	0380	D19 - Typical Works Programme for Installation or Relocation of Public Lighting Controller (1 No.)

Note: Modified (M) / New (N). Templates without table number are not shown in this report. Refer to a separate submission in MS Excel file for details.

A total of 8 standard templates are set for ASD, of which 5 are newly added and 3 are modified from the existing. 2 templates are set for CEDD, of which 1 is newly added and 1 is modified from the existing. 8 templates are set for HSD, of which 5 are newly added and 3 are modified from the existing. 12 templates are set for HTL, of which 3 are newly added and 9 are modified from the existing. 38 templates are set for HyD, of which 6 are newly added and 31 are modified from the existing.

Table 6-8 Proposed new standard template for ASD and HSD

0010a. Typical Works Programme for Connection Work on Flexible Carriageway					Multiplication Factors													Width	(a) Up to 1m Up to 1.2m 10 m			(b) >1m to 1.5m >1.2m to 2.5m 10m			(a) Up to 1m Up to 1.2m 50m			(b) >1m to 1.5m >1.2m to 2.5m 50m		
					A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2	depth											
					2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8	length											
No.	Work activity	Ess	Bas	Qty																Stm	Ovl	Con	Stm	Ovl	Con	Stm	Ovl	Con	Stm	Ovl	Con
011	Take over site	0																		1.00		**0.00**	1.00		**0.00**	1.00		**0.00**	1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																		2.00	1.00	**0.00**	2.00	1.00	**0.00**	3.00	1.00	**0.00**	3.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																		3.00		**0.00**	3.00		**0.00**	3.00		**0.00**	3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																		7.00		**0.00**	7.00		**0.00**	7.00		**0.00**	7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																		10.00		**0.00**	10.00		**0.00**	10.00		**0.00**	10.00		**0.00**
031	Locate utilities (gas pipe / cable location)	0																		2.00	1.00	**0.00**	2.00	1.00	**0.00**	4.00	1.00	**0.00**	4.00	1.00	**0.00**
041b	Break up road surface and remove spoil - Flexible surface	0																		2.00		**0.00**	2.50		**0.00**	2.81		**0.00**	3.71		**0.00**
051	Excavate trench / pit in soft material, install shoring and remove spoil	0																		2.38		**0.00**	8.31		**0.00**	4.44		**0.00**	17.21		**0.00**
052	Support and protect utilities	0																		2.00		**0.00**	2.00		**0.00**	2.00		**0.00**	2.00		**0.00**
055	Provide temporary decking	0																		2.00		**0.00**	2.00		**0.00**	2.00		**0.00**	2.00		**0.00**
061e	Diverse existing underground utilities	0	10	0																30.00		**0.00**	30.00		**0.00**	30.00		**0.00**	30.00		**0.00**
061f	Remove abandoned pipe and backfilling	0	10	0																3.00		**0.00**	3.00		**0.00**	3.00		**0.00**	3.00		**0.00**
061	Lay pipe / cable	0																		2.00		**0.00**	2.00		**0.00**	4.00		**0.00**	4.00		**0.00**
062a	Construct drawpit / manhole / valve pit	0																		7.00		**0.00**	7.00		**0.00**	7.00		**0.00**	7.00		**0.00**
063	Conduct site inspection, testing and commissioning (CCTV record) / Water test and water connection / Cable connection including testing and commissioning	0	1	0																7.00		**0.00**	7.00		**0.00**	7.00		**0.00**	7.00		**0.00**
071	Conduct backfilling and soil test	0																		2.00		**0.00**	2.66		**0.00**	2.00		**0.00**	6.64		**0.00**
072a	Reinstate (concrete / asphalt)	0																		3.00		**0.00**	3.00		**0.00**	3.00		**0.00**	3.00		**0.00**
074	Provide road marking and furniture	0																		1.00		**0.00**	1.00		**0.00**	1.00		**0.00**	1.00		**0.00**
075	Conduct site clearance (demobilisation)	0																		1.00		**0.00**	1.00		**0.00**	1.00		**0.00**	1.00		**0.00**
081	Check reinstatement quality and report completion of road opening work	0																		2.00		**0.00**	2.00		**0.00**	2.00		**0.00**	2.00		**0.00**
					Total critical working period for all essential items (working days)																	**0.00**			**0.00**			**0.00**			**0.00**

Table 6-9 Proposed new standard template for ASD and HSD

0010b. Typical Works Programme for Connection Work on Rigid Carriageway					Multiplication Factors													Width	(a) Up to 1m Up to 1.2m 10 m			(b) >1m to 1.5m >1.2m to 2.5m 10m			(a) Up to 1m Up to 1.2m 50m			(b) >1m to 1.5m >1.2m to 2.5m 50m		
					A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2	depth											
					2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8	length											
No.	Work activity	Ess	Bas	Qty																Stm	Ovl	Con	Stm	Ovl	Con	Stm	Ovl	Con	Stm	Ovl	Con
011	Take over site	0																		1.00		**0.00**	1.00		**0.00**	1.00		**0.00**	1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																		2.00	1.00	**0.00**	2.00	1.00	**0.00**	3.00	1.00	**0.00**	3.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																		3.00		**0.00**	3.00		**0.00**	3.00		**0.00**	3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																		7.00		**0.00**	7.00		**0.00**	7.00		**0.00**	7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																		10.00		**0.00**	10.00		**0.00**	10.00		**0.00**	10.00		**0.00**
031	Locate utilities (gas pipe / cable location)	0																		2.00	1.00	**0.00**	2.00	1.00	**0.00**	4.00	1.00	**0.00**	4.00	1.00	**0.00**
041a	Break up road surface and remove spoil - Rigid surface	0																		2.25		**0.00**	2.88		**0.00**	3.56		**0.00**	4.84		**0.00**
051	Excavate trench / pit in soft material, install shoring and remove spoil	0																		2.38		**0.00**	8.31		**0.00**	4.44		**0.00**	17.21		**0.00**
052	Support and protect utilities	0																		2.00		**0.00**	2.00		**0.00**	2.00		**0.00**	2.00		**0.00**
055	Provide temporary decking	0																		2.00		**0.00**	2.00		**0.00**	3.00		**0.00**	3.00		**0.00**
061e	Diverse existing underground utilities	0	10	0																30.00		**0.00**	30.00		**0.00**	30.00		**0.00**	30.00		**0.00**
061f	Remove abandoned pipe and backfilling	0	10	0																3.00		**0.00**	3.00		**0.00**	3.00		**0.00**	3.00		**0.00**
061	Lay pipe / cable	0																		2.00		**0.00**	2.00		**0.00**	2.00		**0.00**	2.00		**0.00**
062a	Construct drawpit/ manhole / valve pit	0																		7.00		**0.00**	7.00		**0.00**	7.00		**0.00**	7.00		**0.00**
063	Conduct site inspection, testing and commissioning (CCTV record) / Water test and water connection / Cable connection including testing and commissioning	0	1	0																7.00		**0.00**	7.00		**0.00**	7.00		**0.00**	7.00		**0.00**
071	Conduct backfilling and soil test	0																		2.00		**0.00**	2.66		**0.00**	2.00		**0.00**	6.64		**0.00**
072a	Reinstate (concrete / asphalt)	0																		3.00		**0.00**	3.00		**0.00**	3.00		**0.00**	3.00		**0.00**
073	Provide curing to freshly laid concrete (3 days)	0																		3.00		**0.00**	3.00		**0.00**	3.00		**0.00**	3.00		**0.00**
074	Provide road marking and furniture	0																		1.00		**0.00**	1.00		**0.00**	1.00		**0.00**	1.00		**0.00**
075	Conduct site clearance (demobilisation)	0																		1.00		**0.00**	1.00		**0.00**	1.00		**0.00**	1.00		**0.00**
081	Check reinstatement quality and report completion of road opening works	0																		2.00		**0.00**	2.00		**0.00**	2.00		**0.00**	2.00		**0.00**
	Total critical working period for all essential items (working days)																					**0.00**			**0.00**			**0.00**			**0.00**

Table 6-10 Proposed new standard template for ASD and HSD

0010c. Typical Works Programme for Connection Work on Paving Block Footway					Multiplication Factors												Width	(a) Up to 1m Up to 1.2m 10 m			(b) >1m to 1.5m >1.2m to 2.5m 10m			(a) Up to 1m Up to 1.2m 50m			(b) >1m to 1.5m >1.2m to 2.5m 50m		
					A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2	depth											
					2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8	length											
No.	Work activity	Ess	Bas	Qty																Stm	Ovl	Con	Stm	Ovl	Con	Stm	Ovl	Con	Stm	Ovl	Con
011	Take over site	0																		1.00		**0.00**	1.00		**0.00**	1.00		**0.00**	1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																		2.00	1.00	**0.00**	2.00	1.00	**0.00**	3.00	1.00	**0.00**	3.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																		3.00		**0.00**	3.00		**0.00**	3.00		**0.00**	3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																		7.00		**0.00**	7.00		**0.00**	7.00		**0.00**	7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																		10.00		**0.00**	10.00		**0.00**	10.00		**0.00**	10.00		**0.00**
031	Locate utilities (gas pipe / cable location)	0																		2.00	1.00	**0.00**	2.00	1.00	**0.00**	4.00	1.00	**0.00**	4.00	1.00	**0.00**
041c	Break up road surface and remove spoil - Footway	0																		1.29		**0.00**	1.43		**0.00**	2.43		**0.00**	3.14		**0.00**
051	Excavate trench / pit in soft material, install shoring and remove spoil	0																		2.38		**0.00**	8.31		**0.00**	4.44		**0.00**	17.21		**0.00**
052	Support and protect utilities	0																		2.00		**0.00**	2.00		**0.00**	2.00		**0.00**	2.00		**0.00**
055	Provide temporary decking	0																		2.00		**0.00**	2.00		**0.00**	3.00		**0.00**	3.00		**0.00**
061e	Diverse existing underground utilities	0	10	0																30.00		**0.00**	30.00		**0.00**	30.00		**0.00**	30.00		**0.00**
061f	Remove abandoned pipe and backfilling	0	10	0																3.00		**0.00**	3.00		**0.00**	3.00		**0.00**	3.00		**0.00**
061	Lay pipe / cable	0																		2.00		**0.00**	2.00		**0.00**	2.00		**0.00**	2.00		**0.00**
062a	Construct drawpit/ manhole / valve pit	0																		7.00		**0.00**	7.00		**0.00**	7.00		**0.00**	7.00		**0.00**
063	Conduct site inspection, testing and commissioning (CCTV record) / Water test and water connection / Cable connection including testing and commissioning	0	1	0																7.00		**0.00**	7.00		**0.00**	7.00		**0.00**	7.00		**0.00**
071	Conduct backfilling and soil test	0																		2.00		**0.00**	2.66		**0.00**	2.00		**0.00**	6.64		**0.00**
072b	Reinstate (paving block)	0																		3.00		**0.00**	3.00		**0.00**	3.00		**0.00**	3.00		**0.00**
074	Provide road marking and furniture	0																		1.00		**0.00**	1.00		**0.00**	1.00		**0.00**	1.00		**0.00**
075	Conduct site clearance (demobilisation)	0																		1.00		**0.00**	1.00		**0.00**	1.00		**0.00**	1.00		**0.00**
081	Check reinstatement quality and report completion of road opening work	0																		2.00		**0.00**	2.00		**0.00**	2.00		**0.00**	2.00		**0.00**
	Total critical working period for all essential items (working days)																					**0.00**			**0.00**			**0.00**			**0.00**

Table 6-11 Proposed new standard template for ASD

0050. Typical Works Programme for Ground Investigation on Footway (not exceeding 30m in depth)					Multiplication Factors													
					A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2
					2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8
No.	Work activity	Ess	Bas	Qty														
011	Take over site	0																
021	Fence off site with necessary temporary traffic arrangement	0																
031	Locate utilities (gas pipe / cable location)	0																
041c	Break up road surface and remove spoil - Footway	0																
045a	Drill hole (up to 30m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement	0																
073	Provide curing to freshly laid concrete	0																
075	Conduct site clearance (demobilisation)	0																
081	Check reinstatement quality and report completion of road opening work	0																

Stm	Ovl	Con
1.00		**0.00**
2.00	1.00	**0.00**
2.00	1.00	**0.00**
1.06		**0.00**
14.00		**0.00**
3.00		**0.00**
1.00		**0.00**
2.00		**0.00**
		0.00

Total critical working period for all essential items (working days)

Table 6-12 Proposed new standard template for ASD

0060. Typical Works Programme for Installation of Settlement Marker (1 No)					Multiplication Factors													
					A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2
					2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8
No.	Work activity	Ess	Bas	Qty														
011	Take over site	0																
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																
041a	Break up road surface and remove spoil - Rigid surface	0																
041b	Break up road surface and remove spoil - Flexible surface	0																
041c	Break up road surface and remove spoil - Footway	0																
051	Excavate trench / pit in soft material, install shoring and remove spoil	0																
050	Install settlement marker	0																
071	Conduct backfilling and soil test	0																
075	Conduct site clearance (demobilisation)	0																
081	Check reinstatement quality and report completion of road opening work	0																
					Total critical working period for all essential items (working days)													

Stm	Ovl	Con
1.00		**0.00**
2.00	1.00	**0.00**
3.00		**0.00**
7.00		**0.00**
10.00		**0.00**
1.50		**0.00**
1.40		**0.00**
1.09		**0.00**
2.00		**0.00**
1.00		**0.00**
1.50		**0.00**
1.00		**0.00**
2.00		**0.00**
		0.00

Table 6-13 Proposed new standard template for CEDD

0080. Typical Works Programme for Landslip Preventive Measures (LPM) Work							Multiplication Factors															
							A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2			
							2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8			
No.	Work activity	Ess		Bas		Qty															Stm	Ovl	Con
011	Take over site	0																			1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																			3.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																			3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																			7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																			10.00		**0.00**
024aP	Mobilize material and plant	0																			7.00		**0.00**
023aP	Conduct clearance to new site	0	100	sq m	0	sq m															1.20		**0.00**
023bP	Conduct initial survey on existing slope	0	100	sq m	0	sq m															0.20		**0.00**
023cP	Conduct surface stripping on existing slope	0	100	sq m	0	sq m															10.00		**0.00**
024lP	Stabilize rock slope (as mesh protection)	0	100	sq m	0	sq m															7.00		**0.00**
024mP	Conduct landscaping work (as hydroseeding)	0	100	sq m	0	sq m															0.20		**0.00**
024nP	Conduct hard rock slope surfacing work	0	100	sq m	0	sq m															10.00		**0.00**
053	Drill and install rock dowel	0	20	no.	0	no.															7.00		**0.00**
024pP	Conduct rock scaling and remove boulders (only rock scaling)	0	100	sq m	0	sq m															3.00		**0.00**
053aP	Install wire mesh	0	100	sq m	0	sq m															7.00		**0.00**
054P	Construct raking drain	0	10	m	0	m															0.67		**0.00**
024qP	Construct granite stone facing	0	100	sq m	0	sq m															6.70		**0.00**
024rP	Construct skin wall (for 500mm thick)	0	100	sq m	0	sq m															120.00		**0.00**
024sP	Erect fence and gate	0	10	m	0	m															1.00		**0.00**
024tP	Install railing on slope	0	10	m	0	m															2.00		**0.00**
069zP	Conduct planting work (as hydroseeding)	0	100	sq m	0	sq m															0.20		**0.00**
024uP	Carry out tree protection and preservation work	0	100	sq m	0	sq m															0.50		**0.00**
024vP	Conduct tree survey	0	100	sq m	0	sq m															0.20		**0.00**
024zP	Erect hoarding for LPM	0	10	m	0	m															3.33		**0.00**
033b	Erect working platform for soil nail and rock dowel	0	1	no.	0	no.															1.00		**0.00**
024bP	Set out soil nail position	0	1	no.	0	no.															3.00		**0.00**
024dP	Drill hole for soil nail	0	10	m	0	m															0.67		**0.00**
024eP	Install soil nail and conduct grouting	0	10	m	0	m															0.67	0.67	**0.00**
024fP	Conduct pull out test	0	1	no.	0	no.															2.00		**0.00**
024gP	Construct soil nail head	0	1	no.	0	no.															3.00		**0.00**
055b	Remove working platform for soil nail and rock dowel	0	20	no.	0	no.															2.00		**0.00**
024yP	Construct drainage system (as 300mm U-channel with masnory apron)	0	10	m	0	m															2.00		**0.00**
024xP	Construct staircase on slope (for 1m wide with single handrailing)	0	10	m	0	m															5.00		**0.00**
024jP	Fix erosion control mat	0	100	sq m	0	sq m															6.00		**0.00**
024kP	Conduct hydroseeding to slope	0	100	sq m	0	sq m															4.00		**0.00**
025cP	Dismantle hoarding (as Type A hoarding)	0	10	m	0	m															1.50		**0.00**
075	Conduct site clearance (demobilisation)	0																			1.00		**0.00**
081	Check reinstatement quality and report completion of road opening work	0																			2.00		**0.00**
						Total critical working period for all essential items (working days)																	**0.00**

Table 6-14 Proposed new standard template for HSD

0090. Typical Works Programme for Construction of Draw Pit / Manhole / Value Pit					Multiplication Factors												Width	(a) 3.5m			(b) 3.5m		
					A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2	Length	10m			50m		
					2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8	Depth	1m			1m		
No.	Work activity	Ess	Bas	Qty																Stm	Ovl	Con	Stm	Ovl	Con
011	Take over site	0																		1.00		**0.00**	1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																		2.00	1.00	**0.00**	3.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																		3.00		**0.00**	3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																		7.00		**0.00**	7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																		10.00		**0.00**	10.00		**0.00**
031	Locate utilities (gas pipe / cable location)	0																		2.00	1.00	**0.00**	4.00	1.00	**0.00**
041a	Break up road surface and remove spoil - Rigid surface	0																		5.38		**0.00**	11.94		**0.00**
041b	Break up road surface and remove spoil - Flexible surface	0																		4.50		**0.00**	9.75		**0.00**
041c	Break up road surface and remove spoil - Footway	0																		1.78		**0.00**	2.94		**0.00**
051	Excavate trench / pit in soft material, install shoring and remove spoil	0																		6.83		**0.00**	15.58		**0.00**
062a	Construct drawpit / manhole / valve pit	0	1	0																7.00		**0.00**	7.00		**0.00**
071	Conduct backfilling and soil test	0																		3.92		**0.00**	8.29		**0.00**
075	Conduct site clearance (demobilisation)	0																		1.00		**0.00**	1.00		**0.00**
081	Check reinstatement quality and report completion of road opening work	0																		2.00		**0.00**	2.00		**0.00**
					Total critical working period for all essential items (working days)																		**0.00**			**0.00**

Table 6-15 Proposed new standard template for HTL

0190. Typical Works Programme for Tram Pole Erection Work						Multiplication Factors												Width	(a) 2.5m			(b) 2.5m		
						A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2	Length	10m			50m		
						2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8	Height	5m			5m		
No.	Work activity	Ess	Bas		Qty																Stm	Ovl	Con	Stm	Ovl	Con
011	Take over site	0																			1.00		**0.00**	1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																			2.00	1.00	**0.00**	3.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																			3.00		**0.00**	3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																			7.00		**0.00**	7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																			10.00		**0.00**	10.00		**0.00**
031	Locate utilities (gas pipe / cable location)	0																			2.00	1.00	**0.00**	3.00	1.00	**0.00**
041a	Break up road surface and remove spoil - Rigid surface	0																			4.13		**0.00**	8.81		**0.00**
041b	Break up road surface and remove spoil - Flexible surface	0																			3.50		**0.00**	7.25		**0.00**
041c	Break up road surface and remove spoil - Footway	0																			1.56		**0.00**	2.39		**0.00**
052	Support and protect utilities	0																			2.00		**0.00**	2.00		**0.00**
055	Provide temporary decking	0																			2.00		**0.00**	3.00		**0.00**
064f	Remove tram pole	0	1	no.	0	no.															3.00		**0.00**	3.00		**0.00**
064g	Erect tram pole	0	1	no.	0	no.															3.00		**0.00**	3.00		**0.00**
071	Conduct backfilling and soil test	0																			3.08		**0.00**	6.21		**0.00**
072a	Reinstate (concrete / asphalt)	0																			1.56		**0.00**	2.39		**0.00**
072b	Reinstate (paving block)	0																			1.56		**0.00**	3.78		**0.00**
073a	Provide curing to freshly laid concrete (7 days)	0																			7.00		**0.00**	7.00		**0.00**
075	Provide road marking and furniture	0																			1.00		**0.00**	1.00		**0.00**
081	Check reinstatement quality and report completion of road opening work	0																			2.00		**0.00**	2.00		**0.00**
	Total critical working period for all essential items (working days)																						**0.00**			**0.00**

Table 6-16 Proposed new standard template for HTL

0200. Typical Works Programme for Central Refuge Construction on Carriageway (1 No.)					Multiplication Factors												1 no. of central refuge		
					A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2	
					2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8	
No.	Work activity	Ess	Bas	Qty													Stm	Ovl	Con
011	Take over site	0															1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and	0															2.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0															3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0															7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0															10.00		**0.00**
031	Locate utilities (gas pipe / cable location)	0															2.00	1.00	**0.00**
041a	Break up road surface and remove spoil - Rigid surface	0															1.00		**0.00**
041b	Break up road surface and remove spoil - Flexible surface	0															1.00		**0.00**
041c	Break up road surface and remove spoil - Footway	0															1.00		**0.00**
051	Excavate trench / pit in soft material, install shoring and remove spoil	0															1.00		**0.00**
052	Support and protect utilities	0															2.00		**0.00**
055	Provide temporary decking	0															2.00		**0.00**
061	Lay pipe / cable	0															2.00		**0.00**
062a	Construct drawpit / manhole / valve pit	0															7.00		**0.00**
071	Conduct backfilling and soil test	0															1.00		**0.00**
C001	Build central refuge	0															3.00		**0.00**
076a	Lay kerb (for central refuge)	0															2.00		**0.00**
072a	Reinstate (concrete / asphalt)	0															1.00		**0.00**
072b	Reinstate (paving blocks)	0															1.00		**0.00**
073a	Provide curing to freshly laid concrete (7 days)	0															7.00		**0.00**
074	Provide road marking and furniture	0															1.00		**0.00**
075	Conduct site clearance (demobilisation)	0															1.00		**0.00**
081	Check reinstatement quality and report completion of road opening work	0															2.00		**0.00**
				Total critical working period for all essential items (working days)															**0.00**

Table 6-17 Proposed new standard template for HTL

0210. Typical Works Programme for Light Pole Erection Work (1 No. of Light Pole with 40m Cable)						Multiplication Factors												Width	(a) Up to 1.0m Up to 1.2m 10m			(b) Up to 1.0m Up to 1.2m 50m		
						A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2	Depth						
						2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8	Length						
No.	Work activity	Ess	Bas		Qty																Stm	Ovl	Con	Stm	Ovl	Con
011	Take over site	0																			1.00		**0.00**	1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																			2.00	1.00	**0.00**	3.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																			3.00		**0.00**	3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																			7.00		**0.00**	7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																			10.00		**0.00**	10.00		**0.00**
031	Locate utilities (gas pipe / cable location)	0																			2.00	1.00	**0.00**	2.00	1.00	**0.00**
041a	Break up road surface and remove spoil - Rigid surface	0	40	m	0	m															1.25		**0.00**	3.13		**0.00**
041b	Break up road surface and remove spoil - Flexible surface	0	40	m	0	m															1.00		**0.00**	2.50		**0.00**
041c	Break up road surface and remove spoil - Footway	0	40	m	0	m															0.22		**0.00**	0.56		**0.00**
051	Excavate trench / pit in soft material, install shoring and remove spoil	0	40	m	0	m															2.88	2.00	**0.00**	5.69	2.00	**0.00**
052	Support and protect utilities	0																			2.00		**0.00**	2.00		**0.00**
055	Provide temporary decking	0	40	m	0	m															2.00		**0.00**	2.00		**0.00**
061	Lay pipe / cable	0	40	m	0	m															2.00		**0.00**	2.00		**0.00**
062a	Construct drawpit / manhole / valve pit	0	1	no.	0	no.															7.00		**0.00**	7.00		**0.00**
P001	Prepare pole hole	0	1	no.	0	no.															1.00		**0.00**	1.00		**0.00**
P003	Erect pole, install lantern and internal wiring	0	2	no.	0	no.															1.00		**0.00**	1.00		**0.00**
071	Conduct backfilling and soil test	0	40	m	0	m															2.00		**0.00**	2.34		**0.00**
072a	Reinstate (concrete / asphalt)	0	40	m	0	m															1.22		**0.00**	1.56		**0.00**
072b	Reinstate (concrete / asphalt)	0	40	m	0	m															1.22		**0.00**	2.11		**0.00**
073	Provide curing to freshly laid concrete (3 days)	0																			3.00		**0.00**	3.00		**0.00**
075	Conduct site clearance (demobilisation)	0																			1.00		**0.00**	1.00		**0.00**
081	Check reinstatement quality and report completion of road opening work	0																			2.00		**0.00**	2.00		**0.00**
	Total critical working period for all essential items (working days)																						**0.00**			**0.00**

Table 6-18 Proposed new standard template for HyD

0390. Typical Works Programme for Construction of Pedestrian Zone with Paving Block					Multiplication Factors												Area of Pedestrain Zone 10 sq m			Area of Pedestrain Zone 50 sq m		
					A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2						
					2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8						
No.	Work activity	Ess	Bas	Qty															Stm	Ovl	Con	Stm	Ovl	Con
011	Take over site	0																	1.00		**0.00**	1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																	3.00	1.00	**0.00**	3.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																	3.00		**0.00**	3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																	7.00		**0.00**	7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																	10.00		**0.00**	10.00		**0.00**
031	Locate utilities (gas pipe / cable location)	0																	3.00		**0.00**	3.00		**0.00**
041a	Break up road surface and remove spoil - Rigid surface	0																	2.25		**0.00**	4.13		**0.00**
041b	Break up road surface and remove spoil - Flexible surface	0																	2.00		**0.00**	3.50		**0.00**
041c	Break up road surface and remove spoil - Footway	0																	1.22		**0.00**	1.56		**0.00**
051	Excavate trench / pit in soft material, install shoring and remove spoil	0																	1.83		**0.00**	3.08		**0.00**
071	Conduct backfilling and soil test	0																	1.83		**0.00**	3.08		**0.00**
072b	Reinstate (paving block)	0																	1.22		**0.00**	2.11		**0.00**
074	Provide road marking and furniture	0																	1.00		**0.00**	1.00		**0.00**
075	Conduct site clearance (demobilisation)	0																	1.00		**0.00**	1.00		**0.00**
081	Check reinstatement quality and report completion of road opening work	0																	2.00		**0.00**	2.00		**0.00**
				Total critical working period for all essential items (working days)																	**0.00**			**0.00**

Table 6-19 Proposed new standard template for HyD

0400. Typical Works Programme for Construction of Lift					Multiplication Factors													Length*	(a) 10m*			(b) 50m*		
					A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2							
					2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8							
No.	Work activity	Ess	Bas	Qty																Stm	Ovl	Con	Stm	Ovl	Con
011	Take over site	0																		1.00		**0.00**	1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																		2.00	1.00	**0.00**	3.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																		3.00		**0.00**	3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																		7.00		**0.00**	7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																		10.00		**0.00**	10.00		**0.00**
026	Conduct site clearance for lift construction	0																		20.00		**0.00**	20.00		**0.00**
045	Conduct ground investigation for lift construction	0																		30.00		**0.00**	30.00		**0.00**
051al	Excavate trench / pit in soft material, install shoring and remove spoil for lift construction	0																		20.00		**0.00**	30.00		**0.00**
061g	Diverse existing underground utilities for lift construction	0																		90.00		**0.00**	105.00		**0.00**
062a	Construct drawpit / manhole / valve pit	0	1	0																7.00		**0.00**	7.00		**0.00**
066a	Remove existing staircase	0	1	0																20.00		**0.00**	20.00		**0.00**
066b	Construct temporary staircase foundation	0	1	0																30.00		**0.00**	30.00		**0.00**
066c	Construct temporary staircase	0	1	0																50.00		**0.00**	50.00		**0.00**
066d	Remove existing ramp for lift construction	0	1	0																45.00		**0.00**	60.00		**0.00**
067a	Construct link bridge foundation & columns	0	1	0																60.00		**0.00**	60.00		**0.00**
067b	Construct link bridge	0	1	0																30.00		**0.00**	30.00		**0.00**
067c	Construct pre-bored H-piles	0	1	0																60.00		**0.00**	60.00		**0.00**
067d	Construct mini piles	0	1	0																60.00		**0.00**	60.00		**0.00**
067e	Construct lift foundation	0	1	0																50.00		**0.00**	50.00		**0.00**
067f	Construct lift tower	0	1	0																60.00		**0.00**	60.00		**0.00**
067g	Construct lift shaft	0	1	0																60.00		**0.00**	75.00		**0.00**
067h	Provide finishing	0	1	0																30.00		**0.00**	30.00		**0.00**
067i	Construct electric room	0	1	0																20.00		**0.00**	20.00		**0.00**
067j	Install glass canopy	0	1	0																15.00		**0.00**	15.00		**0.00**
067k	Install E&M, testing & commissioning	0	1	0																50.00		**0.00**	50.00		**0.00**
067l	Install untensioned beam barrier, railing and signage	0	1	0																10.00		**0.00**	10.00		**0.00**
067m	Conduct backfilling & reinstatement after lift construction	0																		20.00		**0.00**	30.00		**0.00**
072c	Reinstate (concrete / asphalt) for all excavated area after lift construction	0																		4.00		**0.00**	10.00		**0.00**
072d	Reinstate (paving block) for all excavated area after lift construction	0																		7.00		**0.00**	14.00		**0.00**
073	Provide curing to freshly laid concrete (3 days)	0																		3.00		**0.00**	3.00		**0.00**
075al	Conduct site clearance (demobilisation) after lift construction	0																		2.00		**0.00**	2.00		**0.00**
081	Check reinstatement quality and report completion of road opening work	0																		2.00		**0.00**	2.00		**0.00**
					Total critical working period for all essential items (working days)																	**0.00**			**0.00**

Table 6-20 Proposed new standard template for HyD

0410. Typical Works Programme for Cold Milling and Resurfacing Work (Intermittent Permit Period)							Multiplication Factors												
							A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2
							2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8
No.	Work activity	Ess	Bas		Qty															
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																		
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																		
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																		
068P	Conduct cold milling after fence off site with approved TTM, strength local area, adjust manhole cover, spray tack coat, conduct resurfacing, curing, conduct testing, provide road marking and furniture, clear site	0	400	sq m	0	sq m														

	Stm	Ovl	Con
3.00			**0.00**
7.00			**0.00**
10.00			**0.00**
1.00			**0.00**
Total critical working period for all essential items (working days)			**0.00**

Table 6-21 Proposed new standard template for HyD

0420. Typical Works Programme for Installation of Soil Nail						Multiplication Factors															
						A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2		
						2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8		
No.	Work activity	Ess	Bas		Qty															Stm	Ovl	Con
011	Take over site	0																		1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																		3.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																		3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																		7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																		10.00		**0.00**
024cP	Erect hoarding	0	10	m	0	m														3.33		**0.00**
033b	Erect working platform for soil nail and rock dowe	0	5	no.	0	no.														1.00		**0.00**
024bP	Set out soil nail position	0	20	no.	0	no.														1.00		**0.00**
024dP	Drill hole for soil nail	0	10	m	0	m														0.67		**0.00**
024eP	Install soil nail and conduct grouting	0	10	m	0	m														0.67		**0.00**
024fP	Conduct pull out test	0																		2.00		**0.00**
024gP	Construct soil nail head	0	10	no.	0	no.														1.00		**0.00**
055b	Remove working platform for soil nail and rock dowe	0	20	no.	0	no.														2.00		**0.00**
024jP	Fix erosion control mat	0	100	sq m	0	sq m														6.00		**0.00**
024kP	Conduct hydroseeding to slope	0	100	sq m	0	sq m														4.00		**0.00**
025	Dismantle hoarding	0	10	m	0	m														4.00		**0.00**
075	Conduct site clearance (demobilisation)	0																		1.00		**0.00**
081	Check reinstatement quality and report completion of road opening worl	0																		2.00		**0.00**
						Total critical working period for all essential items (working days)																**0.00**

Table 6-22 Proposed new standard template for HyD

0430. Typical Works Programme for Natural Terrain Work						Multiplication Factors														
						A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2	
						2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8	
No.	Work activity	Ess	Bas		Qty															Stm	Ovl	Con
011	Take over site	0																		1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																		3.00	1.00	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																		3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																		7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																		10.00		**0.00**
024cP	Erect hoarding	0	10	m	0	m														3.33		**0.00**
032b	Erect scaffolding for typical work	0	100	sq m	0	sq m														1.00		**0.00**
078P	Excavate & provide temporary shoring	0	10	cu m	0	cu m														6.00		**0.00**
079P	Erect formwork	0	10	cu m	0	cu m														5.00		**0.00**
080P	Conduct R.C works	0	10	cu m	0	cu m														12.00		**0.00**
024hP	Construct drainage system	0	10	m	0	m														10.00		**0.00**
024iP	Construct staircase on slope	0	10	m	0	m														12.00		**0.00**
024jP	Fix erosion control mat	0	100	sq m	0	sq m														6.00		**0.00**
024kP	Conduct hydroseeding to slope	0	100	sq m	0	sq m														4.00		**0.00**
025	Dismantle hoarding	0	10	m	0	m														4.00		**0.00**
058b	Remove scaffolding for typical work	0																		1.00		**0.00**
075	Conduct site clearance (demobilisation)	0																		1.00		**0.00**
081	Check reinstatement quality and report completion of road opening work	0																		2.00		**0.00**
																						0.00

Total critical working period for all essential items (working days)

Table 6-23 Proposed new standard template for HyD

0440. Typical Works Programme for Boulder Stabilisation Work						Multiplication Factors														
						A1	A2	A3	A4	A5	A6	A7	B1	C1	C2	C3	C4	D1	D2	
						2.0	2.4	4.0	3.0	6.0	2.3	0	1.1	6.5	5.2	3.2	1.9	1.5	1.8	
No.	Work activity	Ess	Bas		Qty															Stm	Ovl	Con
011	Take over site	0																		1.00		**0.00**
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)	0																		3.00	1	**0.00**
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days	0																		3.00		**0.00**
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days	0																		7.00		**0.00**
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days	0																		10.00		**0.00**
024cP	Erect hoarding	0	10	m	0	m														3.33		**0.00**
032b	Erect scaffolding for typical work	0	100	sq m	0	sq m														1.00		**0.00**
070aP	Conduct boulder stabilisation work	0	10	cu m	0	cu m														20.00		**0.00**
070bP	Construct foundation for flexible barrier	0	10	cu m	0	cu m														30.00		**0.00**
070cP	Erect flexible barrier	0	100	sq m	0	sq m														30.00		**0.00**
025	Dismantle hoarding	0	10	m	0	m														4.00		**0.00**
058b	Remove scaffolding for typical work	0																		1.00		**0.00**
075	Conduct site clearance (demobilisation)	0																		1.00		**0.00**
081	Check reinstatement quality and report completion of road opening work	0																		2.00		**0.00**
						Total critical working period for all essential items (working days)																**0.00**

6.4.2.6 Deployment of polygon model

The application of polygon model in standard templates was considered necessary with consideration to the practical situation, particularly line model was not able to represent diversified excavation work with width greater than 2 m. Polygon model was proposed to introduce into standard templates in the following aspects.

ASD and HSD

No template was considered necessary to adopt polygon model.

CEDD

Work undertaken by this stakeholder was often large in scale; hence, polygon model was needed for most of the cases. The model could be applied onto Templates N4, N5 and N6 (only N6 was developed finally), which were used for the applications of greening works, planting works and landslip preventive works on slopes; whilst, the polygon model might not be needed to the existing template for ground investigation.

HTL

For this stakeholder, polygon model could be applied to the existing template TT1 for tram track renewal work. The reason was that the trenching width on site for replacing a pair of tram tracks was about 2.5 m, which was currently out of the coverage by line model.

HyD

No requests were made by the stakeholders for introducing polygon model to the existing templates, but there were requests for some new templates which the current line model had not covered the work types. Polygon model in new templates N12, N14, N15, N16 and N17 used for the applications of construction of pedestrian zone with paving block, cold milling and resurfacing, installation of soil nailing, natural terrain work and boulder stabilization work would be proposed.

6.5 After completion of site activities

Part of the permit period was found to be unused after the completion of excavation work on site. Further efforts to shorten waiting time of the consecutive works and so better efficiency of the PPA method under the XPMS would be required.

6.5.1 Findings from the analyses on the IIUMS and the XPMS

Currently, it was not mandatory for permittees to submit completion notification upon completion. An automatic Completion Notification (CN) would be generated once the time approved for an XP expired. Having analyzed the XP data from the IIUMS and XPMS, an overall 13 and 8 days median values of the unused permit period were revealed respectively.

6.5.2 Current practice of permittees

The number itself obtained from the analysis, however, might not help to clearly explain how the unused permit periods were derived. Therefore, in the interviews with permit applicants of the five utility stakeholders, specific questions were set to ask their general practices on site. The question set for permit applicants of the five utility stakeholders was,

- *"When the whole duration of an XP is completely used to finish up the planned works, report completion through XPMS is not necessary because CN will be automatically reported some days after the XP expiry date. For those plans completed well before the expiry of XP, what are the common practices?"*

Responses from interviewees were:

- *ASD: there were guidelines in the department as to remind their staff to submit Completion Notice (CN) after completion, and thus the majority cases did.*
- *CEDD: in usual cases, Completion Notice (CN) was submitted immediately after completion of works unless the work on site was outstanding.*
- *HSD: in the majority cases, Completion Notice (CN) was submitted immediately after completion.*
- *HTL: Completion Notice (CN) was generally submitted after completion if there was no outstanding work.*
- *HyD: Completion Notice (CN) was normally submitted after completion of works.*

6.5.3 Recommendations

According to statistical figures and permittees' responses in the interviews, the way to deal with the issue aroused from unused permit periods after completion would be relatively straight forward. It was suggested to remove automatic CN generation and ask permittees to submit their CNs immediately after completion of work. In fact, with reference to the information extracted from the two databases, approximately 90% work plans were found with CNs submitted by them. In this case, once the new measure was put in place, it would not be a difficult issue for them to handle as they had been doing that for years in most occasions.

More importantly, permittees of the work plans nearby would not need to spend time on unnecessary coordination. A more efficient management process under the use of XPMS is expected to obtain thereafter.

6.6 Issue on the XPMS other than the PPA method

After going through the interviews with applicants from the five utility stakeholders, there were comments on issues of the XPMS other than the PPA method. Albeit the aspect was not within the scope of current study, this chapter would like to serve as a reference for HyD's consideration in future enhancement on the XPMS or the permit application system.

Issues raised in the interviews with applicants of the five utility stakeholders:

- It was noticed that some applicants interviewed did not aware of the existence of Multiple Factors (MFs) in the XPMS, which might noticeably affect reflection of actual work progress on site. It was suggested to have a prompt (i.e. Q&A) in the mid-way of the electronic application process.
- It was suggested that MFs could be automatically applied to XPs in case some conditions/constraints were met. For instance, work sites located on sensitive routes/Red/Pink Routes or at sensitive areas like the new government office, schools and theater etc. In addition, for XPs approved for works undertaken during rainy season, built-in MFs could be automatically applied as for granting an appropriately long permit period.

- It was requested to have improvements on user-friendliness of the system interface. For instance, provision of color coding for work/template of different natures/categories; color coding for standard and non-standard templates (i.e. user-self defined templates); provision of simple steps for defining polygon on map (e.g. input polygon model by key in lane width on line model); provision of full-lane width function for line model.
- The XPPT suggested that they would like to see the details of the permit period calculation on their web interface. The tool could assist them to make accurate and faster responses to Standard Work applications. For Non-standard works, references of work items that were available in typical work programmes could be provided in the interface as for assisting the approval process. Furthermore, critical path of work programme could be provided.
- Provision of a step-by-step user guide for the XPMS in graphic format was suggested.
- Slow response of the computing system was a concern; applicants could take up an hour time to complete one application.

6.7 Training on excavation permit applications in the XPMS

With the recommendations given in this report, it was expected that some changes would be made to the XPMS. Applicants and the XPPTs would be required to get familiar with the templates and the system thereafter as to better illustrate their excavation works on sites and to obtain a reasonable permit period.

Since the implementation of the IIUMS, HyD had provided trainings for practitioners who were required to apply XPs for excavation work on roads. A step-by-step user guideline and trainings on the use of permit application system were provided [7]. Further to these early efforts, the user guideline was going to be enriched and trainings for addressing the issues raised by the current study were going to be undertaken.

In the interviews with permittees from the five utility stakeholders, the interviewees commented about the details of trainings. These comments offered an indication to the areas, which required emphases on helping applicants on how to submit a work plan to the XPMS in a proper manner. Comments given by the interviewees were as follows:

- *ASD: they were not familiar with the application system and choices available from the system interface, e.g. the availability of Multiplication Factors (MFs) and PPA templates of typical work programmes.*
- *HSD: they did not recognize there are eight standard templates set exclusively for them.*

With reference to these comments, the coming new guideline and training for practitioners shall focuse on guiding the application of standard templates and MFs. It was expected that work plans adopting standard templates and MFs where necessary would have a better reflection of their actual work duration on sites. Nevertheless, the original frameworks of the user guideline and trainings shall be kept as to retain the essential features and information that every permittee shall pay attention to.

Chapter 7 Guideline on Permit Period Assessment for Road Excavation Works

7.1 Introduction

7.1.1 Under Land (Miscellaneous Provisions) Ordinance (LMPO), a street excavation promoter shall apply for an excavation permit (XP) from Highways Department (HyD) before making and maintaining excavation works (hereinafter called the works) in unleased Government land which is a street. The XP is only valid for the period (hereinafter called the permit period) specified therein with a view to control the time of excavation and minimize disturbance to traffic network and road users.

7.1.2 To cater for delay of excavation due to unexpected issues, an XP extension mechanism is established under the LMPO. HyD, may on payment of the appropriate prescribed fee, inclusive of economic cost if carriageway is affected, extend the permit period. Permittees can apply for an extension without any charge if it is unable to have access to a reasonably substantial portion of the street before the commencement of the works, or can apply for refund of economic cost if the extension is caused by any reasons other than the fault of the permittee or its contractor.

7.1.3 In order to determine a reasonable permit period, permit period assessment (PPA) shall be carried out during the XP application. Under the PPA process, applicants are required to propose a permit period of its excavation works to HyD for approval. The permit period is the duration from the start date of the first plan item to the end date of the last plan item for its excavation works covered by an XP.

7.1.4 This guideline aims to set out principles and criteria of HyD on approving XPs and procedures for applicants to follow during the PPA process. For step-by-step PPA procedures in Excavation Permit Management System

(XPMS), please refer to Training Notes B5. For details on other application and administration processes, please refer to XP Processing Manual.

7.2 Types of Excavation Permit

7.2.1 Under the current XP system, there are several types of XP to cater for different nature and scale of excavation works. The common types of XP include Normal Excavation Permit (NXP), Urgent Excavation Permit (UXP), Emergency Excavation Permit (EXP), Small Scale Works Excavation Permit (SSWXP) and Capital Works Excavation Permit (CWXP). Permit period of some of these permit types are determined by the PPA process, whereas some are dictated under the LMPO or the XP Processing Manual.

7.2.2 For EXP and SSWXP, PPA process is not required and the permit period is set as follows:

Type of XP	Duration of Block Permit	Duration of Permit Section
EXP	6 months	7 days for each emergency incident*
SSWXP	184 days	24 hours for each SSW job affecting carriageway
		48 hours for each SSW job not affecting carriageway

* Remarks: If emergency excavation work cannot be completed within 7 days, the EXP permittee shall apply a continuing emergency XP of which the PPA process is the same as the UXP.

7.2.3 For NXP and UXP, the need of PPA process to undergo is dependent on the type of works. Permit period of excavation works under the category of short duration works, standard works and non-standard works shall be determined by the respective method.

7.2.4 For CWXP, permit period shall be determined through the PPA process for non-standard works.

7.3 Types of Work

7.3.1 Road excavation works can be categorized into 3 types, namely the short duration works, standard works and non-standard works. Their definitions and requirements are described as follows:-

7.3.2 Short Duration Works

Short duration works refer to minor road excavation works, in which the permit period is limited to 14 working days. The list of short duration works under each trade is shown in Table 1, Appendix A.

In the PPA process, applicants shall indicate the minor work involved and a permit period shall be proposed to HyD for vetting; no detailed works programme is required.

7.3.3 Standard Works

Standard works refer to typical excavation works on roads, in which the permit period of an XP is assessed by standard templates set in the XPMS. The list of standard templates for each trade is shown in Table 2, Appendix B.

In the PPA process, applicants shall adopt standard templates, of which each includes a list of work items for different common works of the trades, to apply for a permit period.

7.3.4 Non-standard Works

Non-standard works refer to uncommon works other than short duration works and standard works. It can also be works of nature similar to standard works but with some specific work items which have not been covered by standard works.

In the PPA process, applicants shall clearly explain the reason(s) the excavation works have to be categorized as non-standard works. The

applicants shall propose to HyD a permit period supported with a works programme in the form of a simple Gantt chart. The applicants are encouraged to develop the works programme for the non-standard works by modifying the standard templates, such as inserting specific work items into the standard templates, as far as possible. If no suitable standard templates can be modified, the applicants shall then complete a blank template for each plan items under the non-standard works to develop the works programme. The applicants may need to provide further substantiation, such as breakdown of works activities or master programme of the construction contract for justification.

7.4 Structure of PPA Templates for Road Excavation Works

7.4.1 In the XPMS, there are standard templates established for assessing permit period of excavation works under various utility trades: Architectural Services Department (ASD), Civil Engineering and Development Department (CEDD), Drainage Service Department (DSD), electricity supplies (ELE), fixed telecommunication network services (FTN), gas supplies (GAS), Housing Department (HSD), Hong Kong Tramway Limited (HTL), Highways Department (HyD) and Water Supplies Department (WSD). The applicants are only allowed to use standard templates of its own trade during the application.

7.4.2 Under each utility trade, some templates are set to cater for excavation works on different road surface types: flexible carriageway, rigid carriageway and footway. Applicants shall use templates appropriate to the road surface types. In case the works lay across both carriageway and footway, the applicants shall register individual plan items for the works undertaken on two road surface types.

7.4.3 In each template, works are further broken down into a series of work items with logical sequences. Some of these work items are common across standard templates and utility trades while some are specific for individual trades. The list of work items under each trade is shown in Table 3, Appendix

C, for utility trench works and excavation works other than utility trench, respectively.

7.4.4 The logical sequence among work items is governed by predecessor and overlap. The preceding work item(s) are the works, of which they must be completed before the subsequent work item(s) can start. The overlap indicates the length of time of concurrence work items.

7.4.5 Duration of a work item is determined by the formula set in the standard templates. Different formulas are used for various combinations of excavation length, width, and depth for line model, and area for polygon model. In addition, fixed duration work items and dimension dependent work items are specified in the standard templates for better determination of permit period.

7.4.6 The fixed duration work items are the activities not dependent on excavation dimensions. For instance, item 011 for “take over site” and item 062a for “construct drawpit / manhole / valve pit"; fixed durations are assigned for these types of work items in the standard templates.

7.4.7 For line model, the dimension dependent work items are the activities dependent on excavation length, width and/or depth. Their durations are determined by two parts: a nominal and a varied part. The former part is a fixed value set in the formulas; the latter part is directly proportional to the excavation size.

7.4.8 For polygon model, the dimension dependent work items are the activities dependent on excavation area. Their durations are directly proportional to the area of the excavation.

7.4.9 For trench excavation works with trench length between 10m and 50m, the length is rounded up to the nearest 10m in the calculation process of permit period.

7.4.10 In some occasions, duration of work items can be influenced by site conditions, such as time constraints, climatic condition, hard rock condition and other physical site constraints. Applicants can select suitable and justifiable multiplication factor(s), which are listed in Table 4, Appendix D, to represent the effect of site conditions on work progress. The duration of the affected work items will be prolonged by multiplying the corresponding multiplication factor(s).

7.4.11 For applications including multiplication factors, HyD may require the applicants to provide substantiation such as site photos and records, temporary traffic arrangement (TTA) plans and/or ground investigation reports as reference in assessment.

7.5 Procedures of PPA

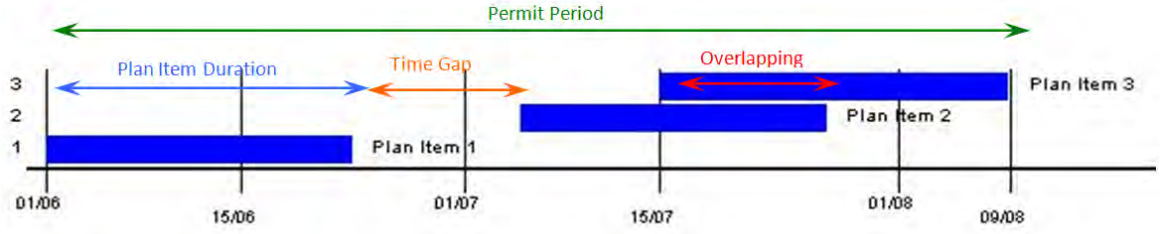
7.5.1 Firstly, the excavation alignments should be digitized. Applicants shall indicate the locations and dimensions of all plan items under the XP in this step. Multiple numbers of plan items are allowed in each XP application. Length or area of each plan item shall represent the extent of workfront to be fenced off at each stage of works (e.g. each TTA phase). In practice, lengths of road openings are usually limited to 20m to 30m as imposed by Hong Kong Police Force (HKPF) / Transport Department (TD). To avoid unreasonably long excavation works, the excavated length is limited to 50m; the excavated area is limited to 250m^2 with either the length or width being less than 50m in the XPMS. However, there is an exception to the works of cold milling and resurfacing which the excavated area can be up to maximum 500m^2 with either the length or width being less than 150m in every eight-hour operation period. For step-by-step process of alignment and area digitization in the XPMS, please refer to Training Notes B2.

7.5.2 Secondly, the appropriate category of road excavation works should be selected. Applicants shall indicate whether the excavation works are short

duration works, standard works or non-standard works. For standard works, applicants shall use the standard templates established under the PPA process to determine the durations of the plan items. For short duration and non-standard works, the requirements in Clauses 7.3.2 and 7.3.4 should refer. For step-by-step process of using templates for standard work applications, please refer to Training Notes B5.

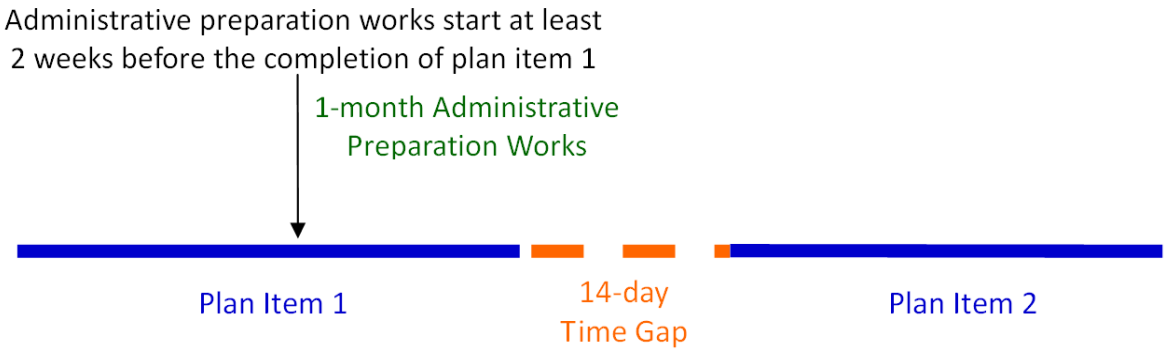
7.5.3 After assessing the duration of each plan item by the standard PPA template, the applicants shall schedule all plan items under the XP by adjusting the start date of individual work items. Under normal circumstance, administrative time gap of not more than 14 days can be introduced between plan items to cater for the time required for necessary administrative preparation works (Please refer to Scenario 5.1). Typical administrative preparation works include applications of road work advice, parking meter suspension and/or gazette for road closure, etc. However, there is also practical situation that the area covered by an XP is neither occupied nor excavated in most of the time during the permit period and works will only be carried out under several plan items on discrete days (e.g. cold milling and resurfacing works and renewal of tram track). Under this occasion, a longer time gap of not more than 28 calendar days can be introduced between these plan items (Please refer to Scenario 5.2). Applicants shall clearly state the reason(s) of introducing any time gap. HyD may require the applicants to provide substantiation to justify the need and duration of such time gap introduced. The permit period is calculated after scheduling the plan items (See Figure 5.1).

Figure 5.1 - Permit Period = Sum of Plan Item Duration + Time Gaps – Overlapping



7.5.4 The applicants are reminded to start any administrative preparation works as early as practical to avoid unnecessary delay. For instance, if 1 month is required to complete the administration preparation works before the commencement of the succeeding plan item, the application shall start the administrative preparation works at least 2 weeks before the completion of the preceding plan item and make use of the 14-day administrative time gap so as to ensure timely commencement of the succeeding plan item (See Figure 5.2). The applicants shall also change the proposed start date throughout the permit application process until reaching the permit application stage so as to isolate the time for administration preparation works before commencement of the XP.

Figure 5.2 – Administrative Time Gap

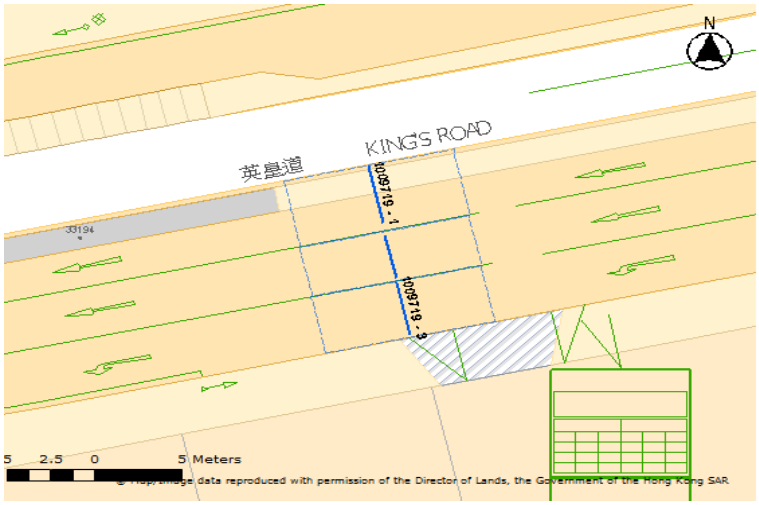


7.5.5 Permittees shall submit the Completion Notice (CN) in the XPMS to notify HyD about the satisfactory completion of the works.

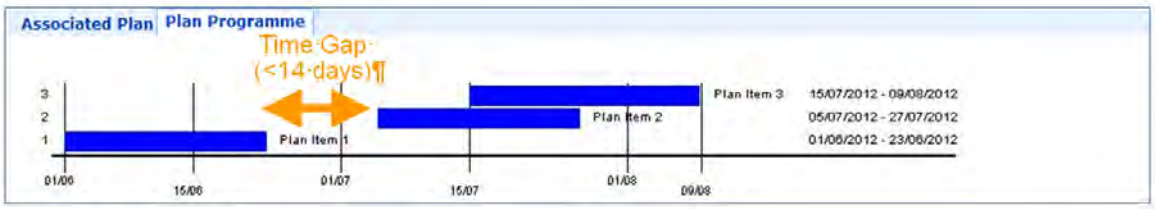
Scenario 5.1 - Excavations affect carriageways (Normal circumstance – Introduction of administrative time gap of not more than 14 days)

Example: A cross road duct will be laid in 3 phases. Site area under each phase will be kept occupied / temporarily decked until the completion of the works in that phase.

Step 1: Draw the plan items according to the phasing of approved TTA.



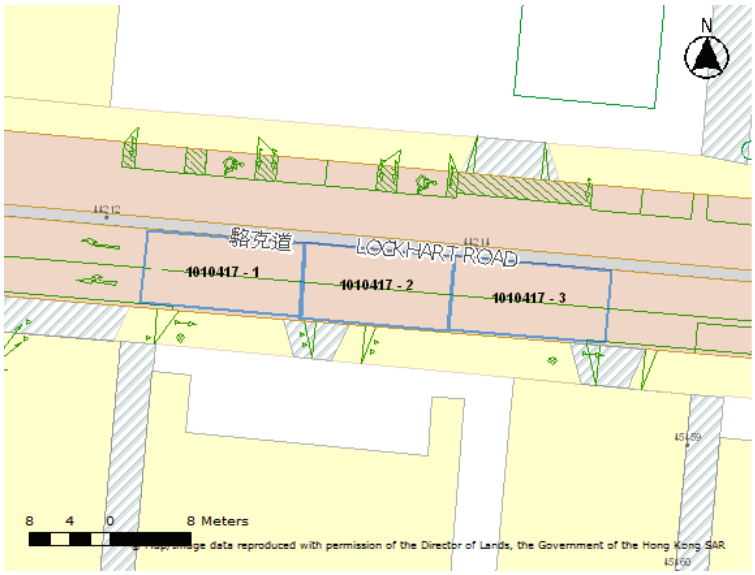
Step 2: Adjust the start date of each plan item to allow time for administrative preparation works. Introduce time gap(s) of not more than 14 days between plan items where necessary.



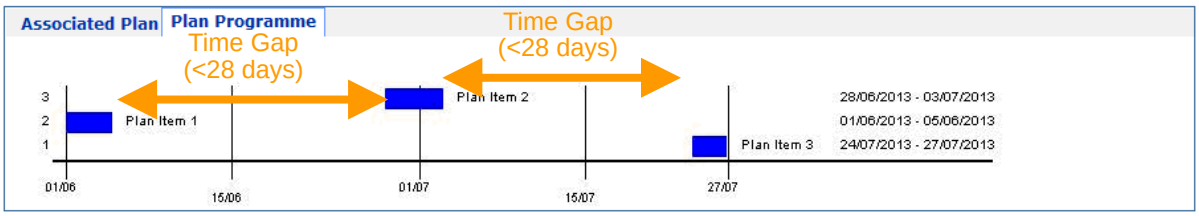
Scenario 5.2 - Excavations affect carriageways (Neither occupied nor excavated in most time of the permit period – Introduction of administrative time gap of not more than 28 days)

Example: Cold milling and resurfacing works will be carried out in 3 phases. Works under each phase will be completed in 1 day (on 3 Sundays). The roads will be fully reopened for public use (not occupied / temporarily decked) for other time during the permit period.

Step 1: Draw the plan items according to the phasing of approved TTA.



Step 2: Adjust the start date of each plan item. Introduce time gap(s) of not more than 28 days between plan items where necessary.



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Appendix A – List of Short Duration Works

Table 1 - List of Short Duration Works

Trade	Short Duration Works	
ASD	(1)	Excavation for hoarding, signage, railing, street furniture, tree planting and planter construction
	(2)	Trial pit excavation to identify utilities location
	(3)	Minor service connection / repair works
CEDD	(1)	Inspection pit excavation
	(2)	Drilling of borehole
	(3)	Trial pit excavation
	(4)	Trial trench excavation
	(5)	Slope stripping
	(6)	Rectification of reinstatement defects
	(7)	Removal / installation of traffic signs for Temporary Traffic Measures or rectification of defects
	(8)	Continuation of emergency work carried out under Emergency Excavation Permit
DSD	(1)	Breaking up manhole shafts for lining works
	(2)	Continuation of emergency work carried out under Emergency Excavation Permit
	(3)	Filling and sealing the disused pipes and manholes
	(4)	Make good or repair manholes
	(5)	Minor diversion in conjunction with the work of other utilities
	(6)	Minor service / reinforcement / repair work of drainage or sewerage system
	(7)	Rectification of reinstatement defects
	(8)	Removal / installation of traffic signs, railings, crash gate, lamp post, fire hydrants, post box, etc. for Temporary Traffic Measures or rectification of defects
	(9)	Temporary carriageway / footway widening for TTA
	(10)	Trial pit excavation
ELE	(1)	Continuation of emergency work carried out under Emergency Excavation Permit
	(2)	Minor diversion in conjunction with the work of other utilities
	(3)	Minor service / reinforcement / repair work of power supply system
	(4)	Rectification of reinstatement defects
	(5)	Removal of low voltage service cables not requiring shutdown of supply to other customers
	(6)	Removing / installing traffic signs for Temporary Traffic Measures or carrying out retification of defects
	(7)	Replacement of underground pit cover / rectification of pit cover defect
	(8)	Trial pit excavation
FTN	(1)	Adjusting / raising / replacing jointing chamber frames and covers

Trade	Short Duration Works	
	(2)	Carrying out minor underground duct repair
	(3)	Carrying out rectification work to minor reinstatement defects
	(4)	Erecting / recovering telephone poles
	(5)	Excavating one to three trial holes (up to 1m length x 1m breadth x 1m depth each) at adjacent locations
	(6)	Laying lead-in ducts to buildings (up to 5 metres trench length)
	(7)	Removing / installing traffic signs for Temporary Traffic Measures or carrying out retification of defects
GAS	(1)	Capping-off of underground main / service
	(2)	Inspection of underground pipes
	(3)	Installation / repair / replacement of valve
	(4)	Installation of recessed type cover
	(5)	Locate lost pit cover
	(6)	Rectify unsatisfactory reinstatement work
	(7)	Repair / replacement of subsided or damaged pit cover
	(8)	Repair / replacement of syphon standpipe, corroded service pipe and risers
	(9)	Repair governor impulse line / vent stack
	(10)	Small pipe laying / connection work
	(11)	Trial pit excavation
HSD	(1)	Excavation for hoarding, signage, railing, street furniture, tree planting and planter construction
	(2)	Trial pit excavation to identify utilities location
	(3)	Minor service connection/repair works
HTL	(1)	Broken rail joint repair / renewal
	(2)	Repair of underground signaling system for autopoint switching
	(3)	Erection and removal of tram pole
	(4)	Trial hole excavation for facilities installation
	(5)	Unsatisfactory Reinstatement Notice or road defect rectification
	(6)	Continuation of emergency works carried out under Emergency Excavation Permit
HyD	Regions / Structures Division	
	(1)	Cold milling and resurfacing with wearing course
	(2)	Cold milling and resurfacing with base course and wearing course
	(3)	Coring of construction materials for testings and subsequent reinstatement
	(4)	Repair of potholes, anti-skid surface and colour dressings
	(5)	Repair of spalled joints and movement joints

Trade	Short Duration Works	
	(6)	Repair of manhole covers, rodding-eye covers, gullies, drainage gratings and utility trough covers
	(7)	Construction of drop kerbs with new tactile warning tiles
	(8)	Repair of paving blocks, floor tiles, tactiles warning tiles and kerbs
	(9)	Installation / relocation / repair of post for street name plate, traffic sign, traffic signal, crash cushions, parapets, barriers, railings and fencing
	(10)	Construction of ATC drawpit, plinth for traffic controller and bollard
	(11)	Installation of mail box
	(12)	Installation of detector loop
	(13)	Construction of tree pits / planting
	(14)	Removal of planter
HyD	Lighting Division	
	(1)	Installation / repair / replacement / removal / relocation of public lighting column/controller
	(2)	Repair of public lighting cable faults
	(3)	Installation of joint bays
	(4)	Excavation of trial holes
	(5)	Excavation on footway for laying lighting cables
WSD	(1)	Adjust / raise / replace manhole, pit cover or frame
	(2)	Connection to consumer supplies
	(3)	Connection to fire hydrant for temporary supply
	(4)	Continuation of emergency work carried out under Emergency Excavation Permit
	(5)	Ground investigation (such as trial pit excavation, borehole, piezometer installation etc.)
	(6)	Installation of pedestal fire hydrant
	(7)	Installation of small size valves (150mm and below)
	(8)	Minor diversion in conjunction with the work of other utilities
	(9)	Minor diversion works in conjunction with the works of other utility undertaking
	(10)	Rectification of minor reinstatement defects e.g. missing road markings
	(11)	Removal / installation of traffic signs
	(12)	Repair of damaged fire hydrants
	(13)	Repair of valves / mains with minor leakage

Appendix B - List of Standard Works Templates

Table 2 - List of Standard Works Templates

Trade	Standard Works Template	
ASD	0010a	Typical Works Programme for Connection Work on Flexible Carriageway
	0010b	Typical Works Programme for Connection Work on Rigid Carriageway
	0010c	Typical Works Programme for Connection Work on Paving Block Footway
	0050	Typical Works Programme for Ground Investigation on Footway (not exceeding 30m in depth)
	0060	Typical Works Programme for Installation of Settlement Marker (1 No.)
	0020	Typical Works Programme for Run-in Construction
	0030	Typical Works Programme for Construction or Removal of Hoarding Footing
	0040	Typical Works Programme for Ground Investigation with Trial Pit on Footway (not exceeding 1.5mx1.5m width and 3m in depth)
CEDD	0080	Typical Works Programme for Landslip Preventive Measures (LPM) Work
	0070	Typical Works Programme for Ground Investigation
DSD	D1	Typical Works Programme for Flexible Carriageway - Drainage Pipe Laying Work
	D2	Typical Works Programme for Rigid Carriageway - Drainage Pipe Laying Work
	D3	Typical Works Programme for Footway - Drainage Pipe Laying Work
ELE	D1	Typical Works Programme for Flexible Carriageway - Distribution Work
	D2	Typical Works Programme for Rigid Carriageway - Distribution Work
	D3	Typical Works Programme for Footway - Distribution Work
FTN	T1	Typical Works Programme for Flexible Carriageway - Ducts / Cables Laying Works
	T2	Typical Works Programme for Rigid Carriageway - Ducts / Cables Laying Works
	T3	Typical Works Programme for Footway - Ducts / Cables Laying Works
GAS	T1	Typical Works Programme for Flexible Carriageway - Gas Pipe Laying Work
	T2	Typical Works Programme for Rigid Carriageway - Gas Pipe Laying Work
	T3	Typical Works Programme for Footway - Gas Pipe Laying Work
HSD	0010a	Typical Works Programme for Connection Work on Flexible Carriageway
	0010b	Typical Works Programme for Connection Work on Rigid Carriageway

Trade	Standard Works Template	
	0010c	Typical Works Programme for Connection Work on Paving Block Footway
	0050	Typical Works Programme for Ground Investigation on Footway (not exceeding 30m in depth)
	0090	Typical Works Programme for Construction of Draw Pit / Manhole / Value Pit
	0020	Typical Works Programme for Run-in Construction
	0030	Typical Works Programme for Construction or Removal of Hoarding Footing
	0040	Typical Works Programme for Ground Investigation with Trial Pit on Footway (not exceeding 1.5mx1.5m width and 3m in depth)
HTL	0190	Typical Works Programme for Tram Pole Erection Work
	0200	Typical Works Programme for Central Refuge Construction on Carriageway (1 No.)
	0210	Typical Works Programme for Light Pole Erection Work (1 No. of Light Pole with 40m Cable)
	0100	Typical Works Programme for Renewal of Tram Track
	0110	Typical Works Programme for Ducts / Cables Laying Work on 50 m Flexible Carriageway
	0120	Typical Works Programme for Ducts / Cables Laying Work on 50 m Rigid Carriageway
	0130	Typical Works Programme for Ducts / Cables Laying Work on 50 m Footway
	0140	Typical Works Programme for Ducts / Cables Laying Work on 10 m Flexible Carriageway
	0150	Typical Works Programme for Ducts / Cables Laying Work on 10 m Rigid Carriageway
	0160	Typical Works Programme for Ducts / Cables Laying Work on 10 m Footway
	0170	Typical Works Programme for Ducts / Cables Laying Work on Road Crossing of Flexible Carriageway (per lane)
	0180	Typical Works Programme for Ducts / Cables Laying Work on Road Crossing of Rigid Carriageway (per lane)

Trade	Standard Works Template	
HyD	0390	Typical Works Programme for Construction of Pedestrian Zone with Paving Block
	0400	Typical Works Programme for Construction of Lift
	0410	Typical Works Programme for Cold Milling and Resurfacing Work (Intermittent Permit Period)
	0420	Typical Works Programme for Installation of Soil Nail
	0430	Typical Works Programme for Natural Terrain Work
	0440	Typical Works Programme for Boulder Stabilisation Work
	0220	Typical Works Programme for Concrete / Paving Block Footway Construction
	0230a	Typical Works Programme for Flexible Carriageway Construction
	0230b	Typical Works Programme for Rigid Carriageway Construction
	0240a	Typical Works Programme for Repairing Safety Fence or New Safety Fence
	0240b	Typical Works Programme for Repairing Railing or New Railing
	0240c	Typical Works Programme for Repairing Crash Cushion or New Crash Cushion
	0250a	Typical Works Programme for Road Crossing Work of Flexible Carriageway (per lane) - Roadside Gully with 5m Pipe Connection / Construction Work
	0250b	Typical Works Programme for Road Crossing Work of Rigid Carriageway (per lane) - Roadside Gully with 5m pipe Connection / Construction Work
	0250c	Typical Works Programme for Flexible Carriageway-Drainage Pipe Installation
	0250d	Typical Works Programme for Rigid Carriageway-Drainage Pipe Installation
	0250e	Typical Works Programme for Concrete / Paving Block Footway-Drainage Pipe Installation
	0250f	Typical Works Programme for Surface Channel Work
	0260	Typical Works Programme for Roadside Slope Maintenance Work
	0270	Typical Works Programme for Run-in Construction
	0280	Typical Works Programme for Demolition, Extension or Repair of Central Divider
	0290a	Typical Works Programme for Cross Road Duct Laying on Flexible Carriageway (per lane)

Trade	Standard Works Template	
	0290b	Typical Works Programme for Cross Road Duct Laying on Rigid Carriageway (per lane)
	0300a	Typical Works Programme for Ducting / Drawpit Construction on Flexible Carriageway
HyD	0300b	Typical Works Programme for Ducting / Drawpit Construction on Rigid Carriageway
	0300c	Typical Works Programme for Ducting / Drawpit Construction on Footway
	0310	Typical Works Programme for Construction of Taxi Shelter
	0320a	Typical Works Programme for Construction of Tram Shelter with Service Duct on Flexible Carriageway
	0320b	Typical Works Programme for Construction of Tram Shelter with Service Duct on Rigid Carriageway
	0330	Typical Works Programme for Directional Sign (Installation)
	0340	Typical Works Programme for Construction of Footing of Gantry Sign (1 No.)
	0350a	Typical Works Programme for Construction of Signalized Junction (without Kerb Realignment)
	0350b	Typical Works Programme for Construction of Signalized Junction (with Addition of a Traffic Lane / Kerb Realignment)
	0200	Typical Works Programme for Central Refuge Construction on Carriageway (1 No.)
	0360	Typical Works Programme for Public Lighting Installation (1 No. Lighting with 40m Cable) on Footway
	0370	Typical Works Programme for Replacement of Rusty Public Lighting Column (4 No.)
	0380	Typical Works Programme for Installation or Relocation of Public Lighting Controller (1 No.)
WSD	T1	Typical Works Programme for Flexible Carriageway - Pipe Laying Work
	T2	Typical Works Programme for Rigid Carriageway - Pipe Laying Work
	T3	Typical Works Programme for Footway - Pipe Laying Work

Appendix C - List of Work Items for Excavation Works Other Than Utility Trench Works

Table 3 - List of Activities for Excavation Works Other Than Utility Trench

Work Activity Code	ASD	CEDD	HSD	HTL	HyD
011	Take over site				
021	Fence off site with necessary temporary traffic arrangement (follow the approved TTM; demarcation of site by the appropriate signs and guarding, relocation of road signs, etc)				
022a	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 3 days				
022b	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 7 days				
022c	Conduct major traffic arrangement (e.g. trial run as requested by the Police, temporary rerouting of carriageway) - 10 days				
023aP		Conduct clearance to new site			
023bP		Conduct initial survey on existing slope			
023cP		Conduct surface stripping on existing slope			
024aP		Mobilize material and plant			Mobilize material and plant
024bP		Set out soil nail position			Set out soil nail position
024cP					Erect hoarding
024dP		Drill hole for soil nail			Drill hole for soil nail
024eP		Conduct grouting to soil nail			Conduct grouting to soil nail
024fP		Conduct pull out test			Conduct pull out test
024gP		Construct soil nail head			Construct soil nail head
024hP					Construct drainage system
024iP					Construct staircase on slope
023jP		Fix erosion control mat			Fix erosion control mat
024kP		Conduct hydroseeding to slope			Conduct hydroseeding to slope
024lP		Dismantle hoarding			
024mP		Conduct landscaping work (as hydroseeding)			
024nP		Conduct hard rock slope surfacing work			
024pP		Conduct rock scaling and remove boulders (only rock scaling)			

Work Activity Code	ASD	CEDD	HSD	HTL	HyD
024qP		Construct granite stone facing			
024rP		Construct skin wall (for 500mm thick)			
024sP		Erect fence and gate			
024tP		Install railing on lope			
024uP		Carry out tree protection and preservation work			
024vP		Conduct tree survey			
024xP		Construct staircase on slope (for 1m wide with single handrailing)			
024yP		Construct drainage system (as 300mm U - channel with masnory apron)			
024zP		Erect hoarding for LPM			
025					Dismantle hoarding
025cP		Dismantle hoarding (as Type A hoarding)			
026					Conduct site clearance for lift construction
031	Locate utilities (gas pipe / cable location)				
032a					Erect scaffolding for spray concrete
032b					Erect scaffolding for other work
033a					Erect working platform for surface stripping
033b		Erect working platform for soil nail and rock dowel			Erect working platform for soil nail and rock dowel
041a	Break up road surface and remove spoil - Rigid surface				
041b	Break up road surface and remove spoil - Flexible surface				
041c	Break up road surface an remove spoil - Footway			Break up road surface and remove spoil - Footway	
041d			Cover walkway		
042					Break up and remove defective slope surface
042a					Demolish central divider

Work Activity Code	ASD	CEDD	HSD	HTL	HyD
042b					Extend central divider
042c					Repair central divider
043					Strip surface
044		Excavate plant hole			
044a					Conduct greening work (with drilling)
045					Conduct ground investigation for lift construction
045a		Drill hole (up to 30m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement			
045b		Drill hole (> 30m to 60m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement			
045c		Drill hole (> 60m to 90m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement			
045d		Drill hole (> 90m to150m deep) - Excavate inspection pit, set up drill rig & equipment, drilling, in-situ testing & sampling, logging, backfill, reinstatement			
045e		Drill core hole			
045f		Drill inclined hole			
046a		Conduct trial pit work (1.5m x 1.5m, up to 3m deep) -			

Work Activity Code	ASD	CEDD	HSD	HTL	HyD
		Excavate, in-situ testing & sampling, logging, backfill, reinstatement			
046b		Conduct trial pit work (1.5m x 1.5m, > 3m to 5m deep) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement			
047a		Conduct trial trench work (1.5m wide, 3m deep, >1.5m to 3m long) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement			
047b		Conduct trial trench work (1.5m wide, 3m deep, >3m to 5m long) - Excavate, in-situ testing & sampling, logging, backfill, reinstatement			
048a		Conduct slope stripping work (0.5m wide, 0.3m deep, up to 15m long) – Erect access ladder, excavate, in-situ testing & sampling, logging, backfill, reinstatement			
048b		Conduct slope stripping work (0.5m wide, 0.3m deep, > 15m to 30m long) – Erect access ladder, excavate, in-situ testing & sampling, logging, backfill, reinstatement			
049		Provide instrumentation			
050	Install settlement marker				
051	Excavate trench / pit in soft material, install shoring and remove spoil				
051al					Excavate trench / pit in soft material,

Work Activity Code	ASD	CEDD	HSD	HTL	HyD
					install shoring and remove spoil for lift construction
052	Support and protect utilities / Drill and install soil nail (HyD) / Insitu tests / Conduct other insitu testing (ASD)		Support and protect utilities / Drill and install soil nail (HyD) / Insitu tests / Conduct other in-situ testing (ASD)		
053		Drill and install rock dowel			Drill and install rock dowel
053a					Install rock mesh
053b					Construct tubular steel framed passenger shelter
054					Construct raking drain
055	Provide temporary decking				
055a					Remove working platform for surface stripping
055b		Remove working platform for soil nail and rock dowel			Remove working platform for soil nail and rock dowel
056					Conduct tunneling work (e.g. under tram track per carriageway lane) / Form weep hole
056a					Form weep holes
057					Provide concrete for binding layer
057a					Spray concrete (include BRC fixing, curing and coring for checking)
058					Construct surface channel (including formworking and concreting) / Remove scaffolding for spray concrete
058a					Remove scaffolding for spray concrete
058b	Remove scaffolding for typical work				Remove scaffolding for typical work
059					Construct planter wall

Work Activity Code	ASD	CEDD	HSD	HTL	HyD
060a					Construct simple retaining structure up to 2m high
060b					Construct simple retaining structure > 2m and up to 3m high
061	Lay pipe / cable				
061a					Construct U-channel of size up to 300mm
061b					Construct U-channel of size >300mm up to 450mm
061c	Adjust existing utility / manhole covers		Adjust existing utility / manhole covers		
061d	Lower existing underground utilities		Lower existing underground utilities		
061e	Diverse existing underground utilities		Diverse existing underground utilities		
061f	Remove abandoned pipe and backfilling		Remove abandoned pipe and backfilling		
061g					Conduct utility diversion for lift construction
062a	Construct drawpit / manhole / valve pit			Construct drawpit / manhole / valve pit	
062b	Connect existing manhole				
063	Conduct site inspection, testing and commissioning (CCTV record) / Water test and water connection / Cable connection including testing and commissioning				
063a	Erect hoarding post and construct concrete footing				
063b	Dismantle hoarding footing				
064	Lay drop kerb			Lay drop kerb	
064aP				Remove and dispose of tram track	

Work Activity Code	ASD	CEDD	HSD	HTL	HyD
064bP				Install and fix track alignment	
064cP				Conduct rail joint welding and grinding	
064dP				Level track	
064eP				Drill and install of holding down bolt	
064f				Remove tram pole	
064g				Erect tram pole	
065a	Construct paving block run-in		Construct paving block run-in		Construct paving block run-in
065b	Construct concrete run-in		Construct concrete run-in		Construct concrete run-in
066a					Remove existing staircase
066b					Construct temporary staircase foundation
066c					Construct temporary staircase on footbridge
066d					Remove existing ramp for lift construction
067a					Construct link bridge foundation and columns
067a					
067b					Construct link bridge
067c					Construct prebored H-piles
067d					Construct mini pile
067e					Construct lift foundation
067f					Install lift tower
067g					Construct lift shaft
067h					Provide finishing
067i					Conduct electric room
067j					Install glass canopy
067k					Install E&M, testing &

Work Activity Code	ASD	CEDD	HSD	HTL	HyD
					commissioning
067l					Install untensioned beam barrier, railing and signage
067m					Construct backfilling & reinstatement after lift construction
068P					Conduct cold milling after fence off site with approved TTM, strength local area, adjust manhole cover, spray tack coat, conduct resurfacing, curing, conduct testing, provide road marking and furniture, clear site
069f		Conduct planting work			
069zP		Conduct planting work (as hydroseeding)			
070aP					Conduct boulder stabilisation work
070bP					Construct foundation for flexible barrier
070cP					Erect flexible barrier
071	Backfill trench and soil test				
072a	Reinstate (concrete / asphalt)				
072b	Reinstate (paving block)				
072c					Reinstate (concrete / asphalt) after lift construction
072d					Reinstate (concrete / asphalt) after lift construction
073a	Provide curing to freshly laid concrete (3 days)		Provide curing to freshly laid concrete (3 days)		
073b	Provide curing to freshly laid concrete (7 days)		Provide curing to freshly laid concrete (7 days)		

Work Activity Code	ASD	CEDD	HSD	HTL	HyD
074	Road marking and furniture				
075	Conduct site clearance (demobilisation)				
075al					Conduct site clearance (demobilisation) after lift construction
076				Lay kerb	
076a				Lay kerb (for central refuge)	
077	Conduct geological logging by geologist		Conduct geological logging by geologist		
078					Excavate and provide temporary shoring
079					Erect formwork
080					Conduct R.C work
081	Check reinstatement quality and report completion of road opening work				
C001				Build central refuge	
C002					Prepare concrete foundation
C003					Install controller and internal wiring
C004					Remove of existing controller
F051					Footing
F052					Place anchor block
F053					Install safety fence
F054a	Install railing on straight road				Install railing on straight road
F054b					Install railing at junction bend
F055					Construct crash cushion
F071					Construct gantry footing
F071a					Construct gantry sign footing
P001				Prepare pole hole	
P002				Disconnect power and remove existing column	
P003				Erect pole, install lantern and internal wiring	

Work Activity Code	ASD	CEDD	HSD	HTL	HyD
S001					Erect traffic signal post
S002					Connect cable for traffic signal by EMSD
S003					Connect power supply by CLP / HEC
S74a					Fabricate and erect directional sign support & frame
T051					Erect tram shelter

Appendix D - Multiplication Factors for PPA Templates

Table 4 - Multiplication Factors for PPA Templates

Site Condition	Division	Description	Multiplication Factor
A - Time constraint	A1	10:00-16:00 only (Police / customer restriction)	2.0
	A2	2.5 hours * 2 per day (e.g. 09:00 - 11:30 & 14:30 - 17:00 for restaurants, schools or busy shopping areas)	2.4
	A3	3 working hours per day (e.g. 13-16 at Kam Wah St. market)	4.0
	A4	CNP - 19:00 to 23:00 only	3.0
	A5	CNP - 21:00 to 23:00 only	6.0
	A6	CNP - Night (19 to 23) and Sunday/holidays (10 to 17)	2.3
	A7	Others	
A - Time constraint (exclusive factors for HTL)	A7	Light Traffic Zone; (i.e. Kennedy Town, Sai Wan Ho, Shau Kei Wan, Happy Valley) (for tram track renewal only)	1.2
	A8	Heavy Traffic Zone; (i.e. Whitty Street Depot to North Point) (for tram track renewal only)	1.6
	A9	Others	
B - Climatic conditions	B1	Rainy season (April to September with % days lost > 10%) - necessity for additional preventive measures such as water pumping, erection of bund walls etc.	1.1
C - Hard rock factor	C1	Hard rock > 80% *	6.5
	C2	Hard rock > 50% & < = 80% *	5.2
	C3	Hard rock > 30% & < = 50% *	3.2
	C4	Hard rock > 10% & < = 30% *	1.9
D - Site constraint (physical)	D1	Congested underground installations (e.g. footpath of urban area or footpath of <3.5m width in rural area)	1.5
	D2	Steep road (> 1 : 10) / staircase	1.8