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PROJECT PROFILE

METALOQ

METALOQ Joist to Rim-Joist Connections

PROJECT BACKGROUND

The METALOQ modular steel structure system employs a light gauge, cold formed steel joist system connected through a proprietary shear tab to a channel section rim-joist. This connection may be subjected to a variety of force demands during shipping, craning, and service live of the module. This project intended to initiate a larger testing and analysis program of the METALOQ system by testing the joist to rim-joist connection under tension loads to failure. In doing so, the tests identified failure modes and identified any potential improvements that may be incorporated in the design.

RESULTS

The project tested and made observations on the component assembly or construction of the rim-joist, joist, and joist to rim-joist connection. The following conclusions were found:

- The system is stiff and elastic up to approximately 12kN at approximately 0.2mm slip between joist and shear tab.
- The system responded inelastically for the majority of the response with increasing resistance and decreasing stiffness up to approximately 52kN at approximately 15mm slip.
- The bending of the thick-walled backer plate allowed slip between the detents resulting in a loss of bearing.
- The detent system transferred stress (through strain measurements) with fairly uniform distribution over the joist width.
- The bolts are sufficient for this application.
- The tension member ultimately failed in a block shear mode with four shear planes as expected. This mode is likely for a two bolt-line connection into the web of a flanged tension member and is neither good nor bad.
- The rim-joist was undamaged.
- The shear tab was undamaged.

RECOMMENDATIONS

Future work of the following nature was proposed for the METALOQ system:

- Modification of the existing METALOQ system through stiffening of the backer plate
- Component behaviour research including in part:
  - Joist to rim-joist connection under shear, bending, combined loading, compression, tension (contrinuation of this work)
  - Column to beam connection
  - Columns under compression
  - Columns under combined loads
- System behaviour research following, or in parallel, with the component testing to be conducted on:
  - Floor system behaviour under different gravity loading configurations
  - Wall racking under lateral loads
  - Module torsion
  - Module racking
  - Multi-module lateral load, gravity load, and torsional load testing
  - Testing of critical devastations from typical modular system such as those around elevator shafts and stair wells.
  - Testing of system response to progressive collapse
- In addition to the ultimate capacity testing of components and systems, testing that focuses on the following items should be considered:
  - Service vibrations for occupancy
  - Vertical and lateral deflection limits for occupancy
  - Building envelope testing against water and air ingress, cyclic pressures, thermal cycles, and windborne debris impacts.

If you are interested in getting involved in this initiative or other research and development projects, please contact the Off-site Construction Research Centre at: **offsiteconstruction@unb.ca**

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