Case Study: Class 390 Door Steps

Situation and nature of failure mode

- Incidents were being reported involving passengers falling from the train within stations
- This was not fully understood until one event was captured on station CCTV
- The events had potential for serious passenger injury
- It was identified that the fault was associated with the retracting door step 'going limp' if a door push button was operated mid-cycle
- It was also noted that that the duration of the door closing alarm was insufficient and the door closed too fast for some passengers

Investigation and action taken

- A software modification was proposed to extend the duration of the door closing alarm and to slow down the door leaf closing time
- This addressed the issues identified but impacted door reliability
- The software was tested on a single train, and then up to ten trains, before full fleet roll-out
- Further problems were later encountered with 'door fail to close faults' where there was not enough momentum to make the final close switch
- It was noted that there was variance over the 2000 doors in the fleet, and also in the summer due to the effects of bodyshell expansion impacting tolerances
- A further modification was undertaken to speed-up the final door closure and this successfully addressed the issues

Key Learning

- The software design should cater for unexpected user or sensor inputs and fail to a safe state
- Hazard identification exercises should be performed using guide words as a prompt