

## **For Information**

# **Legislative Council Panel on Transport**

## **Structural Safety of Hing Fat Street Slip Road to Island Eastern Corridor**

### **PURPOSE**

This paper informs Members of the results of the investigation into the incident of the Island Eastern Corridor (IEC) Hing Fat Street slip road abutment movement caused by the works of Central-Wanchai Bypass and IEC Link (CWB project)<sup>1</sup> as well as the follow-up actions taken by the Administration in respect of the incident.

### **BACKGROUND**

2. In late January 2011, the contractor for the Whitfield Depot re-provisioning works<sup>2</sup> under the CWB project was carrying out excavation and pipe pile wall construction works in the vicinity of the IEC Hing Fat Street slip road abutment. During the period, the Highways Department (the Department) noted from the monitoring reports<sup>3</sup> that there was slight movement of the bridge abutment of the concerned slip road, and also observed some more-than-expected widening of the movement joint on the bridge surface. Although the

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1 The proposed CWB is a 4.5 km trunk road (with a 3.7 km long tunnel) linking up the Rumsey Street Flyover in Central with the IEC. The trunk road can help ease the east-west traffic along the existing Connaught Road Central - Harcourt Road - Gloucester Road corridor, alleviate traffic congestion along the corridor and existing road network within the area, and cater for the anticipated increase in traffic.

2 The IEC Hing Fat Street slip road abutment is located near the work site of the Food and Environmental Hygiene Department (FEHD) Whitfield Depot reprovisioning works (see Annex 1). The works involve the conversion of part of the existing Whitfield Depot into an underground carpark for use by FEHD so that space at the ground level can be released for the CWB works.

3 As far as the Whitfield Depot re-provisioning works are concerned, in accordance with the contractual requirements, tilt markers were already installed on the IEC structures within the site. In addition, settlement markers for monitoring settlement of the ground and structures were installed around the perimeter of the future basement car park and at the IEC pile caps within the site.

stability and safety of the slip road abutment were not affected, the Department immediately implemented a series of measures to ensure structural safety of the abutment, including temporary suspension of the nearby ground level excavation works, soil stabilization measures such as grouting and backfilling, as well as replacement of the joint sealant within the concerned movement joint and strengthened the monitoring of the abutment, etc. In addition, the Department had followed the advice of the experts of the bridge bearing supplier, and added supporting steel plates between the bridge and the abutment to enhance the stability of the structure. The abutment structure has remained stable and safe since the detection of abutment movement in late January 2011.

3. The Department had also requested the contractor and engineering consultant concerned to separately conduct thorough investigation and submit reports on the incident, so as to facilitate the Department to confirm the cause of the incident and the contractual liability, and to decide on whether there is any need for other follow-up actions or arrangements, on the basis of the reports.

4. In late April 2011, the independent consultant of the contractor and the engineering consultant separately submitted their respective investigation reports to the Department. The Department had studied in detail the substance and arguments of these two reports, examined thoroughly relevant records on construction and supervision, and concluded on the cause and liability of the incident.

## **RESULTS OF INVESTIGATION INTO ABUTMENT MOVEMENT INCIDENT**

5. To prepare for the construction of underground carpark under the Whitfield Depot re-provisioning works, the contractor had to design and implement in advance temporary works at the work site, which included construction of temporary pipe pile walls and associated drilling and grouting operations in the vicinity of the concerned bridge abutment. In accordance with the contractual requirement, the contractor employed an independent checking engineer (ICE) who checked the temporary works design and certified that the design and associated method statement were appropriate for implementation. The engineering

consultant of the Department had also examined the design and method statement of the contractor's temporary works, and considered them practicable and viable, subject to the pipe pile drilling and grouting operations being carried out by skillful and experienced operators and under serious works supervision.

***Complex and variable subsoil stratum at abutment***

6. The investigation revealed that the Hing Fat Street slip road abutment was founded on an old breakwater located in an old reclamation area. During the design of the Whitfield Depot re-provisioning works, the engineering consultants sank a drillhole near the abutment to obtain the necessary subsoil information for the design. Prior to the commencement of the associated excavation works, the contractor also sank 3 drillholes to verify the subsoil conditions thereat. The drillhole records indicated that there was complex and variable subsoil stratum in the old reclamation area. Underneath the old breakwater, there were layers of localized marine / alluvial deposit layers with soil strength weaker than normal subsoil, and such layers were susceptible to disturbance. The risk of subsoil movement was relatively higher. Hence, any drilling operations involving marine / alluvial deposit layers should be undertaken with extra care and proper control in order to avoid subsoil loss and affecting nearby structures.

7. Based on the relevant information, the contractor designed the temporary works and method statement for the construction of the underground carpark, which included stripping of two metres of top soil within the work site adjoining the eastern and northern walls of the abutment, construction of pipe pile walls and associated drilling and grouting works.

8. In addition, prior to commencement of construction, the Department specifically requested the contractor to set up a monitoring system to closely monitor the effect of construction on the IEC, including installation of movement markers on the IEC structures. These movement markers had effectively and timely revealed the abutment movement conditions in this incident.

### ***Non-skillful temporary pipe pile works***

9. From December 2010 to mid January 2011, the contractor carried out topsoil stripping and drilling of pipe piles related to the temporary works at the portion of the work site north of the concerned bridge abutment. During the period, the monitoring system set up by the contractor kept monitoring the effect of construction on the IEC, and the monitoring records revealed that the abutment structure was in normal condition. By late January 2011, when the contractor was undertaking pipe pile drilling at the portion of the work site east of the concerned bridge abutment, monitoring records showed abnormal movement of the bridge abutment.

10. The investigation revealed that the contractor's supervision on pipe pile drilling operation was inadequate. When drilling through the underlying marine / alluvial deposit layers of the abutment, the operator had not exercised due care and serious control over the drilling speed and pressure, hence causing over-disturbance to the marine / alluvial deposit layer and localized subsoil loss. Coupled with the loss of lateral earth pressure due to the 2m-ground stripping at the part of the work site beside the bridge abutment, and the contractor's failure to take necessary remedial measures such as backfilling of topsoil in time, abutment movement eventually occurred.

### ***Contractual Liability***

11. Pursuant to the relevant provisions of the contract, the contractor should provide and engage supervisors and labour with suitable skills and experience for the proper execution of the works. The contractor should indemnify and keep indemnified the Administration (being the employer of the contract) against all losses which may arise from the execution of the works.

12. Accordingly, we consider that the contractor should bear contractual responsibility for the abutment movement incident caused by its inadequate supervision and non-skillful construction of pipe pile

works, and be responsible for the cost of repairing the facilities damaged<sup>4</sup> in the abutment movement incident. Moreover, given the contractor's non-skillful construction of pipe pile works in the incident, the Department has, in accordance with the established contract management and performance appraisal mechanism, duly reflected the matter in the performance report of the contractor.

13. With regard to the engineering consultant of the Department, such consultant has a contractual duty to examine whether the contractor's temporary works design has obvious deficiency and whether the construction meets the design requirements, as well as to ascertain that the ICE appointed by the contractor had performed the checking diligently. The Department has reviewed the performance of the engineering consultant regarding these aspects, and considered that it had generally met the procedural requirements. However, the Department considers that the resident site staff of the engineering consultant can further enhance its efforts in reminding the contractor to exercise vigilance in respect of the work details in future in order to avoid recurrence of similar incidents. The Department has, in accordance with the established contract management and performance assessment mechanism, duly reflected the incident in the performance report of the engineering consultant.

## **FOLLOW-UP ACTIONS**

14. This incident reveals the presence of marine / alluvial deposit layers with weaker-than-normal soil strength underneath the concerned bridge abutment, resulting in a higher than anticipated risk of ground movement. Hence, the abutment concerned is relatively sensitive to adjacent construction activities, in particular underground works. To further enhance the stability and safety of the concerned bridge abutment, the Department has urged the contractor and the engineering consultant to learn experience from the incident and implement the following improvement measures:

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<sup>4</sup> The repair of the damaged facilities comprised replacement of the movement joint sealant within the movement joint concerned as well as provision of supporting steel plates between the bridge and the abutment to enhance the stability of the structure.

***By the Contractor***

- (i) undertake round-the-clock monitoring, with the aid of automatic monitoring system, of the structural response of the concerned abutment throughout the works period, so as to maintain serious supervision over the drilling and excavation of the subsoil;
- (ii) re-visit relevant temporary works design and construction methods, and implement appropriate modifications<sup>5</sup>; and
- (iii) re-assess the construction programme and re-sequence appropriate construction activities to ensure the completion of the remaining works<sup>6</sup> as soon as possible.

***By the Engineering Consultant***

- (iv) ensure the practicality and viability of the contractor's method statement through more comprehensive and detailed examination of the contractor's temporary works proposals as well as its capability in executing the proposed works effectively;
- (v) enhance the level of supervision of drilling operation at subsoil layers with weaker-than-normal soil strength, so as to identify construction problems, if any, as early as possible, avoid excessive disturbance of the subsoil and safeguard the stability and safety of the nearby structures; and
- (vi) through training, raise the vigilance and response capability of the engineering consultant's resident site staff, in order to enhance their effectiveness in supervising construction

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5 In consideration of the actual subsoil conditions underneath the concerned bridge abutment, the contractor has revised the works sequence for the temporary pipe pile cofferdam. The subsoil surrounding the proposed cofferdam would first be strengthened by a round of initial grouting, followed by drilling and installation of pipe piles, and then a final round of grouting to complete the pipe pile cofferdam.

6 The Whitfield Depot re-provisioning works and associated excavation have resumed. The target commissioning of the entire CWB project (i.e. 2017) will not be affected by the incident.

activities in the vicinity of the abutment.

15. In March this year, we informed the Panel that on the recommendation of the engineering consultant, we required the contractor for the CWB tunnel works at Causeway Bay Typhoon Shelter to carry out stabilization works for the foundation of the abutment prior to the deep tunnel works to eliminate any safety risks. Such stabilisation works commenced in May 2011, and are expected to be completed before end 2011.

**Transport and Housing Bureau  
Highways Department  
September 2011**