

## Safety Corner

What is a wrong side failure?

Engineers are often asked to design a component or system that is fail-safe. A fail-safe component or system is one that, when fails, harmful effect to other components or personnel can be eliminated or controlled to a minimum. However, a fail-safe component or system may also fail in an unsafe state with a probability, however small.

In the railway industry, when a piece of railway signalling component fails in an unsafe state, the component is having a “wrong side failure”. The probability for a wrong side failure should be a lot smaller than the probability of a “right side failure” for a given component.

In traditional railway where a train is driven manually, an example of a wrong side failure would be having a signal to show a “proceed” aspect (e.g., green or blue light) to notify the train driver that it would be safe to proceed when it should actually be showing a “stop” aspect (e.g., red light). The driver might then run the train into an obstruction when he was supposed to stop the train. A typical fail-safe design to control the risk of this situation would require the signal relay to be energized to show a “proceed” aspect. A relay is an electrical switch operated by an electromagnet to open or close one or many sets of contacts. If a wire breaks, then the relay will de-energize and the signal will have an open circuit to show no light (or a red light). However, a stray wire from another circuit may touch the wire connected to the same relay, leading to a wrong side failure with an inadvertently closed circuit. Typical control measures to reduce the wrong side failure risk would be to install good wire insulation or to incorporate a double-switched relay design.

Fortunately, most modern railways are equipped with an Automatic Train Protection system with a SIL 4 design to keep the probability of a wrong side failure very small; thus, assuring passenger railway the safest mode of transportation.

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