

How Configuration Management Helps Ensure Information Integrity

Improve safety, ensure compliance with PTC requirements, and extend the life of rail assets

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Rail and transit agencies struggle with a complex set of challenges, including: increased safety concerns and regulatory compliance; accelerating demands on a rapidly aging infrastructure; too many sources of data (or siloed systems); limited financial resources; and an overextended workforce. These challenges are occurring against the backdrop of immense technological advances. There is a nexus of old and new processes where digital transformation, the Industrial Internet of Things (IIoT), and the business of railroading all intersect. The federal mandate for Positive Train Control (PTC) perfectly encapsulates this new reality. If you are in the rail business, your organization has already allocated some level of investment in PTC, but how does that investment of financial and human capital fit into your overall business architecture? How are you going to ensure that you do not just implement another siloed system?

PTC, as mandated by Congress, must be designed to prevent train-to-train collisions, derailments caused by excessive speed, unauthorized incursions by trains onto sections of track where maintenance activities are occurring, and the movement of a train through a track switch left in the wrong position. There are three main elements of a PTC system that are integrated by a wireless communications system:

- Onboard or Locomotive System: An onboard or locomotive system monitors the train's position and speed and activates braking as necessary to enforce speed restrictions and unauthorized train movement into new sections of track.
- Wayside System: A wayside system monitors railroad track signals, switches, and track circuits to communicate authorization for movement to the locomotive.
- Back-Office Server: The storehouse for all information related to the rail network and trains operating within it, a back-office server transmits authorization for individual trains to move into new segments of track. This last element is where information management and configuration management occur.

Configuration Management Helps Ensure Information Integrity

What exactly is configuration management? One description is that configuration management is the systematic approach for identifying, documenting, and changing the characteristics of a site or product's structures, systems, and components and ensuring that conformance is maintained between the design requirements, physical configuration, and site configuration information.

The strategy utilized to implement PTC must satisfy the mandate as well as improve all operations. Configuration management ensures asset configurations conform to their requirements by identifying and retaining the context of information and its relationship to projects, processes, equipment, organizations, and users throughout their lifecycles. It maintains information integrity and consistency with configuration management best practices and closed-loop change management. And, in the context of PTC, sensor data, software, and geo-coordinates all become part of the configuration. Configuration management can help enable PTC deployment and provide best practice configuration management capabilities and information integrity in a changing environment.

The PTC regulations identify specific elements for compliance that align with configuration management: Hardware, software, and firmware revisions must be documented in the operations and maintenance manual according to the railroad's configuration management control plan. You must specifically and rigorously document each variance, including the significance of each variance between the PTC system or attest that there are no variances between the PTC system and its applicable operating conditions. It is important to identify configuration and revision control measures in the Positive Train Control Safety Plan (PTCSP) that is designed to ensure safety-functional requirements and the safety-critical hazard mitigation processes are not compromised as a result of any change.

PTC REGULATIONS: Configuration management supports compliance with many PTC mandates

- 236.1039 Operations and Maintenance Manual: Hardware, software, and firmware revisions must be documented in the Operations and Maintenance Manual according to the railroad's configuration management control plan and any additional configuration/revision control measures specified in the PTCDP and PTCSP
- 236.1015 PTC Safety Plan content requirements and PTC System Certification: (2) (i) Specifically and rigorously document each variance, including the significance of each variance between the PTC system ...; or
 - » (ii) Attest that there are no variances between the PTC system and its applicable operating conditions as described in the applicable PTCDP from that as described in the PTCSP; and (3) Attest that the system was otherwise built in accordance with the applicable PTCDP and PTCSP and achieves the level of safety represented therein.
- 236.1023 Errors and malfunctions: Identify configuration/revision control measures in its PTCSP that are designed to ensure the safety-functional requirements and the safety-critical hazard mitigation processes are not compromised as a result of any change and that such a change can be audited.
- 236.1037 Records retention: Each railroad with a PTC system required to be installed under this subpart shall maintain at a designated office on the railroad: Adequate documentation to demonstrate that the PTCSP and PTCDP meet the safety requirements of this subpart, including the risk assessment; ... Training and testing records; ... Results of inspections and tests.

Rail organizations can better understand the details and location of assets, including how they have changed, their current condition, and their remaining life, when investing in PTC and configuration management. The inter-related asset information and configuration management drive everything from safety to capital planning, compliance, and efficiency in the workforce.

Configuration Management Use Case

Bentley Systems' configuration management and information management capabilities have been used by numerous organizations across a wide range of industries including rail, road, mining, and energy for over 15 years. One long-term configuration management use case is Crossrail, who needed to ensure that the railway could be operated and maintained efficiently and effectively over its life in accordance with good practice approaches to asset management.

Crossrail's motivation for using configuration management software was that being a large, complex, and highly integrated rail system presented many challenges and risks in terms of establishing and maintaining the integrity of information and the system configuration throughout the asset lifecycle. Crossrail faced issues including incomplete, inaccurate, and out-of-date information that was not accessible or relevant to the role, or not related to physical assets and configurations. As a result, the impact of change was difficult to manage, making information obsolete.

In 2009, Crossrail began creating and managing their asset information using Bentley's configuration management capabilities. Crossrail's vital asset information is supported by a configuration management process for establishing and maintaining the consistency and integrity of configuration items and the relationships between these items. Crossrail is now able to manage over 1 million information assets throughout the lifecycle, ensure compliance to standards, reduce risk and costs, achieve operational readiness, and ensure customer satisfaction.

The Benefits of Configuration Management

An asset configuration information management system lets you know exactly what and where your assets are and how they have changed over time. In addition, it enables you to track the current state of all assets to optimize operational performance and leverage data from IIoT enabled systems, including PTC sensor technology to make the right decisions at the right time. Use configuration management to improve safety and ensure compliance with Federal Railroad Administration (FRA) requirements as well as extend the operable life of rail, transit, and right-of-way assets.