IIE has been very successful in receiving grant funding from the Australian Research Council (ARC).

Three current ARC Discovery Projects and one ARC Future Fellowship grant typify the nature and excellence of research undertaken in the IIE.

HIGH STRENGTH COMPOSITE COLUMNS
The behaviour and design of composite columns coupling the benefits of high strength steel and high strength concrete for large scale infrastructure

This project is investigating the design and behaviour of columns composed of high strength structural steel coupled with high strength concrete. The project will enable more efficient column systems to be developed for major civil engineering infrastructure.

High strength steel casings in composite columns have the ability to enable high strength concrete to be more efficiently utilised and can delay crushing and improve ductility considerably. They can also significantly reduce column dimensions in buildings and other infrastructure systems.

The benefits of this project will be an improved understanding of the complex behaviour of tubular steel and composite steel-concrete assemblages in bridges, buildings and offshore structures. These models will result in increased savings in the design of structural buildings and civil engineering infrastructure. Outcomes of this project will result in significant benefit to the construction industry and the Australian economy.
HYBRID STAINLESS-CARBON STEEL JOINTS

**Hybrid stainless-carbon steel composite beam-column joints at ambient and elevated temperatures**

Through the use of experimental and analytical research, this project represents a first-ever attempt to investigate the behaviour of hybrid stainless-carbon steel composite beam-column joints at ambient and elevated temperatures. Reliable connections will be developed to connect carbon steel beams to concrete-filled stainless steel tubular columns for gravity and lateral loads from wind or earthquakes in regions of low to moderate seismicity, as well as under fire conditions. The idea is to significantly increase the durability of key elements in a structure, but cause only a minor increase to the overall cost of the structure.

The joints put forward consist of stainless steel composite columns and carbon steel beams. Bolted joints using blind bolts and through-plate joints are being investigated. The results of this project will be the development of reliable and economical joints to connect stainless steel columns and carbon steel beams. New insights will be gained into the behaviour of composite joints that will lead to the revision of design guidelines of composite joints at ambient and elevated temperatures.

CONCRETE AND STEEL

**Behaviour and design of concrete-filled stainless steel tubular columns at ambient and elevated temperatures**

Investigating the behaviour of concrete-filled stainless steel columns used in building construction. Theoretical and experimental testing will examine the behaviour of stainless steel and concrete composite beam-columns. Factors such as load-bearing capacity, stability and ‘slip’ of a concrete column against the steel outer shell will be assessed, as well as fire resistance and buckling of the steel at room and elevated temperatures. Stress and strain and thermal characteristics will be measured and a suitable theoretical model will be used to validate the results.

The outcomes of this research will likely be used to develop new design codes for structural engineers enabling the use of an economical and more environmentally friendly building technique. By using this in building, bridge and offshore infrastructure, significant socio-economic benefits will be provided to Australia while also increasing the country’s infrastructure maintenance capability.

WIND-EXCITED TALL BUILDINGS

**Occupant comfort, cognitive performance and task performance in wind-excited tall buildings**

This project is investigating the effects of wind-induced vibration on occupants of tall buildings. The researchers use a combination of methods to find out how people are affected by the experience of being in a very tall building, including a motion simulator experiment. Research involves taking detailed physiological measurements to assess people’s physical reactions to vibration at frequencies and magnitudes comparable to those induced by wind excitation of tall structures in various locations around the world, as well as using the motion-simulator machine at the Hong Kong University of Science and Technology.

Outcomes from the research will enable practical, internationally recognised standards for building-vibration design that will be acceptable for the comfort of the occupants. It will also improve the understanding of physiological and psychological responses to building vibration induced by wind and establish a unified standard that will deliver superior building performance and enhanced living quality for those building inhabitants under conditions of strong winds.