South Fulton Community Improvement District

FREIGHT INTELLIGENT TRANSPORTATION SYSTEM

prepared for

South Fulton Community Improvement District

prepared by

Cambridge Systematics, Inc.

with

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South Fulton Community Improvement District

CAMBRIDGE SYSTEMATICS

July 1, 2020

report

South Fulton CID Freight Intelligent Transportation System Concept of Operations

Draft

prepared for

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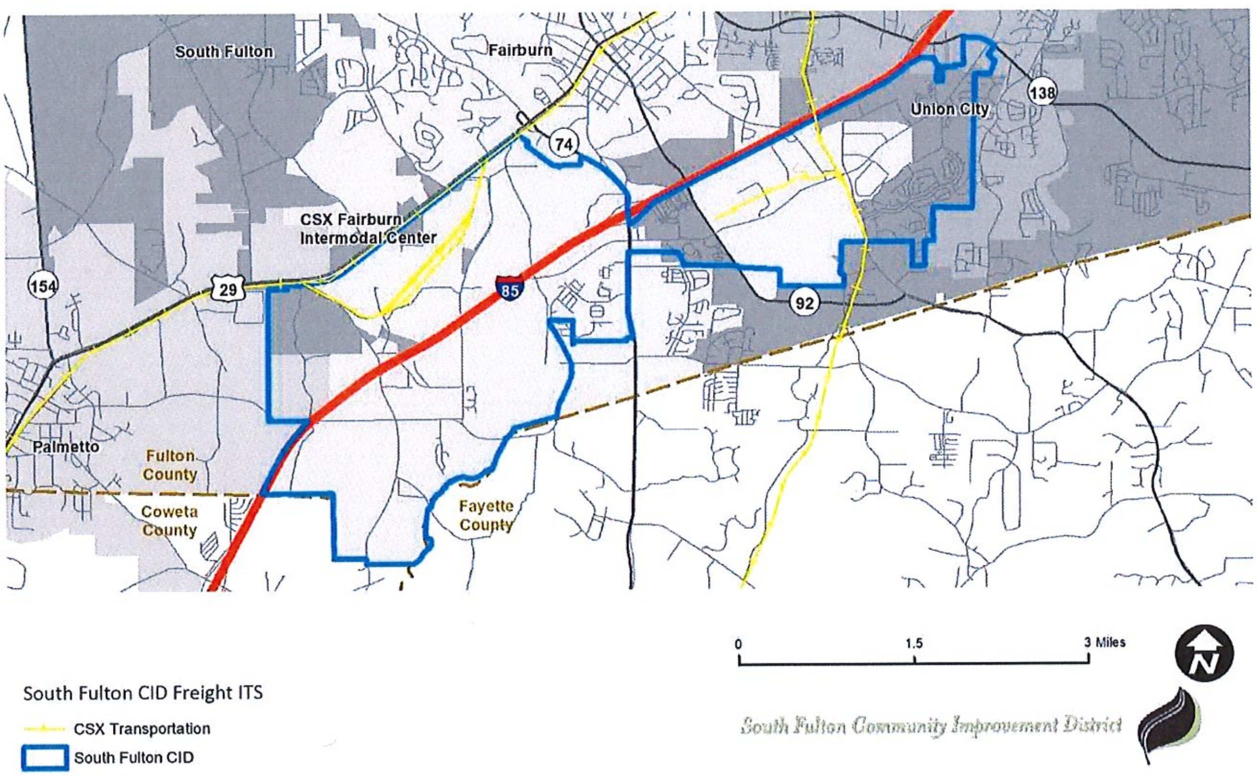
1.0 Purpose

The purpose of this document is to describe the basic intelligent transportation system (ITS) architecture and communications network for near-term and long-term deployments of a Freight ITS project for the area surrounding the CSX Fairburn Intermodal Center using commercially available technologies. The South Fulton CID is shown in Figure 1.1 with CSX.

The prevalence of heavy truck traffic throughout the CID area takes a significant toll on the condition and performance of its multimodal transportation network and impacts employee commutes. A specific challenge is the impact of freight trains entering and exiting the CSX Fairburn Intermodal Center on the surrounding roadway network. Trains entering or exiting the intermodal terminal block multiple at-grade crossings which in turn blocks heavy trucks operating in the area. This is most pronounced on McLarin Road, where blocked crossings result in the roadway acting as a de facto staging area for trucks needing to access the intermodal terminal or one of the businesses along McLarin and Bohannon Roads. This is a significant source of nonrecurring congestion and negatively impacts surrounding businesses. The Freight ITS outlined in this report is part of the solution to addressing this particular challenge -- as well as broader freight mobility issues -- impacting the study area.

Figure 1.1 South Fulton CID Area



Source: South Fulton CID; Cambridge Systematics, Inc. analysis.

The report details the deployment of various ITS strategies into one integrated ITS system for an improved capacity for proactive and reactive management in and around the Fairburn Intermodal Terminal. The report clearly describes the various system integration and deployment requirements. It includes the following:

- Section 1 – Document Purpose defines the intent of this document and an overview of the contents.
- Section 2 – Plan Background contains overview information for the Project and purpose and need for the improvements contained in the Plan.
- Section 3 –Existing ITS Assets and Facilities provides an overview of the relevant existing ITS equipment and facilities in the study area.
- Section 4 – Concept of Operations provides recommendations of operational objectives to address the needs at the CSX Intermodal Center and the necessary roadway and ITS improvements needed to meet those operational objectives.
- Section 5 – Ultimate System summarizes the functionalities of the proposed Freight ITS system including desired features inclusive of regional goals, required architecture, and high-level system requirements.
- Section 6 – Technology Scan identifies the technologies considered and summarizes the results of the technology scan which involved research into the types of products available for the proposed projects and recommended solutions.

2.0 Freight ITS Plan Background

The prevalence of heavy truck traffic takes a significant toll on the condition and performance of the South Fulton CID's multimodal transportation network and it's businesses. A specific challenge identified in the South Fulton CID Multimodal Transportation Study was the impact of freight trains entering the CSX Intermodal Center on the surrounding roadway network. Trains entering the intermodal terminal block multiple at-grade crossings which in turn blocks heavy trucks operating in the area, especially McLarin Road. This results in McLarin Road acting as a de facto staging area for trucks needing to access the intermodal terminal or one of the businesses along McLarin and Bohannon Roads. This represents a source of significant nonrecurring congestion and negatively impacts the quality of life for surrounding residents. A freight ITS investment for the area is a potential solution as it could alert trucks to the presence of a train blocking at-grade rail crossings along McLarin Road, allowing them to avoid the area. In addition, the system could be paired with a short-term parking facility/staging area in which the ITS would direct drivers to a truck staging area where they could wait safely until a train clears the crossings.

Figure 2.1 Vehicle Queueing Along McLarin Road – 8-9 a.m., January 24, 2020

Source: Cambridge Systematics, Inc.

Figure 2.2 Vehicle Queueing Along McLarin Road – 8-9 a.m., January 24, 2020

Source: Cambridge Systematics, Inc.

3.0 Existing ITS Assets and Facilities

Existing ITS assets within the study area or that are physically located outside the study area but provide coverage include:

- GDOT NaviGAtor;
- GDOT Traffic Management Center (TMC);
- GDOT Field Equipment; and
- CSX Field Equipment.

3.1 GDOT ITS Assets

3.1.1 GDOT NaviGAtor

GDOT ITS assets located within the study area, or that are physically outside the study area but provide coverage, include the GDOT NaviGAtor, Traffic Management Center (TMC), and various field equipment. The GDOT NaviGAtor is the State's Advanced Traffic Management System (ATMS). The NaviGAtor system was first incepted in 1996 for the Olympic Games to help handle the expected influx of roughly 2 million visitors. The NaviGAtor system provides real time speed, volume, and travel time data by using field devices like closed circuit television and detection cameras, ramp meters and changeable message signs. Relevant hubs and field equipment from the freight ITS project may be integrated into the GDOT NaviGAtor system and this will allow the state's existing traffic management devices and equipment within and near the project area to connect to the South Fulton CID Freight ITS systems.

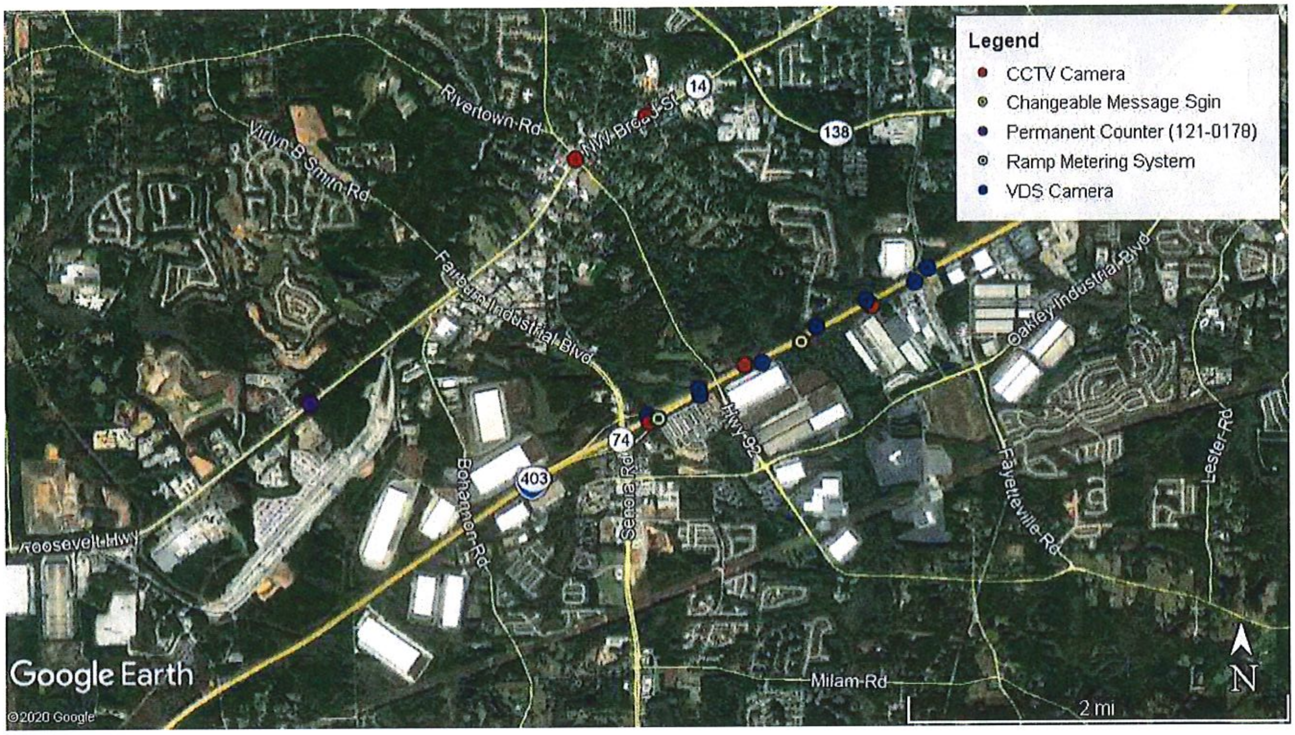
3.1.2 GDOT Traffic Management Center

GDOT has an extensive deployment of traffic operations systems and technology on the states highway network connected to their TMC. The GDOT TMC is the headquarters and information clearinghouse for NaviGAtor. It monitors travel conditions on the State's roadways and collects real-time information from video detection system cameras and other field devices. The GDOT TMC then communicates to the traveling public (i.e., via changeable message signs, the NaviGAtor web, and other means) useful information to improve safety, improve travel time reliability, and mitigate congestion, among others. Utilizing existing fiber and wireless connections, the South Fulton CID Freight ITS components have a communications pathway to the GDOT TMC. This helps in the integration of the of the regional ITS into the GDOT ITS program.

3.1.3 GDOT Field Equipment

The existing GDOT field equipment within the study area consists of 18 video cameras along I-85 and SR 14/U.S. 29/Roosevelt Highway, a changeable message sign and associated equipment north of SR 92/Spence Road on I-85, a ramp metering system for SR 74/Senoia Road onto I-85 Northbound, and a permanent count station on SR 14/U.S. 29/Roosevelt Highway. Other GDOT field equipment is located along I-85 and consists of fiber optic cable, conduit duct bank, and conduit access points.

Figure 3.1 GDOT Field Equipment – Cameras



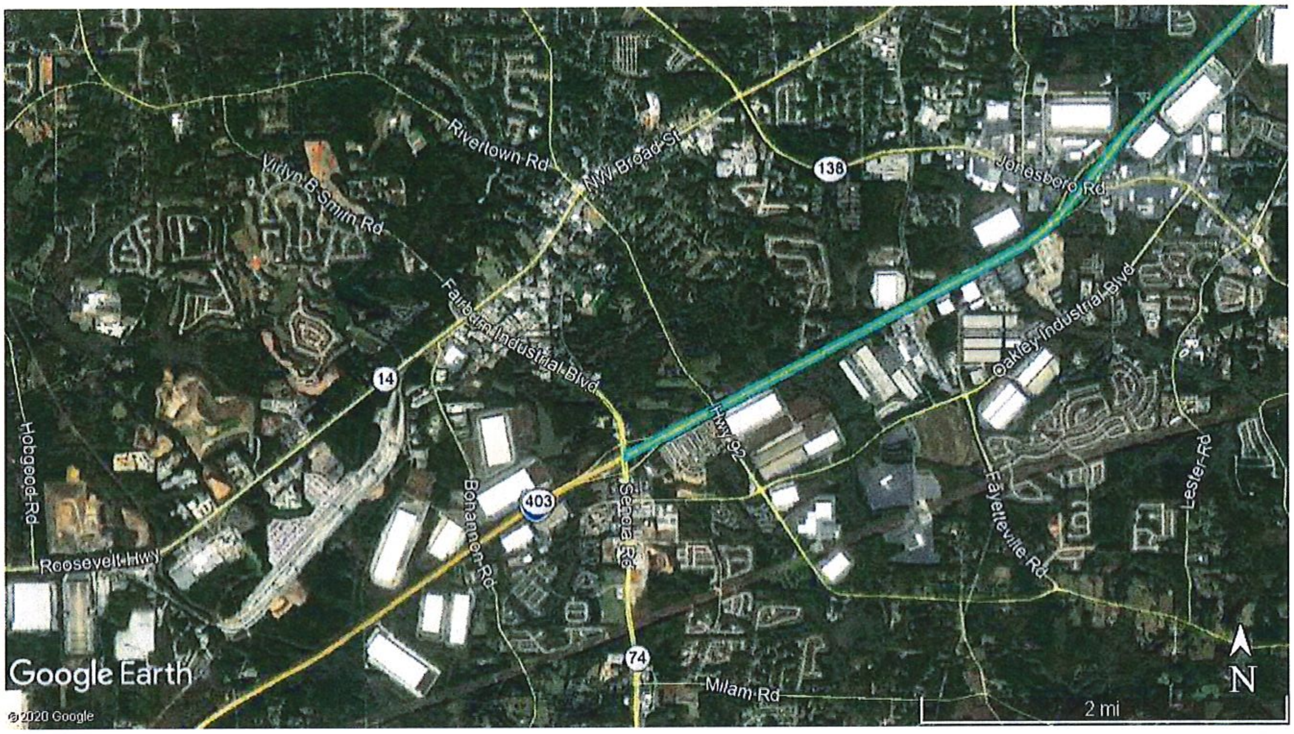
Source: Georgia Department of Transportation, Office of Traffic Operations.

The existing GDOT field equipment within the project area can be utilized to power and communicate with the new South Fulton CID Freight ITS components. Splicing existing fiber lines if any and routing them to the new freight ITS components can be done to be able to integrate into the GDOT ATMS. If there are no existing fiber lines in the vicinity of the project, a new fiber line and conduit will have to be installed. Coordination with GDOT is required for their interconnect/fiber layout plans.

Cameras were identified at SR 14/ US 29 / W. Broad Street and SR 14/ US 29 / Main Street intersections, to the north and south respectively. These cameras were identified to be connected to the GDOT NaviGAtor system with either fiber or radio wave antennas. This can be utilized to establish a communications pathway between the proposed ITS components and the GDOT ATMS.

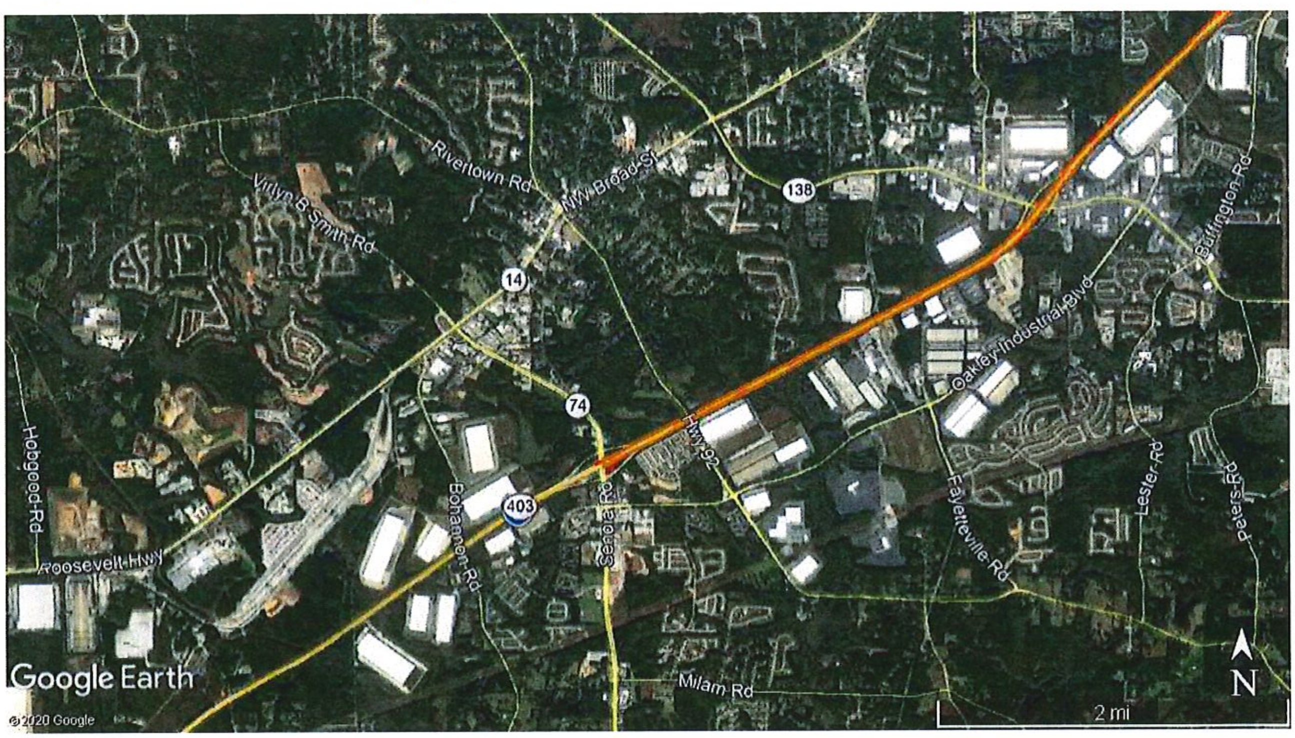
Once the Howell Avenue Extension is completely constructed, the communications to the GDOT system can be established fairly easily since the intersection is anticipated to be a signalized intersection.

Figure 3.2 GDOT Field Equipment – Fiber Optic Cable



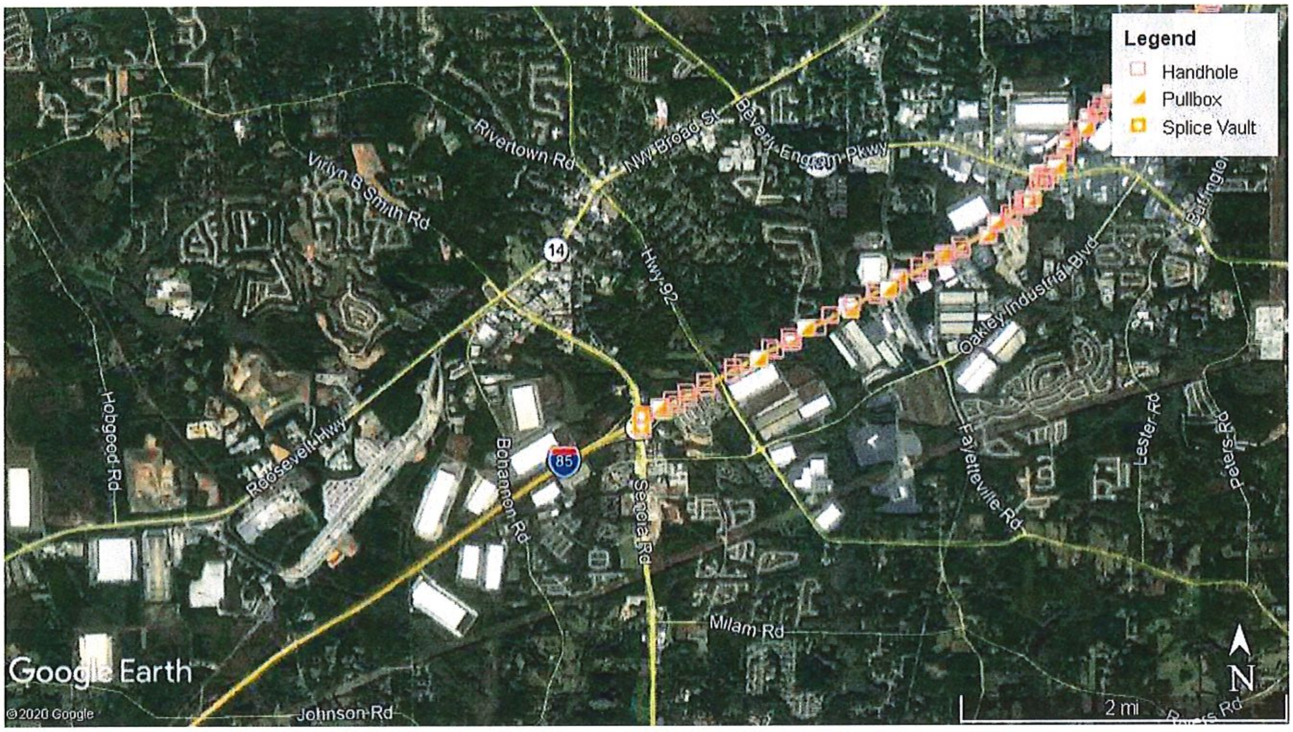
Source: Georgia Department of Transportation, Office of Traffic Operations.

Figure 3.3 GDOT Field Equipment – Conduit Bank



Source: Georgia Department of Transportation, Office of Traffic Operations.

Figure 3.4 GDOT Field Equipment – Conduit Handholes, Pullboxes, and Splice Vaults



Source: Georgia Department of Transportation, Office of Traffic Operations.

3.2 CSX Field Equipment

CSX's Active Warning System is deployed at at-grade crossings within the study area – notably at crossings with McLarin Road, Peters Street, and Gullatt Road. CSX field equipment includes crossing gates, warning lights, and controller cabinets at at-grade crossings.

4.0 Concept of Operations

This Concept of Operations document describes the high-level consensus vision of stakeholders in the South Fulton CID regarding freight transportation management and operations in the area surrounding the CSX Fairburn Intermodal Center. It also describes the agencies involved and their roles and responsibilities for the Freight ITS. Furthermore, the Concept of Operations addresses questions of what freight transportation management systems and improvements are needed in the study area and how they can be integrated into the broader regional system.

The vision for the Freight ITS is to support sustainable economic growth and expansion within the South Fulton CID through the development of a communications network that provides direct, real time information to local, regional, and State partners; the provision of an institutional environment that implements strategies and technological tools that enhance freight operations; provides safe, viable alternative routes for freight traffic; and the development of a system that allows for the measurement and monitoring of performance to allow for future enhancements.

The goals of the Freight ITS are as follows:

- Improve multi-jurisdiction and public-private coordination and collaboration;
- Improve communications and information sharing among public sector agencies and between the public and private sectors;
- Improve traffic and incident management throughout the South Fulton CID with a focus on the area surrounding the CSX Fairburn Intermodal Center;
- Reduce non-recurring congestion throughout the South Fulton CID with a focus on the area surrounding the CSX Fairburn Intermodal Center;
- Disseminate real-time information on traffic conditions in the South Fulton CID including the Fairburn Intermodal Center; and
- Mitigate impacts to the environment and the community caused by the movement of goods.

These goals are consistent with the Atlanta regional ITS Vision and goals.[1] Table 4.1 shows how the Freight ITS goals align with those of the Atlanta Region.

[1] https://cdn.atlantaregional.org/wp-content/uploads/atlanta-regional-its-architecture-2004-with-exhibit-2b-excerpt-2.pdf

Table 4.1 Alignment of South Fulton Freight ITS Goals with Regional ITS Goals

	Multi-jurisdiction coordination	Incident management	Communications and information sharing	Real time travel information	Traffic management	Safety	Non-recurring congestion	Air quality
Improve multi-jurisdiction and public-private coordination and collaboration.	●		●					
Improve communications and information sharing among public sector agencies and between the public and private sectors.	●		●					
Improve traffic and incident management throughout the South Fulton CID with a focus on the area surrounding the CSX Fairburn Intermodal Center.		●		●	●	●		
Reduce non-recurring congestion throughout the South Fulton CID with a focus on the area surrounding the CSX Fairburn Intermodal Center.		●		●	●		●	
Disseminate real-time information on traffic conditions in the South Fulton CID including the Fairburn Intermodal Center.				●	●		●	
Mitigate impacts to the environment and the community caused by the movement of goods.								●

Source: Atlanta Regional Commission, Atlanta Regional ITS Architecture, 2004; Volkert, Inc; Cambridge Systematics, Inc.

4.1 Agency Roles and Responsibilities

The primary entities and agencies involved in the deployment of the Freight ITS include the City of Fairburn, CSX Transportation, and the Georgia Department of Transportation. Though not formally designated as a responsible entity, the South Fulton CID will play a critical role as a convenor of local, regional, and State stakeholders and also as a guiding hand in the evolution of the Freight ITS as the study area's needs and priorities change over time.

4.1.1 City of Fairburn

The proposed Freight ITS is primarily within the limits of the City of Fairburn. Furthermore, key first-/last-mile freight connectors included in the proposed system are locally owned and maintained roadways. These include Howell Avenue (including the planned extension), McLarin Road, Bohannon Road, Peters Street, Gullatt Road, and the SR 74-McLarin Road ramp. As a key stakeholder, the role and responsibilities of the City of Fairburn include:

- Manage and maintain local roadways included in the Freight ITS;
- Manage and maintain ITS equipment and devices; and
- Disseminate information on construction and work zones that may impact the Freight ITS to other stakeholders.

4.1.2 CSX Transportation

The CSX Fairburn Intermodal Center is a freight rail terminal that serves domestic intermodal freight. It moves containers between trucks and trains (e.g., lifts) as goods are shipped to their final destinations. On average, there are about 500,000 annual lifts at the Fairburn Intermodal Center[2]. Operations at the intermodal terminal and their impacts on surrounding roadways is the primary motivating factor for the Freight ITS. As such, CSX Transportation plays a critical role in the success and operation of the Freight ITS. As discussed in greater detail in sections 4 and 5, the proposed Freight ITS includes as a component the CSX active warning system. Furthermore, as the system grows and evolves over time, greater information on operations within the intermodal terminal may be incorporated into the Freight ITS including truck turn times, loading/unloading times, and advanced warning information for long trains, among others. The roles and responsibilities of CSX Transportation include:

- Manage and maintain the active warning system; and
- Disseminate information on operations at the Fairburn Intermodal Center to other stakeholders.

4.1.3 Georgia Department of Transportation

GDOT is a critical stakeholder for the Freight ITS as the proposed system will be incorporated into the broader regional ITS that GDOT owns and operates. Existing ITS assets in the study area are wholly owned

[2] January 16, 2020 interview with CSX.

by GDOT. In addition, SR 74 and U.S. 29/Roosevelt Highway are the primary arterial roadways providing access to the CSX Intermodal Center and the broader State network and National Highway Freight Network. These routes are owned and operated by GDOT. As the primary operator of the proposed Freight ITS, GDOT's roles and responsibilities include:

- Real time video control;
- Traffic signal control on state routes;
- Traffic, incident, and construction information collection and dissemination through CMS and 511;
- Manage and maintain state roadways; and
- Manage and maintain the ITS including equipment and devices.

4.2 Proposed Freight and ITS Improvements

The identification and planning of the ITS and technology improvements in this report came through research and data gathering, meetings conducted with CSX Transportation, GDOT, the South Fulton CID, City of Fairburn and the Atlanta Regional Commission and interviews with key stakeholders in both the public and private sectors. The projects are intended to improve the efficiency, safety, and reliability of truck and rail access and circulation within and near the Fairburn Intermodal Terminal, as well as provide improved truck traveler information.

The Freight ITS focus is primarily aimed at traffic management and operations of the roadways that provide first-/last-mile connectivity to the Fairburn Intermodal Terminal and regional traveler information dissemination to and from the intermodal terminal. The improvements have been grouped into three categories:

- Phase I
  - These represent immediate roadway and operational improvements in progress intended to provide better access to the area surrounding the Fairburn Intermodal Terminal;
- Phase II
  - These represent near-term ITS investments primarily aimed at alleviating queueing along McLarin Road due to extended blockages of the at-grade crossing;
- Phase III
  - These are longer-term investments intended to better manage truck parking and staging needs in the study area as well as provide advanced warning for very long trains that have the potential to block multiple crossings in the study area for extended periods of time.

Table 4.2 summarizes the ITS improvement projects included in each of the three phases.

Table 4.2 Summary of Freight ITS Improvement Projects

Phase I	Phase II	Phase III
• Howell Avenue Extension	• Roadway and intersection upgrades: SR 74 at McLarin Road and SR 74 at U.S. 29 • Communications (Wi-Fi, fiber) • Queue detection • Wayfinding • Public/private communication and collaboration	• Truck staging lot and operations • Advanced train warning

Source: Volkert, Inc; Cambridge Systematics, Inc.

4.2.1 Phase I and II Freight ITS Improvements

Figure 4.1 contains a high-level decision framework that outlines how the Phase I/ II improvement projects would function to enhance freight mobility in the study area and to alleviate the queueing of trucks along McLarin Road due to extended blockages of crossing 901263C. Figure 4.2 contains a more detailed diagram of the flow of data for the proposed Freight ITS. Figure 4.3 depicts a conceptual layout of the Freight ITS including the roadway and intersection improvements proposed as part of the system. Generally, the proposed Freight ITS would follow these high-level steps:

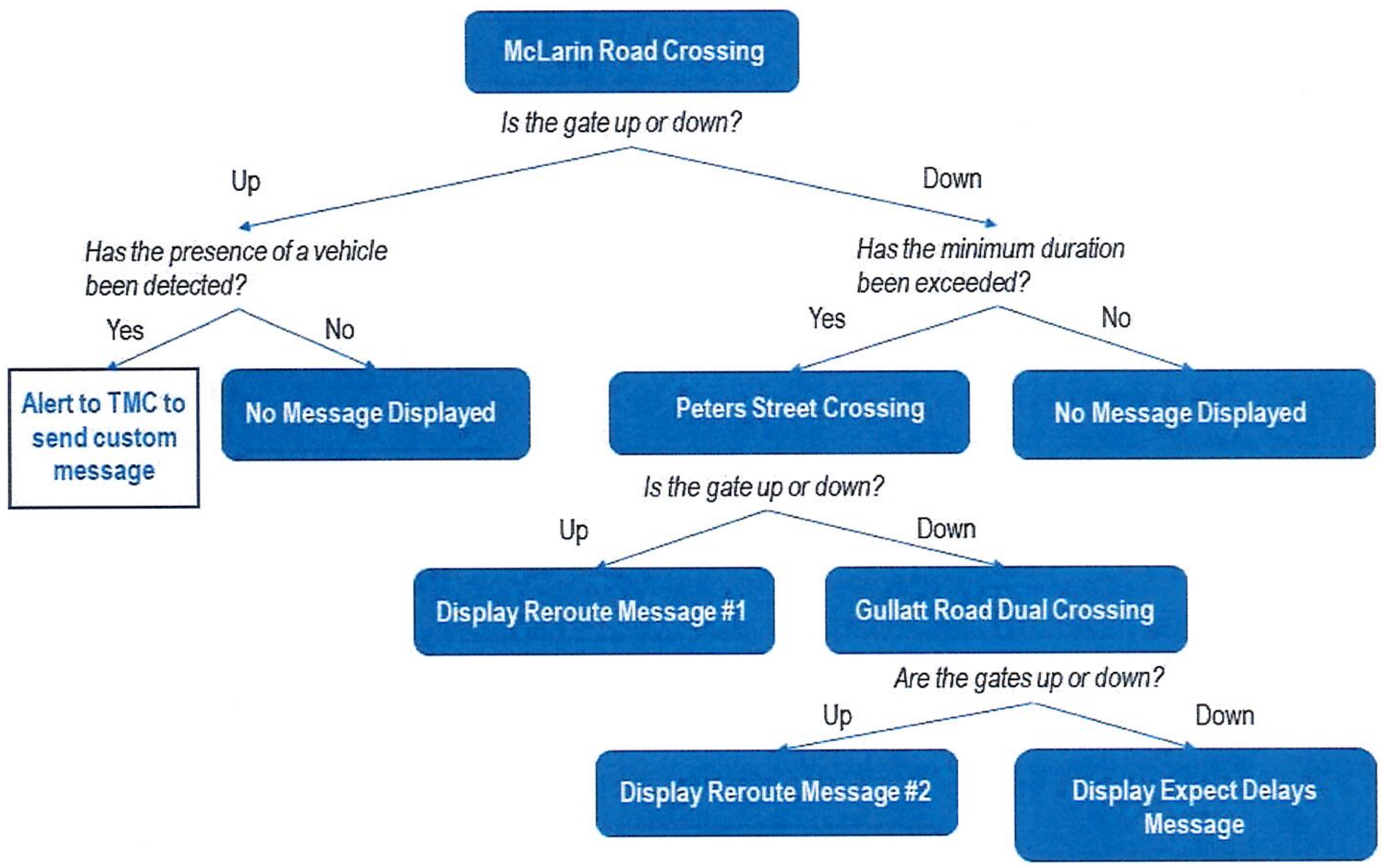
- The Freight ITS would first determine if the gates are up or down (and the active warning system activated) at crossing 901263C. This would be accomplished via a contact closure between the Freight ITS and the CSX controller cabinet. If the gate is up and no queue is detected at the crossing, no message will be displayed on the CMS in the study area. However, if the gate is up but a queue is detected, the Freight ITS will alert GDOT TMC so that a custom message may be transmitted based on area conditions as informed by the Observation and Detection components of the system.
- If the Freight ITS determines that the McLarin Road crossing gate is down, it would then determine if the minimum duration threshold has been exceeded. The minimum duration threshold is a set amount of time (that may be adjusted based on observed performance) that the crossing must be closed before the Freight ITS re-routes trucks to an alternative crossing. As the results of the Traffic Study (included in Appendix A) suggest, due to activity within Fairburn Intermodal Terminal crossing 901263C experiences 1 or more closure every hour with the majority of these closures lasting only 3 to 9 minutes. To prevent freight traffic from being needlessly re-routed during a relatively brief closure, the Freight ITS proposes to re-route truck traffic only if the minimum threshold has been exceeded. So, if the McLarin Road crossing gate is down but the minimum threshold has not been exceeded, no message is transmitted to the CMS. Alternatively, if the McLarin Road crossing gate is down and the minimum threshold has been exceeded, the Freight ITS then checks if the queue length is met. If the queue length is not met, then a custom message is transmitted to the CMS indicating that the crossing is blocked and there will be a delay. If the

queue length is met then the freight ITS checks the status of other crossings in the study area (namely, Peters Street and Gullatt Road) to determine if trucks may be re-routed to those crossings.

- If the Freight ITS determines that the McLarin Road crossing gate is down (and the active warning system activated) and the minimum duration threshold has been exceeded and the queue length is met, the Freight ITS then checks if the gates are up or down at the Peters Street at-grade crossing. If the gate is up, the Freight ITS will transmit a message to the CMS to re-route to the Peters Street at-grade crossing. If the gate is down at Peters Street, the Freight ITS will then determine the status of the Gullatt Road dual at-grade crossings. If the gate is up, the Freight ITS will transmit a message to the CMS to re-route to the Gullatt Road dual at-grade crossings. If the gate is down at the Gullatt Road dual at-grade crossings, the Freight ITS will then display a message indicating to expect delays for accessing the study area.

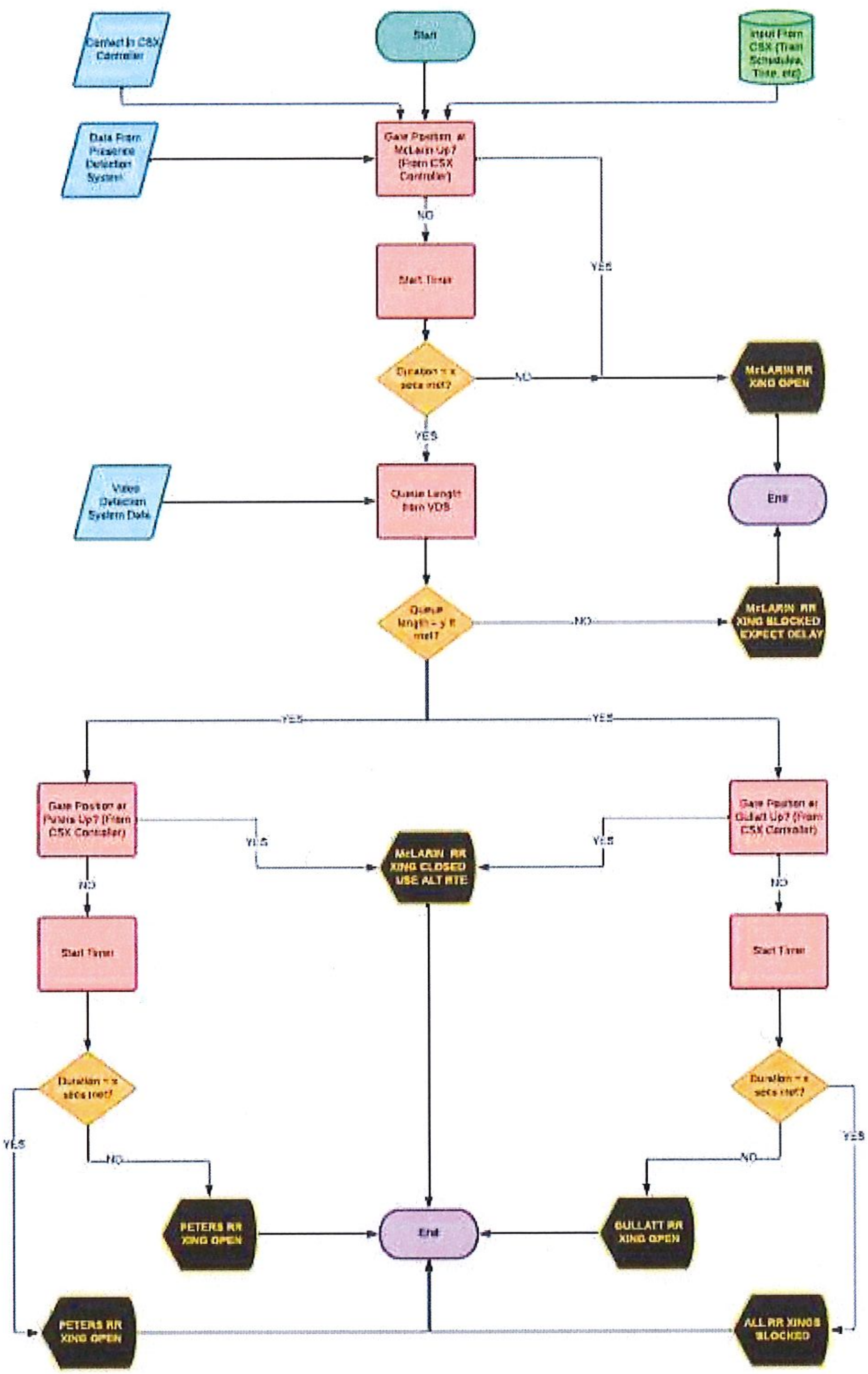
It is important to note that the diagrams in Figure 4.1 and Figure 4.2 assume that the Freight ITS will perform semi-autonomously via a roadside logic controller capable of sorting and distributing data to the State's existing network of Highway Advisory Radio (HAR) systems, dynamic message signs, flashing beacon systems, and in-vehicle warning systems via Dedicated Short-Range Communication (DSRC) radios and infrastructure. Thus, the Freight ITS will be capable of transmitting to the CMS predetermined messages based on the statuses of study area at-grade crossings and the presence or absence of queues along McLarin Road without intervention by the GDOT TMC. However, the GDOT TMC will have the capability of entering custom messages if they are needed based on area conditions as informed by the Observation and Detection components of the Freight ITS.

Figure 4.1 Phase I/II Freight ITS Decision Framework



Source: Volkert, Inc; Cambridge Systematics, Inc.

Figure 4.2 Phase I/II Freight ITS Concept Diagram



Source: Volkert, Inc; Cambridge Systematics, Inc.

Figure 4.3 Phase I/II Freight ITS Concept Layout

VOLKERT

TYPICAL CMS INSTALLATION CONSISTS OF:

1. LED PIXEL CMS, NON-WALK-IN, 3X15
2. CMS CABINET
3. SHOULDER MOUNTED SIGN ASSEMBLY, TP 3
4. 4G LTE ROUTER
5. PULL BOX
6. POWER SOURCE
7. CAT6 CABLE, OUTDOOR RATED, SHIELDED
8. CONDUIT, NONMETAL
9. CCTV
10. STRAIN POLE

Source: Volkert, Inc; Cambridge Systematics, Inc.

Roadway and Intersection Upgrades

As shown in Figure 4.3 (with additional drawings included in Appendix B), intersection improvements will be made at the following locations to ensure that safe, viable alternative routes are provided:

- SR 74-U.S. 29 Ramp at U.S. 29/Roosevelt Highway;
- SR 74-U.S. 29 Ramp at SR 74; and
- SR 74-McLarin Road Ramp at SR 74.

The intersection of SR 74-U.S. 29 Ramp at U.S. 29 will be improved by adding an acceleration lane to the existing roadway geometry. Since the ITS concept diverts trucks onto U.S. 29 using the SR 74-U.S. 29 Ramp, an acceleration lane will be helpful in aiding the semi-trucks to accelerate up to speed before merging onto U.S. 29. Stakeholder feedback gathered as part of the SFCID Multimodal Study suggested that stakeholders perceive this intersection as being less safe for trucks due to the need for trucks to accelerate from a complete stop into traffic traveling at a high rate of speed.

As a part of long-term plans, improvements can be made to the intersection between Oakley Industrial Boulevard and Bohannon Road. This will enable semi-trucks to make a smoother right turn from Oakley Industrial Boulevard onto Bohannon Road.

Communications

The goal is to provide communication infrastructure (fiber optic lines or radio waves) that allows communication between the Traffic Management Center (TMC) and its components. Specifically, the railroad's active warning system and three (3) dynamic message signs for the purpose of advance warning. This will be shown through an interconnect communication plan that will include splice points at the existing communication infrastructure. Power service locations are needed for the proposed South Fulton CID Freight ITS components such as the Changeable Message Signs. Coordination with utility companies is needed to meter the power service locations.

Field Devices

The proposed Freight ITS will include a variety of field devices. These field devices will include ATMS cabinets and controllers, fiber boxes, fiber cables and conduits, CCTV cameras with poles, power meters, changeable (or dynamic) message signs and detection cameras. These devices will collect and transmit data to the TMC as appropriate, providing the operators a view of traffic flow within the project area. A summary of the needed field devices in included below:

- Close Circuit Television (CCTV) Cameras – CCTV cameras will provide coverage on McLarin Road, Bohannon Road, SR 74, and U.S. 29/Roosevelt Highway and provide feedback to the GDOT TMC, allowing for quick response times to incidents on the road network. The CCTV cameras will have the capability of being viewed and controlled from the GDOT TMC.

- Changeable Message Signs – Changeable (or dynamic) message signs will be used to display important messages to drivers on the key corridors. They will alert trucks to the presence of a train blocking the at-grade rail crossings along McLarin Road and re-direct them to alternate routes.

- Detection Cameras – A detection camera is proposed for the Freight ITS and will be located at the McLarin Road at-grade crossing (Federal Railroad Administration ID 901263C). This camera will be used to detect and measure queue lengths at the crossing.

- Roadside Logic Controller Cabinet – The controller cabinet will establish a wireless communications pathway between the proposed ITS components and the existing regional system. Furthermore, this study proposes that the Freight ITS use a logic controller cabinet capable of sorting and distributing data to the State's existing ITS.

- Other Field Devices – Other field devices to deliver power and to establish a communication pathway (e.g., conduit, power meters, pull boxes, etc.) will be installed as needed.

Wayfinding

Improved wayfinding, similar to the existing wayfinding at the intersection of McLarin Road and the SR 74-McLarin Road Ramp shown in Figure 4.4, will aid motor carriers in navigating alternative routes to the CSX Fairburn Intermodal Terminal. Wayfinding is proposed at the following locations:

- SR 74-U.S. 29 Ramp at SR 74;

- SR 74-U.S. 29 Ramp at U.S. 29/Roosevelt Highway;

- U.S. 29/Roosevelt Highway at Peters Street;

- U.S. 29/Roosevelt Highway at Gullatt Road;

- Peters Street at McLarin Road; and

- Gullatt Road at McLarin Road.

Figure 4.4 CSX Wayfinding – McLarin Road and the SR 74-McLarin Road Ramp

Source: Google Earth.

4.2.2 Phase III Freight ITS Improvements

Phase III improvements represent longer-term investments intended to better manage truck parking and staging needs in the study area as well as provide advanced warning for very long trains that have the potential to block multiple crossings in the study area for extended periods of time. These investments are estimated to require significantly greater financial resources than Phase I and II projects and also increased collaboration between the public and private sectors. Thus, Phase III investments are included in this report only to articulate the broader concept of the Freight ITS.

Truck Staging Lot

As part of Phase III (e.g., long-term) plans, the existing private truck parking facility at 7860 Senoia Road or a new facility within the CID area can be incorporated into the freight ITS as a truck staging area. Dynamic message signs can be used to divert trucks to the staging area in the event that the crossing is closed. The staging area can further be used to meter trucks into the CSX terminal as part of a slot-style scheduling system and as a general staging area for trucks making pick-ups or deliveries to businesses in the CID area.

A Parking Management System for managing the lot would be composed of entry control equipment and vehicle sensors that would be deployed in a parking lot, and control equipment that would be deployed at the GDOT TMC and/or at the Fairburn Intermodal Terminal. The equipment would be connected to through the fiber optic cable infrastructure.

Advanced Train Warning

Also, as part of Phase III plans, an advanced train warning system may also be incorporated into the Freight ITS. Stakeholder outreach with CSX revealed that the Fairburn Intermodal Center typically receives trains that are about 9,000 feet long. However, the intermodal terminal periodically receives trains that are closer to 12,000 feet long. These trains cause much more significant disruption to traffic in the study area as multiple switching movements are necessary to break these trains down so that they are short enough to enter the intermodal terminal. An advanced train warning system would alert the traveling public on the impending arrival of these trains and direct them to grade-separated crossings.

5.0 Ultimate System

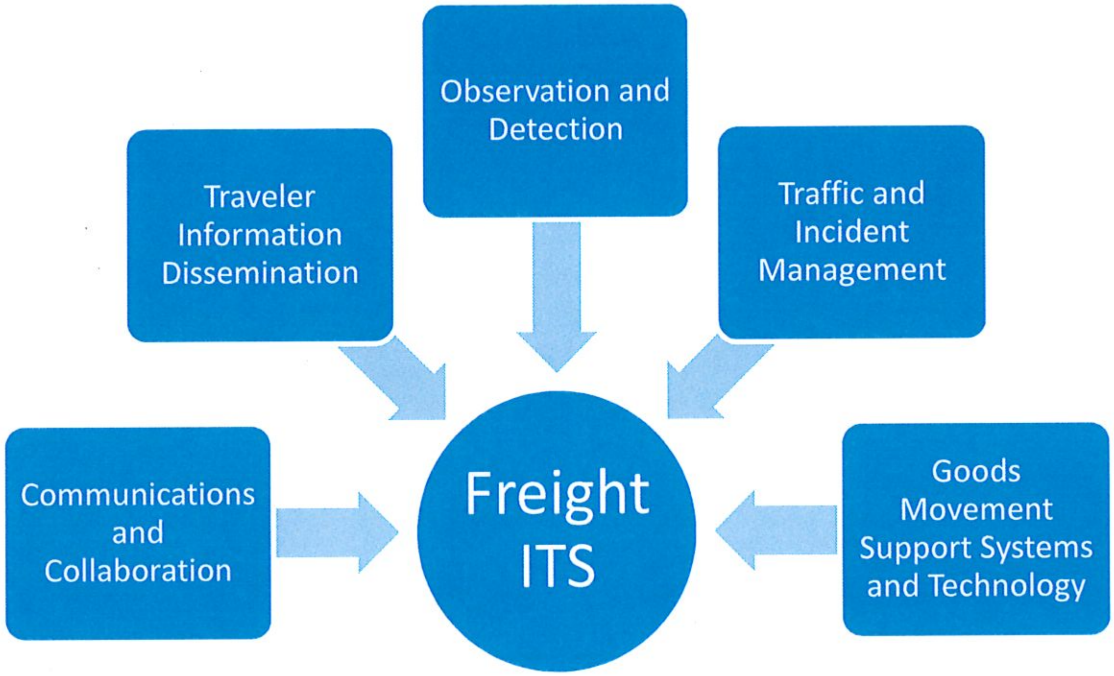
The Ultimate System is a compilation of every project from Phase I through Phase III as shown in Table 4.2. Some of the key objectives of the ITS and technology components of the Freight ITS are to:

- Improve traffic information and management along the Fairburn Intermodal Center's access routes
- Improve traffic observation, verification, and monitoring;
- Enhance information sharing during an emergency or incident;
- Develop an ITS communication network that serves future needs;
- Reduce traffic congestion, truck idling, and related emissions;
- Minimize conflicts between transportation modes; and
- Improve goods movements along major traffic routes.

This section of the report describes the proposed system and improvements that have been identified based on stakeholder desired changes and identified user needs. The descriptions are provided at a high-level, indicating the operational features and functionalities without specifying design details or technology specific solutions. There are 5 groups of interrelated project improvements, listed below and in Figure 5.1, to improve goods movement within the Fairburn Intermodal Center area and for regional freight travel to and from the intermodal terminal including:

1. Communications and Collaboration;
2. Traveler Information Dissemination;
3. Observation and Detection;
4. Traffic and Incident Management; and
5. Goods Movement Support Systems & Technology.

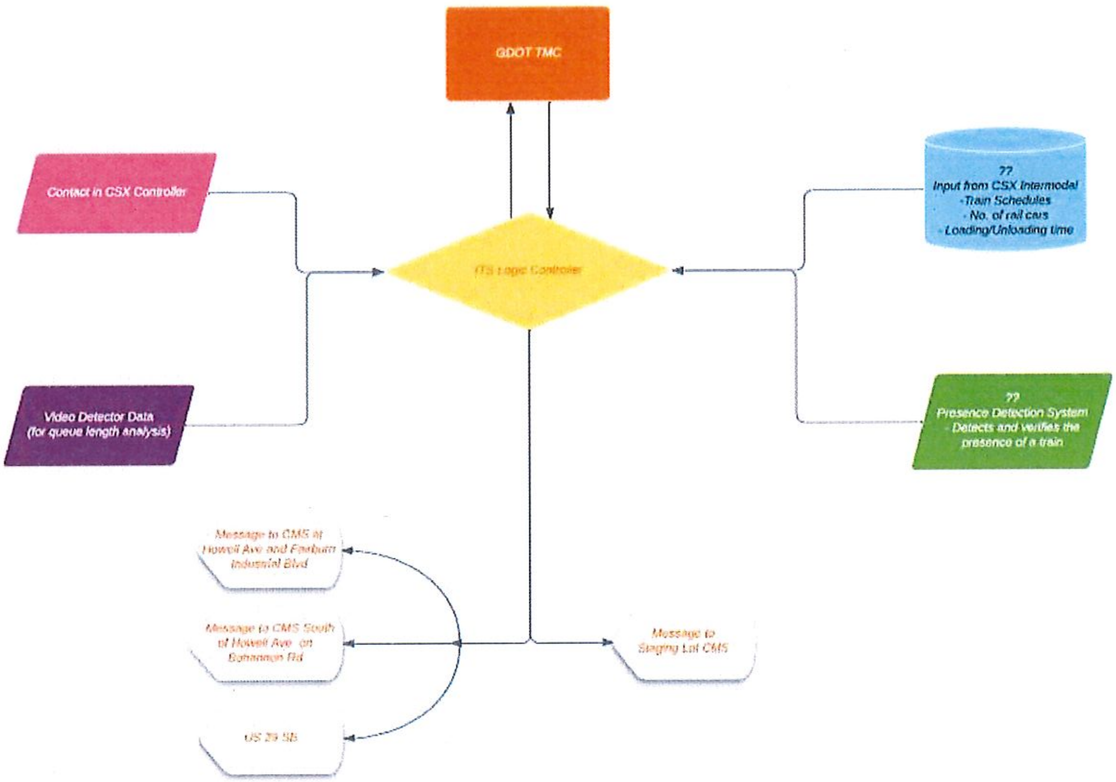
Figure 5.1 Freight ITS Operations Overview



Source: Volkert, Inc; Cambridge Systematics, Inc.

Figure 5.2 demonstrates how data will flow through the proposed Phase I/II Freight ITS. As discussed in section 4.2.1, the Freight ITS will perform semi-autonomously via a roadside logic controller capable of sorting and distributing data to the State's existing network of HAR systems, dynamic message signs, flashing beacon systems, and in-vehicle warning systems via DSRC radios and infrastructure. Thus, the logic controller serves as the primary point where data is input into the Freight ITS. The proposed data inputs include information on terminal operations from CSX (loading/unloading times, approximate crossing closure times, etc.), which can be conveyed to CMS in the study area. Data inputs also include information from the presence detection and rail active warning system on the status of the warning system (activated/not activated) at study area at-grade crossings, the length of time the active warning system has been activated, and the presence of queued vehicles. With these data inputs, the logic controller is able to send pre-determined messages to the CMS in the area. These data will also be transmitted to the GDOT TMC for purposes of monitoring the system and in the case that custom messages must be transmitted to the CMS in the area.

Figure 5.2 Freight ITS Data Flow Diagram



Source: Volkert, Inc; Cambridge Systematics, Inc.

5.1 Desired Features Inclusive of Regional Goals

The GDOT TMC, and other regional partners, will be able to manage traffic operations in the study area based on the real-time exchange of field device status and data as well as provide additional communications means when traditional communications (e.g. landline and cellular phone) are not available. The exchange of this real-time management information would allow GDOT to maintain a near real-time dissemination of traffic and incident information that occurs within the study area and the first-/last-mile truck routes to and from the Fairburn Intermodal Center. Table 5.1 presents the 5 implementation groupings with the individual project improvements includes in each grouping. Note that some improvements could be placed into multiple groupings but are only identified in one (e.g., CCTV upgrades also support traffic and incident management and traveler information with live video feeds).

Table 5.1 Summary of Freight ITS Improvement Projects

Implementation Group	ITS Deployments
Traveler Information Dissemination	• Changeable message signs
Communications and Collaboration	• Communications (Cellular, Wi-Fi, Fiber)

	• Public/private communications and collaboration
Observation and Detection	• CCTV • Queue detection
Traffic and Incident Management	• ATMS • Active warning rail system
Goods Movement Support Systems	• Truck parking • Advanced train warning

Source: Volkert, Inc; Cambridge Systematics, Inc.

5.1.1 Communications and Collaboration

Figure 5.3 presents the diagram for the interconnectivity of the Communications and Collaboration group, what devices will utilize the communications pathways and the type of connection, and the agencies that will be connected. The fiber optic cable infrastructure will connect the roadside controller to the proposed changeable message signs and traffic signal. As additional phases of the Freight ITS are developed, more fiber optic coverage may be provided. As shown in Figure 5.3, the fiber optic cable infrastructure will link the GDOT TMC and field devices (Wi-Fi, Roadside Controller Cabinet, CCTV, CMS, etc.) in the intermodal terminal area. Wi-Fi coverage in the intermodal terminal area could be used to provide last mile connectivity for field devices as an alternative to connecting directly to the fiber optic cable infrastructure.

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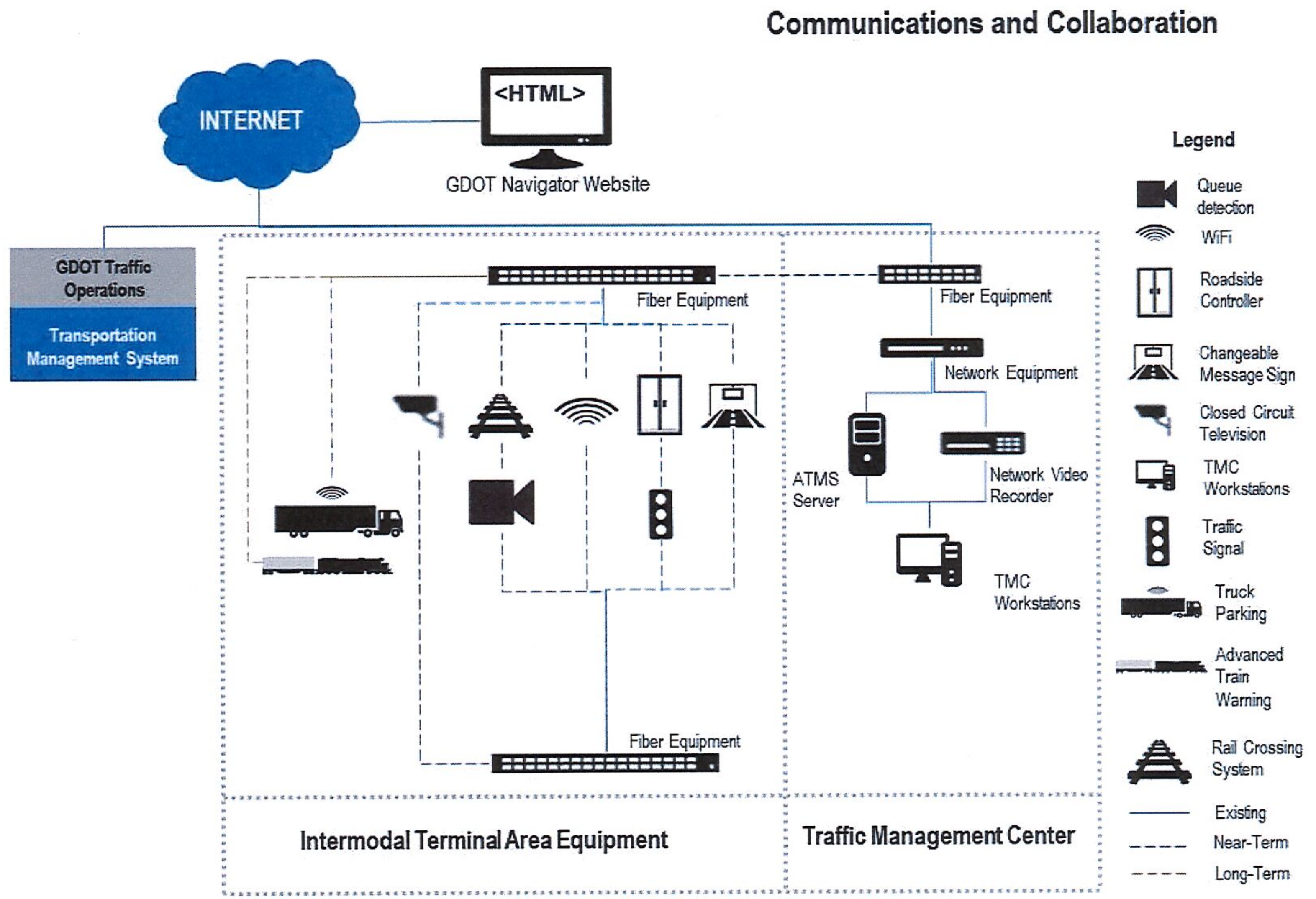
Figure 5.3 Communications and Collaboration Systems Diagram

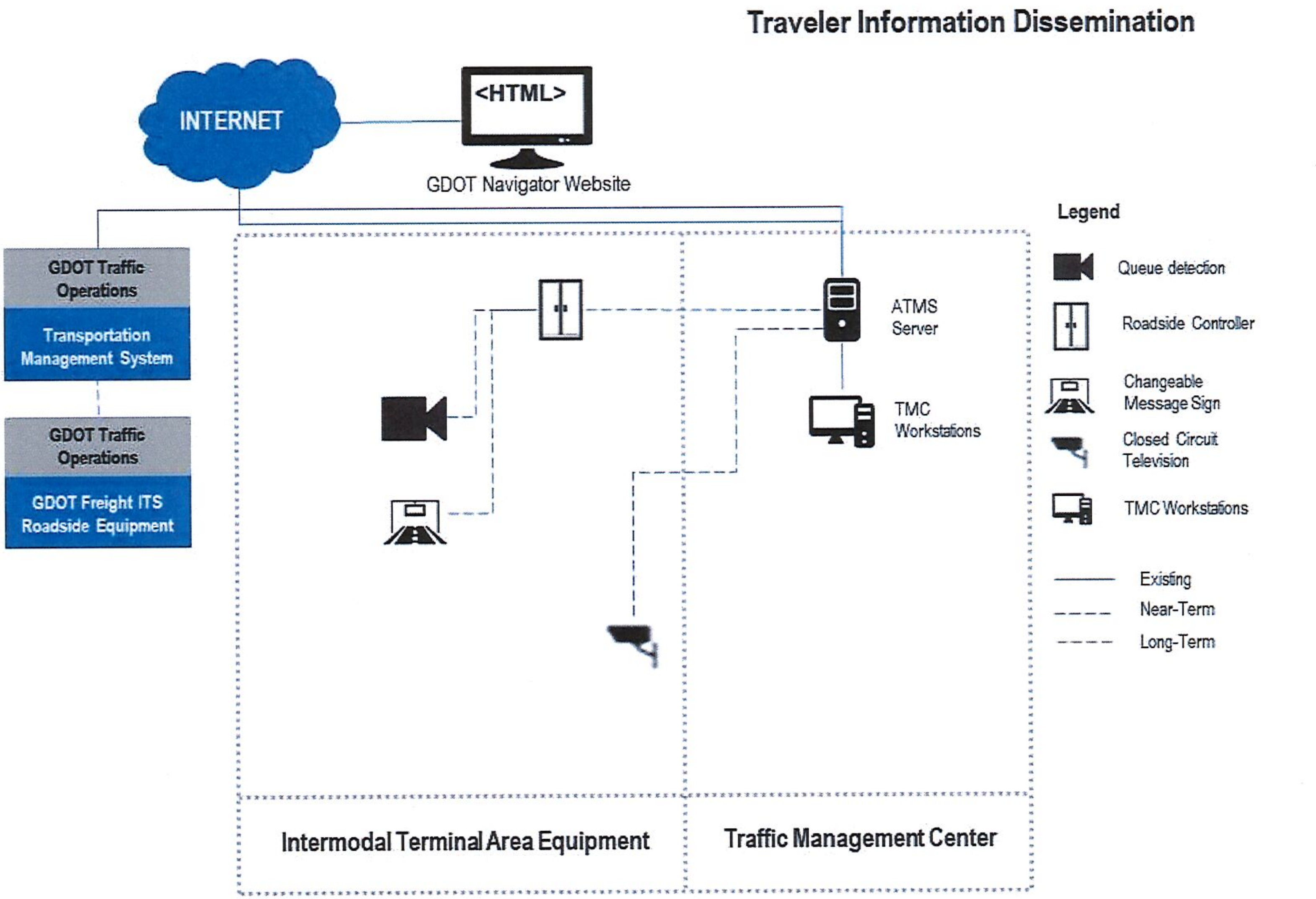


Source: Volkert, Inc; Cambridge Systematics, Inc.

5.1.2 Traveler Information Dissemination

Figure 5.4 illustrates a high-level conceptual view of the Freight ITS information and data integration approach including data sources, dissemination approaches, and potential users. Deployment of the proposed ITS technologies will allow collection and integration of data from sources in the study area. The Freight ITS information delivery services include the GDOT Navigator website and CMS notifications. Trucking fleet dispatchers serving the Fairburn Intermodal Terminal and freight-intensive businesses in the study area can be directed to the Navigator website so that they may relay information directly to truckers via in-vehicle monitoring systems. The CMS's would be connected to the GDOT TMC through the fiber optic cable infrastructure, so operators could disseminate messages to the signs. The CMS's would provide emergency, traffic, and intermodal terminal related information to motor carriers and the traveling public.

Figure 5.4 Traveler Information Dissemination Diagram



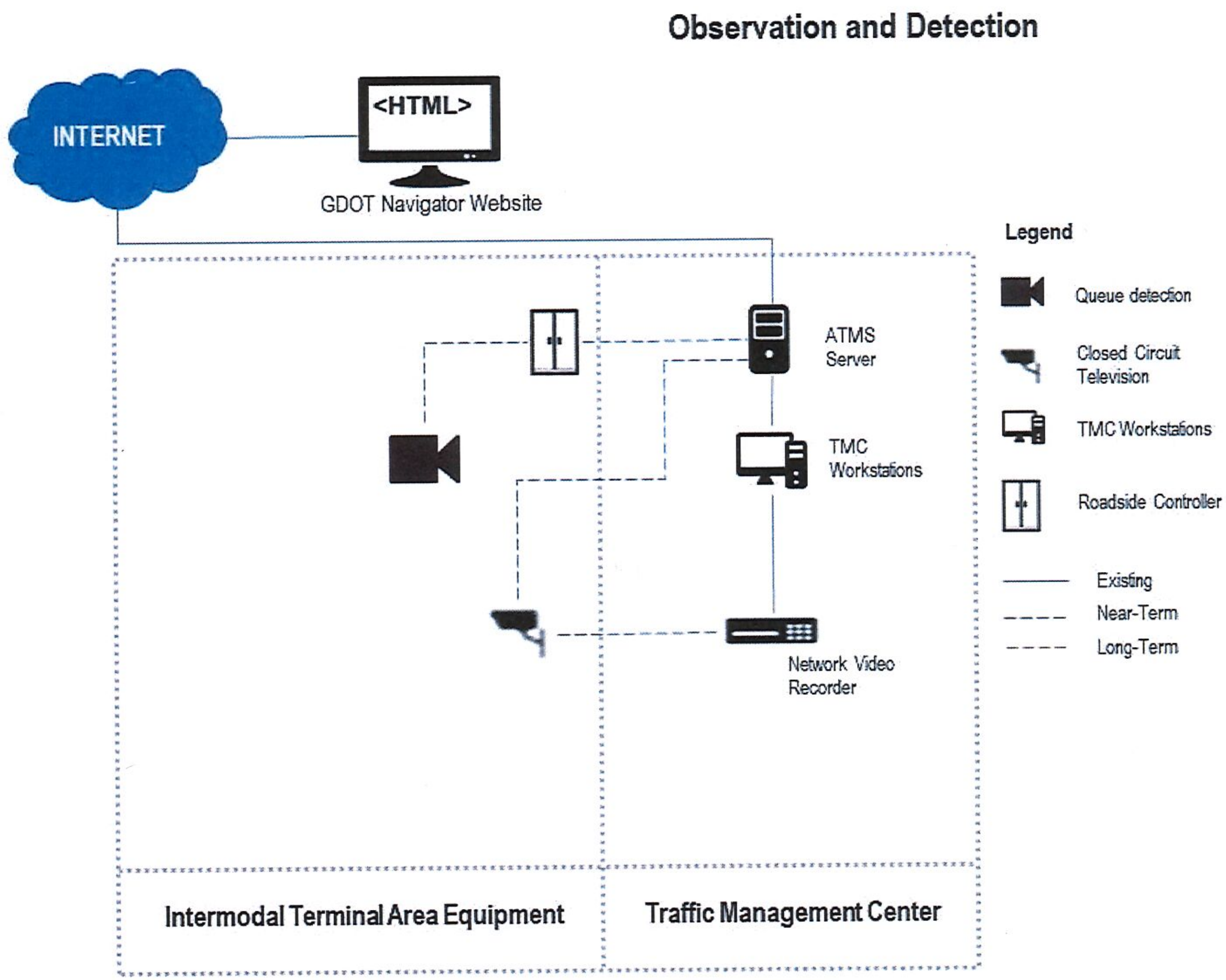
Source: Volkert, Inc; Cambridge Systematics, Inc.

5.1.3 Observation and Detection

Figure 5.5 shows the functional connections between the various pieces of equipment in the Observation and Detection group. CCTV cameras will be installed at key intersection locations where there is a potential of congestion related problems because of disruptive incidents, recurring high traffic volumes, etc. CCTV cameras would provide operators in the GDOT TMC, through the region's existing video management system (VMS) and network video recorder (NVR), surveillance of the area surrounding the Fairburn Intermodal Center. The GDOT TMC would also be able to control the CCTV cameras and monitor situations as the need arises.

Queue Detection would detect vehicles at the McLarin Road at-grade crossing. This information would be processed by the roadside logic controller. The logic controller would send pre-determined messages to the area changeable message signs based on the operating logic presented in Figure 4.2. It would also transmit this information to the GDOT TMC.

Figure 5.5 Observation and Detection Diagram



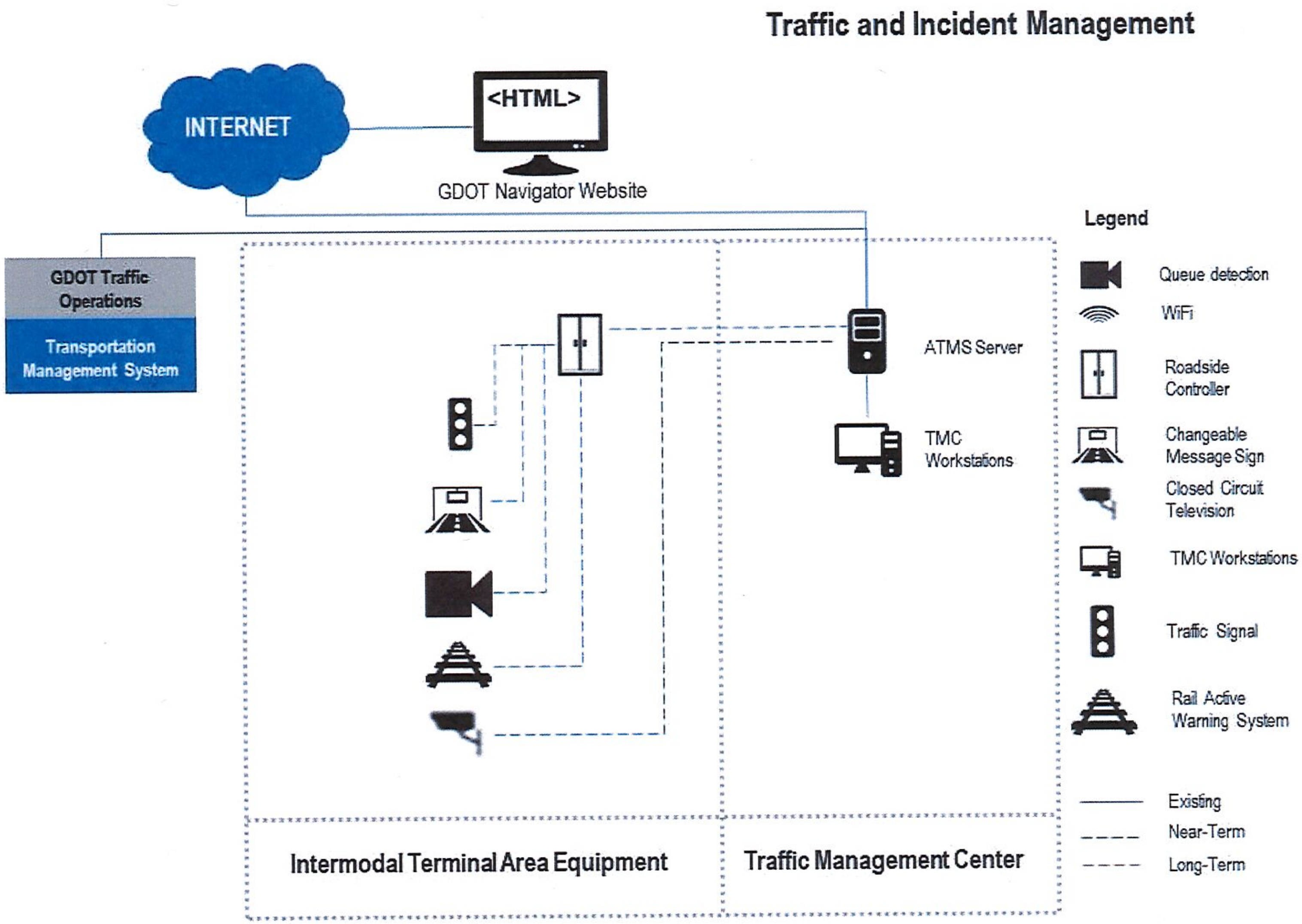
Source: Volkert, Inc; Cambridge Systematics, Inc.

5.1.4 Traffic and Incident Management

Figure 5.6 depicts the connectivity between the Traffic and Incident Management field devices and the GDOT TMC. A traffic signal at the intersection of Howell Avenue and SR 74 is under consideration by GDOT District 7. If the intersection is signal-controlled, it may be timed to facilitate trucks entering and exiting the Fairburn Intermodal Center.

The rail grade crossing active warning system and the queue detection alert the Freight ITS to the presence of a train and queued vehicles at the McLarin Road crossing. The rail active warning system is existing as there are already gates and flashing lights at the at-grade crossing. The proposed Freight ITS will link into the existing CSX infrastructure. Queue detection will be added as part of the proposed system.

Figure 5.6 Traffic and Incident Management Diagram



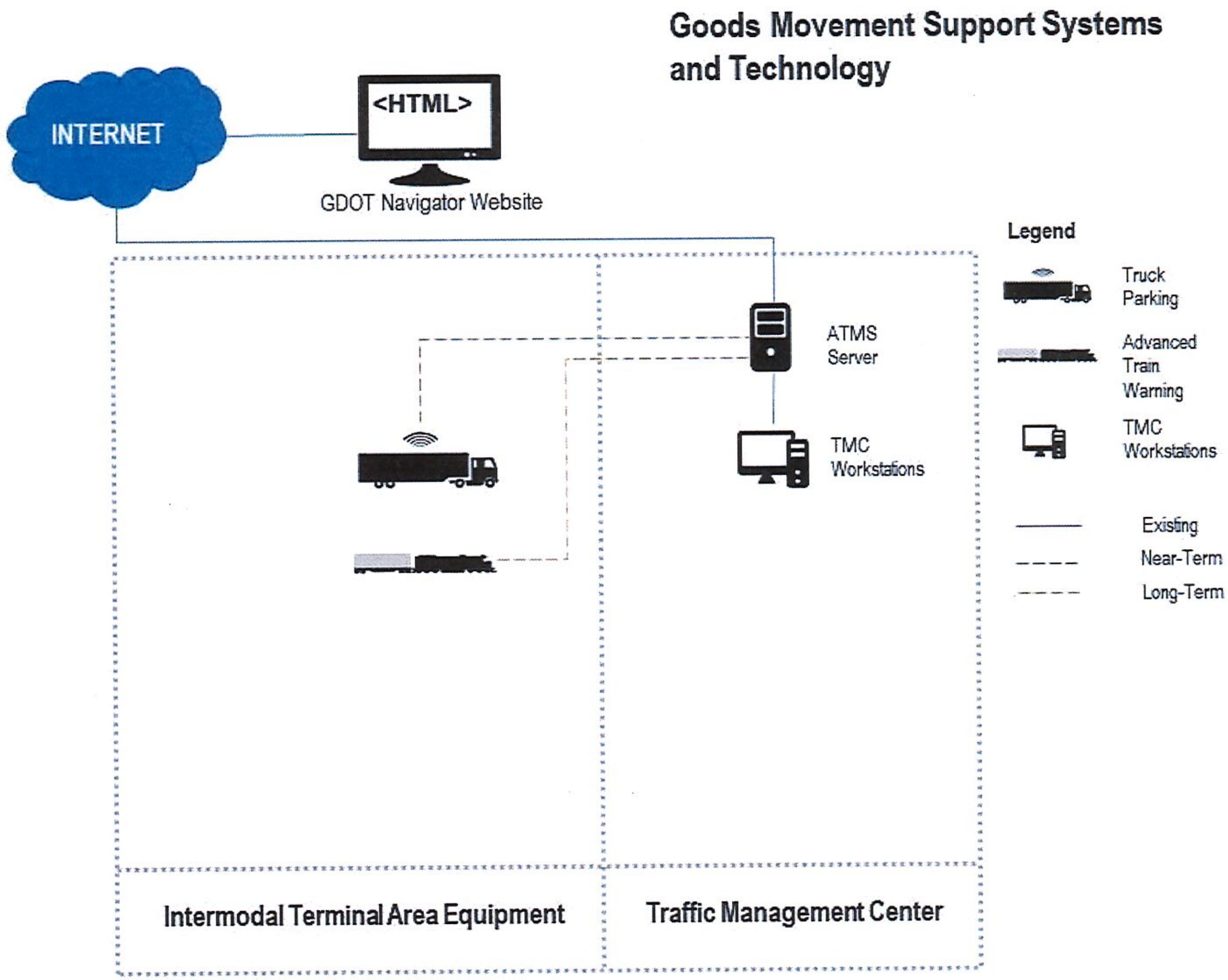
Source: Volkert, Inc; Cambridge Systematics, Inc.

5.1.5 Goods Movement Support Systems and Technology

Figure 5.7 presents the Goods Movement Support Systems and Technology field devices and the connections back to the GDOT TMC. As a long-term improvement, the truck parking system and associated staging lot will give truck drivers a designated area to park as they await entry into the Fairburn Intermodal Terminal. From the lot, drivers may be metered into the intermodal terminal, limiting their impact on area roadways. The system could also be able to monitor the availability of parking spaces for overnight and longer rest periods at the nearby Fairburn Travel Center and provide this to the public through the GDOT Navigator system. This would improve regional traffic safety as it would help to limit the number of fatigued drivers on the region's highways as well as mitigate drivers parking on Interstate highway ramps and shoulders due to lack of truck parking in the region.

Another long-term, Phase III improvement would be the implementation of an advanced train warning system. Stakeholder outreach with CSX revealed that the Fairburn Intermodal Center typically receives trains that are about 9,000 feet long. However, the intermodal terminal periodically receives trains that are closer to 12,000 feet long. These trains cause much more significant disruption to traffic in the study area as multiple switching movements are necessary to break these trains down so that they are short enough to enter the intermodal terminal. An advanced train warning system would alert the traveling public on the impending arrival of these trains and direct them to grade-separated crossings.

Figure 5.7 Goods Movement Support Systems and Technology Diagram



Source: Volkert, Inc; Cambridge Systematics, Inc.

5.2 High Level System Requirements

This section summarizes the high-level system requirements for ATMS, CCTV cameras, detection system and changeable message signs to be implemented within South Fulton CID and the immediate vicinity of the CSX Intermodal Center.

5.2.1 ATMS

This proposed Freight ITS will look at a completely new advanced traffic management system (ATMS) that will be used to monitor traffic and improve flow of traffic. The data collected from the ATMS will have the ability to be accessed by the GDOT TMC. The anticipated benefits would include reducing congestion in the study area, reduction in the truck idle times and reduced emissions. It is anticipated that this ATMS will expand the existing GDOT ATMS capability.

5.2.2 CCTV

As a part of the Freight ITS, Closed-Circuit Television Cameras (CCTV) will be installed. CCTV cameras provide coverage on high-traffic corridors and provide feedback to the TMC, allowing for quick response times to incidents on the road network. The CCTV cameras will have the capability of being viewed and controlled from the TMC using video management software.

5.2.3 Detection System

The proposed Freight ITS will incorporate the existing CSX active warning system (AWS) for the at grade rail crossings along McLarin Road. The efficiency of the AWS system will be a key component to the effectiveness of the changeable message signs. In addition to the AWS, the Freight ITS will also use a video queue detector to alert the system to the presence of queued vehicles at crossing 901263C. As outlined in Figure 4.1, the AWS and video queue detection will work together to enhance the reliability of the Freight ITS.

5.2.4 Changeable Message Signs

Dynamic message signs display important messages to drivers on key corridors This plan will consist of installing three (3) dynamic message signs that will alert trucks to the presence of a train blocking the at-grade rail crossings along McLarin Road. The dynamics message signs will be preempted from the active warning system at the at grade rail crossings along McLarin Road. Dynamic message signs promote safe and efficient traffic movement and could reduce congestion.

6.0 Technology Scan

The technology scan includes a review of the technology elements to be considered for deployment and a review the state of the practice and recent advancements of these technologies. Recommendations are made for each of the technology elements. Only technologies that are being considered for the immediate and near-term have been evaluated.

6.1 Identification of Hardware Considered

Research was conducted on available hardware which can be utilized for the South Fulton CID ITS project in its immediate phase. The field equipment that will be used in this project will be in accordance to the GDOT Qualified Products List QPL 48. The items identified in Table 6.1 were considered.

Table 6.1 Hardware Considered for the Freight ITS

Product	Manufacturing Company	Purpose
Battery		
Battery Backup System	Econolite	The battery backup system will provide power for the active warning system (AWS) and Changeable Message Signs in the case of power loss.
Battery Backup System	Peek Traffic Corporation	
Cabinet Components		
Wireless Communication	Infinet Wireless	The controller cabinet will establish a wireless communications pathway between the existing ITS components and the proposed ITS components.
Wireless Radio	Encom	
Wireless Receiver/Transmitter	Proxim	
Controller	MH Corbin	
Changeable Message Signs		
3 Line X 15-character LED Front Access	Ledstar	The changeable message signs will be used to display messages that warn truck drivers of the blocked crossing and direct them to the alternate route along U.S. 29/ Roosevelt Highway.
Permanent CMS	SES America, Inc.	

Source: Volkert, Inc; Cambridge Systematics, Inc.

6.2 Identification of Software Solutions Considered

The software solution for the Long-term phase of the project may utilize the Intelligent NETworks ATMS software developed by Delcan Technologies to collect, disseminate, and manage transportation systems. This ATMS is customizable with an exact set of features as per requirements for small and large-scale deployments. The web-based application using a standard PC browser with web makes access very simple.[3]

7.0 Summary

This report has described the basic intelligent transportation system (ITS) architecture and communications network for near- and long-term deployment of a Freight ITS project for the area surrounding the CSX Fairburn Intermodal Center. Key groupings of the project improvements that comprise the proposed system included Communications and Collaboration, Traveler Information Dissemination, Observation and Detection, Traffic and Incident Management, and Goods Movement Support Systems and Technology. Taken together, these components of the proposed Freight ITS will help to alleviate the impacts of heavy truck traffic while enhancing freight operations as the study area's freight assets, most notably the CSX Fairburn Intermodal Center, serve as an economic engine for south Metro Atlanta and the State as a whole. A future update of this report will include a detailed benefit-cost analysis of the proposed system.

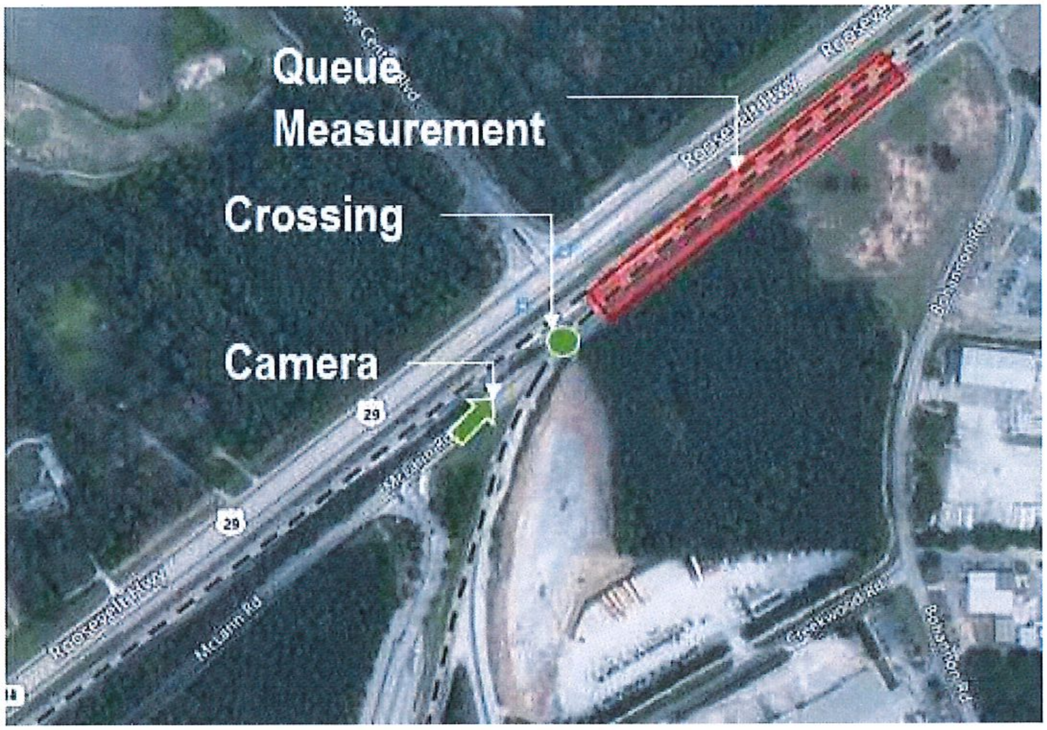
[3] http://delcantechnologies.com/intelligent-networks/

Appendix A. Traffic Study

In order to better understand the impact of crossing closures on the McLarin Road corridor, traffic data was collected over the 2/26/2020 to 3/3/2020 time period. The primary purpose of the data collection was to estimate the frequency and extent of queueing on McLarin Road between crossing 901263C and Bohannon Road. In addition, the data collection provided information on traffic patterns near the CSX Fairburn Intermodal Terminal, specifically at the two intersections adjacent to the terminal gate that must be passed in order to access the facility – (1) Bohannon Road at McLarin Road and (2) Owens Corning Driveway at McLarin Road.

So that the frequency and magnitude of vehicle queues along the westbound approach of McLarin Road due to the presence of a train at the at-grade crossing could be estimated, an eastward facing video camera was placed just west of the crossing. Over 4 separate 24-hour periods from Monday to Thursday (including one day each), video footage was recorded. The collected information included number of gate closures, length of gate closures, presence of a train, vehicle queue length, and the types of vehicles in the queue by Federal Highway Administration classification[4].

Figure 7.1 Queue Measurement Along McLarin Road



Source: Bing Maps; Volkert, Inc.; Cambridge Systematics, Inc.

[4] Federal Highway Administration, Traffic Monitoring Guide, Appendix C, October 2016, https://www.fhwa.dot.gov/policyinformation/tmguide/tmg_2013/vehicle-types.cfm, Accessed April 13, 2020.

Figure 7.2 McLarin Road Looking West

Source: Google Earth.

There were 18 to 33 closures recorded over each 24-hour observation period as shown in Table 7.1. On average, there is nearly at least one closure during every hour of a day. Many closures are spurred by activity within the terminal as several occur with no train present. Furthermore, most closures are relatively short with the average being 3 to 9 minutes. However, some closures exceeded 30 minutes with the longest observed closured exceeding 2 hours. The frequency and length of closures have implications for the type of ITS technology that would be most effective. For example, the frequency of relatively short closures with no train present suggest that a freight ITS activated by the CSX Active Warning System may not be effective as motorists would receive multiple messages per day with warnings to divert when it is not necessary given the duration of the closure.

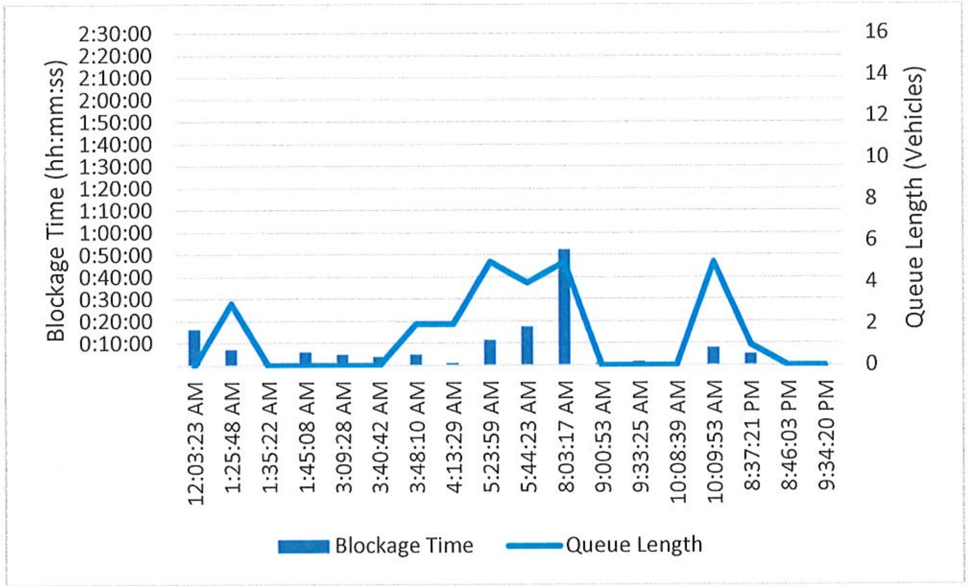
Table 7.1 Summary Analysis of McLarin Road Crossing Closures

Date	No. of Closures	No. of Closures with Train Present	Average Length of Closure (00:00:00)	Minimum Length of Closure (00:00:00)	Maximum Length of Closure (00:00:00)
Wednesday, 2/26/2020	18	10	0:08:04	0:00:28	0:52:26
Thursday, 2/27/2020	32	16	0:09:43	0:00:19	2:08:17
Monday, 3/2/2020	28	16	0:04:31	0:00:22	0:37:31
Tuesday, 3/3/2020	33	15	0:02:56	0:00:36	0:11:59

Source: National Data Surveying; Cambridge Systematics, Inc.; Volkert, Inc.

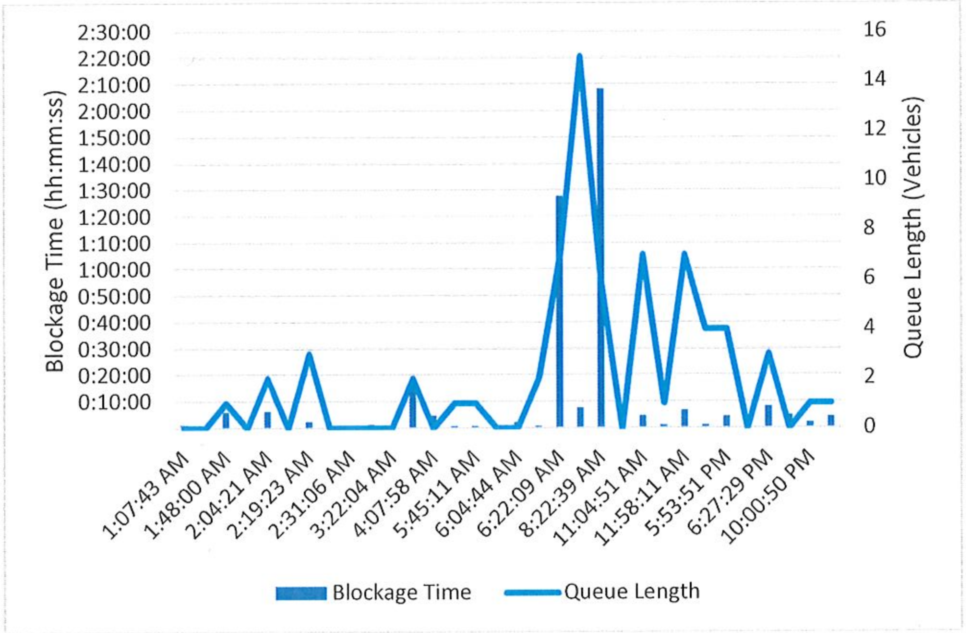
Queue lengths were estimated by counting the number and type of vehicles that crossed the railroad upon the gate's opening. The queue was assumed to dissipate once headways exceeded 15 seconds. The data for Wednesday, 2/26/2020 indicates that the longest blockage lasted over 52 minutes and that 5 vehicles waited in the queue (see Figure 7.3); on Thursday, 2/27/2020 the longest blockage lasted over 2 hours and approximately 6 vehicles waited in the queue (see Figure 7.4); on Monday, 3/2/2020 the longest blockage lasted 37 minutes and that 11 vehicles waited in the queue (see Figure 7.5); on Tuesday, 3/3/2020 the longest blockage lasted only about 12 minutes with 5 vehicles waiting in the queue.

Figure 7.3 Blockage Time and Queue Length (vehicles) – Wednesday, 2/26/2020



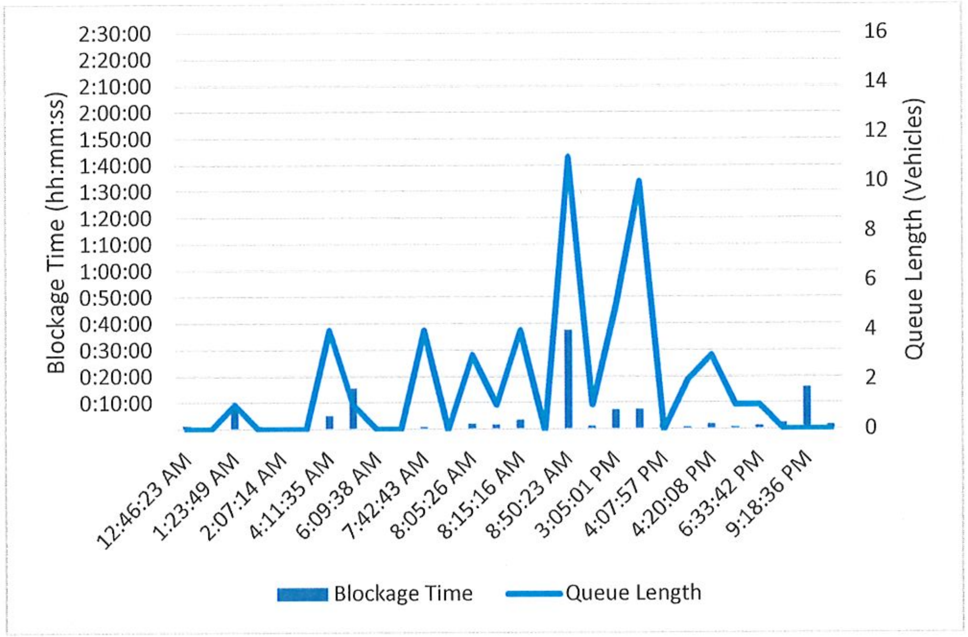
Source: National Data Surveying; Cambridge Systematics, Inc.; Volkert, Inc.

Figure 7.4 Blockage Time and Queue Length (vehicles) – Thursday, 2/27/2020



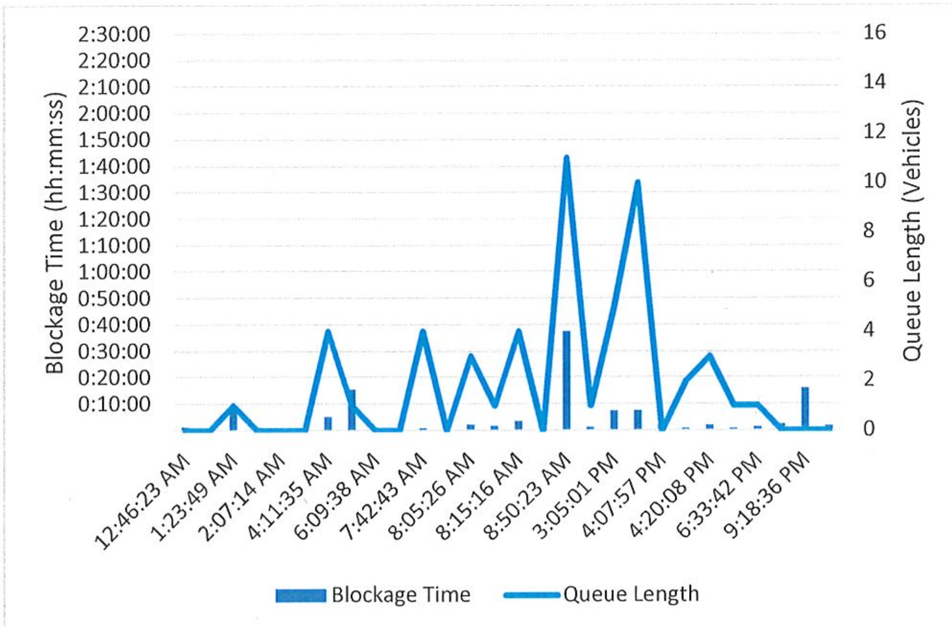
Source: National Data Surveying; Cambridge Systematics, Inc.; Volkert, Inc.

Figure 7.5 Blockage Time and Queue Length (vehicles) – Monday, 3/2/2020



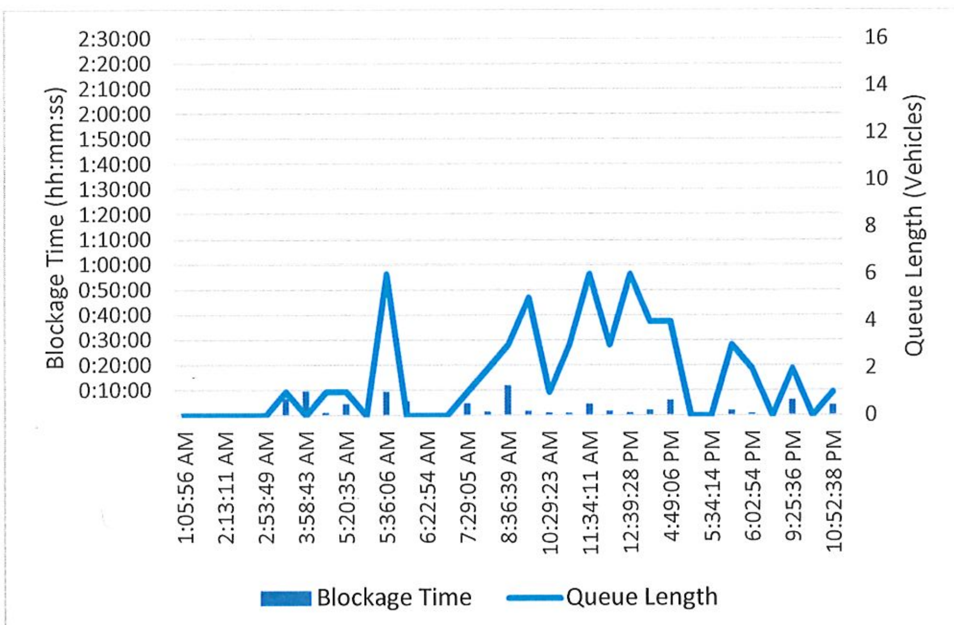
Source: National Data Surveying; Cambridge Systematics, Inc.; Volkert, Inc.

Figure 7.6 Blockage Time and Queue Length (vehicles) – Monday, 3/2/2020



Source: National Data Surveying; Cambridge Systematics, Inc.; Volkert, Inc.

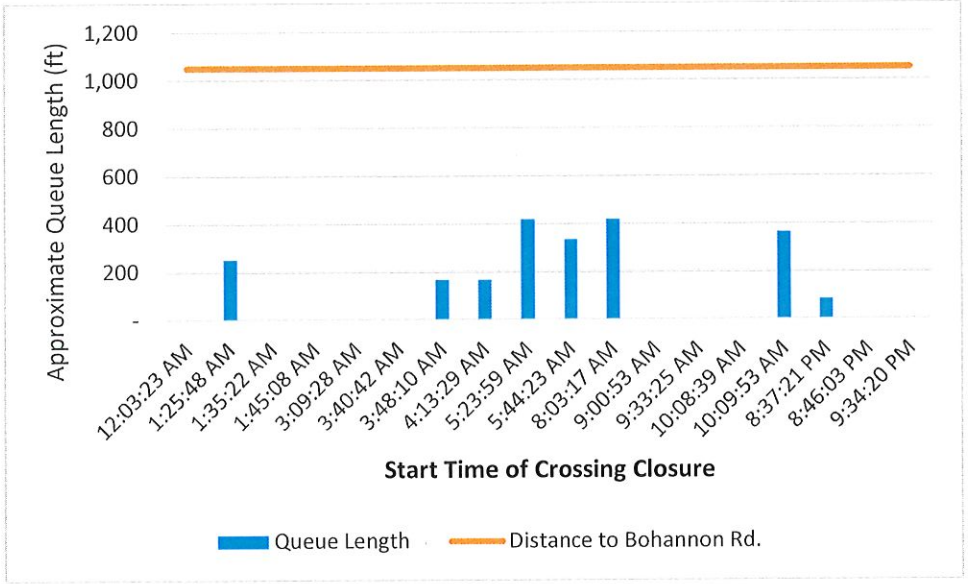
Figure 7.7 Blockage Time and Queue Length (vehicles) – Tuesday, 3/3/2020



Source: National Data Surveying; Cambridge Systematics, Inc.; Volkert, Inc.

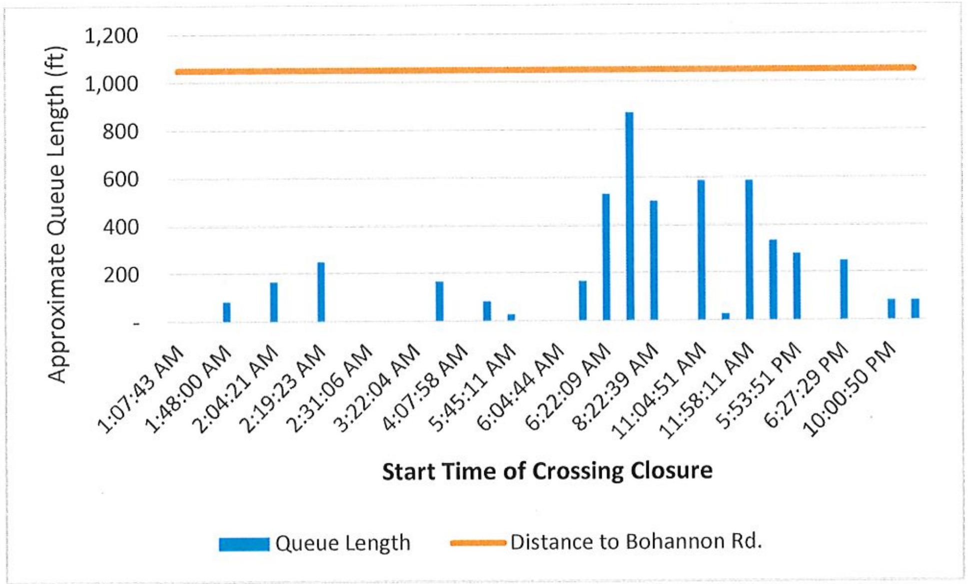
The length of queues in feet was also estimated. It was assumed that passenger vehicles measured 19 feet in length and that trucks measured 73.5 feet in length. Additionally, it was assumed that vehicles left a 10 feet buffer between vehicles and the at-grade crossing stop bar. The data for Wednesday, 2/26/2020 suggests that longest queue may have measured nearly 420 feet (see Figure 7.8); on Thursday, 2/27/2020 the longest queue is estimated to have measured approximately 870 feet (see Figure 7.9); on Monday, 3/2/2020 the queue is estimated to have measured approximately 860 feet, which is just short of the Bohannon Rd. intersection (see Figure 7.10); on Tuesday, 3/3/2020 the queue is estimated to have measured 864 feet (see Figure 7.12).

Figure 7.8 Approximate Queue Length (feet) – Wednesday, 2/26/2020



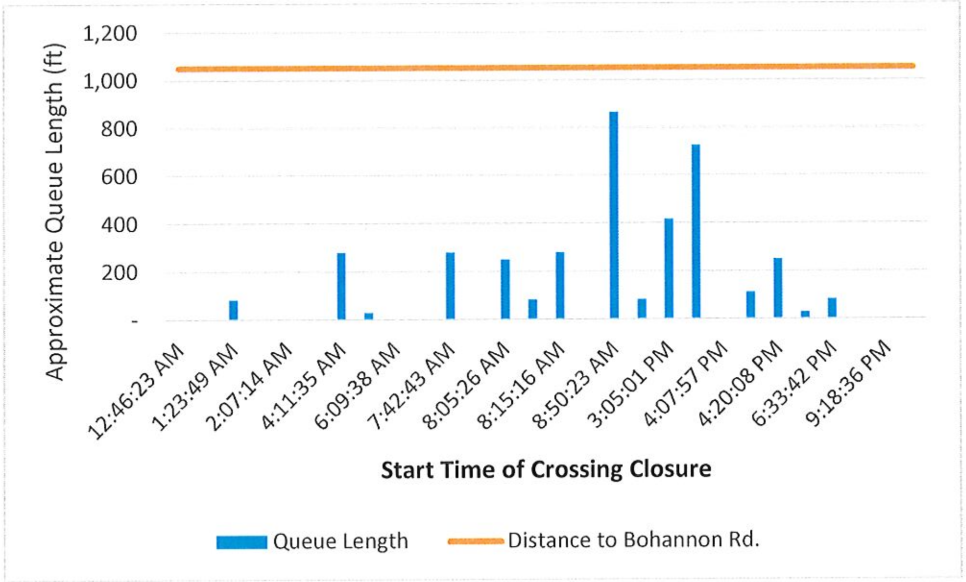
Source: National Data Surveying; Cambridge Systematics, Inc.; Volkert, Inc.

Figure 7.9 Approximate Queue Length (vehicles) – Thursday, 2/27/2020



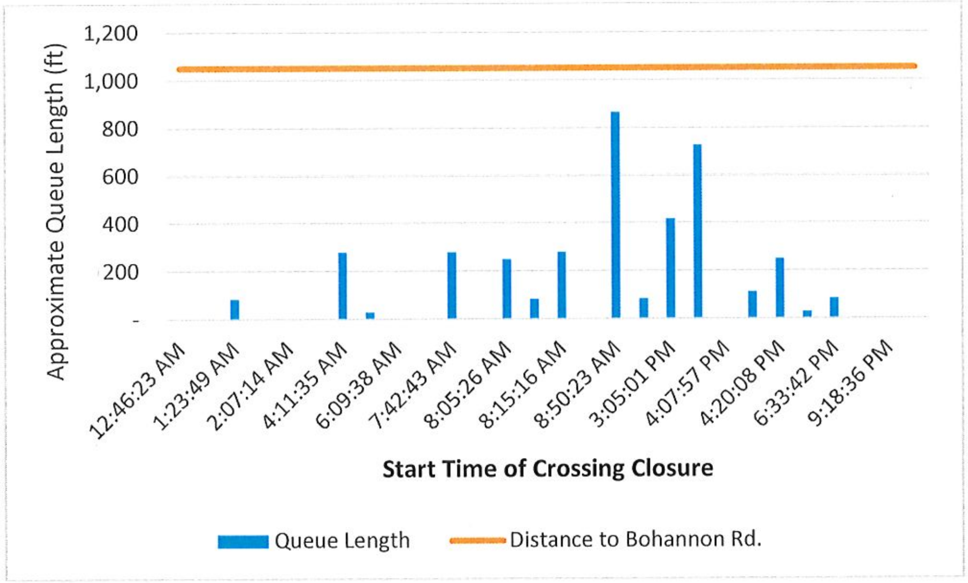
Source: National Data Surveying; Cambridge Systematics, Inc.; Volkert, Inc.

Figure 7.10 Approximate Queue Length (vehicles) – Monday, 3/2/2020



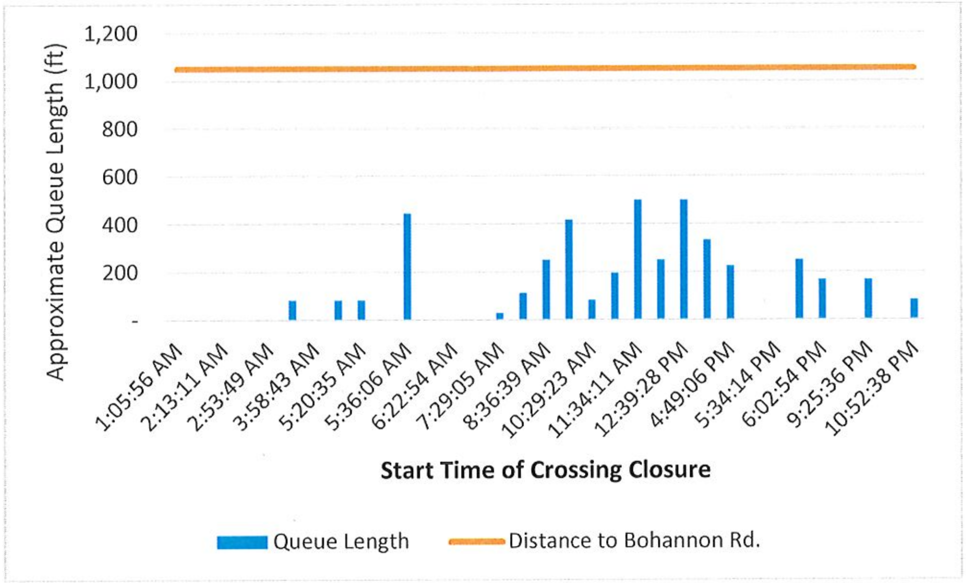
Source: National Data Surveying; Cambridge Systematics, Inc.; Volkert, Inc.

Figure 7.11 Approximate Queue Length (feet) – Monday, 3/2/2020



Source: National Data Surveying; Cambridge Systematics, Inc.; Volkert, Inc.

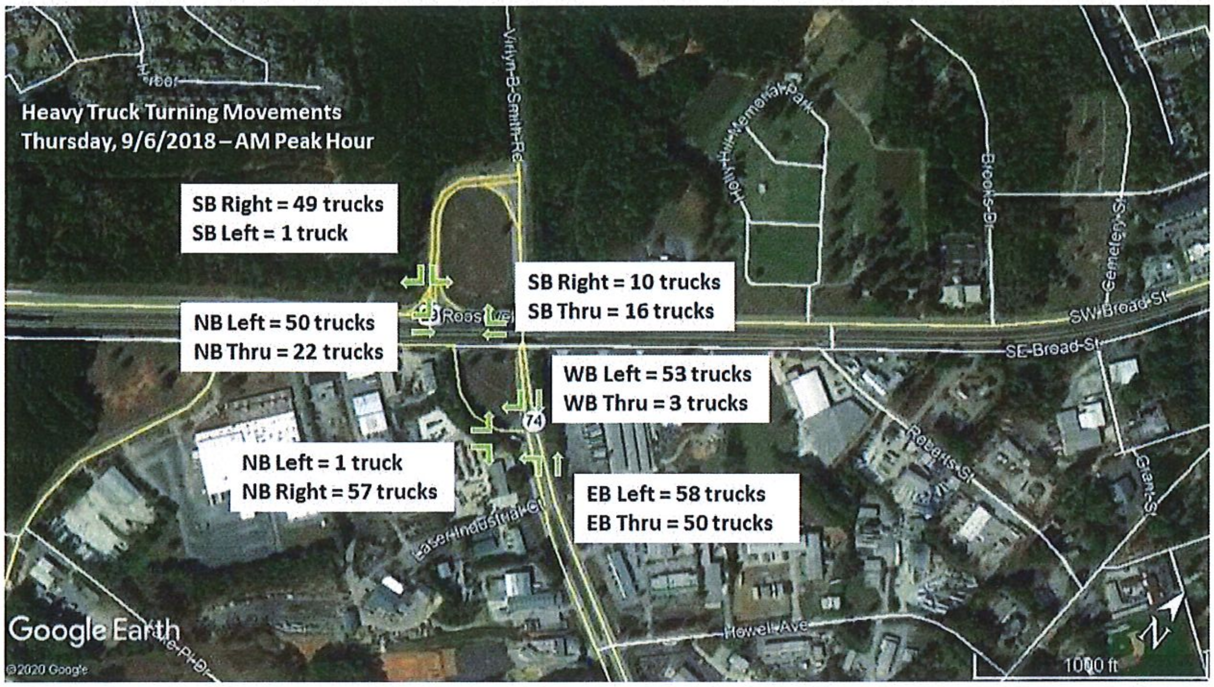
Figure 7.12 Approximate Queue Length (feet) – Tuesday, 3/3/2020



Source: National Data Surveying; Cambridge Systematics, Inc.; Volkert, Inc.

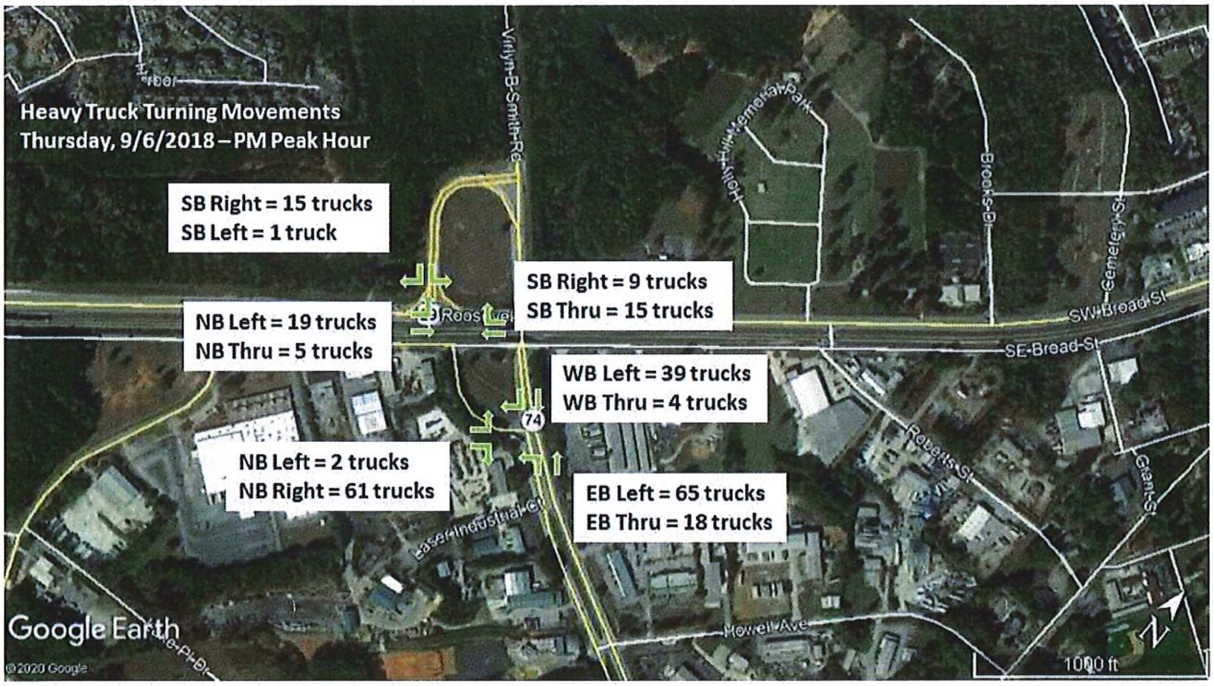
Traffic data collected in 2018 show significant volumes of turning trucks at key intersections in the study area during the A.M. (see Figure 7.13) and P.M. (see Figure 7.14) peak periods. These intersections include SR 74 at SR 74-McLarin Road Ramp and U.S. 29/Roosevelt Highway at SR 74-U.S. 29/Roosevelt Highway Ramp. Over 50 turning truck movements were observed at these intersections during the morning peak. While overall truck turning movement volumes were lower during the afternoon peak period, some volumes exceeded 60 trucks per hour. In addition, data from the GDOT Traffic Analysis Data Tool indicate nearly 4,300 trucks per day travel SR 74 within the study area (i.e., Station 121-0282 at Howell Avenue).

Figure 7.13 Truck Turning Movement Counts, 2018 A.M. Peak



Source: National Data and Surveying.

Figure 7.14 Truck Turning Movement Counts, 2018 P.M. Peak



Source: National Data and Surveying.

More recent traffic data was collected as part of this study at the intersections of McLarin Road with Bohannon Road and at the intersection of McLarin Road with Peters Street (see Figure 7.15). The results of the traffic data collection (see Figure 7.16, Figure 7.17, and Figure 7.18) indicate significant volumes of turning trucks during the A.M. (7-8 a.m.) and P.M. (4-5 p.m.) peak periods. During peak periods, approximately 58 to 85 westbound trucks (89 to 113 vehicles total) approach crossing 901263C at McLarin Road based on current traffic conditions. This creates the opportunity for significant queues to develop along McLarin Road towards Bohannon Road if a train is blocking the crossing, negatively impacting businesses along that corridor and contribution to congestion and emissions from truck idling. Furthermore, current turning count data indicate that some trucks approach crossing 901263C through left turns from Bohannon Road onto McLarin Road. This is important because it suggests that a Freight ITS must deliver information to motorists at points along Bohannon Road in addition to SR 74.

There is potential for the current impacts to businesses along the McLarin Road and Bohannon Road corridors to be exacerbated by future traffic growth in the study area. Table 7.2 shows growth rates at various locations throughout the study area calculated from annual volume statistics from the Atlanta Regional Commission's travel demand model. On average, traffic volumes are projected to grow at a rate of about 1.7 percent annually. Using the 1.7 percent annual growth rate, and a more conservative 1 percent growth rate, Table 7.3 shows estimated peak period approach volumes for crossing 901263C at McLarin Road for the year 2040. The results indicate that peak period westbound approach truck volumes may grow to 80-120 (140-160 total vehicles) during peak periods. This implies that queues may grow longer over time. Furthermore, this analysis does not account for external factors that may increase train volumes and container lifts at the Fairburn Intermodal Center, such as growth at the Port of Savannah, and thus increase the frequency and length of blockages.

Table 7.2 Growth Rates from ARC Travel Demand Model

Location	Annual Growth Rate (2020 – 2040)
U.S. 29/ Roosevelt Highway southwest of SR 74	1.3%
U.S. 29/ Roosevelt Highway-SR 74 Ramp	1.4%
U.S. 29/ Roosevelt Highway northeast of SR 74	1.4%
Virlyn B. Smith Road northwest of U.S. 29/ Roosevelt Highway-SR 74 Ramp	1.2%
Bohannon Road southeast of Creekwood Road	3.5%
McLarin Road southwest of SR 74	4.0%
McLarin Road-SR 74 Ramp	1.8%
SR 74 northwest of Howell Avenue	1.5%
Senoia Road northeast of SR 74	1.4%
Senoia Road southeast of Howell Avenue	1.5%
SR 74 northwest of I-85	1.4%

I-85 SB On-Ramp	2.1%
I-85 NB Off-Ramp	1.9%
I-85 NB On-Ramp	1.4%
I-85 SB Off-Ramp	0.4%
U.S. 29/ Roosevelt Highway west of SR 74	1.3%
Average	**1.7%**

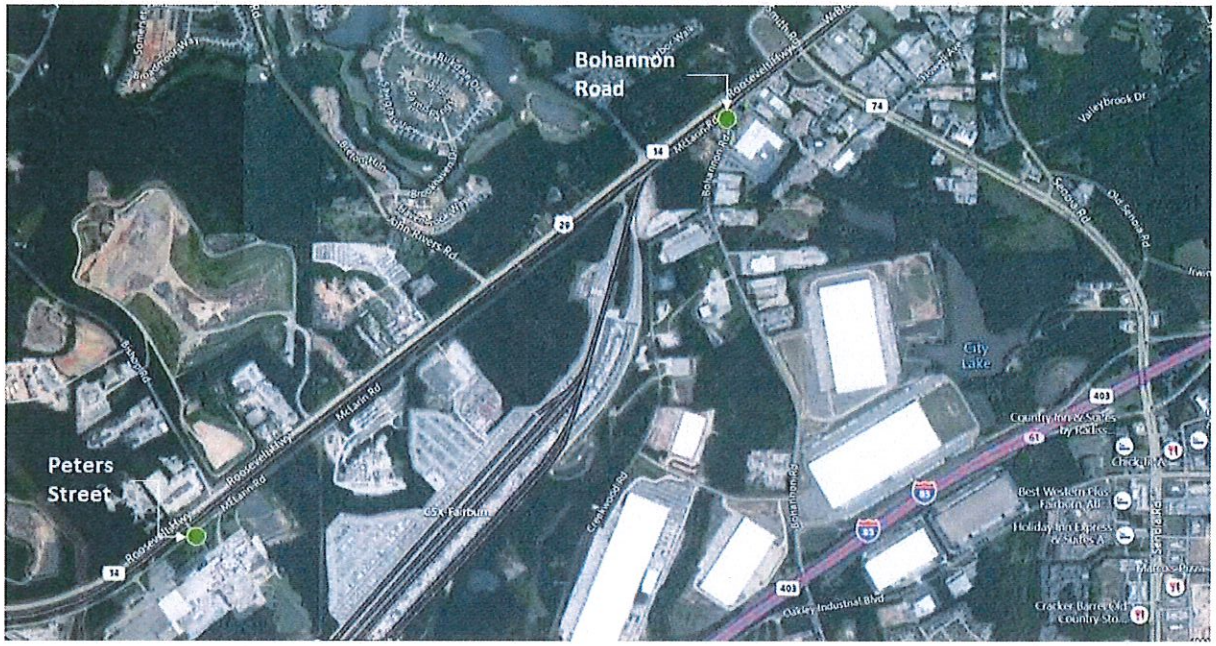
Source: Cambridge Systematics, Inc.; Volkert, Inc.

Table 7.3 Peak Period Westbound Approach Volumes for Crossing 901263C

Traffic Type	Peak Period	Year 2020 Peak Period Westbound Approach Volumes	Year 2040 Peak Period Westbound Approach Volumes (1% Annual Growth Rate)	Year 2040 Peak Period Westbound Approach Volumes (1.7% Annual Growth Rate)
Trucks	A.M.	58	71	81
	P.M.	85	104	119
Passenger Vehicles	A.M.	31	38	43
	P.M.	28	34	39
Total Volume	A.M.	89	109	125
	P.M.	113	138	158

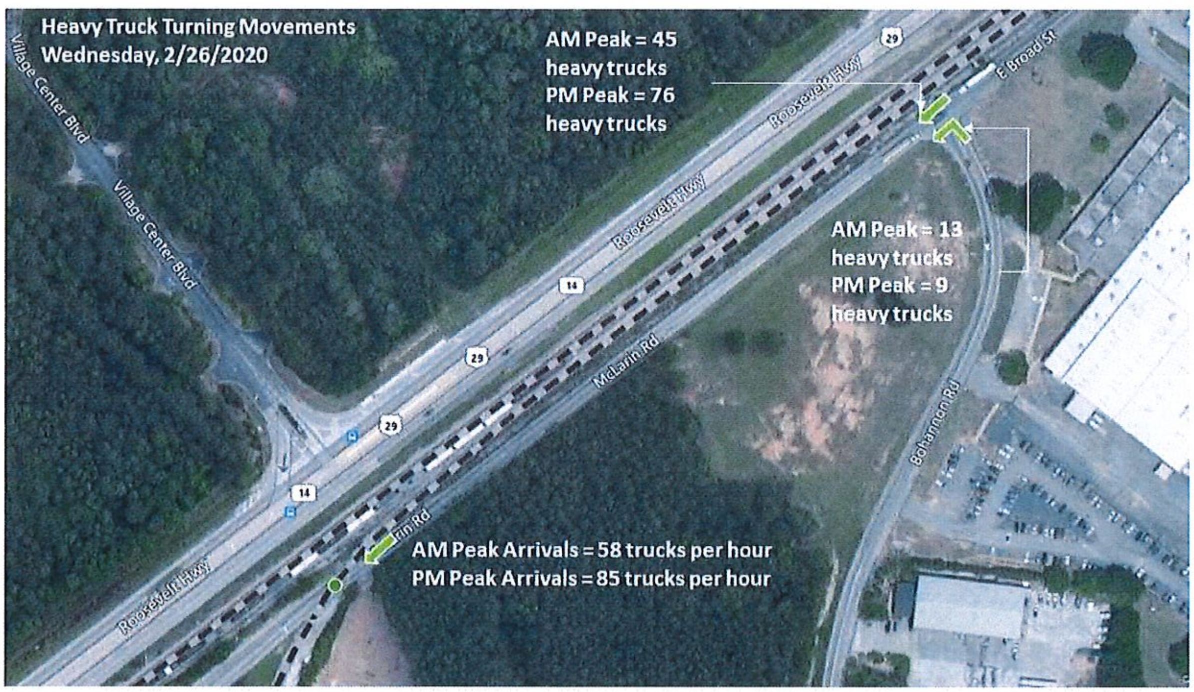
Source: Cambridge Systematics, Inc.; Volkert, Inc.

Figure 7.15 Truck Turning Movement Count Locations, 2/26/2020



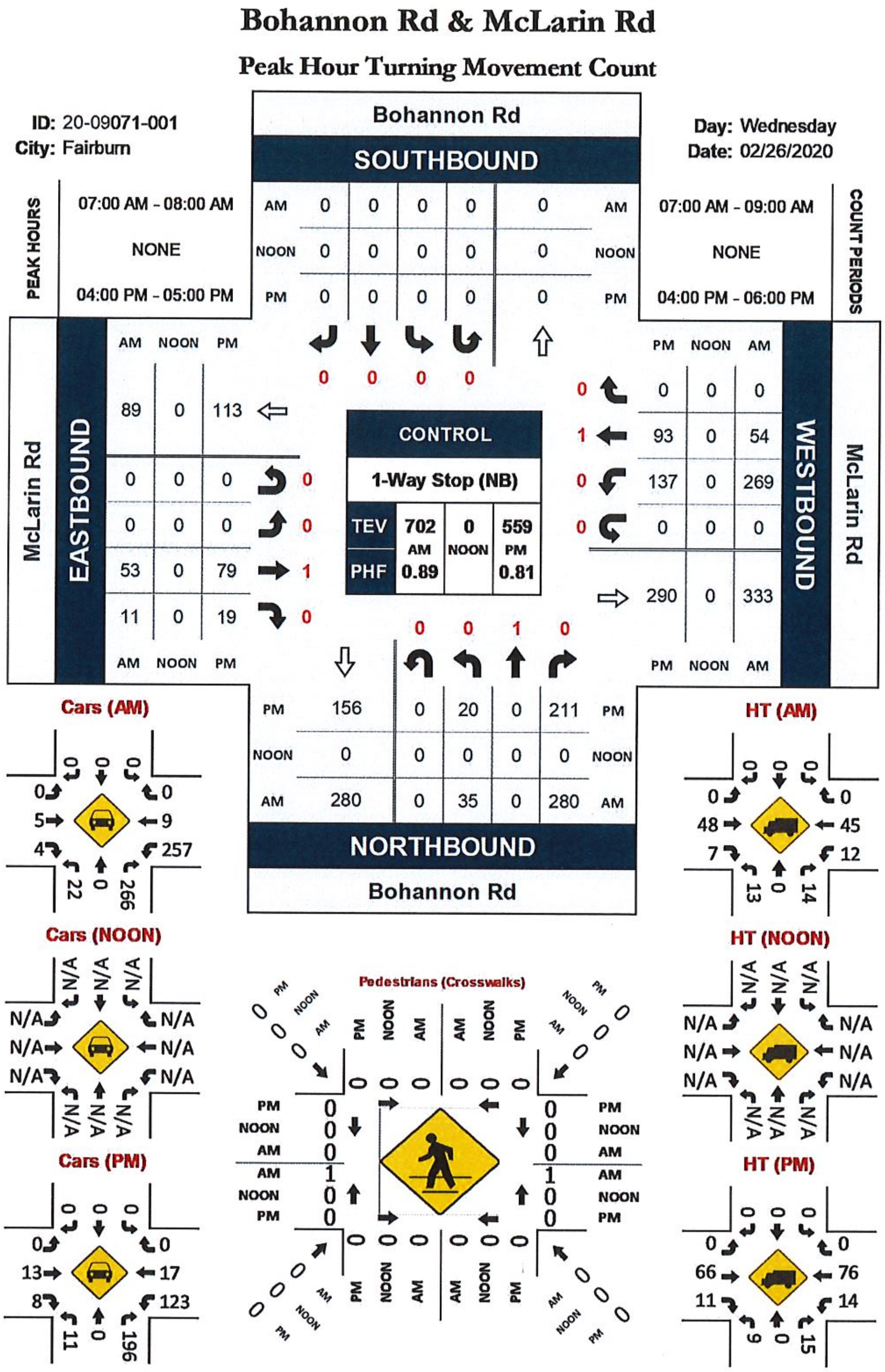
Source: National Data and Surveying.

Figure 7.16 Truck Turning Movement Counts, 2020 A.M. and P.M. Peak Periods



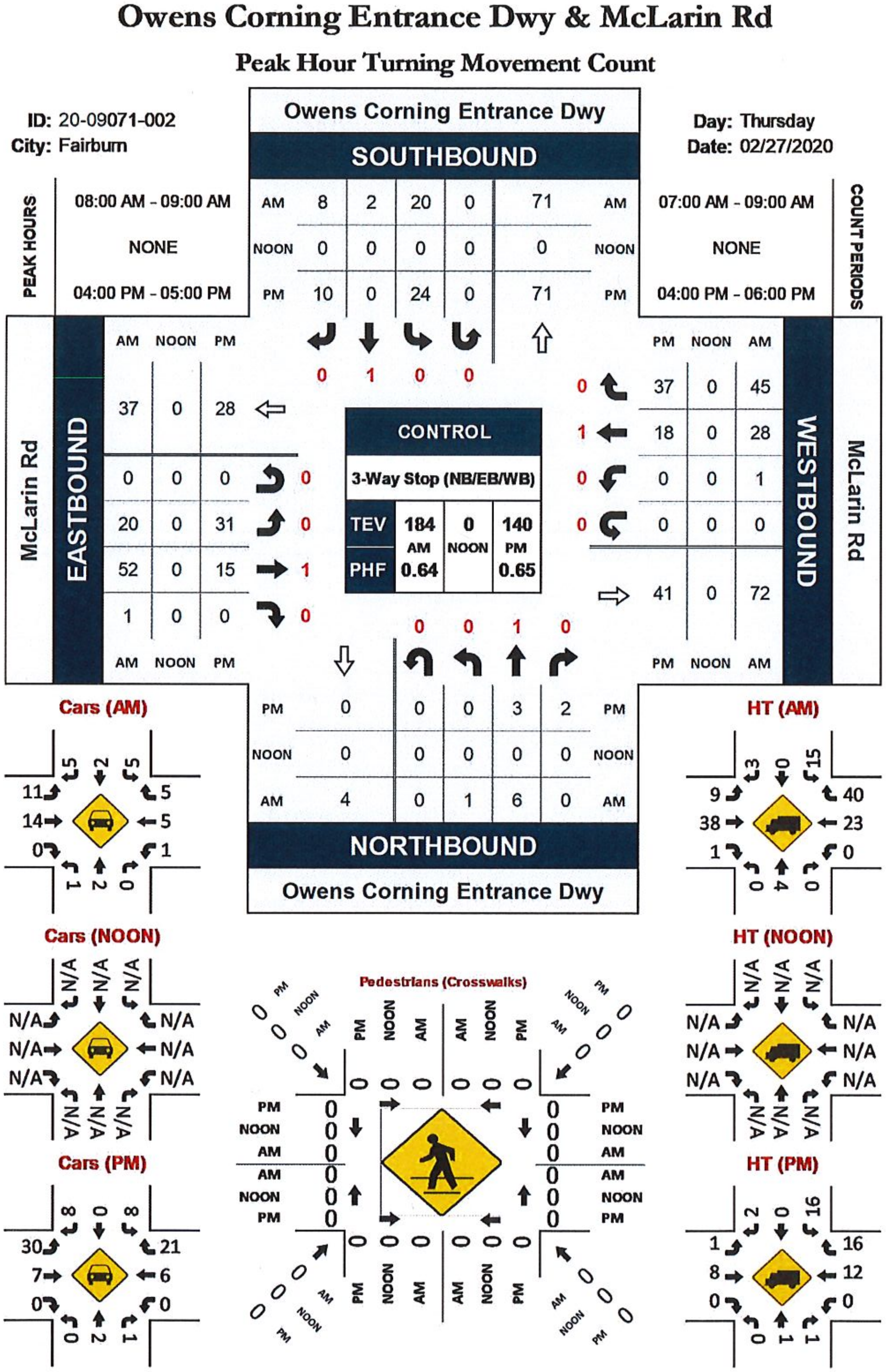
Source: National Data and Surveying.

Figure 7.17 Bohannon Road at McLarin Road Turning Movement Counts



Source: National Data and Surveying.

Figure 7.18 Bohannon Road at McLarin Road Turning Movement Counts



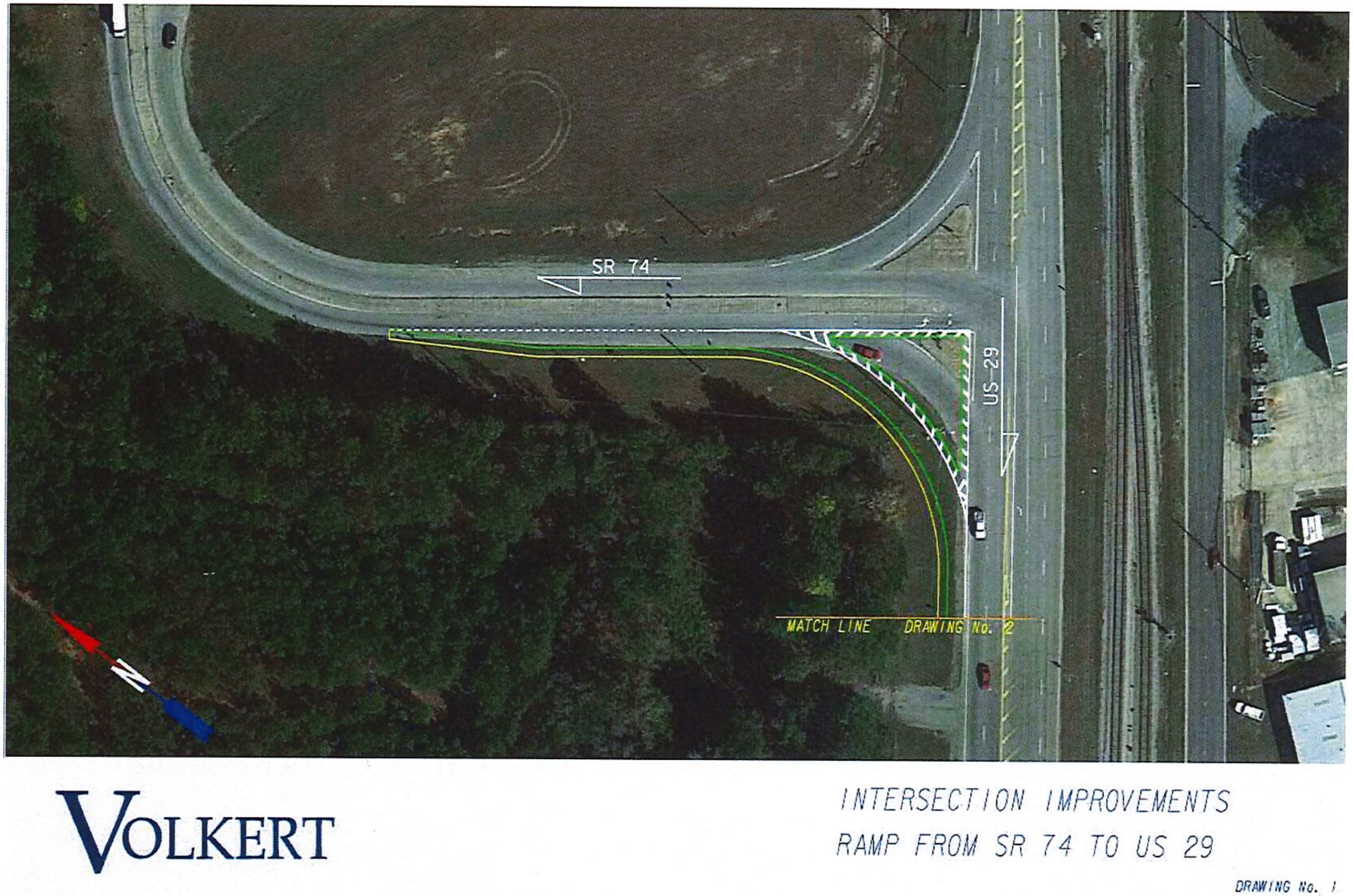
Source: National Data and Surveying.

Overall, the results of the traffic study support the need for a Freight ITS in the study area and help to inform the development of the proposed system. Some key takeaways from the traffic study that impact the proposed Freight ITS include:

- Queues consisting of trucks serving the CSX Fairburn Intermodal Center develop along McLarin Road when trains block crossing 901263C. These queues are sometimes long enough to block the intersection of McLarin Road with Bohannon Road, negatively impacting businesses along those corridors.
- In addition to through movements on McLarin Road at the intersection of Bohannon Road, there are significant truck turning movements from Bohannon Road onto McLarin Road westbound. This indicates that trucks serving the CSX Fairburn Intermodal Center and other businesses on McLarin Road, also use Bohannon Road as a primary route. These trucks are likely coming from the Oakley Industrial Boulevard corridor. This implies that the proposed Freight ITS must deliver information to motor carriers traveling on that corridor in addition to those on SR 74 and U.S. 29/Roosevelt Highway.
- Crossing 901263C is blocked multiple times a day, at least once every hour on average. There is significant variation in the duration of these blockages. Some last only a few seconds with others exceeding 1 hour in duration. The average blockage lasts 3 to 9 minutes as observed in the data.
- Crossing 901263C is impacted by activity within the intermodal terminal. The crossing's active warning system is activated multiple times a day due to activity within the terminal, with no train being present at the crossing. This occurs, on average, about 50 percent of the time based on the data.

Appendix B. Proposed Intersection Improvements

Figure 7.19 Proposed Improvements at SR 74-U.S. 29 Ramp at U.S. 29/Roosevelt Highway



Source: Volkert, Inc; Cambridge Systematics, Inc.

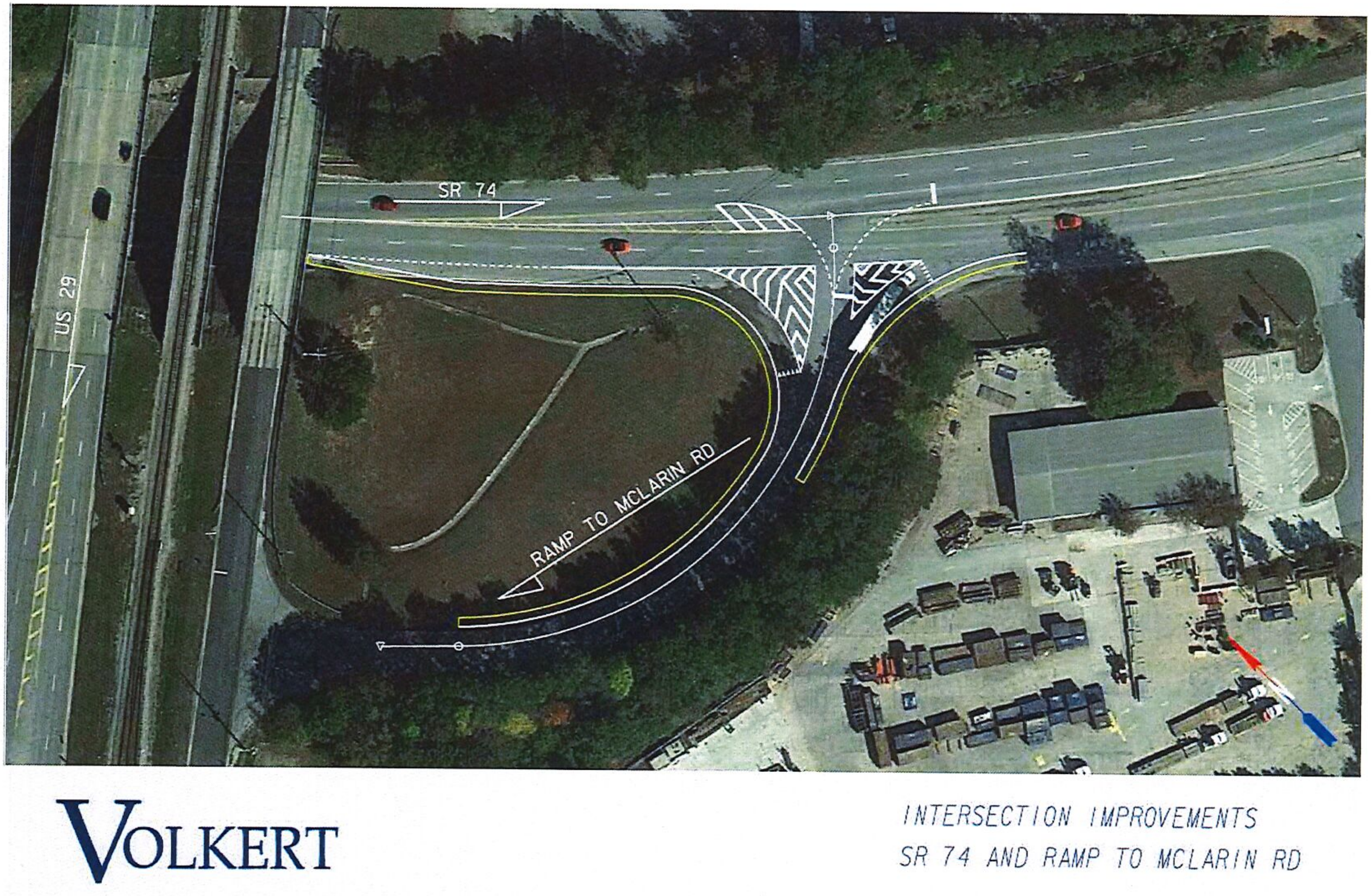
Figure 7.20 Proposed Improvements on U.S. 29/Roosevelt Highway

Source: Volkert, Inc; Cambridge Systematics, Inc.

Figure 7.21 Proposed Improvements at SR 74-U.S. 29 Ramp at SR 74

Source: Volkert, Inc; Cambridge Systematics, Inc.

Figure 7.22 Proposed Improvements at SR 74-McLarin Road Ramp at SR 74



Source: Volkert, Inc; Cambridge Systematics, Inc.