Case Study | US

Reducing Mass Transit Station Delays RSR180 and FAdC

Background

A large urban transit operator identified a station in its system where significant bottlenecks frequently occur. The track layout of this station includes a grade-separated junction of three subway lines. At the lower platform, 'A' trains take the normal route on track 1, but 'B' trains on the same track take a diverging route to connect to the 'C' line. Delays occur when trains on the 'B' route are forced to move slowly to match open slots between the 'A' and 'C' lines. Any delay on either the 'A' or 'C' line is extended to the other line by the 'B' trains. In addition, the complexity of auto-routing triggers at this station can further delay trains on the 'B' line that request the connecting route. Switches at this location are "forced and locked" in the normal position to allow trains to safely approach the station platform at higher speeds. An ASR timer limits the release of interlocking switches after a route has been cancelled, preventing a train moving towards the interlocking and unable to stop from having a switch thrown underneath it. At this location, the timer is set to the AREMA minimum value of 30 seconds.

Solution

A Frauscher wheel detection solution was commissioned into service to verify when southbound trains on Track 1 are berthed at the platform, allowing a bypass of the 30 second timer and a safe, early release of the switches. With the existing system, trains were forced to extend their dwell times unnecessarily each time a train had to diverge onto the 'C' line. When timer bypass criteria are met, dwell time is reduced from thirty seconds to five seconds. This significantly reduced dwell time greatly improved efficiency at this station, eliminating the frequent bottlenecks of the past.

Benefits

The Frauscher Advanced Counter FAdC and Wheel Sensors RSR180 provide more predictable equipment circuit delay, less reliance on average speeds for timing calculations, and are not susceptible to loss-of-shunt delays. Due to these factors, the FAdC is extremely well suited to control the timing circuits for this approach-locking application. It allows for quicker response times and relief at bottleneck areas if there are trains on approach to an interlocking when an unscheduled or accidental route occurs. This station handles numerous trains that arrive frequently and regularly throughout the day, with approximately half of these trains using the diverging route. By consistently reducing dwell time from thirty seconds down to five, there is a significant implied savings in unnecessary dwell times every day.

Project Details

Functional Description

In this application, three Wheel Sensors RSR180 were installed on the track, identified in Figure 1 as WS 1, WS 2, and WS 3. The operator required two wheel sensors to be used to verify a train has entered the platform; however, the same could be accomplished with just one sensor. Verification of the train entering the platform is accomplished via signals from the wheel sensors that feed directly into the Frauscher Advanced Counter FAdC, which then produces direction outputs to verify train presence. These direction outputs to verify presence are provided in a failsafe manner, and without exception are output only when a complete passing of a wheel is detected in normal travel direction over the respective sensor. This output is used to start the bypass logic circuit based on a valid train movement towards the switch.

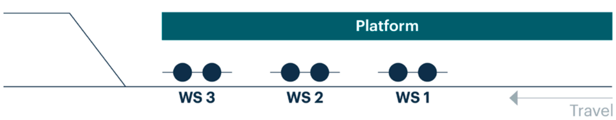

Figure 1

When a train is berthed at the platform, the front axle of the train rests between WS 2 and WS 3, as illustrated in Figure 2. The signal from WS 3 is utilized for overrun detection based on another type of direction output of the FAdC. These outputs are failsafe and indicate that the train has overrun the switch foul point. Contrary to the outputs used for verification of train presence described above, the output for WS 3 is provided at the beginning of a wheel passing being detected, as well as when any exception or system fault occurs. In the case of an overrun, the bypass logic would be aborted immediately, reverting back to the 30 second timer to maintain safety.

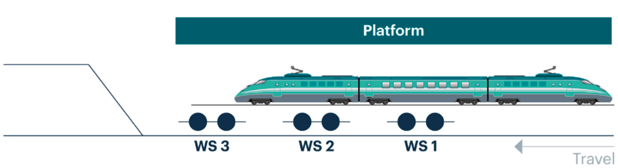

Figure 2

Conclusion

A busy station on a large mass transit subway line consistently experienced significant system delays due to a layout that includes diverging tracks. The point where the trains diverge is where most of the delays occurred. In addition, this station utilizes complex auto-routing triggers and switches that are in the “forced and locked” position, requiring a 30 second ASR timer – adding to delays in certain situations.

Frauscher was able to provide a solution that has greatly improved dwell time at this busy station. This system detects trains and can verify when they are berthed at the platform, allowing a bypass of the 30 second timer and a safe, early release of the switches. Significant dwell time is now saved every day, a major factor in the smooth and efficient operation of this station.

General Station Berthing Application

Every transit system is unique, and the example above illustrates a specific means of implementing a station berthing application based on this transit’s particular needs and requirements.
A basic layout that can easily be adapted to any transit station would include a minimum of two wheel sensors to detect the presence of a train and also to detect if a train has overrun the berthing area. Additional sensors can be deployed depending on specific requirements, such as increased position accuracy or determination of train length. Axle counter-based station berthing systems can be used for many functions, such as:

- Vital input to adjacent grade crossings
- Vital input for opening auxiliary signaling functions
- Control input for open or closing platform doors
- Train approach warning systems for passengers on the platform