A10600 – Rep001 - Rail Repair Squat – Literature Review

A literature study in which information was collected to form the basis of a subsequent study.

The conclusion was that the following processes should be considered as a potential solution for the rail repair.

Laser welding, plasma transfer arc, cold metal transfer, submerged arc.

A10600 – Rep002 - Rail Squat Repair – Rail Defect Analysis

To assess a typical squat defect and generate a report characterising the defect prior to the repair

Results identified the average length and depth of a typical squat defect, and this data was used in subsequent trials. (99mm long x 4.6mm depth across the width of the rail).

A01600 – Rep003 – Rail Squat Repair – Cladding Trials and Equivalency Trials

To undertake welding trials representative of a typical squat defect, using a variety of welding processes. To compare the results, using an equivalency test based on London Underground repair acceptance criteria.

All four welded tests failed the equivalency test, albeit on different factors. Lowest dilution was seen on PTA and CMT processes. Hot tears were observed in three of the processes, with Submerged arc showing the highest severity. This eliminated the Submerged arc process. Laser welding was also discounted due to porosity adjacent to the weld toes on subsequent layers. PTA and CMT had the least defects, with PTA showing a maximum crack size of 95 microns, and CMT showing possible lack of fusion at the vertical boundary line of the weld. All of these issues could be eradicated with optimization of welding parameters and joint configuration.

A10600 – Rep004 – Rail Squat Repair – Rail Defect Repair

To undertake a typical squat defect repair, on a sample of used rail, using one of the potential processes.

The CMT process was selected as the most suitable welding process. The weld was carried out on a rail sample with a section removed, in accordance with A10600 – Rep002. The Fronius CMT process was used for this trial, is it gave the best opportunity of being utilized on a trackside application. Results were encouraging, although the sample showed slight lack of fusion on the two vertical walls of the machined defect. It was agreed that this problem could be eradicated with careful modifications to the weld prep' angles, enabling more suitable blend between weld and the rail.

The rail repair development work carried out in the above reports, has focused on determining a suitable welding process which can be delivered to the track side. However, consideration has also been given to the method by which this process can be automated. The Flex track system provides a method of delivery which can be utilized on range of welding processes, and will significantly improve control of the rail repair procedure. Weld defects using the existing process can be up to 30%, requiring further grinding out, re-welding, and added time to compete the repair process.

The Flex Track system, combined with the CMT welding process, would introduce a semi-automated repair procedure, which would ensure that the repair were carried out in a more controlled way, thus reducing potential for weld defects, and repair work.