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Work Theme B: Structural engineering on modern steel construction
B1 Effective use of high performance steel materials - Q690 ~ Q960

Project Title:
c) "Effective use of High Performance Steel Materials – Q690 to Q960"

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Project Outline:

With the development of metallurgical technology and fabrication techniques, the use of high strength steels (defined as >460 MPa yield strength) are now commercially viable in the steel industry. Compared with normal steels (NSs), HSSs have the advantages of cost efficiency and high strength-to-weight ratio which are very suitable for the construction of high-rise buildings and large-span structures. Moreover, the reduction of material consumption and the associated cost of construction complies well with the global sustainable development. With the increasing popularity of HSSs, more research studies are needed to examine and explore the use of HSSs for structural steel members and connections.

The design of structural steel members and connections requires the steel materials to have sufficient ductility so that stresses can be redistributed when localised yielding of the materials occurs. In particular, sufficient ductility are needed to avoid premature fracture of the material at the connections and also allow the redistribution of stresses around the connected areas. The inherent material properties such as relatively lower ultimate tensile strength/yield strength ratio and toughness of HSSs may also need further examination to ensure a proper structural behaviour of members and connections designed using HSS. As existing design guidelines for steel connections were mainly based on the research of NSs, further research studies are required to examine experimentally and theoretically the strength and behaviour of HSS connections.

The present research aims to provide a deeper insight into the structural performance of HSS bolted connections, and to develop rational design methods on their effective use in construction. The key research objectives are (1) to perform experimental and numerical studies of the bolt bearing strength and net-cross section strength of HSS connections; to evaluate the applicability of the current bolt bearing resistance equation and net-cross section equation for HSS connections, and to develop new design equations for the bolt bearing strength and net section strength of HSS connections if necessary; (2) to perform experimental and numerical studies of the effects of connection length, bolt spacing, bolt stagger on the

bearing strength of HSS connections and to propose new design equations for HSS connections if necessary; (3) to perform experimental and numerical studies of the block shear strength of HSS plates, to evaluate the applicability of current block shear design equations for HSS plates, and to develop a new design method for predicting the block shear strength of HSS plates if necessary.