LEGISLATIVE COUNCIL PANEL ON TRANSPORT

Tuen Mun Road Traffic Incident – The Use of Vehicular Parapets and Proposed Way Forward

PURPOSE

This paper briefs Members on the design and use of bridge parapets in Hong Kong, the work of the Independent Expert Panel following the traffic incident at Tuen Mun Road on 10 July 2003 and the immediate improvement measures being implemented.

BACKGROUND

The Traffic Incident

2. The traffic incident happened on the westbound carriageway of Tuen Mun Road on 10 July 2003. A KMB double-deck bus collided with a container truck and smashed the bridge parapet, plunging 30m into the valley resulting in 21 deaths and 20 injuries. The Police is conducting a full investigation to establish the causes of the incident and the truck driver has been arrested for suspected Dangerous Driving Causing Death.

Tuen Mun Road

3. The first phase of Tuen Mun Road was completed and opened to two way traffic in 1978. In 1983 an additional carriageway was completed, enabling the segregation of the Kowloon-bound and Tuen Mun-bound traffic with 3-lanes in each direction. From 1994 to 1996 and 1998 to 2001, sections of the Kowloon-bound carriageway totaling 8.5 km were improved by adding climbing lanes and hard shoulders and by increasing lane widths to expressway standard. The section of the bridge where the accident happened was widened under the Route 3 Country Park Section Project to accommodate a slip road leading to Tai Lam Tunnel. The widening work was completed in 1998.

4. The Tuen Mun Road was designed in the 1970's. Minor improvement works have been carried out from time to time. However, due to topographical constraints, the lane widths and widths of hard shoulders of certain sections of the road have not yet been upgraded to the present day standards. To further improve Tuen Mun Road, the Government proposed in 2001 to widen the traffic lanes of the section from Tsuen Wan to Sam Shing Hui to expressway standard and to provide standard hard shoulders and emergency laybys at appropriate locations in between. Maintenance work would be made

easier and more efficient upon completion of these works. The Finance Committee has given approval for the funding of the preliminary design. The project is scheduled for commencement in 2005 for completion in 2011. The commencement work is scheduled to tie in with the completion of the Castle Peak Road improvement works in 2005 so as to minimise disruption to the Tuen Mun Road traffic.

BRIDGE PARAPETS

5. Bridge parapets are designed to contain vehicles during impact and to redirect them away in a controlled manner to minimise injuries to passengers of the vehicles and other road users.

6. Parapet structures have to be so designed to prevent vehicles from penetrating, overriding or underriding the parapets. To reduce risk of injuries to passengers and other road users, parapets used should avoid excessive damages to the errant vehicle, high velocity of rebound and high deceleration during impact. Controlled deflection of the parapet elements is therefore allowed to absorb the impact energy and to bring the vehicle to a safe standstill. While strong parapet elements, which are more rigid, may be more effective to withhold heavy vehicles, they are less capable of deflecting and absorbing the impact energy which would add to the seriousness of the impact by a light vehicle and may cause severe injuries to the passengers inside. To achieve maximum traffic safety, a balance has to be struck between rigidity and flexibility in designing the parapet structure, taking into account the traffic condition of the roads.

7. In Hong Kong, three groups of parapets are used for vehicular bridges, namely P1, P2 and P4. The P1 and P2 groups are generally used at bridges and viaducts (elevated road structure over land) along expressways and roads, whilst the P4 group is used at high risk areas, such as bridges or viaducts over railways. The standards used in Hong Kong are in line with international standards.

P1 Parapets

8. P1 parapets are mainly of two types, one with metal post and three metal rails (3 rails type) and the other with a concrete base with top rails (concrete type). They are designed to retain a 1.5 tonne vehicle travelling at 113 kph impacting at an incident angle of 20 degrees. P1 parapets are more flexible and will cause less damage and injuries to light vehicles during accidents.

9. The 3 rails type parapet is lighter in weight. It attracts less wind load, absorbs more energy of impact and hence rebounds vehicles back at a lower angle and lower speed. The risk of overturning the errant vehicle is therefore lower. The concrete type parapet can prevent debris falling over the bridge and is easier to maintain.

P2 Parapets

10. P2 parapets are similar to P1 parapets but the metal rails used are lighter. They are designed to retain a 1.5 tonne vehicle travelling at 80 kph impacting at an incident angle of 20 degrees. P2 parapets are only used at local roads where the speed limit is 50 kph. The lighter metal rails provided a greater degree of protection for light vehicles as they are more flexible and therefore will result in less damage to impacting vehicles and injuries to passengers.

P4 Parapets

11. P4 parapets are commonly designed with a 1.5m high concrete wall to retain a 24 tonne vehicle travelling at 50 kph impacting at an angle of 20 degrees. This kind of parapet is used for high risk areas such as vehicle bridges over railway lines and has the advantage of high level of containment for errant vehicles. It requires a much stronger design for the bridge decks and may pose sight line problems. As it is stiff and rigid, it will pose a higher risk to passengers in light vehicles and cause more damage on impact as the light vehicle will rebound at higher speeds and greater angles, causing a secondary impact especially on a busy highway.

12. The parapets of our big bridges such as the Tsing Ma Bridge and the Ting Kau Bridge are special design of P4 parapets. They are highly tensioned steel strands anchored on strong metal posts, hence can only be used at long, straight sections of a road.

The Independent Expert Panel

13. The Chief Executive has appointed an Independent Expert Panel (the Panel) to examine various safety aspects, including highway design and traffic management, and to make recommendations for enhancement having regard to the Tuen Mun Road traffic incident on 10 July 2003. It will submit a report to the Chief Executive in three to four months. Membership and the Terms of Reference of the Expert Group are at **Annex**.

14. The Panel report will be made public and we will consult Members on the recommendations.

Immediate Improvement Measures on Tuen Mun Road

15. To enhance the containment capacity of the parapet at locations of tall bridges such as the bridge over Ting Kau Village, we intend to install additional steel posts to further strengthen the existing parapets. Apart from stiffening the parapet with additional posts, we will examine the feasibility of installing an additional row of barrier so as to form a double layer protection.

16. Transport Department (TD) will implement further traffic management measures to enhance safety at Tuen Mun Road including more traffic signings and double white line marking at appropriate locations. In addition, arrangements have been made to broadcast more frequently messages on road safety and proper driving behaviour through television and radio channels. TD has also liaised with bus companies to exercise closer supervision on the driving manner of bus drivers and to enhance their training as necessary. For other professional drivers, TD would remind them of the importance of cautious and responsible driving behaviour through the regular fora TD maintains with the trade. The Police will also step up enforcement on speeding and contraventions such as overtaking and not keeping to the appropriate lanes.

Reconstruction and Improvement of Tuen Mun Road

17. As part of the Tuen Mun Road Improvement project, we will review the design of vehicular parapets having regard to the incident to determine if additional measures would better suit our local conditions thereat.

ADVICE SOUGHT

18. Members are requested to note the content of this paper.

Environment, Transport and Works Bureau
Government Secretariat
16 July 2003

Annex

Tuen Mun Road Traffic Incident Independent Expert Panel

Membership

Chairman : Dr Cheng Hon-kwan

Members : Mr Edmund Leung Kwong-ho
Dr Wong Sze-chun

Secretary : Mr C S Wai, Principal Assistant Secretary for the Environment, Transport and Works (Works)

Terms of Reference

Having regard to the circumstances of the traffic incident at Tuen Mun Road on 10 July 2003, to examine and make recommendations to the Chief Executive as to measures (including highway design and traffic management) to prevent similar catastrophes in the future.

* Note : Brief biographies of the Members of the Panel are at **Appendix**.

Appendix

Tuen Mun Road Traffic Incident
Independent Expert Panel

Chairman

Dr Cheng Hon-kwan, GBS, JP

Dr Cheng Hon-kwan is a civil structural engineer by profession with over 50 years of experience in the field. Dr Cheng was awarded the Gold Medal by the Institution of Structural Engineers in 2002 in recognition of his contribution and achievement in the structural engineering field. Dr Cheng is currently the Chairman of the Transport Advisory Committee and is fully conversant with road safety legislation and the local transport scene.

Members

Mr Edmund Leung Kwong-ho, JP

Mr Edmund Leung is a mechanical engineer by profession with over 35 years of experience. Mr Leung is the former President of the Hong Kong Institution of Engineers and the former Chairman of the Hong Kong Branch of the Institution of Mechanical Engineers. Mr Leung has recently retired from the chairmanship of a major transport consultancy firm.

Dr Wong Sze-chun

Dr Wong Sze-chun is an Associate Professor in the Department of Civil Engineering of the University of Hong Kong. He is a Fellow of the Chartered Institute of Logistics and Transport in Hong Kong and the Vice President and Founding Member of the Hong Kong Society for Transportation Studies. Dr Wong specialises in transportation and traffic engineering and is on the Editorial Advisory Board of a number of transportation and urban planning journals.