

Here is the footage from “Site Safety Seminar for Capital Works New Works Contracts”, which was held on May 12, 2014

The speaker is Mr. C Y YEUNG, Group Safety & Environment Manager of Paul Y

His presentation topic is "Lifting of Precast Concrete Façade”

Ladies and gentlemen, thank you for joining today's seminar. In this session, I will talk about an accident happened in our company's construction site on 12 February 2012 where a worker was struck by a toppled precast concrete façade .

Let's take a look.

This was the accident scene.

The accident happened on 12 February 2012, about 2 years ago.

As you can see from the site photos, there was a precast facade and the worker was struck right there.

A mobile crane was used to rescue the worker.

Let us look at the scene. You can see this was the construction site where six blocks were being built. This is one of the two precast facades storage yards. Another one was located at a larger space. This photo was taken on the accident day. This is the truck delivering the precast facades to the site. Well now we know how the accident scene looked like. These photos are all raw without editing.

I would like you to have a look at the precast facade. It is 2 meters wide, around 290 millimeters thick, 3,015 millimeters tall and weighs 3.13 tons. But we should note that this facade is special, it is asymmetrical. That means it is irregular.

This is the drawing of the facade. Why did I put an arrow pointing the broken part of windows? We can see this area of the facade was depressed, which is believed to be where the worker's head was smacked. What is more important for us to pay attention here, is whether or not the worker wore his safety helmet. The worker was severely injured but we cannot see any bloodstain here, which firmly suggests the worker did wear a helmet. This brings us another question - why would the worker stand at such location? Let us focus on investigating the facade and not talk about the worker for the time being. Hong Kong Housing Authority is generous. Why do I say

so? In general, every block has 12 facades. However, this site was full of precast facades. There are about 80 to 90 precast facades to be installed together with other precast components. You may wonder why all components were put here. As there was a slope at the back, nothing can be stored, this was the only available space. We were under this limitation. You may ask why we do not build a steel platform to store these facades, I can tell you they were actually under construction. But as everyone can imagine, construction programme is always tight. We wanted to complete the platform as soon as possible, but we had no choice, time was needed to get the platform done. So what was the design adopted now? We would use metal base frames, two identical metal base frames were used for each facade and unload the whole at the site. Basically it should be stable enough. This is how the base frames look like. For every facade we need two base frames and each base frame would be fixed by two anchor bolts. Here is one, and beneath is another. Which means - the precast facade was secured by four anchor bolts at the front and a tightening screw-bolt at the back. Theoretically it is unlikely to topple on a flat ground. However, we should be aware of the fact that all anchor bolts and tightening screw-bolt needed to be removed before the facades were lifted.

When we re-enact the accident, we went back to the site and found that all four anchor bolts had been removed. We were questioned whether we have removed them after the incident during the Enquiry Panel Hearing conducted by both Development Bureau and Labour Department. But I can assure you, under such circumstances, they were impossibly removable as it was blocked. Even we removed them after the incident, they would not have looked like this. There is no way we removed them after the incident. We must clarify. Of course, it was proved by experts later that they couldn't have been removed after the incident. And the so-called tightening screw-bolt, with two here, they were completely loosened obviously. It comes back to the same question. Did we unscrew them? The reason of collapse is that it was placed on an uneven ground. See those screw pits here, they were undamaged. Another one was semi-loosened. We are confident to suggest the four bolts were unscrewed manually, someone removed this part and loosened this.

Because it is irregular and the centre of gravity is not within the component, it collapsed when the screw was being turned to certain point. This is how the worker was overwhelmed.

So what safety measures can be adopted to prevent such incident? We have learnt there was such a potential hazard. If someone loosens the screws or places the facade

on an uneven ground, the facade will topple. Therefore, in our risk assessment, method statement or even our internal safety guideline and training, these potential hazards were well communicated to the workers. This was definitely explained in details to the victim as well. An individual spreader beam must be used in lifting a facade. Only when the facade is secured can the screws be taken off. You may ask me, 'CY, did you make these all up after this incident?' Ever since the accident happened, Labour Department took a comprehensive investigation on all method statement, risk assessment, internal safety guideline; this type of potential risk was illustrated in the risk assessment already. The risk assessment had covered all these risks, we also extracted part of our method statement, to indicate the potential risk and clearly instruct that no screw could be removed before the facade was well secured by the lifting machine. These are our internal safety guidelines. Even the rules were reinstated and posted at site, the effect is in doubt.

Was the lifting the cause of accident? Though it is a private construction site, a CCTV was installed properly at the tower crane to monitor the lifting operations. There were no witnesses at that moment and only this worker was working at the precast facade storage area. We interviewed the only possible witness which is the tower crane operator and asked what he was doing before the accident. There were six facades that needed to be lifted up to the 9th floor on that day. The operator told us the worker took 3 to 5 minutes to rig each facade before lifting, which means, he did follow the instructions for the 1st and 2nd facades. He took the time to use a spreader beam to lift up the facade, then removed the screws, loosened the tightening screw-bolt and managed the lifting at last. However, when it came to the 3rd to 6th pieces, the process was shortened. It took him only about one minute to complete the task. Thus we believe someone removed the screws beforehand to speed up the process and take a short cut causing the collapse.

Let us review what safety measures were applied before the incident. Besides the scheme design, method statement, precast facade steel brackets mentioned earlier, we had the method statement for precast facade hoisting and assembling by another subcontractor. Whenever a job is assigned, the safety officer conducts a risk assessment, which involves the transportation, stacking, assembling and hoisting of facade. Related internal guideline was communicated to the workers. Workers were well advised about the safety measures necessary for lifting and placing facades. Safety training and safety guideline were absolutely in place, and someone was appointed to monitor the facade lifting job.

Taking into account the high risk of this procedure, we specially employed an assistant general foreman, Tommy Cheung, who is a specialist in this type of façade work. As you know, there are so many facades on the site. If we are saying 80 to 90 pieces for each block, there will be few hundred facades for 6 blocks. Therefore, the project cannot be completed without someone being held responsible for the supervision. Another Site Foreman was sent to assist Tommy and carry out supervision work on site. As you can view from the previous pictures, although they do not look so pleasant, there were indeed precast facade storage area, hard surface and concrete. I will tell you later how to improve these areas. The tower crane and lifting appliance were all endorsed with certificates. The operator of tower crane had license too. You may doubt about the qualification of the signaler and rigger, but I can assure you they do have the green card and silver card.

What can be implemented after the incident? The first is to re-design how the facades would be supported temporarily. It is risky to place the facades without support. We will show you some photos on how we handle it later. Moreover, we need to re-design the precast façade storage yard, especially on how to flatten the surface with secure fencing. Once, we decided to place temporary fences at the site only due to site limitations but we found it is necessary to build permanent fences. There should be proper notice to remind workers not to enter the designated area except authorized persons. We would like to highlight this ladder, usually there are no hand-rails for these ladders but we custom designed this ladder with hand-rails. Coming after are the re-evaluation of risk assessment and safety guidelines. In view of the inadequacy of having only one foreman for such large façade storage areas, we re-assign one front-line foreman for each precast facade storage area to ensure everything is under supervision. Refresher training was put forward beyond the captioned safety guideline, risk assessment, revised method statement to remind the workers about the safety practices on site. The workers were made clear through practices and demonstrations about the proper lifting procedures. Safety supervisors were also sent on site to monitor the implementation of safety measures.

For sustainable improvements, what we should do after the Suspension Notice is revoked? Our boss has instructed that facades should not be left without support. Permission from company's board directors is required if exemption is necessary. We are not talking about one director's approval, but permission by more than one board director. And everyone agrees to that. The supervisors were held responsible for this. Secondly, in safety management walk, precast facade storage yard and the lifting process shall be crucial items to be inspected. Last but not least, it is

worthwhile to organize workshops to inform the employees about this accident so as to avoid any future accident alike.

Back to the scene, in the re-design, the supporters should not be lack of, what can we do? The engineer suggested fixing the steel channels to the ground by anchor bolts. It is critical to ensure the pins are well-installed when the facades are transported so they are supported properly. There are two subcontractors involved, one being the supplier of precast facade whilst another one being the installer. The installer can remove the anchor bolts, but not the frame. The frame shall not be removed unless the supplier do so and remove the pins. Everything should be in order with this division of work. Otherwise, the facades will collapse eventually if someone removes the pins before the anchor bolts are unscrewed. Let's have a look here. This is how the pins are supposed to look in the new design, with a shaft locked in here. As the facades are all distinct in shape with almost 500 different designs, we can only adjust the horizontal shaft to facilitate the transportation of facades.

Undoubtedly there are other solutions in the industry. These are the examples from other sites. If we are not bound by the large quantity and variety of facade shapes, we can definitely adopt a permanent framework to lock them all by anchor bolts or more than locking the façade's frame, there should be sufficient working platform made of bamboo and fences as well for workers to hook the facades. Those adopted by Housing Department are relatively good and strong. There is a plinth with some holding-down bolts, holding the façade stably. The chance of toppling is not high. Again, warning notice and secure fencing are essential at storage yard of the precast facades. That is the lesson we have learnt from the accident. We wish everyone can carefully evaluate the facade like this in the future. Please do not hesitate to let me know if you have any questions. Thank you very much.