

ITEM FOR FINANCE COMMITTEE

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

Transport Department

New Subhead “Replacement of high voltage switchboards, transformers and low voltage system of the tunnel power supply system in Lion Rock Tunnel”

New Subhead “Replacement of field equipment of toll collection system in Cross-Harbour Tunnel”

New Subhead “Replacement of ventilation control panels, exhaust fans, motors and flexible connectors in Aberdeen Tunnel”

Members are invited to approve new commitments of –

- (a) \$26.6 million for the replacement of high voltage switchboards, transformers and low voltage system of the tunnel power supply system in Lion Rock Tunnel;
- (b) \$19.8 million for the replacement of the field equipment of toll collection system in Cross-Harbour Tunnel; and
- (c) \$13.7 million for the replacement of ventilation control panels, exhaust fans, motors and flexible connectors in Aberdeen Tunnel.

PROBLEM

The following systems and equipment in various tunnels are reaching the end of their serviceable life –

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- (a) the high voltage switchboards, transformers and low voltage system of the tunnel power supply system in Lion Rock Tunnel;
- (b) the field equipment of toll collection system in Cross-Harbour Tunnel; and
- (c) the ventilation control panels, exhaust fans, motors and flexible connectors in Aberdeen Tunnel.

We need to maintain the reliability of these systems and equipment to ensure safe and efficient tunnel operations and to avoid traffic congestion induced by failure of systems and/or equipment.

PROPOSAL

2. We propose to replace the following systems and equipment at the stated estimated costs –

- (a) the high voltage switchboards, transformers and low voltage system of the tunnel power supply system in Lion Rock Tunnel at \$26.6 million;
- (b) the field equipment of toll collection system in Cross-Harbour Tunnel at \$19.8 million; and
- (c) the ventilation control panels, exhaust fans, motors and flexible connectors in Aberdeen Tunnel at \$13.7 million.

JUSTIFICATION

3. The systems and equipment of the tunnels have been in use for many years since the tunnels were built. While they are subject to regular maintenance or enhancement and are rendering smooth tunnel operations, many of them are reaching the end of their serviceable life and beyond economical repair. Some spare parts have even become obsolete due to technological advancement over the years. Hence, apart from regular maintenance, the Government also conducts periodic reviews on the need for replacement of the systems. Given that replacement takes time, it is necessary to plan ahead and start the replacement programmes in time so as to maintain a reliable service.

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(a) Replacement of high voltage switchboards, transformers and low voltage system of the tunnel power supply system in Lion Rock Tunnel

4. The existing high voltage switchboards, transformers and low voltage system have been in service for over 22 years. The Director of Electrical and Mechanical Services (DEMS) advises that the equipment and system have reached the end of their serviceable life and are beyond economical repair. It is very difficult to find the obsolete spare parts in the market and repairing the components piecemeal is very expensive. If these electrical components are not replaced, even with intensive maintenance, the performance of the whole electrical supply system will still be very unstable. As the electrical supply system is the core component of all other electrical and electronic systems in the tunnel, it is unacceptable to allow an unreliable electrical system to persist.

5. According to DEMS, delay in replacement could result in total failure of the electricity supply to the tunnel. This would paralyze the whole tunnel operation, resulting in closure of the tunnel and consequential serious congestion in the adjacent areas, especially the New Territories East. Given so and the long lead time required for tendering, delivery, installation and commissioning works, we consider that early replacement of the equipment is necessary.

6. Furthermore, we propose to take the opportunity to upgrade the overall security and stability of the power supply to the tunnel. We propose a new replacement system comprising high and low voltage switchboards, transformers and distribution boards. Maintenance-free vacuum circuit breakers for high voltage switchboard will be used to replace the existing oil circuit breakers, hence reducing the manpower required in maintaining the high voltage switchboard.

7. Subject to funding approval, we expect to start the replacement project in May 2001 for completion in March 2005. To minimise impact to traffic during the period, we will carry out works at night time when the tunnel is subject to one-tube-two-way operation for maintenance.

(b) Replacement of field equipment of toll collection system in Cross-Harbour Tunnel

8. The existing field equipment of the toll collection system in Cross-Harbour Tunnel has been operating for nearly 13 years. DEMS' assessment is that most components of the equipment are reaching the end of their serviceable life and are beyond economical repair. It has also become increasingly difficult

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to maintain the aged equipment and to secure spare parts from the market. The equipment is now showing signs of aging with reducing reliability. There have been breakdowns caused by aged components.

9. DEMS advises that delay in replacement could result in system failures. These would seriously affect the efficiency of toll collection and also traffic throughput of the tunnel, leading to congestion in the tunnel and adjacent areas. In view of these problems and the long lead time for tendering, delivery, installation and commissioning works, we consider it necessary to start a replacement project early.

10. We propose to replace the toll booth and lane equipment for 14 toll lanes and other ancillary toll collection field equipment. The new field equipment will adopt the most advanced technologies to minimize equipment downtime and hence unexpected toll lane closures. Detailed real-time equipment status and toll registration information will be indicated at the toll supervisor control console in the tunnel control room. The storage period of toll data in toll lane processors will also be extended in case the central toll computer system breaks down. Shift roster table and card reader will be implemented to enhance access control. The overall design will emphasize high data security, high availability, high operation efficiency and low maintenance.

11. Subject to funding approval, we plan to start the replacement project in May 2001 for completion in July 2003. To avoid disrupting the traffic flow through the tunnel during the replacement period, we will replace the equipment lane by lane and divert the traffic to other lanes if closure of one lane is required.

(c) Replacement of ventilation control panels, exhaust fans, motors and flexible connectors in Aberdeen Tunnel

12. The ventilation system in Aberdeen Tunnel has been in service for about 19 years. DEMS is of the view that the ventilation control panels have reached the end of their serviceable life and are beyond economical repair. With aging of the control panels which are the core component of the tunnel ventilation system, even with intensive maintenance, the ventilation system will still be unreliable. There is no further supply of spare parts from the existing manufacturer as the panel components have become obsolete. In the event of occurrence of major breakdowns, there would be great difficulties to reinstate the system. The safety of tunnel operation will be compromised if the obsolescent ventilation control panels are not replaced.

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13. DEMS recommends early replacement of the ventilation equipment. The ventilation system is a critical system of a tunnel, without which a tunnel could not be open to traffic. If the service of the tunnel has to be suspended due to the failure of the ventilation system, there would be serious traffic congestion on the external links of the Southern District as they do not have sufficient capacity to take up the displaced traffic from the tunnel. In view of these problems and the long lead time for tendering, delivery, installation and commissioning works, we consider it necessary to start a replacement project early.

14. The new control panels will be installed with programmable logic controller and control devices, which can provide more efficient and reliable control. The new ventilation fans, motors and flexible connectors can withstand the high temperature of smoke for a period of time to ensure that the system will remain operational under fire condition in accordance with the requirements of the Fire Services Department and the Transport Department. This will improve the overall operational efficiency of the tunnel.

15. Subject to funding approval, we will start the replacement project in May 2001 for completion in March 2004. To minimise impact to traffic during the works period, we will carry out works at night time when the tunnel is subject to one-tube-two-way operation for maintenance.

FINANCIAL IMPLICATIONS

(a) Replacement of high voltage switchboards, transformers and low voltage system of the tunnel power supply system in Lion Rock Tunnel

16. We estimate the capital cost of the project to be \$26.6 million, made up as follows –

	\$ million
(a) Replacement of high voltage switchboards, transformers and low voltage system	20.2
(i) four high voltage switchboards	10.0
(ii) four transformers	3.0
(iii) four low voltage switchboards	2.8
(iv) high voltage cables	2.0
(v) low voltage cables	0.8
(vi) cable tray and other mounting accessories	0.2
(vii) distribution boards	1.3
(viii) protection analysis on protection relays	0.1

/(b)

	\$ million
(b) Builder's works (for building of two new switch rooms)	2.2
(c) Electrical and Mechanical Services Trading Fund (EMSTF) project management charges	2.0
(d) Contingency (10% of (a) to (b))	<u>2.2</u>
Total	<u>26.6</u>

17. As regards paragraph 16(a), the cost of \$20.2 million is for the dismantling and removal of the existing high voltage switchboards, transformers and low voltage system, the supply, installation, testing and commissioning of a new replacement system comprising high and low voltage switchboards, transformers, distribution boards and the associated cabling works.

18. As regards paragraph 16(b), the cost of \$2.2 million is for the civil works on building of two new switch rooms for the high voltage switchboards of the power supply company. At present, the incomer switchboards of the power supply company (for supplying incoming electrical power to the Lion Rock Tunnel) and the high voltage switchboards of the tunnel are housed inside the same compartment in the switch room at each end of the tunnel. This arrangement is undesirable from safety point of view, and we take the opportunity to build two new switch rooms, one at each end of the tunnel, to separately house the high voltage switchboards of the power supply company.

19. As regards paragraph 16(c), the cost of \$2 million is for paying the EMSTF engineering consultancy services. EMSTF will undertake the whole project which involves 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 Encl. 1 Enclosure 1.

20. Subject to Members' approval, we will phase the expenditure as follows –

/Year

Year	\$ million
2001-2002	3.5
2002-2003	14.0
2003-2004	7.6
2004-2005	<u>1.5</u>
Total	<u>26.6</u>

(b) Replacement of field equipment of toll collection system in Cross-Harbour Tunnel

21. We estimate the capital cost of the project to be \$19.8 million, made up as follows –

	\$ million
(a) Replacement of the toll booth equipment for 14 toll lanes	5.4
(b) Replacement of the toll lane equipment for 14 toll lanes	7.5
(c) Replacement of other ancillary toll collection field equipment	2.8
(d) EMSTF project management charges	2.5
(e) Contingency (10% of (a) to (c))	<u>1.6</u>
Total	<u>19.8</u>

22. As regards paragraph 21(a), the cost of \$5.4 million is for the supply, installation, testing and commissioning of the toll booth equipment for 14 toll lanes, including the toll lane processors for control and monitoring of all field equipment, the toll collector consoles, the card readers for access control, the intercoms and the interfacing devices with Autotoll System at the autotoll lanes.

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23. As regards paragraph 21(b), the cost of \$7.5 million is for the supply, installation, testing and commissioning of the toll lane equipment for 14 toll lanes, including the toll lane status signals, the manual barriers, the classification signs, the vehicle detectors and axle counters, the toll paid signs, traffic lights as well as the security switches and beacons.

24. As regards paragraph 21(c), the cost of \$2.8 million is for the supply, installation, testing and commissioning of other ancillary field equipment of the toll collection system. This includes the toll supervisor console, the communication network between the toll lane processors and the toll central computer, and the uninterruptible power supply for the toll collection system.

25. As regards paragraph 21(d), the cost of \$2.5 million is for paying the engineering consultancy services provided by EMSTF. 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 2.

Encl. 2

26. Subject to Members' approval, we will phase the expenditure as follows –

Year	\$ million
2001-2002	1.6
2002-2003	11.2
2003-2004	7.0
Total	19.8

(c) Replacement of ventilation control panels, exhaust fans, motors and flexible connectors in Aberdeen Tunnel

27. We estimate the capital cost of the project to be \$13.7 million, made up as follows –

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	\$ million
(a) Replacement of four ventilation fans (including motors)	6.5
(b) Replacement of flexible connectors for the ventilation fans	0.9
(c) Replacement of four control panels for the ventilation system and the associated work	2.4
(d) Builder's works and associated civil works	1.5
(e) EMSTF project management charges	1.3
(f) Contingency (10% of (a) to (d))	1.1
Total	13.7

28. As regards paragraph 27(a) to (c), the cost of \$9.8 million is for the supply, installation, testing and commissioning of four new ventilation fans (including motors and flexible connectors) and four new control panels for the ventilation system as well as the associated electrical works such as wiring.

29. As regards paragraph 27(d), the cost of \$1.5 million covers the builder's works and the associated civil works required for this replacement project, which include the demolition and rebuilding of the concrete fence for the fan room outlets, and the modification of the structural base for accommodating the equipment.

30. As regards paragraph 27(e), the cost of \$1.3 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 3.

Encl. 3

31. Subject to Members' approval, we will phase the expenditure as follows –

/Year

Year	\$ million
2001-2002	4.0
2002-2003	7.7
2003-2004	<u>2.0</u>
Total	<u>13.7</u>

32. There will be no additional recurrent expenditure for the above three systems and equipment in Lion Rock, Cross-Harbour and Aberdeen Tunnels as the operation and maintenance costs of the replaced systems and equipment will be met by the contractors managing the tunnels.

33. We shall award the contracts of the above three systems and equipment on a lump-sum fixed price basis. We consider that the fees charged by EMSTF are reasonable when compared to fees charged by consultancy firms in the private sector for projects of similar nature.

34. The above proposals will have no impact on toll charges of Lion Rock, Cross-Harbour and Aberdeen Tunnels.

BACKGROUND INFORMATION

Replacement of high voltage switchboards, transformers and low voltage system of the tunnel power supply system in Lion Rock Tunnel

35. Installed for over 22 years, the high voltage switchboards, transformers and low voltage system are the core components of the tunnel power supply system. Power supply from the power company is transmitted through these equipment to all tunnel equipment such as tunnel luminaries, ventilation system, toll system and other equipment required for tunnel operation. The equipment performs the switching and stepping down of voltage of the electricity supply of the tunnel and protects electrical and electronic equipment of the tunnel from faults of the power supply system. Electricity for the tunnel is supplied by the power company via the high voltage switchboards to the transformers and subsequently the low voltage switchboards, to which individual electrical and electronic equipment of the tunnel is finally connected.

/Replacement

Replacement of field equipment of toll collection system in Cross-Harbour Tunnel

36. Installed in 1987, the field equipment of the toll collection system includes traffic control equipment, vehicle detection equipment, vehicle classification equipment and toll registration equipment. All these equipment are under the control of the toll lane processors. The toll registration details are fed by the toll lane processors to the toll central computer system for real-time monitoring and generation of toll collection reports. The toll central computer system was replaced in 1999 for Year 2000 compliance.

Replacement of ventilation control panels, exhaust fans, motors and flexible connectors in Aberdeen Tunnel

37. Installed in 1982, the ventilation control panels, exhaust fans, motors and flexible connectors in Aberdeen Tunnel are for maintaining air freshness inside the tunnel tubes during normal operation of the tunnel. In case of fire, they are used for smoke extraction. Upon detecting a fire, the tunnel controller will turn on the fire mode of the ventilation system through the ventilation control panels. The exhaust fans will start to direct smoke away from the affected tunnel tube, thereby creating a smoke free zone for facilitating evacuation and rescue. The system should be able to operate under sustained high temperature.

38. We consulted the Legislative Council Panel on Transport on 30 March 2001 on the three proposals. Members did not raise any objection but requested supplementary details. Accordingly we issued a paper to Panel Members with supplementary information on 17 April 2001.

**Project Management Charges under
Electrical and Mechanical Services Trading Fund (EMSTF)
for Replacement of High Voltage Switchboards,
Transformers and Low Voltage System of the
Tunnel Power Supply System in Lion Rock Tunnel**

% of charges on project value		Project estimate for electrical and mechanical works (\$ million)	Charges (\$ million)
First \$1 million	20%	1.0	0.2
Next \$4 million	15%	4.0	0.6
Next \$5 million	10%	5.0	0.5
Remainder \$10.2 million	8%	10.2	0.8
	Total	<u>20.2</u>	<u>2.1</u>

The estimated contract sum for calculation of EMSTF charges does not include the builder's work of \$2.2 million which is planned to be wholly undertaken by the Architectural Services Department. In the light of the Enhanced Productivity Programme, the EMSTF has rationalised its costs and offered about 5% reduction on the above computed charges. The charges by the trading fund after the reduction are to be \$2 million.

**Project Management Charges under
Electrical and Mechanical Services Trading Fund (EMSTF)
for Replacement of Field Equipment of Toll Collection System
in Cross-Harbour Tunnel**

% 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 \$0.7 million	11%	0.7	0.1
	Total	<hr style="width: 50%; margin: 0 auto;"/> 15.7 <hr style="width: 50%; margin: 0 auto;"/>	<hr style="width: 50%; margin: 0 auto;"/> 2.6 <hr style="width: 50%; margin: 0 auto;"/>

In the light of the Enhanced Productivity Programme, the EMSTF has rationalised its costs and offered about 5% reduction on the above computed charges. The charges by the trading fund after the reduction are to be \$2.5 million.

**Project Management Charges under
Electrical and Mechanical Services Trading Fund (EMSTF)
for Replacement of Ventilation Control Panels, Exhaust Fans, Motors and
Flexible Connectors in Aberdeen Tunnel**

% of charges on project value		Project estimate for electrical and mechanical works (\$ million)	Charges (\$ million)
First \$1 million	20%	1.0	0.2
Next \$4 million	15%	4.0	0.6
Next \$5 million	10%	5.0	0.5
Remainder \$1.3 million	8%	1.3	0.1
	Total	<u>11.3</u>	<u>1.4</u>

In the light of the Enhanced Productivity Programme, the EMSTF has rationalised its costs and offered about 5% reduction on the above computed charges. The charges by the trading fund after the reduction are to be \$1.3 million.