

# Interlock Control System for New 7000 Series Rail Cars Access Platforms

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## ABSTRACT

New 7000 Series Rail Cars bought have the A/C units located on top and access platforms have been built and installed at each Shop in order to access these units for maintenance purposes. With this, a safety issue of fall risk has been identified from either, by leaving swing or sliding gates unintentionally opened. As a result, a complete assessment has been developed including going through the proper problem solving and decision making processes in order to provide the best solution and path forward for solving the safety issue. Therefore, after a complete analysis, it has been determined to install an automation system to control swing and sliding gates for different scenarios associated to whether the train is present or not. Consequently, based on the plan, this will establish the required controls to mitigate the fall risk hazard in order to provide the employees a safe work environment.



New 7000 Series

## PROBLEM

Washington D.C. Metropolitan Area Transit Authority has purchased new 7000 Series Rail Cars as part of the new upgrade made to replace old rail cars within the Metrorail system, which service Maryland, Virginia and Washington D.C. With this, one important difference of these new trains is that the new rail cars have the A/C units located on top instead of the bottom location like the old ones.

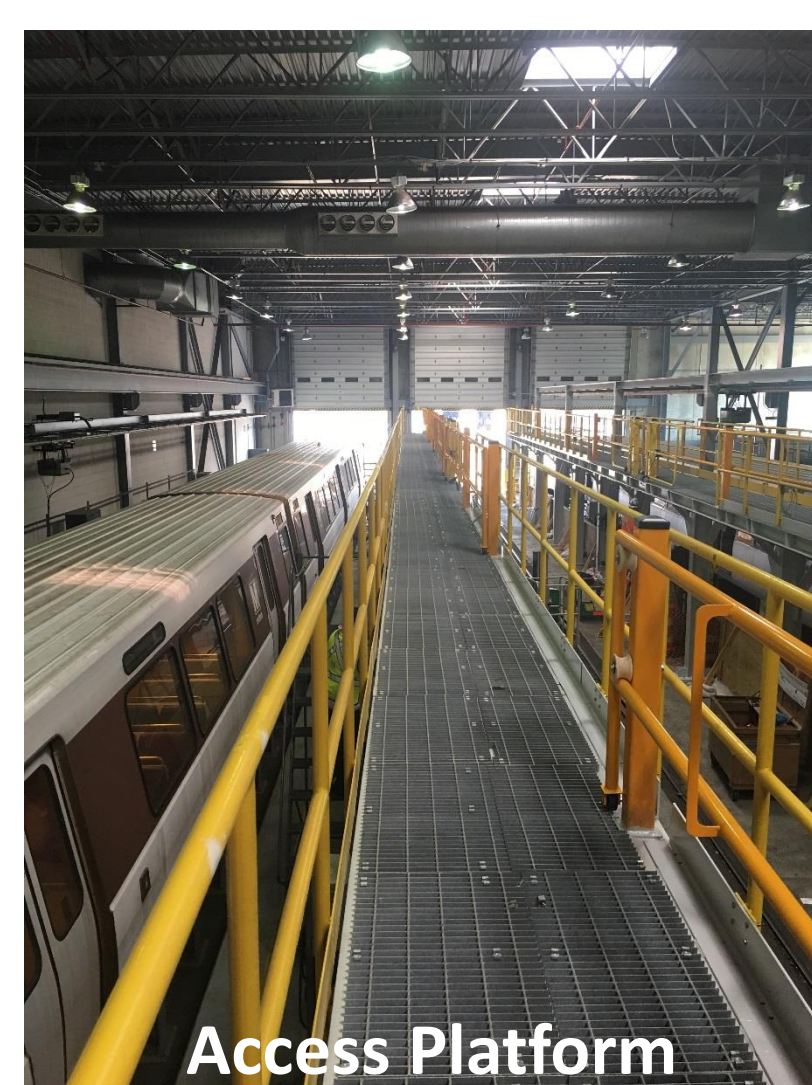


Therefore, in order to provide maintenance to new A/C units, access platforms have been built and installed in multiple shops located in the yards within the Metrorail system. So, because of the installation of these access platforms, a safety concern was brought up to the attention of engineering and other disciplines as part of the responsibility of the employer to provide a safety work environment to all workers.

Furthermore, since access-platforms are elevated and there are swing and sliding gates, and if any of these are left behind opened accidentally or unintentionally, there would be a risk of falling off the platform.



A/C units on top



Access Platform



Train Present Status

## OBJECTIVES

Since a risk of falling off the platform has been identified as a potential “safety issue”, a plan has been put in place as part of the problem solving process in order to provide a safe work environment to all workers which is the main focus in this project. By the implementation and installation of the proposed gates interlock control system for new 7000 Series access platforms, workers will have a safer work environment.

## METHODS

Typically, engineering problems are worked through by using many different tools and procedures in order to get to the most feasible solution related to the problem-solving process. In this section, it is provided the approach used to select the most practical option to addressing the safety issue.

### Survey and Assessment

An assessment was performed by reviewing the structural drawings and walking through the shop as part of the process of gathering the information. The following information was obtained:

- The number of swing and sliding gates in question.
- Possible locations of all field devices like solenoid gate locks, open/close sensors, swing gates operators, etc.
- Electrical power requirements.
- Existing Programmable Logic Controller (PLC) including its conditions.



Existing PLC



New Gate Operator



Existing Train Lift Ctrl

### Decision Making and Problem Solving

Establishing the correct techniques and methods is always vital for solving problems. In this case, Decision Making and Problem Solving processes were utilized in order to perform a complete analysis to determine the best solution. As a result, the following problem solving process was established:

- Identify the problem, which has been confirmed as a “safety issue”.
- Analyze the problem based on the information gathered which was the result of a complete assessment and field survey performed.
- Establish possible feasible options that would be available to solve the problem.
  - In this case, the most acceptable option was the installation of a new interlock control system for swing and sliding gates.
  - Retraining the employees on safety while working on access platforms at the Shop was another option. However, since humans commit accidents unexpectedly, this did not ensure a considerable minimization of the safety risk.
- Select the most feasible option. As mentioned before, it was determined to install a new interlock control system for swing and sliding gates.
- Implementation of the chosen option (Construction and installation stage).
- Verification of the implemented option chosen including installation verification, inspection, testing and commissioning.

### Access Platforms Interlock Control System Design and Installation

The following are specific key elements of the design to be implemented:

- PLC control panel and associated conduit and wiring for power and controls.
- PLC programming including sequence of operation and control matrix. This will determine the instructions and conditions for gates operation.
- Field devices (laser sensors, prox. sensors, gates operators, solenoid gates locks, etc.).

## RESULTS

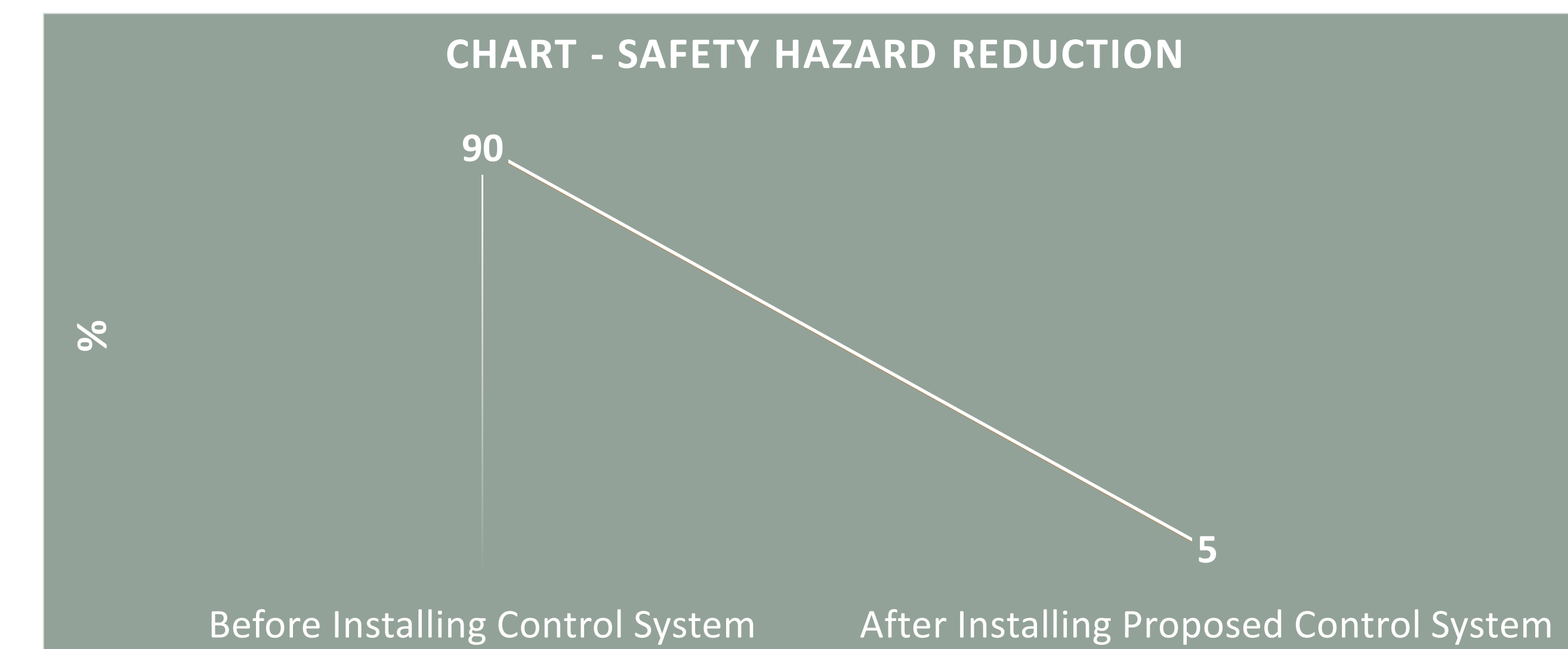
As part of the automation process, a comprehensive and logic plan including complete design have been put in place in order to satisfy the requirements to control adequately the access platforms gates and sensors. The following are general guidelines established for the operation:

- Based on the proposed design, all gates will be controlled in coordination with train presence/absence status.
- By establishing an automated control system, the access to the platforms will be safer since workers will be able to operate the gates only under certain conditions.
- By establishing an accurate sequence of operation through programming the PLC Control System, it would support the safety protocols associated to control the gates in a way that the safety hazard is reduced considerably.

### System Implementation and Installation

Implementation and testing would be the final stage on the process and the most critical one. At this point, the plan and design have to be carried out in an accurate way in order to have a correct and reliable installation. With this, the following are several details regarding information used to ensure quality and the stages of construction and installation:

- High quality installation in accordance with applicable codes, organization’s design criteria and specifications including safety standards.
- Coordination of the supervision and inspection of the new control system implementation includes but is not limited to the following:
  - Installation Verification and Inspection.
  - Field Acceptance Test and Commissioning.
  - System Turn Over (including turn over package) and As-Built Drawings.



## CONCLUSIONS

It has been established the main objective and purpose of this project which is providing a safe work environment to all employees. That is why it has been developed a complete assessment and analysis including going through the adequate problems solving and decision making processes in order to determine the correct path forwards to solve the safety issue that has been identified. Key implementation points are:

- By having a complete analysis performed, it has been recognized ways to implement the proposed design by considering alternate solutions and options identified during the problems solving stage.
- It was possible to choose the best option to achieve the established objective or goal in order to satisfy the project focus on safety.