Legislative Council Panel on Transport

Supplementary Information on
Replacement of Tunnel Systems and Equipment

Traffic control and surveillance system of Lion Rock Tunnel

PURPOSE

At the Panel meeting held on 30 March 2001, Members noted from the paper on "Replacement of Tunnel Systems and Equipment" the Administration's four proposals to replace various tunnel systems and equipment for three Government tunnels. Members in general supported the proposals but requested for further details. For the proposal on the traffic control and surveillance system (TCSS) of Lion Rock Tunnel, Members suggested that the Sha Tin District Council Traffic and Transport Committee should also be consulted. This paper provides Members with supplementary information on the Lion Rock Tunnel TCSS proposal and the outcome of the consultation.

BACKGROUND

2. The two tunnel tubes of Lion Rock Tunnel started operation in 1967 and 1978 respectively. The tunnel is currently being operated by a management contractor, and Transport Department (TD) is responsible for the timely replacement of major systems in the tunnel in consultation with the Electrical and Mechanical Services Department (EMSD).

3. In general TCSS is installed in a tunnel and along its approaches for the safe operation of the tunnel and real-time monitoring of tunnel traffic. There are two kinds of facilities in a TCSS. The traffic control facilities are designed to guide the motorists through the tunnel safely and efficiently. The traffic surveillance facilities allow the tunnel operator to observe and monitor the actual traffic condition in the tunnel area at all times and act promptly if there are incidents.

4. The existing TCSS in Lion Rock Tunnel was installed when the first tube opened in 1967 and extended to cover the second tube before its opening in 1978. Some aged sub-systems were replaced piecemeal in the late 80's. Though the system is subject to regular maintenance and is rendering smooth operation,

EMSD considers that the core components of the existing system are reaching the end of their serviceable life. It is also getting increasingly difficult to purchase spare parts to maintain the obsolete TCSS equipment.

5. Designed some 20 years ago, the existing TCSS relies totally on the operators for traffic control manually. A modern TCSS, however, provides important elements like automatic incident detection system, colour closed circuit television (CCTV) system and computerized traffic plan system as standard components.

6. Transport Department plans to replace the existing TCSS in Lion Rock Tunnel with a modern TCSS to ensure the continued provision of a reliable and efficient system to control and monitor the tunnel traffic. This will also bring the facilities and equipment of the tunnel in line with other modern tunnels.

THE PROPOSAL

(a) Major Features of the New System

7. The TCSS equipment to be replaced in this proposed project and their features are given in the table below. The features of the existing TCSS equipment are also shown in the same table for easy reference and comparison: -

(i) Traffic Control Facilities

Item	New System	Existing System
1) Full Variable Message Sign (FVMS) (Mounted on gantries in major approach roads to the tunnel to display bilingual traffic information to tunnel users.)	A number of light emitting diode (LED) type variable message signs will be erected on major tunnel approach roads to disseminate real-time bilingual message to motorists for their timely action.	No such provision.

2) Limited Variable Message Sign (LVMS) (Includes Tunnel Closed/Congested signs and advisory/warning/ regulatory signs to effect traffic management schemes.)	Variable message signs to be installed can display additional pre-set messages, e.g. “Tunnel Congested”.	Most are light-box type, which can only display limited pre-set information and may be difficult to read in daytime.
3) Traffic Light Signal (Installs on approach roads to regulate traffic entering the tunnel and stop over-height vehicles)	Brighter maintenance-free LED type signal will be installed.	Conventional lamp bulb type.
4) Gantry Lane-use Signal (Installs at tunnel approach roads for control of traffic especially during lane or tube closure.)	Brighter maintenance-free LED type signal will be installed.	Non-standard fibre optic signs. These are aged and difficult to read in daytime.
5) Tunnel Lane Control Signal (Installs throughout the tunnel tubes for lane control.)	Brighter maintenance-free LED type signal will be installed.	The existing signals are aged and difficult to read in daytime.
6) Barrier (Used to temporarily close carriageway or lanes, or to channelise traffic between lanes.)	Feasibility of installing barriers for the tunnel will be studied.	No such provision.

(ii) Traffic Surveillance Facilities

Item	New System	Existing System
1) CCTV System (Facilitates traffic surveillance inside tunnel tubes and approach roads. Allows tunnel operators to observe scene of incidents and coordinate rescue and recovery actions.)	Colour system will be installed. It will integrate seamlessly with the traffic management computer system. The coverage of the system will be reviewed to meet the latest operational needs. The cameras in the tunnel approach roads will have pan, tilt and zoom capabilities.	Stand-alone black/white system. The picture quality is degrading despite enhanced maintenance.
2) Automatic Incident Detection System (AIDS) (Monitors the statistical traffic parameters collected from detection stations to determine whether an incident has happened.)	AIDS will be installed to enhance road safety and improve operational efficiency.	No such provision.
3) Over-height Vehicle Detection System (Installs at approach roads to detect vehicles that exceed the permitted height prior to their entering the tunnel.)	Reliable detectors of latest technology will be installed.	Aged system with reducing reliability.

(iii) Control Centre Facilities

Item	New System	Existing System
1) Traffic Management Computer (Controls and monitors the various traffic control and surveillance facilities, alerts tunnel operators by alarms, implement traffic plans and provides the human-machine interface. It is the core component of the TCSS.)	Traffic management computer will be provided to improve the traffic control and surveillance capability for efficient and error-free operation.	No such provision.
2) Control Console (Houses all control panels and computer terminals of the system to facilitate the operation of the control and surveillance facilities.)	All the control panels and computer terminals would be housed on a single console to facilitate operation.	Composed of control panels of different sub-systems installed at different periods.
3) Wall Map (Gives the tunnel operators an overview of the traffic conditions and operating status of the tunnel. The CCTV monitors and large display units are assembled on a roadmap background for showing the real-time control status of the tunnel.)	Sufficient colour CCTV monitors and large display units would be installed to show the real-time aspect and status of the traffic signs and signals on a roadmap background.	Only black/white CCTV monitors are provided. Current space constraint limits the number of monitors, and hence affects the efficiency of surveillance.

8. The new TCSS will be fully computerised using state-of-art technology and designed as a single integrated system. For example, under the new system when an over-height alarm is raised, the nearby CCTV camera will automatically pan to the incident site. The efficiency in incident handling and the mobilisation of recovery vehicles will thus be enhanced.

9. There is no computerised traffic plan system in the existing TCSS of the tunnel. Tunnel operators manually switch on and off different button arrays to change the traffic signs and signals and other field equipment for implementing different tunnel traffic plans. With the new TCSS a number of pre-programmed traffic plans will be devised and stored in a new traffic management computer. When there is a need to change the tunnel traffic plan, operators can select and execute the appropriate traffic plan from the computer. The computer controls the change of traffic signs, signals and other field equipment as well as checks against any conflicts in the signs and signals. This greatly increases the efficiency and reliability in traffic control and safety of the tunnel.

10. The detailed computerised traffic plans will be designed by the traffic sub-consultants of this project. In particular, they will review the tidal flow arrangements of the tunnel to devise the most efficient computerised tidal flow plans. A major consideration of the tidal flow plans is automation. The sub-consultants will study the latest technology and practical experiences in overseas countries with a view to developing traffic plans that will minimise the lead-time for future implementation of tidal flow.

11. Full Variable Messages Signs (FVMS) are large and bright signs capable of displaying real-time bilingual messages. They will be erected on gantries at strategic locations of the main approach roads to provide traffic information of the tunnel to motorists so that motorists could take alternative routes in case of congestion or tunnel closure. At secondary approach roads where it is not practical to have FVMS, there will be Limited Variable Message Signs (LVMS) to display critical traffic information (e.g. Tunnel Closed/Congested) to tunnel users. The tentative locations of the FVMS and LVMS are shown at Annex I. The tunnel tubes and their approach roads will also be equipped with signs and signals which are brighter, more reliable and require less maintenance.

12. At present there is no AIDS in Lion Rock Tunnel. Transport Department will take this opportunity to install an AIDS in Lion Rock Tunnel to help operators detect traffic incidents and prevent secondary accidents. The vehicle detectors will be of the overhead type to allow maintenance to be carried out without affecting normal traffic.

13. New high-resolution colour CCTV will be adopted, rendering more effective surveillance and quicker identification of traffic incidents.

(b) Maintenance Cost

14. The annual maintenance cost of the existing TCSS in Lion Rock Tunnel is about $0.3M while that of the new system is estimated to be about $0.8M. There is an increase in the maintenance cost as the scale of facilities and the functionalities of equipment will be much enhanced to cope with the latest traffic control and surveillance requirements (the number of equipment under the new system will be three times that of the existing one). The maintenance costs of the old system will, moreover, become substantially higher when more and more component parts become obsolete and have to be specially ordered from the suppliers.

FINANCIAL IMPLICATIONS

15. We estimate that the capital cost of the project to be $119.4 million, made up as follows :-

			$ million
(a)	Electronic, electrical and mechanical equipment installation		85.0
	(i) computer hardware and software	12.0	
	(ii) data communication system	5.3	
	(iii) colour closed circuit television system	10.5	
	(iv) automatic incident detection system	5.7	
	(v) signs, signals and other field equipment	30.0	
	(vi) uninterruptible power supply	1.0	
	(vii) cables, accessories and spares	14.2	
	(viii) testing, commissioning, training and documentation	5.5	
	(ix) dismantlement and disposal of replaced equipment	0.8	
(b)	Related installation and works		14.0
	(i) cable ducts	1.7	
	(ii) mountings for gantry signs	1.8	
	(iii) mountings for roadside signs and signal	1.5	

(iv)	civil, builder and building services works and contract preliminaries	9.0	
(c)	Project management charges by EMSD		10.5
(d)	Contingency [10% of (a) to (b)]		9.9
		Total	119.4

16. As regards paragraph 15(a), the cost of $85 million is for the dismantling and removal of the existing TCSS equipment, the supply, installation, testing and commissioning of a new system comprising computer hardware and software, data communication network, colour closed circuit television sub-system, automatic incident detection devices, various traffic signs, signals and field equipment (e.g. over-height detectors, variable message signs, traffic lights, lane signals and remote control signs), as well as the associated cabling work.

17. As regards paragraph 15(b), the cost of $14 million is for the related civil, builder and building services works such as cable ducting, erecting gantries and mountings for signs and signals, building equipment room, engagement of civil and traffic engineering consultants, and contract preliminaries.

18. As regards paragraph 15(c), the cost of $10.5 million is for paying the EMSD engineering consultancy services. EMSD will undertake the whole project which includes feasibility study, definition of requirements, preparation of project programme and estimates, design, tendering, site inspection, installation supervision, testing and commissioning, as well as monitoring defect rectification during the defect liability period.

19. Subject to approval, we will phase the expenditure as follows :-

Year	$ million
2001 – 2002	2.1
2002 – 2003	11.7
2003 – 2004	22.1
2004 – 2005	39.8
2005 – 2006	43.7
Total	119.4

20. There will be no additional recurrent expenditure. The operation and maintenance costs of the system will be borne by the tunnel management contractor.

IMPLEMENTATION PROGRMME

21. We plan to start the project in the middle of this year, which will take about 50 months to complete. A work programme is shown in Annex II. The first 28 months are for preparatory works inclusive of detailed investigation, system design, specification preparation and tendering. The latter 22 months are for system installation, testing and commissioning. The works contract is anticipated to commence in November 2003 and complete by September 2005.

22. We will plan and implement the project with minimal traffic impact to the tunnel as far as possible. There will be proper temporary traffic management measures to facilitate equipment installation. For equipment installation and testing within the tunnel tubes, works will only be carried out at night in the closed tube when the tunnel is operating under the one-tube-two-way mode for normal maintenance.

CONSULTATION

23. The Administration consulted the Sha Tin District Council Traffic and Transport Committee at its meeting on 8 May 2001. Members strongly supported the proposal and had the following comments:

a. the project duration should be shortened where possible;
b. the locations of the variable message signs should be carefully planned to optimise the informative function of these signs; and
c. disruption to the tunnel traffic should be minimised during project implementation.

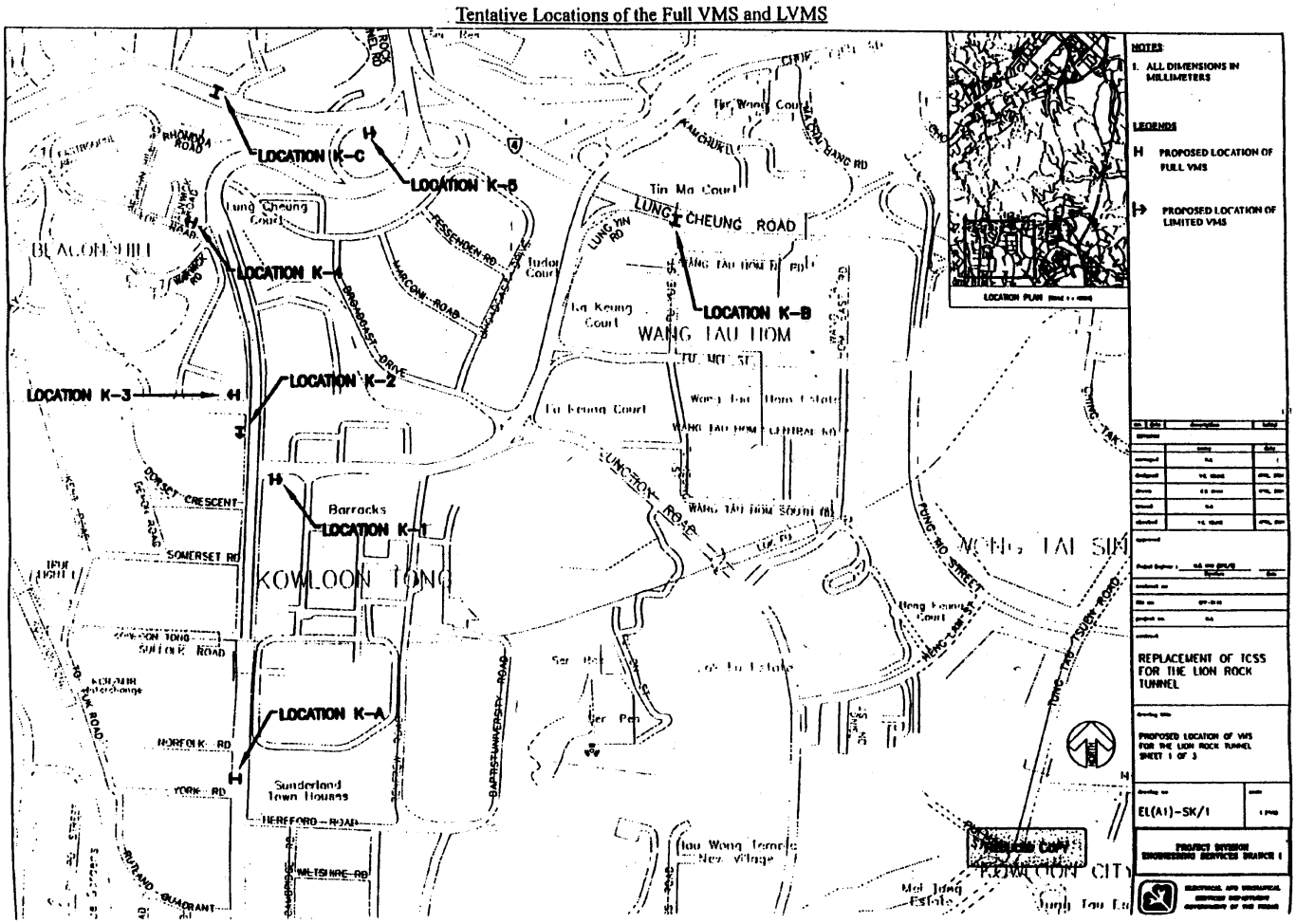
The Administration would take into account these comments in the planning and implementation of the project.

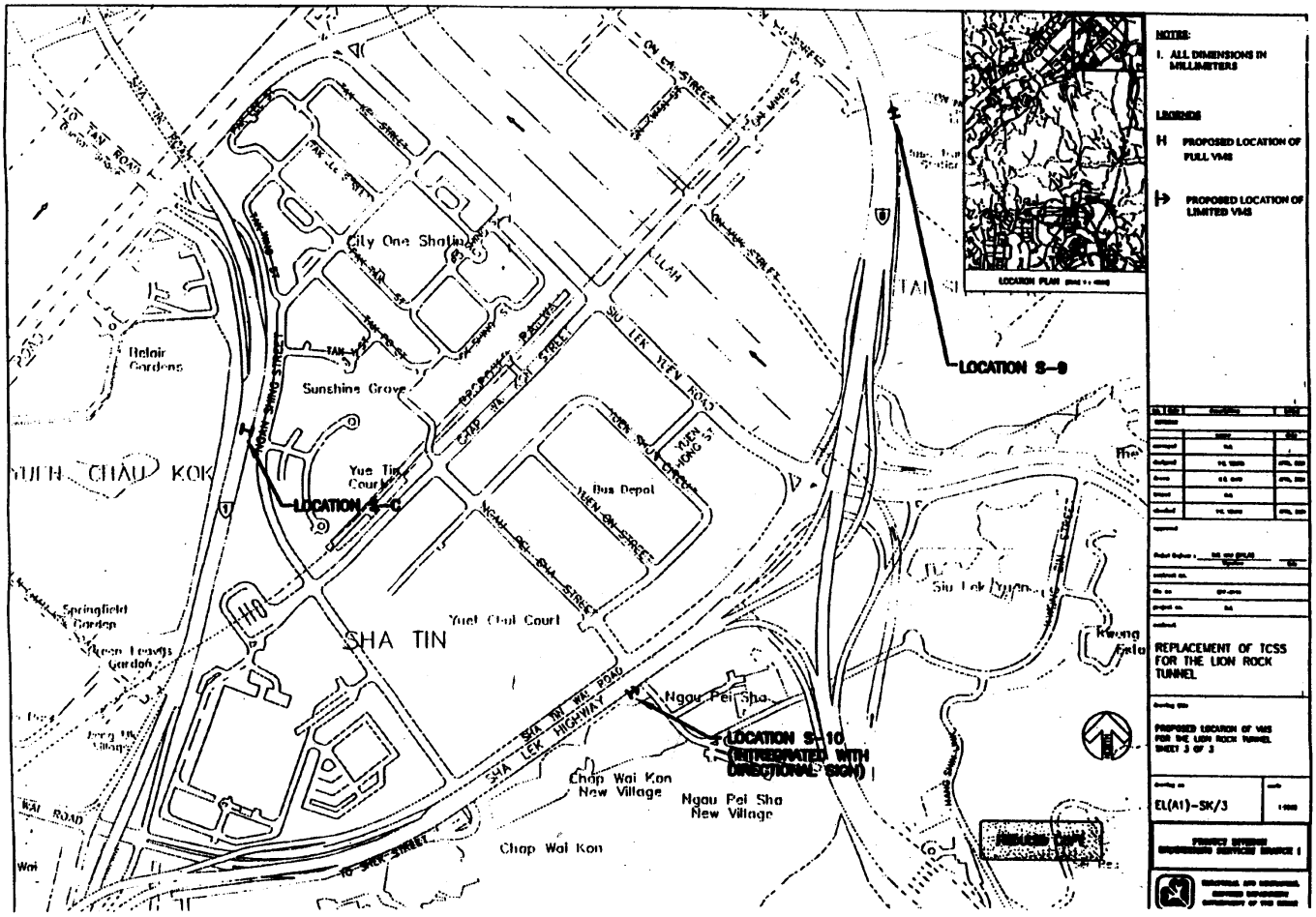
THE WAY FORWARD

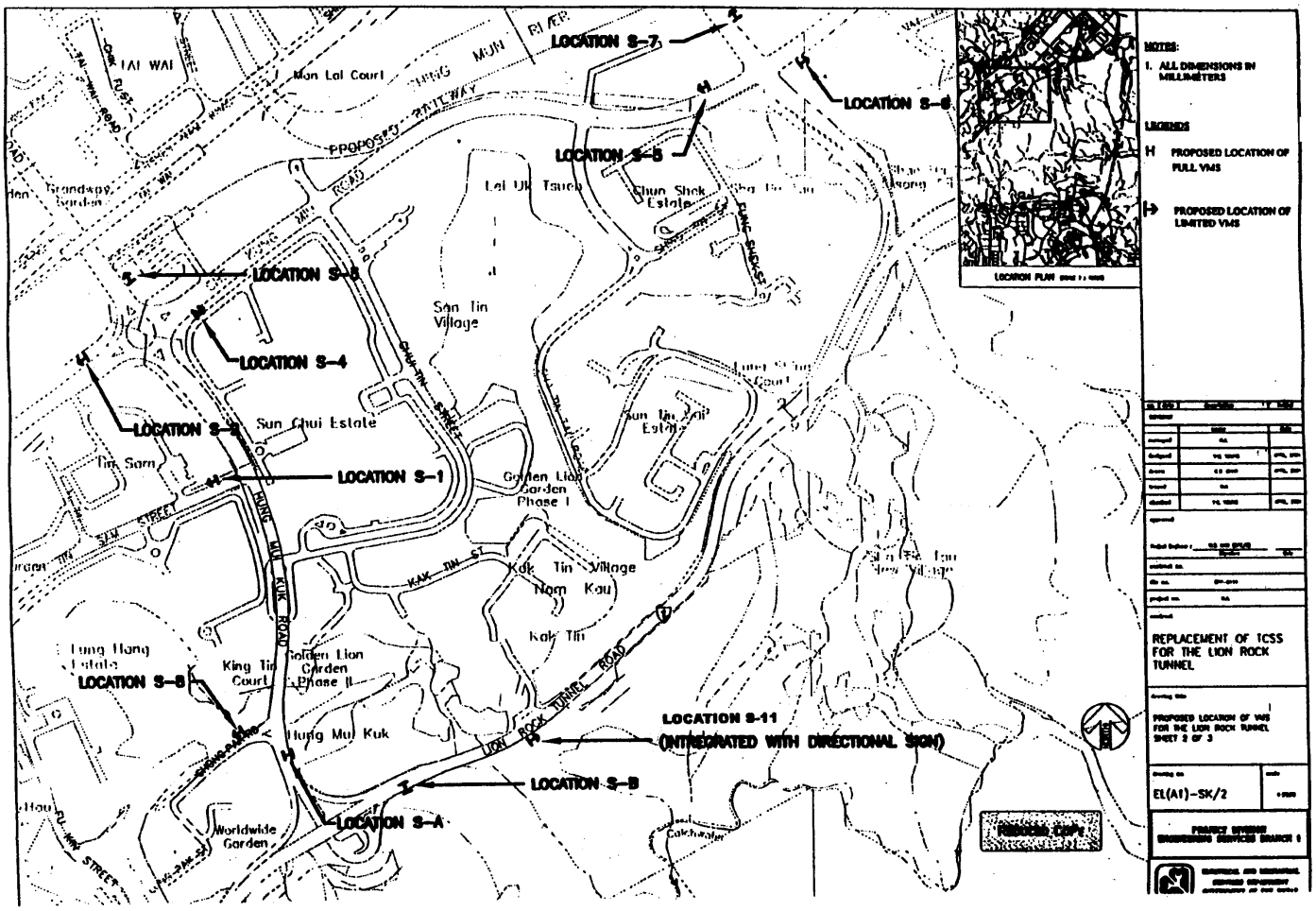
24. We will seek the approval of the Finance Committee on 8 June 2001 on funding for the implementation of this project.

Transport Bureau
May 2001

Tentative Locations of the Full VMS and LVMS




City One Shatin
Belair Gardens
Sunshine Grove
SUI CHAU KOK
Yue Tin Court
LOCATION S-C
Bus Depot
Yuet Chui Court
SHA TIN
Springfield Garden
Ngau Pei Sha
LOCATION S-10
(INTEGRATED WITH DIRECTIONAL SIGN)
SHA LEK HIGHWAY
Chap Wai Kon New Village
Ngau Pei Sha New Village
Chap Wai Kon
LOCATION S-9
NOTES:
1. ALL DIMENSIONS IN MILLIMETERS
LEGENDS
PROPOSED LOCATION OF FULL VMS
PROPOSED LOCATION OF LIMITED VMS
REPLACEMENT OF TCSS FOR THE LION ROCK TUNNEL
PROPOSED LOCATION OF VMS FOR THE LION ROCK TUNNEL SHEET 3 OF 3
EL(A1)-SK/3


LOCATION S-7
LOCATION S-6
LOCATION S-5
LOCATION S-8
LOCATION S-4
LOCATION S-3
LOCATION S-1
LOCATION S-2
LOCATION S-11
(INTEGRATED WITH DIRECTIONAL SIGN)
LOCATION S-9
LOCATION S-A
Mon Lai Court
Lai Uk Tsuen
Shun Shek Estate
San Tin Village
Sun Chui Estate
Tin Sam
Golden Lion Garden Phase I
Kuk Tin Village
Nam Kau
Kuk Tin
Hung Hang Estate
King Tin Court
Golden Lion Garden Phase II
Hung Mui Kuk
Worldwide Garden
LION ROCK TUNNEL ROAD
PROPOSED RAILWAY
NOTES:
1. ALL DIMENSIONS IN MILLIMETERS
LEGENDS
PROPOSED LOCATION OF FULL VMS
PROPOSED LOCATION OF LIMITED VMS
REPLACEMENT OF TCSS FOR THE LION ROCK TUNNEL
PROPOSED LOCATION OF VMS FOR THE LION ROCK TUNNEL SHEET 2 OF 3
EL(AI)-SK/2

Annex II

Replacement of the Traffic Control and Surveillance System in Lion Rock Tunnel

	Task Name	Duration
0	Whole Project	50 months
1	Advance Building and Structural Works	35 months
2	Traffic & Civil Engineering Study	16 months
3	System Engineering Study	11 months
4	Prequalification	5 months
5	Detailed Design	11 months
6	Tendering	7 months
7	Installation, testing & Commissioning	22 months
8	Defects Liability Period	13 months