ODOT Research Executive Summary Report

State Job Number: 134696

Ohio Department of Transportation
Office of Statewide Planning & Research
Research Section
1980 West Broad Street, Mail Stop 3280
Columbus, OH 43223
614-644-8135
Research@dot.state.oh.us
www.dot.state.oh.us/Research

Mining vehicle classifications from the Columbus Metropolitan Freeway Management System

FHWA Report Number:	FHWA/OH - 2015/1
Report Publication Date:	January 2015
ODOT State Job Number:	134696
Project Duration:	32 months
Start Date:	July 13, 2012
Completion Date:	March 13, 2015
Total Project Funding:	$160,000
Research Agency:	The Ohio State University
Researchers:	Benjamin Coifman, Bo Huang, Keith Redmill, Mo Wu
ODOT Technical Liaisons:	David Gardner, Lindsey Pflum

For copies of this final report go to http://www.dot.state.oh.us/research.

Project Background

Vehicle classification data are used in many transportation applications, including: pavement design, environmental impact studies, traffic control, and traffic safety. Ohio has over 200 permanent count stations, supplemented by many more short-term count locations. Due to the high costs involved, the density of monitoring stations is very low given the lane miles that are covered. This study leveraged the deployed detectors in the Columbus Metropolitan Freeway Management System (CMFMS) to collect and analyze classification data from critical freeways where the Traffic Monitoring Section has not been able to collect much classification data in the past due to site limitations.

The CMFMS was designed for real time traffic monitoring. It was deployed in an unconventional manner because it included an extensive fiber optic network, frontloading most of the communications costs, and rather than aggregating the data in the field, the detector stations sent all of the individual per-vehicle actuations (i.e., PVR data) to the traffic management center (TMC). The PVR data include the turn-on and turn-off time for every actuation at each detector at the given station. Our group has collected and archived all of the PVR data from the CMFMS for roughly a decade. The PVR data allows us to reprocess the original actuations retroactively. As described in the report, the research undertook extensive diagnostics and cleaning to extract the vehicle classification data from detectors originally deployed for traffic operations.

State Job Number: 134696

Study Objectives

This work sought to leverage the existing real-time traffic monitoring infrastructure of the CMFMS to collect length based, vehicle classification data. The individual vehicle actuation data were collected from the 69 detector stations in the CMFMS. The first 46 detector stations were installed on I-70/I-71 during Phase I of the CMFMS, completed in 2001. Only 35% of the Phase I detector stations have dual loop detectors, for the most part these stations were deployed with one dual loop detector station every mile, and two single loop detector stations between dual loop stations. Another 23 detector stations were installed on SR 315 / I-270 / I-70 / I-670 during Phase II of the CMFMS, completed in 2006. The Phase II stations were deployed at a much lower density than those from Phase I and roughly 90% of the Phase II detector stations have dual loop detectors.

The primary thrust of this work was extracting classification data for the previous ten years from the archived PVR data. While length based classification from dual loop detectors is common, it relies in finely tuned detectors. The focus of this task was on the details of extracting the classifications, establishing and implementing the desired level of confidence, developing approaches to handle data outages, establishing links with multiple stations and fusing data from those stations, developing tools to aggregate and report the data in the format(s) desired by ODOT, and several other related implementation tasks. The CMFMS detectors are not finely tuned, but we have developed tools using the PVR data to identify problems and in most cases correct for them.

The second thrust of this work sought to develop an on-going process collect these data into the future. The real-time aspect of the CMFMS was decommissioned in 2011 with the statewide move to vendor collected traffic speed and travel time data for real-time operations. Many of the CMFMS loop detector stations, however, remained functional and with the advances from the first thrust, it was hoped that a portion of the CMFMS could be reactivated to continue classifying vehicles.

Description of Work

As described in this report, the research undertook extensive diagnostics and cleaning to extract the vehicle classification data from detectors originally deployed for traffic operations. The classified vehicle counts were reported separately to ODOT, for three vehicle length classes (intended to roughly mapping to passenger vehicles, single unit trucks and multi-unit trucks), aggregated to 15 and 60 min periods over the entire duration of the archived data.

Research Findings & Conclusions

The work yielded length based vehicle classification data from roughly 40 bi-directional miles of urban freeways in Columbus, Ohio over a continuous monitoring period of up to 10 years. The facilities span I-70, I-71, I-270, I-670, and SR-315, including the heavily congested inner-belt. Prior to this study, these facilities previously had either gone completely unmonitored or were only subject to infrequent, short-term counts. With regard to reactivating the CMFMS, while it appears to be technically feasible, the demands to do so proved to be far to great to justify at this time.

State Job Number: 134696

Recommendations for Implementation of Research Findings

The newly available classified vehicle counts should allow ODOT and other agencies to go back and develop a richer picture of traffic volumes on the Columbus freeways for the roughly 10 years that the CMFMS was operational. If the value of these data proves to be beneficial, ODOT should also evaluate the benefit of making a larger investment to reactivate some of the CMFMS detector stations for continued classified vehicle counts into the future.