

## **EFFECTS OF PACK-RUST CORROSION IN COMPRESSION BUILT-UP MEMBERS IN STEEL BRIDGES**

Pack-rust corrosion is a type of corrosion that affects steel built-up members especially old bridges. It is a localized corrosion that happens in the crevice between two mating surfaces. Pack-rust corrosion does not only cause section loss like other types of corrosions, but also induces local distortion in the structural members that are not the intention of the original designs. This corrosion can change the behavior of the connection fixity and could also cause instability in the overall built-up members. The size of distortion and section loss were observed to behave linearly between the free edge and the first line of fasteners. As the distance is moving toward the free edge, the distortion in the members and section loss in the base material were observed to be maximum. Another important observation was that pack-rust corrosion does not grow beyond the fastener at the fastener's line.

The literature revealed that there are no comprehensive experimental and analytical studies focused on the behavior and effect of pack-rust corrosion on the overall performance of built-up members and connections in compression. Therefore, this research studies the effects of pack-rust corrosion on the capacity of built-up compression members including but not limited to stiffness, yield strength, maximum capacity, and change in fastener force under applied load. This research was studied by performing large-scale experimental testing of flexural members with simulated pack rust. Pack-rust distortion was simulated by placing washers in the crevice between two plates and then the two plates were drawn together using high-strength fasteners. There were also members with real pack-rust corrosion damage from bridge components that used to be in service, and were tested in axial compression tests.

The experimental results were compared with hand calculation using conventional design equations. Finite element analysis was also studied to compare with the experimental results in order to calibrate future models, but it is not presented in this report. The findings of the experimental results of all the specimens show that pack-rust corrosion affects yield strength and maximum capacity of the member and minimally affects the member's stiffness. Maximum load of the member affected by pack-rust corrosion can still be estimated conservatively using the conventional design equations with some modifications. There was no indication of significant increase in fastener force under applied load, so the likelihood of fastener failing in tension was very small as observed from this study.