

ITEM FOR FINANCE COMMITTEE

CAPITAL WORKS RESERVE FUND HEAD 708 - CAPITAL SUBVENTIONS AND MAJOR SYSTEMS AND EQUIPMENT

Transport Department

New Subhead "Replacement of traffic control and surveillance system in Lion Rock Tunnel"

Members are invited to approve a new commitment of \$119.4 million for replacing the traffic control and surveillance system in Lion Rock Tunnel.

PROBLEM

The existing traffic control and surveillance system (TCSS) in Lion Rock Tunnel is reaching the end of its serviceable life. We need to maintain the reliability of the system to ensure safe and efficient tunnel operation and to avoid traffic congestion.

PROPOSAL

2. We propose to replace the existing TCSS in Lion Rock Tunnel at an estimated cost of \$119.4 million.

JUSTIFICATION

3. The existing TCSS in Lion Rock Tunnel was installed when the first tube opened in 1967 and extended to cover the second tube when the latter opened 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, the Director of Electrical and Mechanical Services (DEMS) 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.

4. First designed some 30 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 computerised traffic plan system as standard components.

5. Transport Department (TD) proposes 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.

Major Features of the New System

6. 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. Details of the proposed TCSS equipment and their features as compared with the features of the existing equipment are shown at Enclosure 1.

Encl. 1

7. There is no computerised traffic plan system in the existing TCSS. 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.

8. 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 places with a view to developing traffic plans that will minimise the lead-time for future implementation of tidal flow.

9. Full Variable Messages Signs (FVMS) will be erected on gantries at strategic locations of the main approach roads to provide traffic information of the tunnel to motorists so that they could take alternative routes in case of congestion or tunnel closure. FVMS are large and bright signs capable of displaying real-time bilingual messages. It is also possible for these signs to display traffic information from the forthcoming intelligent transport systems such as the Transport Information System or the Journey Time Indication System. 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 Enclosure 2. The tunnel tubes and their approach roads will also be equipped with signs and signals which are brighter, more reliable and require less maintenance.

10. At present there is no Automatic Incident Detection System (AIDS) installed in Lion Rock Tunnel. We 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.

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

Implementation programme

12. We plan to start the project in mid 2001 and complete it in about 50 months. A work programme is at Enclosure 3. The first 28 months are for preparatory works, including detailed investigation, system design, specification preparation and tendering. The latter 22 months are for system installation, testing and commissioning. The works contract is expected to commence in November 2003 for completion by September 2005.

13. 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 inside 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.

/FINANCIAL

FINANCIAL IMPLICATIONS

14. We estimate 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 Electrical and Mechanical Services Trading Fund (EMSTF) | 10.5 |
| (d) Contingency [10% of (a) to (b)] | 9.9 |
| Total | <u>119.4</u> |

15. As regards paragraph 14(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 CCTV 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.

16. As regards paragraph 14(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.

Encl. 4 17. As regards paragraph 14(c), the cost of \$10.5 million is for paying the EMSTF engineering consultancy services. EMSTF 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. A computation of the charges is at Enclosure 4.

18. Subject to approval, we will phase the expenditure as follows –

| Year | \$ million |
|--------------|--------------|
| 2001 – 02 | 2.1 |
| 2002 – 03 | 11.7 |
| 2003 – 04 | 22.1 |
| 2004 – 05 | 39.8 |
| 2005 – 06 | 43.7 |
| Total | <u>119.4</u> |

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

20. We shall award the contract on a lump-sum fixed price basis. We consider that the fee charged by EMSTF is reasonable when compared to fees charged by consultancy firms in the private sector for projects of similar nature.

21. The above proposal will have no impact on toll charges of the tunnel.

BACKGROUND INFORMATION

22. 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 TD is responsible for the timely replacement of major systems in the tunnel in consultation with the Electrical and Mechanical Services Department.

23. 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.

24. We consulted the Legislative Council Panel on Transport on 30 March 2001 on this proposal. Members in general supported the proposal but requested the Administration to provide further details of the proposal and to consult the Traffic and Transport Committee of the Sha Tin District Council.

25. We consulted the Traffic and Transport Committee of the Sha Tin District Council 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 kept to the minimum during project implementation.

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

26. We issued a paper to Panel Members on 23 May 2001 with supplementary information on the Lion Rock Tunnel TCSS proposal and on the outcome of the consultation with the Traffic and Transport Committee of the Sha Tin District Council. Members did not raise any objection to the proposal at the Panel meeting on 25 May 2001.

**Major features of the proposed traffic control and surveillance system
in Lion Rock Tunnel**

(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 which can display a larger number of pre-set messages. | 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 (Installed 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 (Installed 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 (Installed 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. |

| Item | New System | Existing System |
|---|--|--------------------|
| (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. |

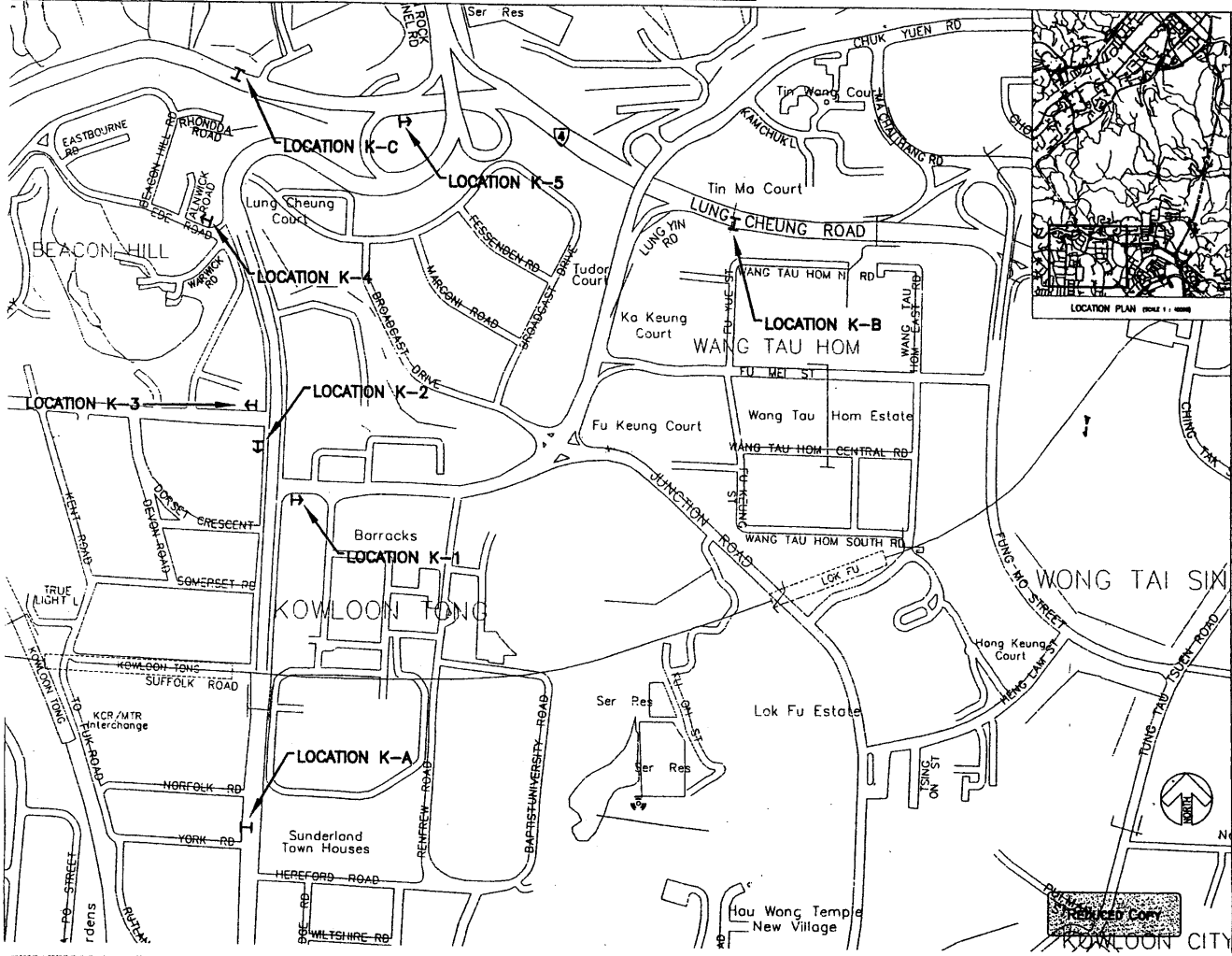
(ii) Traffic Surveillance Facilities

| 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 co-ordinate 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. | 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 (Installed 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. |

Tentative Locations of the Full VMS and LVMS



NOTES:
I. ALL DIMENSIONS IN MILLIMETERS

LEGENDS
H PROPOSED LOCATION OF FULL VMS
I PROPOSED LOCATION OF LIMITED VMS

| No. | Description | Date |
|-----|-------------|----------|
| 1 | Issue | 04/01/01 |
| 2 | Revised | 04/01/01 |
| 3 | Revised | 04/01/01 |
| 4 | Revised | 04/01/01 |
| 5 | Revised | 04/01/01 |

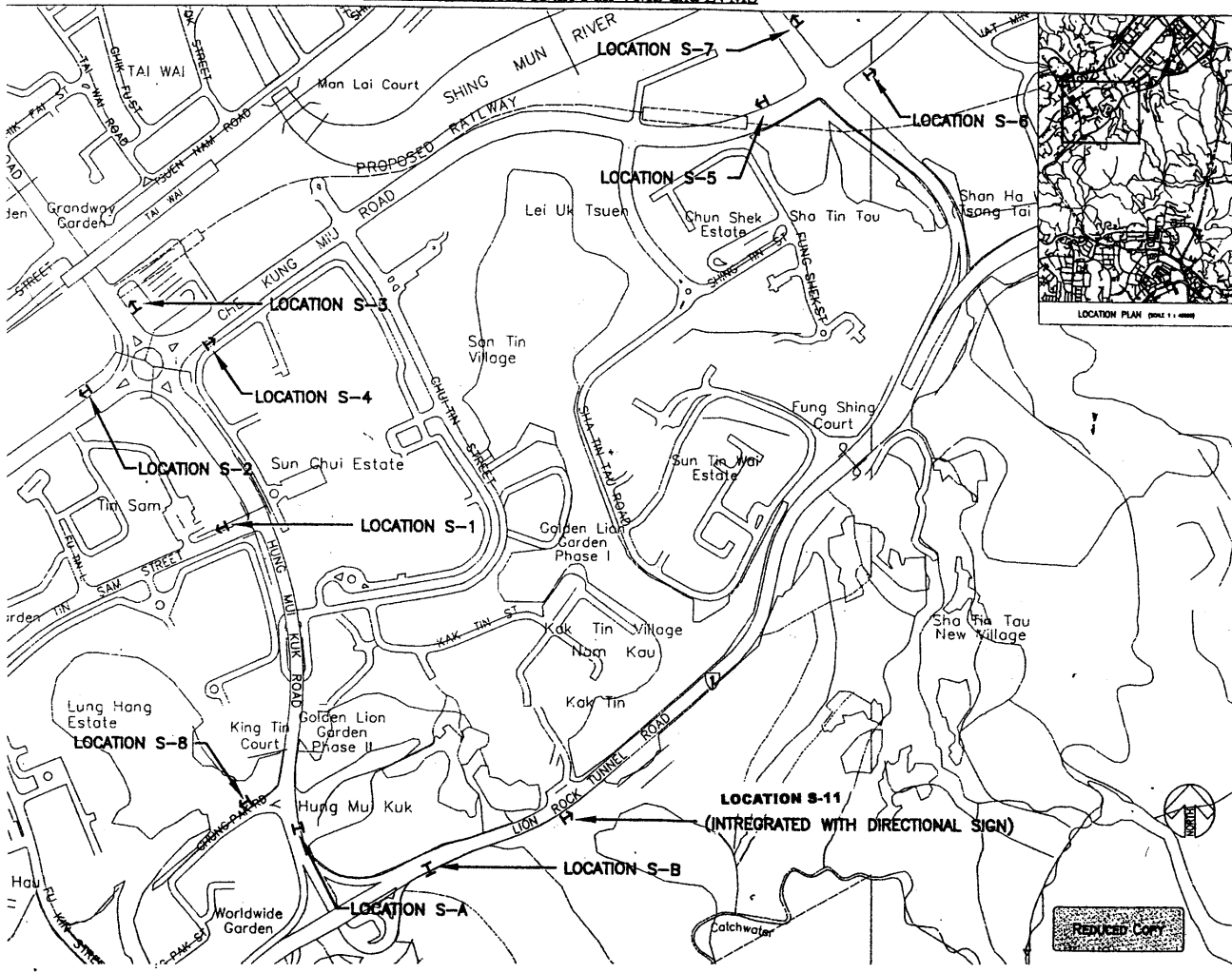
REPLACEMENT OF TCSS FOR THE LION ROCK TUNNEL

PROPOSED LOCATION OF VMS FOR THE LION ROCK TUNNEL SHEET 1 OF 3

Drawing No. EL(A1)-SK/1

PROJECT DIVISION
ENGINEERING SERVICES BRANCH

Tentative Locations of the Full VMS and LVMS



NOTES:
1. ALL DIMENSIONS IN MILLIMETERS

LEGENDS
H PROPOSED LOCATION OF FULL VMS
L PROPOSED LOCATION OF LIMITED VMS

| NO. | DATE | DESCRIPTION | INITIALS |
|-----|------|-------------|----------|
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Project Engineer: S.S. HO (SPL/2)
 Checked by: S.S. HO
 Date: 09-01-15
 Project No.: S.A.
 Drawing No.: S.A.

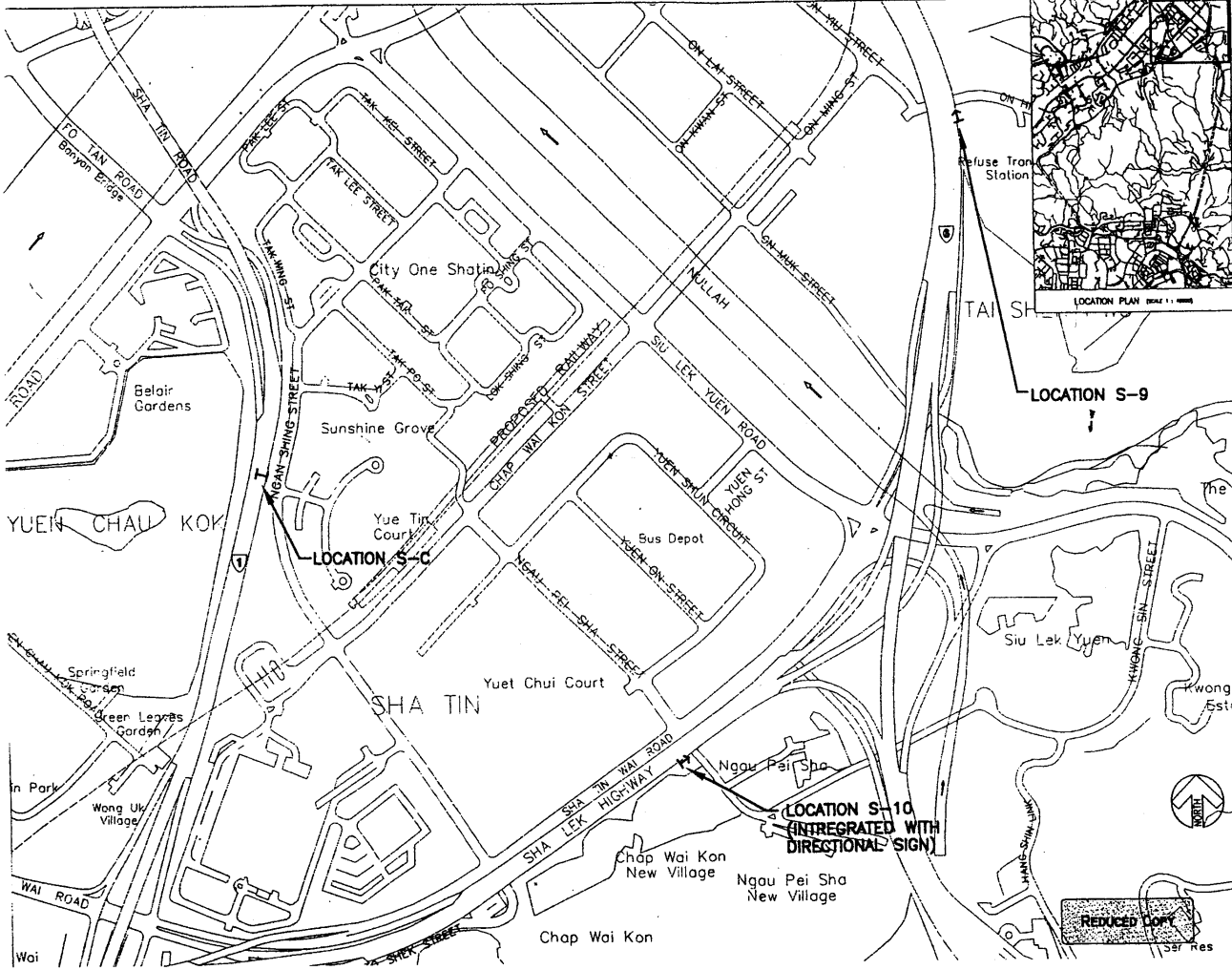
REPLACEMENT OF TCSS FOR THE LION ROCK TUNNEL

Drawing Title:
 PROPOSED LOCATION OF VMS FOR THE LION ROCK TUNNEL SHEET 2 OF 3

Drawing No.: EL(A1)-SK/2
 Scale: 1:2500

PROJECT DIVISION
 ENGINEERING SERVICES BRANCH 1

Tentative Locations of the Full VMS and LYMS



NOTES
 1. ALL DIMENSIONS IN MILLIMETERS

LEGENDS
 H PROPOSED LOCATION OF FULL VMS
 ↳ PROPOSED LOCATION OF LIMITED VMS

LOCATION PLAN (SCALE 1:10000)

| No. | Date | Amendment | By |
|-----|------|-----------|----|
| 1 | | | |
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Project Engineer: S.S. HO (SPE/2)
 Checked by: S.S. HO (SPE/2)
 Date: 09-11-11
 Project No.: SA

REPLACEMENT OF TCSS FOR THE LION ROCK TUNNEL

Drawing title: PROPOSED LOCATION OF VMS FOR THE LION ROCK TUNNEL SHEET 3 OF 3

Drawing No.: EL(A1)-SK/3
 Scale: 1:2500

**PROJECT DIVISION
 ENGINEERING SERVICES BRANCH 1**

**Project Management Charges under
Electrical and Mechanical Services Trading Fund (EMSTF)
for Replacement of Traffic Control and Surveillance System
in Lion Rock Tunnel**

| | Percentage of charges on project value | Project estimate for electronic works \$ million | Charges \$ million |
|------------------------|---|---|-------------------------------|
| First \$0.4 million | 25% | 0.4 | 0.1 |
| Next \$1.6 million | 20% | 1.6 | 0.3 |
| Next \$13 million | 16.5% | 13.0 | 2.1 |
| Remainder \$84 million | 11% | <u>84.0</u> | <u>9.2</u> |
| | Total | <u>99.0</u> | <u>11.7</u> |

In the light of the Enhanced Productivity Programme, the EMSTF has rationalised its costs and offered about 10% reduction on the above computed charges. The charges by EMSTF after the reduction are to be \$10.5 million.