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TecNote 1001 – Light Rail Vehicle Preemption (LRVP)

The Naztec 980 controller fully supports both the NEMA TS-2 standard and the NTCIP protocols. The Naztec 970 is an upgrades for the 170 prom module and front panel to provide the same functionality as the 980 TS-2 controller with full NTCIP support. Both controller lines provide an optional software module that allows a signal to be preempted by light rail trains with signal displays provided for up to two light rail crossings.

All Naztec controllers provide 16 phases and 16 overlaps assignable to 4 separate rings. This functionality combined with the Light Rail Vehicle Preemption (LRVP) can accommodate any traffic control situation requiring adjacent light rail preemption. LRVP requires detector inputs that are not defined in the NEMA or CALTRANS controller specifications.

The Naztec TS-1 and TS-2 (type 2) controllers provide these LRVP detector inputs through a D-connector . The NEMA TS-2 (type 1) specification does not define messages for the TS-2 SDLC to implement LRVP, so a TS-1 or TS-2 (type 2) cabinet facility is required. The CALTRANS 170E specification also provides additional detector inputs to implement LRVP with the Naztec 970 upgrade kit.

The purpose of this TecNote is to document the programming and operation of the Naztec LRVP module that was first developed for the Hudson-Bergen light rail project in New Jersey.

LRVP Detection

To understand LRVP, you need to understand the purpose of each LRVP detector input in the sequence that it is activated as the train approaches the street crossing.

Advance Call Detector

The *Advance Call Detector* is placed far enough from the crossing so that the track signal turns green prior to the train arriving at the crossing. The approaching train activates the *Advance Call Detector* and preempts the controller to turn the track signals green within a specified “Arrival Time” period. The rules for transferring the right-of-way to the specified track phase are similar to those used for rail and emergency vehicle preemption.

Check In Detector

Once the train signal (track phase) turns green, a specified “Minimum Green” period begins timing until the train is detected at the *Check In Detector.* If the “Minimum Green” period times out and a train is not detected at the *Check In Detector,* the train signal will turn red and an alarm will be dispatched to the central control system.

Check Out Detector

If the train arrives at the Check In Detector before the “Minimum Green” times out, another timer called the “Clearance Time” begins to insure that the train makes it to the *Check Out Detector* on the other side of the street crossing. If the “Clearance Time” ends before the train is detected at the

Check Out Detector, an alarm is sent to notify the central office that the train is stalled on the crossing and the track signal clears to red. However, normal operation continues to hold the track signal green until the end of the train clears the intersection and is released by the *Check Out Detector*. The LRVP module also provides a "Maximum Green" timer to limit the track green when multiple trains with short headways would extend the track greens beyond a desirable period.

Additional LRVP Timing Parameters

Separate detector inputs provided an Advance Call Detector, a Check In Detector and a Check Out Detector for the "A" and "B" directions for two separate LRVP crossings. The Naztec LRVP module also provides "Psuedo Advance Call Detectors" which simulate an advance call when the train activates the "Check Out Detector" and the rail line has a green signal indication. A "Pseudo Time" is provided to control the length of these pseudo outputs.

A "Separation Time" is provided to control reservicing the track green. The track signal will not turn green until the "Separation Time" has expired from the end of the last LRVP for the same direction of travel. Additional parameters are provided in the LRTP module to transition from normal stop-and-go operation to LRVP operation. "Clearance Phases" may be specified to clear the crossing prior to the arrival of the LRVP. The time specified to "clear the track" phases prior to the arrival of the train must be included in the "Arrival Time" after the Advance Call Detector is activated. "Return Phases" may also be specified to control where the controller comes out of LRVP. If no "Return Phases" are specified, the controller returns to the phases following the track phase at the end of the LRVP sequence. If the "Return to Interrupted Phase" value is set to YES, the controller will exit the LRVP sequence and return to the signal phases that were interrupted when the signal was preempted.

LRVP Status Screens

The LRVP module provides two status screens that show all timing sequences during preemption and log the duration and direction of each preemption. Each tracks is monitored separately and the "Forward" and "Reverse" direction is indicated for each track sequence. All timers discussed in this documentation are shown on this display with a one second resolution.

Conclusion

The Naztec LRVP module provides a cost effective alternative to grade separation for at-grade light rail crossings. The ability to sense the approaching light rail vehicle and provide a track green indication in advance of the train enhances the mobility of mass transit while satisfying local intersection demand. Naztec can provide the LRVP module for NEMA TS-1, TS-2 (type 2) and 170 control applications at a nominal cost. Naztec plans to include the LRVP module in the 2070 Advanced Traffic Controller. The controller software for the 2070 should be complete by the fourth quarter of 2000.

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