

**For Information****Legislative Council Panel on Transport****Follow-up Actions by Transport and Housing Bureau and Highways  
Department on the Alleged Falsified Concrete Tests Incident****Introduction**

The Government of the Hong Kong Special Administrative Region is highly concerned about the incident of alleged falsified concrete tests involving some staff members of a laboratory outsourced by the Civil Engineering and Development Department (CEDD). The concerned laboratory conducts concrete testing and soil density testing for the Hong Kong-Zhuhai-Macao Bridge (HZMB) Hong Kong-related projects (i.e. Hong Kong Boundary Crossing Facilities (HKBCF) and Hong Kong Link Road (HKLR)) as well as the Tuen Mun – Chek Lap Kok Link (TM-CLKL) project. Due to the importance of the matter, the Chief Executive has requested the relevant departments to follow up seriously and respond quickly. Following the press release on 23 May issued this year on the arrest by the Independent Commission Against Corruption (ICAC), the Secretary for Development, the Acting Secretary for Transport and Housing, the Director of Civil Engineering and Development (DCED) and the Director of Highways jointly convened a media conference on 25 May to explain the incident and the follow up actions. This paper provides the latest developments of the follow-up actions by the Transport and Housing Bureau and the Highways Department (HyD) on the incident.

**HyD's Account of the Incident**

2. As pointed out by DCED at the media conference on 25 May, CEDD's staff overseeing a Government Laboratory had found some abnormalities in the testing time shown in some of the concrete cube test reports during their inspection in July 2016. CEDD then conducted an investigation into the case and at the same time requested the service provider to submit a report to explain the incident. DCED also pointed out at the media conference that although the testing time of some concrete cube tests had been adjusted, CEDD considered at that time that there would be no

significant implication on the test results, and therefore, the incident would not cause material impact on the quality of concrete in the HZMB project; and they had also informed HyD of their assessment at that time. CEDD also pointed out that they had subsequently referred the case to ICAC for further follow-up.

3. On 18 August 2016, HyD received a notice from CEDD informing that the display time in the concrete cube compression machines might have been altered by several minutes up to several days during some concrete cube compression tests. Though CEDD believed that the inaccuracy in the testing time did not have significant implication on the concrete strength results, they requested the service provider to conduct a detailed investigation into the incident and would keep HyD posted of the investigation result when available. HyD only noted on 19 May this year, after the arrest by the ICAC on 16 May this year, that apart from the alleged alteration of display time of the concrete cube testing equipment, the incident may also involve laboratory staff members replacing the concrete cubes to be tested with other materials (i.e. “fraud”). Once learnt about the arrest by the ICAC and the case details, HyD immediately follow up with CEDD.

### **Two-tier Assurance for Works Quality and Structural Safety**

4. The Government always puts works quality and safety at its top priority and does not tolerate any act of fraud. All public works projects must be carried out under the premise of quality and safety which will not be comprised due to expedition of works. There is no exception for the HKBCF, HKLR and TM-CLKL projects. In fact, to ensure works quality and structural safety during the implementation of infrastructure projects, the Government adopts a two-tier assurance system in the design stage and construction stage.

#### ***(I) Design Stage***

5. Firstly, during the design stage, we have allowed for a higher factor of safety in the calculation of strength of the structures to cater for various unpredictable conditions such as quality deviations of construction materials and changes in the estimated load. For the quality of concrete, the factor of safety of the relevant materials applied for in the design of buildings and bridges is 1.5.

## *(II) Construction Stage*

6. The Government attaches great importance to the quality of concrete used in public works projects and have stringent regulations to control the quality. In accordance with a technical circular issued by the Development Bureau and the relevant contract requirements, concrete suppliers for public works projects shall be certified under the Quality Scheme for the Production and Supply of Concrete by the Hong Kong Quality Assurance Agency or other certification organisations accredited by the Hong Kong Accreditation Service. The accreditation requirements include establishing plans to meet the quality standards and implementing stringent control on the production procedures (including quality control of raw materials, production control, product quality control etc.).

7. Besides, the Government has adopted stringent site supervision procedures for inspection of construction materials used in the works to ensure that the materials meet the required standard. For the HKBCF, HKLR and TM-CLKL projects, the inspection of construction materials is supervised by the Resident Site Staff (RSS) employed by the consultants of HyD (hereafter referred to as "RSS"). This includes the delivery of the construction materials to Government Laboratories<sup>1</sup> for testing. This current incident involves problematic concrete tests procedures which took place in a Government Laboratory.

8. The testing standards for the concrete produced in Hong Kong are the same as those produced by the precast yard for production of segments in the Mainland whereby concrete cubes are required to be sent to Government Laboratories for testing. After the concrete produced in Hong Kong has been delivered from the concrete batching plants to the construction sites, sampling and production of concrete cubes to be tested will be conducted under the supervision of the RSS according to the established procedures. The RSS will then embed bar code labels obtained from Government Laboratories in the concrete cubes and place the cubes in a curing tank with temperature control. At least 48 hours prior to the "28<sup>th</sup>-day test of concrete cubes", staff of Government Laboratories or the RSS will deliver the concrete

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<sup>1</sup> Government Laboratories are under the supervision of CEDD. The testing service is provided either by CEDD staff or by service providers outsourced by CEDD.

cubes to Government Laboratories after the RSS has verified the bar code labels on the concrete cubes. The RSS' responsibility for the supervision of relevant work associated with the concrete cube tests will be completed after a Government Laboratory has received the concrete cubes. The Government Laboratory will then be responsible for the testing, and will arrange for the tests on the 28<sup>th</sup> day after the concrete cubes are cast. Concrete cubes of precast segments produced in the Mainland shall also be sampled and produced under the supervision of the RSS in the Mainland and shall be sent to Government Laboratories for testing according to the above procedures.

9. The concrete cube test results will be provided to the RSS directly by the Government Laboratory. The RSS will confirm whether the concrete is up to standard based on the test results of the Government Laboratory.

### **HyD's Follow-up Actions on the Alleged Falsified Concrete Tests Incident**

10. As mentioned above, we have to ensure that the quality of works under the HKBCF, HKLR and TM-CLKL projects are up to standard and the structural safety are not compromised. Therefore, as soon as HyD learnt about the possible problem in concrete cube tests, corresponding actions were taken.

11. HyD conducted a preliminary structural examination for the HKBCF, HKLR and TM-CLKL projects within a few days since 19 May 2017. This included visual inspections of the structures, and the non-destructive concrete strength tests (commonly known as "Schmidt Hammer Tests") for the stress-critical locations of bridge decks, bridge piers, buildings, tunnel structures etc.

#### ***Visual Inspection***

12. In general, if there is defect in a concrete structure, it is very likely that signs of abnormalities will exhibit on the surface of the structures. These include cracks, spalling, pulverisation, rust, discoloration, deformation and so on. By conducting visual inspection on the surface of the viaducts and buildings, one can get hold of the basic condition of the concrete structures by examining whether there are signs of abnormalities, and

whether it is structurally sound. Visual inspection can also provide leads to the engineering team for a more in-depth investigation. Visual inspection is a direct and efficient preliminary testing method which is commonly used world-wide. It is also one of the existing methods adopted by HyD for bridge maintenance. Visual inspections conducted due to the current incident are carried out by professional Resident Engineers or experienced Resident Inspectors of Works deployed by HyD's consultants. The result of visual inspections confirms that the structures are sound and there is no sign of abnormalities.

### ***Non-destructive Concrete Strength Tests (Commonly Known as "Schmidt Hammer Tests")***

13. In addition to visual inspections, HyD is conducting "Schmidt Hammer Tests" on all the stress-critical locations of bridge decks, bridge piers, buildings and tunnel structures etc. under the three relevant projects. The test, which is a commonly recognised method in the industry for testing the strength of concrete, involves using a rebound hammer to strike at a concrete surface and the rebound is measured to assess the concrete compressive strength at the test point to check whether its strength can meet the required standard.

14. The "Schmidt Hammer Tests" are conducted by the RSS. Up to 31 May 2017, "Schmidt Hammer Tests" have been conducted at around 1,400 stress-critical locations (i.e. 47% of the total of 3,000 stress-critical locations) of structures of the three relevant projects. The test results reveal that the tested structures are all up to standard. The tests are still on-going and HyD aims to complete all tests at the stress-critical locations by the end of June this year.

### ***Engagement of a Professional Organisation***

15. HyD has engaged a professional organisation<sup>2</sup> on 31 May. The professional organisation has proposed to HyD the following assessments:

- (i) Apart from continuing the "Schmidt Hammer Tests" on the bridge decks, bridge piers, buildings and tunnel structures etc. of the works

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<sup>2</sup> The professional organisation is C M Wong & Associates Ltd.

completed, core tests will also be conducted on the structures. In addition, core tests will also be conducted at the locations which fail the “Schmidt Hammer Tests”.

- (ii) For structures constructed underground or below sea-level (such as piles etc.) which “Schmidt Hammer Tests” cannot be conducted, it is already specified in all related works contracts that the contractors have to take full cores at 5% of the bored piles to ensure that the quality of the piles are up to standard. The professional organisation proposes to first carry out compressive strength tests on the samples of those tested cores and depending on the results of the compressive strength tests, whether additional cores have to be tested will be further considered .

16. The Standing Committee on Concrete Technology of the CEDD has agreed the proposal provided by the professional organisation. HyD will follow up with the tests in accordance with the proposal of the professional organization and the professional advice of the Standing Committee on Concrete Technology.

### ***The Role of the Professional Organisation and the Work Schedule***

17. The professional organisation will fully monitor the “Schmidt Hammer Tests” and the core tests, and will review the “Schmidt Hammer Tests” conducted by the RSS. The professional organisation will complete all relevant tests and reviews by the end of October 2017 and will submit a report to HyD.

### ***Load Test on Viaduct***

18. HyD also proposes to conduct a load test<sup>3</sup> on the 9.4km-long viaduct of Hong Kong Link Road before the commissioning of the HZMB to ensure that the viaduct structure fulfills the design requirements.

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<sup>3</sup> In general, load tests are conducted for bridges of large span in Hong Kong such as the Tsing Ma Bridge and the Stonecutters Bridge. The test aims to measure the reaction to the bridge structures due to the vehicles load so as to examine whether the loaded state of the bridge structures match with the design expectations under an actual traffic condition.

## **Follow-up with the Information of the Alleged Falsified Concrete Cubes**

19. On the other hand, HyD received information from CEDD, in batches, on the suspected falsified concrete cube tests from 28 May to 1 June. HyD has started reviewing the information of these suspected falsified concrete cubes. If the works locations corresponding to the concerned concrete cubes have been tested by HyD, we will inform CEDD of the testing results. If the works locations corresponding to the concerned concrete cubes have not been tested by HyD, we will give priority to those locations.

## **Conclusion**

20. In summary, as at 31 May 2017, the results of the visual inspections and “Schmidt Hammer Tests” conducted by HyD confirm that all the structures of the three relevant projects are in good condition, and no sign of abnormalities and structural safety problem is revealed. As mentioned above, we are conducting a comprehensive “body check” for the three projects. HyD will complete the “Schmidt Hammer Tests” at all stress-critical locations of the structures by the end of June 2017 as soon as possible. At the same time, the other aforementioned relevant tests will be completed by the end of October 2017.

21. We stress once again that the Government will ensure that the testing of the structures of the HZMB Hong Kong Section is robust, and the structure is safe, before the commissioning of HZMB.

22. This is to inform Members of the latest development of the follow-up actions in relation to the concerned incident.

**Transport and Housing Bureau  
Highways Department  
June 2017**