PRESS RELEASE

OUTCOME OF INVESTIGATIONS INTO THE CAUSE OF THE COLLAPSE OF THE STEEL LATTICEWORK AT THE FUSIONPOLIS WORKSITE LOCATED AT AYER RAJAH AVENUE ON 29 APRIL 2004

The Ministry of Manpower (MOM) has completed its investigations into the collapse of the steel latticework of the basement raft foundation which occurred at the Fusionpolis worksite on 29 April 2004. MOM’s investigations revealed that the bar-chair support system constructed to support the grids of reinforcement bars for the basement raft foundation had collapsed. Two workers were killed and 29 others injured in this accident.

2 The Ministry will be commencing prosecution against the occupier of the worksite, Greatearth-United Engineers Joint Venture (GEUEJV), as well as three officers from GEUEJV for their role in this accident. GEUEJV faces one charge under Section 33(1)(a) of the Factories Act for failing to ensure that the place of work was of sound construction and properly maintained. The three officers from GEUEJV face one charge each under Section 33(1)(a) read with Section 88(13) of the Factories Act in their individual capacities as officers of GEUEJV.

Cause of Accident

3 On the day of the accident, workers were constructing a steel latticework (comprising reinforcement bars supported by bar chairs) at the basement raft foundation. Bar chairs are steel reinforcement bars shaped into an inverted U-shape to serve as “placeholders” to keep the layers of reinforcement bars horizontally apart until the concrete is cast to complete the raft foundation (Diagram 1). Investigations by MOM revealed that the bar chairs had “toppled over” which was indicative of a complete system collapse. The system-wide collapse was triggered by a localised failure of the bar chairs at a particular area.
Key Investigation Findings

4 Prior to the accident, the occupier had designed the bar-chair support system to be installed in connection with the construction of the 3-meter and 5-meter raft foundations (Diagram 2). These designs were provided to Chin Leong Building Contractor Pte Ltd and Kingston Construction who were the subcontractors responsible for the installation of the bar-chair support system.

5 The Ministry engaged Prof N. Krishnamurthy, a consultant engineer who has over 44 years professional experience, as an expert witness to ascertain the cause of the collapse. The expert has given his professional opinion that there were flaws in the design and construction of the bar-chair support system.

6 Based on the expert’s analysis, the design for the bar chairs for the 5-meter raft foundation was inadequate to bear the vertical loads that would be imposed. The designs also specified that each bar chair should include two intermediate vertical supports (known as C-links) to be placed along the span of the bar chair (Diagram 3). However, investigations revealed that only one C-link was installed per bar chair for both raft foundations. In addition, the C-links installed on the bar chairs for the 3-meter raft foundation were improperly installed.

7 Investigations also revealed that the design of the bar chairs did not provide for any bracing or anchoring to serve as restraint against horizontal forces that could be exerted onto the bar chairs (Diagram 4). In the absence of such bracing and anchoring in the design, the expert was of the view that any localised failure would propagate into a system-wide collapse, akin to a “domino effect”.

Adherence to Safety Measures

8 The Ministry would like to remind all occupiers of construction worksites and their contractors to ensure that comprehensive design calculations and drawings are prepared for such large-scale bar-chair support systems. Such systems should be designed in accordance with a relevant design code and subject to a thorough review in the event that deviation from the design is required during the construction phase.
9 Arising from this incident, MOM will be reviewing legislation to enhance the safety of the design of all temporary works including bar-chairs. This will include requiring all occupiers to engage a Professional Engineer (PE) to review and endorse the design calculations and drawings. The PE will also be required to submit his calculations and drawings to the project’s Qualified Person (QP) for verification and acceptance.

For media queries, please contact:

Ms Regina Lim
Manager, Corporate Communications Department
Ministry of Manpower
Tel: 6317 1473
Email: regina_lim@mom.gov.sg

Ms Julia Ng
Assistant Director, Corporate Communications Department
Ministry of Manpower
Tel: 6317 1952
Email: julia_ng@mom.gov.sg
Diagram 1: General view of how the reinforcement bars are placed onto the bar chairs: Each bar chair supports four layers of reinforcement bars

Diagram 2: General snapshot of the collapsed region and location in the plan
Diagram 3:  
The endorsed design specified that each bar chair should include two C-links placed along the span of the bar chair. However, only one C-link was installed per bar chair.

Diagram 4:  
Example of bracings which serve as restraint against horizontal forces that could be exerted onto the bar-chairs. Such bracings were absent from the design.