NORTHEAST OHIO

ITS STRATEGIC PLAN

PREPARED FOR

NORTHEAST OHIO AREAWIDE COORDINATING AGENCY

PREPARED BY

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WITH

AECOM

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Northeast Ohio ITS Strategic Plan

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1.0   Introduction

This report presents the Northeast Ohio Intelligent Transportation Systems (ITS) Strategic Plan, developed by the Northeast Ohio Areawide Coordinating Agency (NOACA) as part of the agency's effort to update the region's ITS Architecture.

1.1   What is ITS?

ITS stands for Intelligent Transportation Systems. The U.S. Department of Transportation (USDOT) describes ITS as, "technologies [that] improve transportation safety and mobility, reduce environmental impacts, and enhance productivity through the integration of advanced communications-based information and electronic technologies into the transportation infrastructure and vehicles."[1]

ITS includes the planning, design, and implementation of technology on transportation infrastructure and services to provide better fill transportation needs and reduce negative externalities on the environment. ITS technologies encompass all transportation modes, from pedestrian activities to freight movement. The goal of implementing ITS technologies is to enhance the mobility and accessibility in a defined region, helping users go where they want to go, when they want to, in an easier and cleaner manner.

1.2   What is an ITS Architecture?

An ITS Architecture is a structured plan which defines and integrates ITS technologies at a National, State, or regional level. The ITS Architecture presents a structured framework to describe the interaction among ITS stakeholders, inventory, and service packages; resulting in a blueprint for efficient ITS deployment and operation.[2]

1.3   What is an ITS Strategic Plan?

An ITS Strategic Plan should clearly define the region's vision for ITS implementation, identify regional ITS gaps and needs, and present feasible ITS projects to consider for short, medium, and long-term implementation. This Strategic Plan aligns closely with the ITS Architecture, supporting the identification and understanding of projects to be considered and included in the regional ITS Architecture.

1.4   Plan Structure

This Plan is organized as follows:

- **Section 1 – Introduction –** A brief introduction to the Plan and its contents.

- **Section 2 – Vision, Goals, and Objectives –** A description of the Strategic Plan's goals and objectives, as well as its integration with other planning efforts in the region.

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[1] ITS Strategic Plan 2015 – 2019, Intelligent Transportation System (ITS) Joint Program Office (JPO), https://www.its.dot.gov/strategicplan.pdf, accessed on January 2019.

[2] United States Department of Transportation, The National ITS Reference Architecture, https://local.iteris.com/arc-it/, accessed on April, 2019.

- **Section 3 – ITS Gaps and Needs Assessment –** A brief summary of the region's ITS gaps and needs identified during the ITS Architecture Update workshops.

- **Section 4 – Plan Review** – A summary of the different sources consulted to identify and describe ITS projects and strategies in the region.

- **Section 5 – Stakeholders, Roles, and Responsibilities –** A brief description of the main actors involved in the different projects identified.

- **Section 6 – Project List –** A comprehensive list of ITS projects identified for the region. The list provides a description of the projects, as well as other attributes identified for this plan.

- **Section 7 – Project Analysis –** An analysis of the ITS projects identifies, to describe how are these projects addressing the different regional needs, and the extends of their applications.

- **Section 8 – Implementation Strategy –** A description of the project prioritization process, as well as recommendations for the short, medium, and long term projects identified.

2.0 Vision, Goals, and Objectives

NOACA presents in its Regional Strategic Plan, *Going Forward Together*, a vision for Greater Cleveland's future. The plan defines five core goals to provide guidance for an uncertain future, and allocate the resources according to the region's vision. The following goals summarize NOACA's vision statement:

- Goal 1: STRENGTHEN regional cohesion

- Goal 2: PRESERVE existing infrastructure

- Goal 3: BUILD a sustainable, multi-modal transportation system

- Goal 4: SUPPORT economic development

- Goal 5: ENHANCE quality of life in Northeast Ohio

The ITS Strategic Plan aligns with the regional goals, defining a project vision that supports the defined Strategic Goals. The ITS Strategic Plan vision is to develop a roadmap to **encourage efficient technology** deployment to better utilize the region's infrastructure, **enhance communication** across regional stakeholders, and position the region for **emerging technology**. To reach this vision, the ITS Strategic Plan defines five general objectives, that at same time align with NOACA's Regional Strategic Plan goals. Table 1 presents a summary of the ITS Strategic Plan objectives, and maps these objectives to their corresponding regional goals.

Table 2.1   ITS Strategic Plan Objectives

	Regional Strategic Plan Goals				
ITS Strategic Plan Objectives	**STRENGTHEN regional cohesion**	**PRESERVE existing infrastructure**	**BUILD a sustainable, multi-modal transportation system**	**SUPPORT economic development**	**ENHANCE quality of life in Northeast Ohio**
Develop a complete inventory of current ITS equipment and technology	✓	✓			
Collaborate with regional stakeholders to identify regional transportation gaps and needs	✓		✓		
Identify planned and proposed ITS projects to address regional needs and emerging technology	✓		✓	✓	✓
Update the region's ITS Architecture to incorporate ITS Strategic Plan			✓	✓	✓
Develop an initial assessment of projects and a proposed project implementation strategy			✓	✓	✓

Source: AECOM and Cambridge Systematics, Inc.

Based on the objectives defined in **Table 2.1**, a set of expected outcomes for this effort can be identified as follows:

- Reflect current and future ITS systems in the region

- Facilitate ITS deployment to meet regional transportation needs

- Identify opportunities and strategies to integrate ITS systems

- Provide structured and strategic approach to future ITS investments

- Support interoperability among systems and jurisdictions

- Position to leverage emerging technology

- Support AIM Forward 2040, Regional Strategic Plan and USDOT ITS Strategic Plan

- Provide better customer service to the public

3.0   ITS Gaps and Needs Assessment

In September of 2018, AECOM and Cambridge Systematics held a series of workshops and surveys with key regional stakeholders to collect first-hand data for the NOACA ITS Architecture update. The goal of these workshops and surveys was to gather information from regional stakeholders to identify the region's ITS gaps and needs. The three workshops had over 50 participants total. 34 surveys were also collected across regional agencies. **Table 3.1** presents a summary of findings identified through these efforts. A detailed description of the workshops and surveys results can be consulted in the project's *Task 4 Tech Memo: Needs Analysis and Gap Assessment*.

Table 3.1   NOACA ITS Gaps and Needs

ID	Gaps Identified	High Priority Needs
ITS Area—Information Management		
IM1	• Lack of regional clearinghouse to monitor and display traffic information off the freeway system. • Local agencies desire to feed incident information on their local roads to ODOT.	**Need to enhance communications and information sharing among transportation agencies at all levels of government**
ITS Area—Traffic Management		
TM1	• There is a need to deploy more CCTV cameras with improved functionality to provide greater road condition monitoring coverage for freeways and arterials. • The region requires additional ITS field equipment and central systems to support active traffic control and management. ODOT and Turnpike have some of this functionality on freeways.	**Need to improve traffic congestion mitigation**
TM2	• There is a need to deploy more CCTV cameras with improved functionality to provide greater road condition monitoring coverage.	**Need to provide early warning of poor visibility conditions (snow squalls, sun, fog, heavy rains, etc.)**
TM3	• There is limited interconnectivity across jurisdictions in the region. • Lack of reliable and centralized control of regionally significant coordinated traffic signal systems. • Poor maintenance of detection on coordinated signal systems.	**Need to improve traffic signal interconnect and coordination to improve mobility**
TM4	• Emergency Vehicle Preemption (EVP) capability for additional police departments, ambulances and other emergency responders is needed. • Deployments of EVP are not standardized in the region which impacts interoperability among systems/agencies. • Lack of newer EVP systems that utilize radios for vehicle-to-intersection communications and GPS for vehicle location, which can be more efficient for emergency service providers and less disruptive to traffic.	**Need to provide expanded traffic signal preemption for emergency vehicles**
TM5	• Local agencies have limited capabilities to detect or monitor roadway incidents. There is a need for additional CCTV cameras on arterials. • Local agencies desire to feed incident information on their local roads to ODOT. • No plans for automated incident detection systems in the region.	**Need to know incidents on major routes**

ID	Gaps Identified	High Priority Needs
ITS Area—Public Transportation		
PT1	• Other transit agencies don't have GPS/AVL systems to monitor transit vehicle locations and perform on-time performance analysis. • Other transit agencies in region have not deployed TSP equipment. • Transit agencies have expressed desire to receive more updated information on construction / lane closures that impact bus service.	**Need to improve on-time performance of transit services**
PT2	• Other transit agencies providing para-transit service in region have noted lack of funding to invest in transit technology for improving service efficiency.	**Need to improve efficiency of demand-responsive transit operations**
PT3	• County and local transit agencies do not collect or share vehicle location in real-time.	**Need to improve transit connections for travelers**
PT4	• Transit agencies have expressed desire to receive real-time information on construction / lane closures that impact bus service.	**Need to improve event, incident, and/or construction coordination with transit providers**
ITS Area—Traveler Information		
TI1	• Need to increase public awareness on where to access the information. • Displaying travel time and delay information via DMS may not be understood by motorists not familiar with the roadway network in the region.	**Need to provide travel times / delays on freeways / turnpike to the public**
TI2	• There is a need to have more fixed message boards as it is challenging to get portable message boards to appropriate places timely during incident events due to congestion. • There is a need to improve incident detection capabilities. • Travelers from out of state may not be familiar with the OHGO traveler information website as a means to get information.	**Need to provide incident information for freeways / turnpike to the public**
TI3	• Difficulties in providing accurate and timely information on short-term lane restriction/road closures due to incidents or for temporary, moving work zones.	**Need to provide road closure / lane restriction information for freeways / turnpike to the public**
TI4	• Local agencies have expressed desire for sending incident information to ODOT regarding closures / incidents on arterial roads to minimize congestion during incidents. • Difficulties in providing accurate and timely information on short-term lane restriction/road closures due to incidents or for temporary, moving work zones.	**Need to provide road closure / lane restriction information for arterial roadways to the public**
ITS Area—Commercial Vehicle Operations and Freight Management		
CV1	• Local agencies have expressed the desire to understand what type of hazardous materials are being transported on roadway to improve emergency preparedness.	**Need to improve hazardous cargo tracking and routing**
CV2	• There is a need to improve and expand access to port facilities. • There is a need to look at all industry along the waterfront, including steel mills, salt mines, etc.	**Need to improve intermodal freight management**
CV3	• Lack of accurate and timely truck parking space availability information for truck operators needing to rest for an extended period.	**Need to provide real-time truck parking availability**

ID	Gaps Identified	High Priority Needs
ITS Area—Maintenance and Construction		
MC1	• Agencies have desired flashing lights to identify an "active work zone" with workers present. • Other technologies to improve safety in larger work zones have not been implemented.	**Need to improve temporary maintenance work zone safety for travelers and maintenance staff**
MC2	• Lack of real-time reporting for changes to work zones along roadways. • Lack of accurate information on the durations/expected durations of work zones, particularly on arterials.	**Need advanced and up-to-date road closure and temporary maintenance work zone information**
MC3	• ODOT / regional agencies have noted desire to collect roadway surface data from vehicles to improve coverage. • Additional RWIS stations could expand road surface condition data collection coverage.	**Need to collect roadway surface conditions data, such as icing, from vehicle sensors**
ITS Area—Incident and Emergency Management		
EM1	• Alternate routes defined in ODOT playbook may be outdated. • Need to pre-identify alternate routes across the region. • Lack of good alternative routes in Lake and Geauga counties. • Need to work with third party providers to incorporate official detour information into their navigation apps.	**Need to identify alternate routes for the traveling public during major incidents on freeways**
EM2	• Alternate routes defined in ODOT playbook may be outdated. Major incidents can lead to traffic congestion on arterials, which can lead to secondary incidents. • Need to pre-identify alternate routes across the region. • Ways to communicate incident and detour information to the public are limited. There is a need to explore methods in addition to using portable message boards. • Lack of good alternative routes in Lake and Geauga counties.	**Need to improve alternate route traffic management, including the communication of detour information**
EM3	• Lack of CCTV camera coverage on arterials. • Lack of CCTV camera coverage in Geauga County, the eastern part of Cuyahoga County and other rural areas. • Lack of enhanced or automated incident detection capability.	**Need improved incident detection on major routes**
EM4	• Lack of common communications channels hinder coordinated response to incidents, particularly in Lake and Geauga Counties. • Need to improve agencies' ability to communicate incident and road closure information to other agencies and the public.	**Need improved incident management and coordination**
EM5	• Lack of common communications channels hinder coordinated response to incidents, particularly in Lake and Geauga Counties. • Emergency responders lack of real-time traffic data to identify alternate/quickest routes for emergency vehicles and to incident scenes. • EVP equipment is not interoperable among neighboring jurisdictions.	**Need to improve emergency notification / dispatch and response times**
ITS Area—Transportation Security		
TS1	There is a need to deploy more security and safety monitoring technology along public roads, on major infrastructure (such as bridges), at rest areas, transit stops, and in downtown areas and other public spaces.	**Need for security and safety monitoring in public spaces (for public safety / crime deterrent)**
TS2	Need for multi-agency communications and interoperability to support evacuation and major traffic disruption.	**Need to improve evacuation plan implementation using technology**

Source: NOACA ITS Architecture Task 4 Tech Memo: Needs Analysis and Gap Assessment. AECOM.

The gaps and needs identified in **Table 3.1** were used as the foundation for the development of a project list to consider for the ITS Strategic Plan. The objective of this plan shall be to address as many gaps and need identified as possible, seeking to provide the region with desirable and needed ITS solutions.

4.0   Plan Review

In addition to the workshops and surveys conducted to identify the region's ITS gaps and needs, an analysis of current ITS-related literature was developed to identify the current state of ITS projects in the region. For the purposes of this analysis, the following sources were considered:

- NOACA AIM Forward 2040

- NOACA Transportation Improvement Program (TIP)

- NOACA Overall Work Program (OWP)

- NOACA Website

- Statewide Transportation Improvement Program (STIP)

- ODOT Transportation Systems Management and Operations (TSMO) Plan

- ODOT Freight Plan

- DriveOhio

- Ohio Turnpike and Infrastructure Commission

The following sections describe each source and provide further information regarding the ITS-related projects identified in them.

4.1   NOACA AIM Forward 2040

NOACA AIM Forward 2040 is the region's long-range transportation plan. The plan was published in June 2017, and describes a "framework for directing investment for all forms of transportation in Northeast Ohio, including motor vehicle, bridge, transit, bicycle, walking and the movement of freight. The plan offers a vision of the region's transportation system through the year 2040 and identifies $15.8 billion in transportation investments that address accessibility, safety and mobility for people who live and work in Northeast Ohio."[3]

NOACA AIM Forward 2040 dedicates a section to "Transportation Safety", where it discusses the need to use the ITS Architecture as a roadmap to promote safer, efficient, and effective transportation systems in the region. The ITS projects mentioned in NOACA AIM Forward 2040 match the projects that were identified in the previous regional ITS Architecture, which includes a list of 42 ITS-related projects. A complete list of ITS-related projects included in the long range transportation plan can be seen in **Table A.1** in **Appendix A**, and further information on each project can be found in the original source.

4.2   NOACA TIP

The NOACA Transportation Improvement Program (TIP) presents the agency's effort to implement the long-range transportation plan. The presents a list of federally funded projects, as well as regionally significant

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[3] NOACA AIM Forward website, accessed in January 2019, http://www.noaca.org/index.aspx?page=7544

projects funded by other means, that will be implemented in the NOACA five-county region. The TIP presents project budgets and schedule to account for the region's immediate transportation system expenditures. The TIP has a four-year timeframe, and contains projects proposed by local communities, county engineers, the Ohio Department of Transportation (ODOT), transit operators and other sponsors. Projects can range from road resurfacing and reconstruction to transit and bicycle facilities to traffic calming and traffic signal upgrade projects.[4] This source can help identify short-term ITS trends and projects to include in the Strategic Plan. A list of all projects considered from this source can be seen in **Table A.2** in **Appendix A**, and further information on each project can be found in the original source.

4.3 NOACA OWP

The NOACA Overall Work Program (OWP) describes NOACA's internal work load to develop and implement transportation and environmental projects in the region. The OWP defines NOACA's staff work considered to plan and implement regional projects across the region, for each fiscal year. This source can help identify regional research and exploratory studies that could lead to medium and long-term ITS projects. A list of all projects considered from this source can be seen in **Table A.2** in **Appendix A**, and further information on each project can be found in the original source.

4.4 NOACA Website

An increasingly important platform for public agencies are their internet website. Public agencies are using this platform to publish public information on different agencies' activities, and provide access to all users. Information shared in websites may include agencies' response to unplanned events, and other relevant programs that may impact users across the region. For the purpose of the ITS Strategic Plan development, the NOACA website was consulted to confirm that all published projects on the website are being considered in the Strategic Plan. A total of three ITS-related projects were found and added to the list of potential projects. These can be seen in **Table A.2** in **Appendix A**, and more information on each project can be found in the original source.

4.5 STIP

The Ohio Statewide Transportation Improvement Program (STIP) is the state's four-year transportation investment plan. This document, as the NOACA TIP, describes all the projects considered for funding and implementation for a short-term future. The current STIP, which spans over 2018 to 2021, considers a list of 7627 projects across all transportation fields. For the purpose of this analysis, the list was queried to find specific ITS-related search terms, such as ITS, smart, AVL, CAD, management, camera, detector, among others. A database of ITS-related projects was developed from the results of these queries. This list was further revised to determine if projects were considered in the NOACA region. The final product consisted of a list of ITS-related projects considered by ODOT for implementation in a short-term timeframe. The list of projects considered from this source can be reviewed in **Table A.3** in **Appendix A**, and more information on each project can be found in the original source.

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[4] NOACA Transportation Improvement Program, accessed January 2019, http://www.noaca.org/index.aspx?page=73

4.6   ODOT TSMO Plan

Since 2013, ODOT, in collaboration with FHWA and the private sector, has been actively pursuing the development of a Transportation Systems Management and Operations (TSMO) Plan. The main objective of a TSMO Plan is to maximize the efficiency, safety, and utility of existing and planned transportation infrastructure. TSMO strategies include many of the ITS areas, such as Freeway Management, Incident Management, Freight Management, among others, which are often enabled through ITS technologies. ODOT TSMO Plan defines an action plan to guide the State towards the implementation of TSMO strategies across the State's main corridors. The ITS Architecture, seeking to support the State and region's transportation plans, will consider the implementation of TSMO strategies in the NOACA region.

4.7   ODOT Freight Plan

The ODOT Freight Plan is the State's guide to inform and support future infrastructure investments. The Freight Plan describes the State's strategy to improve freight movement connectivity, reliability, and access to local, regional and international markets. The Freight Plan mentions the need to support the ODOT's efforts to expand TSMO strategies, as well as opportunities to improve commercial vehicle operations by providing better traveler information to commercial vehicle operators and enhancing parking conditions. ITS-related efforts mentioned in ODOT's Freight Plan were taken into consideration during the identification of projects to include in the ITS Strategic Plan.

4.8   DriveOhio

DriveOhio is ODOT's smart mobility initiative, functioning as a single point for research, development, testing, and deployment of new technologies in transportation. By enabling a platform of collaboration between public and private entities, DriveOhio seeks to foster smart mobility solutions such as connected and automated transportation technologies within the State's roads and facilities. Three DriveOhio projects were identified within the NOACA region, and were incorporated as part of the ITS Strategic Plan projects considered.

4.9   Ohio Turnpike and Infrastructure Commission

The Ohio Turnpike and Infrastructure Commission (OTIC) is currently investing in and testing Dedicated Short Range Communications (DSRC) by taking full advantage of existing fiber optic cable within its right of way and 160 miles of three-lane roadway to improve safety and mobility with a proof-of-concept project. The Commission has installed 15 roadside units (RSUs) on a 52-mile stretch of the turnpike between Toll Plaza 135 (Amherst, Ohio) and Toll Plaza 187 (Streetsboro, Ohio) and equipped 38 Commission vehicles with onboard units (OBUs) for the demonstration. All OBUs have the functionality to broadcast Basic Safety Messages (BSM). Snow plow controller head data is also being collected via cellular.

The 38 Commission vehicles have a human-machine interface (HMI) to share alerts and advisories with the driver. The alerts and advisories will also be received by any private vehicle with an enabled OBU.

5.0   Stakeholders Roles and Responsibilities

5.1   State stakeholders

Ohio Department of Transportation (ODOT)

ODOT is responsible for statewide transportation plans and programs, including statewide ITS plans, architectures, programs, and coordination. As detailed in Section 4.0, ODOT has a strong TSMO program and plan, which spans ITS as well as the operational strategies that are supported by ITS (e.g., traffic management, work zone management, traveler information, etc.). The NOACA region (Cuyahoga, Geauga, Lake, Lorain, and Medina counties) overlaps with parts of ODOT District 3 (Ashland) and District 12 (Garfield Heights).

Ohio Turnpike and Infrastructure Commission

OTIC is a 241-mile toll road offering the safest, best and most convenient route for motorists to reach east/west destinations along the northern corridor of Ohio and between New York and Chicago. Its mission is to be the industry leader in providing safe and efficient transportation services to our customers and communities. Specific benefits for Connected and Autonomous Vehicle (CAV) development on the Ohio Turnpike include: 6-inch lane markings; 14-feet wide paved shoulders (in the 160-mile section) and 29 eastbound plus 28 westbound emergency parking areas that are 15 feet wide and vary between 250 to 400 feet long; and seven sets of modern service plazas that allow for refueling without leaving the right of way. Electric vehicle (EV) charging stations have been added to two sets of service plazas. EV charging stations will be added to the remaining five sets of service plazas by the end of 2019. As advanced research expands, the Turnpike is poised to become the centerpiece of a connecting interstate highway test corridor.

Self-driving leaders have used the Ohio Turnpike as a site for testing autonomous commercial vehicle technology in real-life traffic conditions and the roadway is well positioned for additional testing with six contiguous lanes through 160 of its 241 miles of well-maintained roadway. The Commission exercises its own rule-making authority under the Ohio Revised Code and has a unit of the Ohio State Highway Patrol that polices the turnpike. As a result of this partnership, the Commission's unique authority, partnerships and practices position it as a leader in the mobility industry.

5.2   Regional stakeholders

Northeast Ohio Areawide Coordinating Agency (NOACA)

NOACA is the transportation and environmental planning agency serving northeast Ohio, covering Cuyahoga, Geauga, Lake, Lorain, and Medina counties. NOACA is also the federally designated Metropolitan Planning Organization (MPO) for northeast Ohio. NOACA prepares the region's long-range transportation plan (AIM Forward 2040 is the current version) and the short-range Transportation Improvement Program (TIP); conducts planning for vehicles, freight, transit, bicyclists, and pedestrians; and conducts studies that address congestion, improve safety, and strengthen community livability. NOACA coordinates with ODOT, NOACA's constituent stakeholders, and other partners on planning and projects – including ITS planning and deployment – for the region.

Transit Agencies

Regional transit agencies are key stakeholders in the region's ITS development. There are different transit agencies operating in the region, including:

- Greater Cleveland Regional Transit Authority (GCRTA) – GCRTA is the public transit agency for Cleveland and the surrounding suburbs of Cuyahoga County. GCRTA offers fixed route services through bus, rail, BRT, and Trolley services. GCRTA also offers paratransit services across its jurisdiction.[5]

- Laketran – Laketran is the transit agency that services Lake County, northeast of Cleveland. Laketran operates with fixed routes and schedules, and provides paratransit services through the "Dial-a-Ride" service.[6] Laketran currently offers a cashless mobile ticketing and fare payment EZFare app to serve riders.

- Medina County Transit Public Transit provides fixed route, paratransit, and on-demand services. The agency is working to integrate new technology applications. They will launch access to the EZFare app in late 2019 and are working to install onboard camera systems in their revenue vehicles and install onboard Mobile Data Terminals to communicate, track, and record vehicle and operational data.

- Lorain County Transit operates four fixed bus routes and an Oberlin Connector along with paratransit services.

5.3   Local stakeholders

NOACA Counties

The NOACA region covers Cuyahoga, Geauga, Lake, Lorain, and Medina counties. These counties are key stakeholders in NOACA's ITS planning. In addition, staff from each of these county governments sit on the NOACA board (County Commissioners) and committees.

NOACA Cities and Municipalities

The NOACA region includes a number of cities, including the City of Cleveland, City of Lorain, City of Elyria, City of Euclid, City of Willoughby, City of Mentor, City of Brunswick, and many more cities and municipalities. Like the NOACA counties, these cities and municipalities are important stakeholders in NOACA's ITS planning and have representation on NOACA's board and committees.

Other Stakeholders

In addition to the main government and transportation authorities, there are important stakeholders in the region that form part of the ITS Strategic Plan. Police and Fire Departments in the region play an important role on projects related to Incident and Emergency Management. There are important organization such as hospitals, ports, and airports that also have an important part in ensuring that ITS projects work properly across the region.

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[5] GCRTA website, http://www.riderta.com/, accessed on April 2019.

[6] Laketran website, https://laketran.com/, accessed on April 2019.

6.0   Project List

After conducting the workshops and surveys, and consulting the relevant planning documents in the region, a list of ITS-related projects was developed to summarize all efforts. Tables 6.1, 6.2, and 6.3 show a summary of the projects considered at the three regional levels considered: State, Regional, and Local projects, respectively. The following information is provided for each project identified:

- **ITS Area** – The ITS functional area being addressed by each project.

- **ID** – An individual numeric ID unique to each project.

- **Name** – The project's name

- **Description** – A brief description of the project

- **Related Needs** – A guide to the ITS gaps and needs addressed by each project, as presented in Section 3 of this report

- **Stakeholders** – An initial assessment of stakeholders involved. Stakeholders in **bold** represent primary stakeholders, which may be considered as the project's lead. Other stakeholders mentioned are secondary stakeholders, which may be involved during the design and implementation of each project, but not necessarily leading it.

- **Timeframe** – An initial assessment of the expected timeframe the project can consider for implementation. Three time frames are being considered:

    - ●●●   Short term project – Estimated to be implemented in 1 to 3 years.

    - ●●●   Medium term project – Estimated to be implemented in 3 to 6 years.

    - ●●●   Long term project – Estimated to be implemented in 6 to 9 years.

- Expected Cost – An initial estimation of a potential cost according to the project description. The costs are presented in three tiers:

Low Cost	A potentially low-cost project both for implementation as well as operation and maintenance (approximately below $1 Million)
Medium Cost	A relatively expensive project both for implementation as well as operation and maintenance (approximately from $1 to $5 Million)
High Cost	An expensive project both for implementation as well as operation and maintenance (over $5 Million)

6.1 State Projects

Table 6.1 State ITS Projects Identified

		STATE PROJECTS				
ID	Name	Description	Related Need (by ID)	Stakeholders	Timeframe	Expected Cost
ITS Function—Freeway Management						
1	Freeway Management System (FMS) Expansion	The FMS Expansion project's objective is to extend ODOT FMS field devices and communications on the freeway system, including expansion of: the TMC, DMS, CCTV, flow detection, freeway service patrols, hybrid communications systems, HAR, ramp metering, web-based services, and inter-agency communications networks.	IM1 TM1	**State (ODOT)**	●○○	**High**
2	ODOT Advanced Traffic Management System (ATMS)	ODOT is seeking a commercial off-the-shelve Advanced Traffic Management System software package to replace and expand the current in-house system. The new system shall consolidate resources (including Playbook), enhance capabilities, capture and archive roadway, traffic, speed, and weather data, provide functionality for forthcoming emerging technologies.	IM1 TM1 TM2	**State (ODOT)**	●○○	**Medium**
3	Traffic Monitoring Management System Enhancements	The objective of this project is to enhance/expand a Statewide Traffic Monitoring Management System created by ODOT.	IM1	**State (ODOT)**	●○○	**Medium**
4	Transportation Systems Management and Operations (TSMO)	ODOT's TSMO Plan and ongoing TSMO efforts work to continue the implementation of TSMO strategies across the state's corridors.	TM1	**State (ODOT)**	●●○	**Medium**
5	Freeway Managed Lanes	Freeway managed lanes efforts implement managed lane technology on selected, priority corridors. Strategies may include hard shoulder running and dynamic lane control, with permanent overhead signs for managed lane operations.	TM1	**State (ODOT)**	●●●	**High**
6	Freeway Ramp Metering	Freeway ramp metering efforts implement controlled metering at freeway on-ramps to reduce mainline congestion.	TM1	**State (ODOT)**	●●●	**High**
7	Freeway Speed Harmonization	Freeway speed harmonization efforts implement variable speed limits and speed harmonization on selected corridors to enhance regional mobility and reduce emissions.	TM1	**State (ODOT)**	●●●	**High**

STATE PROJECTS						
ID	Name	Description	Related Need (by ID)	Stakeholders	Timeframe	Expected Cost
ITS Function—Traveler Information						
8	Dynamic Message Signs (DMS)	DMS efforts install DMS signs in strategic locations throughout the region for improved freeway management and operations (enhancing safety, reliability, efficiency) and improved communication with travelers.	TI3	**State (ODOT)** Regional (NOACA)	●●○	Medium
9	Fiber Optic Connectivity	Advancing fiber optic connectivity and coverage could support the development of various regional smart mobility technologies by installing fiber optic cable along key freeways in the region and local roadways, as well as by installing roadside detection units and traffic signal upgrades.	IM1	**State (ODOT)**, Regional (NOACA)	●●○	Medium
10	Expand Traveler Information Delivery Methods	Enhancing traveler information dissemination methods may include enhancing OHGO, information provided through cable TV stations, and new connections to private sector dissemination methods.	TI1 TI2 TI3 TI4	**State (ODOT)**	●○○	Low
ITS Function —Maintenance and Construction						
11	Maintenance Vehicle Upgrade	Maintenance vehicle upgrades pertaining to ITS include the purchasing of new instrumented multi-subsystem data collection vehicles and associated software and maintenance.	MC3	**State (ODOT)**	●○○	Low
12	Expand Road Weather Information System (RWIS)	RWIS expansion efforts may include installing additional RWIS stations at strategic locations. The project also considers testing mobile RWIS.	TM2 MC3	**State (ODOT)**	●○○	Low
13	Winter Maintenance	Winter maintenance projects pertaining to ITS include: installing snow and ice detection management and advanced snow plow systems, as well as a pilot project to assess the use of RWIS integrated with advanced technology snow plows. This project also considers evaluating the use of private data collectors to expand data collection.	MC3	**State (ODOT)**, Regional (NOACA)	●●○	Medium
14	Work Zone Reservation and Traveler Information System	This project is a joint effort between the Ohio Turnpike and Infrastructure Commission, Pennsylvania Turnpike and Pennsylvania Department of Transportation to implement the Work Zone Reservation and Traveler Information System on the Turnpike. WZRTIS will enhance work zone operations and safety by providing accurate, standardized, and real-time work zone information across nearly 41,000 miles of roadway through Pennsylvania and Ohio. The system will also streamline work zone coordination between maintenance crews,	TI3 MC2	**State (ODOT)**	●●○	High

		STATE PROJECTS				
ID	Name	Description	Related Need (by ID)	Stakeholders	Timeframe	Expected Cost
		construction crews, and traffic operation centers by modernizing the way work zones are scheduled and managed.				
15	Work Zone Safety Improvements	ITS applications for work zones improve mobility and safety in work zones by helping to reduce crashes and incidents. Such applications generally alert drivers of a construction zone, roadway hazard, or speed change. This project also considers pilot projects to test portable CMS, queue detection, and integration with VSL systems.	MC1 MC2	**State (ODOT)**	●●◯	**Medium**
ITS Function —Public Safety						
16	Highway-Rail Intersection Advanced Safety Systems	This project's objective is to conduct a study that identifies priority highway-rail crossings and the preferred system to install advanced Highway-Rail Safety Systems at key crossings.	--	**State (ODOT)**, Regional (NOACA)	●●◯	**Low**
17	Intersection Collision Warning Systems	This project considers the installation of Collision Warning Systems on key intersections with high collision rates. Technology may include alerting users of crossing traffic, as well as queue detection on heavy traffic arterials.	--	**State (ODOT)**	●●●	**Low**
18	Speed Radar-activated Chevrons	This project considers the installation of speed radar detection on key road curves, to alert users when taking a curve at high speeds.	--	**State (ODOT)**	●●●	**Low**
ITS Function —Commercial Vehicle Operations and Freight Management						
19	Deploy a Truck Parking Information Management System (TPIMS)	This project's objective is to develop and deploy an information management system that monitors available public and private truck parking spaces and publishes the information "real time" via the internet and roadside signs.	CV2 CV3	**State (ODOT)**	●●●	**Medium**
ITS Function —Emerging Technologies						
20	Ohio Turnpike ACV Testing	The 241-mile Ohio Turnpike is DriveOhio's site for testing ACVs. The turnpike is outfitted – end to end – with fiber-optic cable, and it already has been a testing site for self-driving trucks. Roadside units were installed in a 60-mile stretch of the turnpike and onboard units were installed and operational in fleet vehicles during the first quarter of 2018, giving the Ohio Turnpike Commission the ability to produce traffic and weather alerts for digitally connected vehicles and to use vehicle and road condition data to make better decisions about treating roads and managing incidents.	TM1 TM5	**State (OTIC)** Regional (NOACA)	●◯◯	**High**

STATE PROJECTS						
ID	**Name**	**Description**	**Related Need (by ID)**	**Stakeholders**	**Timeframe**	**Expected Cost**
21	DriveOhio City Use Cases	ODOT is collaborating with Athens, Akron, Canton, Cincinnati, Cleveland, Dayton, Dublin, and Toledo for additional DriveOhio projects. Use cases that highlight each city's unique attributes are under development, ranging from workforce mobility, healthcare and education access, and mobility access for underserved, elderly and disabled populations.	PT2 PT3	**State (ODOT),** Regional (NOACA) City of Cleveland	●○○	**High**
ITS Function —Emerging Technologies						
22	I-90 Lake Effect Corridor	ODOT is equipping 60 miles of I-90 with DSRC units. It will also test wireless technologies designed to send and receive data from those units as well as units on public service vehicles. The data, combined with new variable speed limit signs, will help local officials and law enforcement better manage the roadway to reduce crashes and fatalities. The project considers an expansion to other corridors in the near future.	EM1 EM2 EM3 EM4 EM5	**State (ODOT)**	●○○	**High**
23	Increase Electric Vehicle Infrastructure	Efforts to increase electric vehicles in the public fleet include: increasing electric vehicle infrastructure (for instance by the design and construction of public fleet electric vehicle charging stations) and public fleet electric vehicle purchases.	--	**State (ODOT&OTIC)**	●●●	**High**
ITS Function —Data Management						
24	ODOT Traffic Monitoring Permanent Count Program	The effort advances the ODOT Traffic Monitoring Permanent Count Program, specifically by providing funding for items such as: supplies, utilities, software, counter maintenance, and an upgrade to the existing non-intrusive sensors and accessories.	--	**State (ODOT)**	●○○	**Low**
25	Creation of a GIS Data Centralization Center	The GIS Centralization Project will focus on an enterprise wide approach to managing geospatial resources providing for the development and integration of spatial data and GIS technology throughout ODOT.	--	**State (ODOT)**	●○○	**High**

6.2   Regional Projects

Table 6.2   Regional ITS Projects Identified

ID	Name	Description	Related Need (by ID)	Stakeholders	Timeframe	Cost
Regional Projects						
ITS Function —Freeway Management						
26	Regional Traffic Management Center (TMC)	The objective of this project is to create a regional TMC to coordinate traffic in the region and share information among stakeholders. TMC operation should address: traffic/road condition surveillance, traveler information control, and communication with ODOT TMC for collaborative operations.	IM1 TM1 TM3	**Regional (NOACA)** State (ODOT)	●●○	**Medium**
27	Regional Traveler Information System (TIS)	This project considers the development of a regional Traveler Information System to alert users in the region of road closures, events, and congested routes, providing reasonable alternatives routes, with an emphasis on arterial routes in the region.	TI1 TI2 TI3 TI4	**Regional (NOACA)**	●●○	**Low**
28	Regional Alternate Routes Planning	Develop a plan and operational strategy for alternate routes for traffic diversion due to major incidents with a focus on coordination between ODOT-operated freeways and locally-operated arterials. Plans would identify thresholds for when a specific segment of the roadway is considered affected, which alternate route(s) to implement; which agencies should be involved, how they communicate, and their roles and responsibilities in traffic control, timing adjustments, traveler information; and what ITS assets (CCTV, DMS, etc.) should be utilized to monitor the situation and provide en-route traveler information.	IM1 IM1 TI2 TI3	**Regional (NOACA)** State (ODOT) Municipalities	●○○	**Low**
ITS Function —Public Transportation						
29	GCRTA Computer Aided Dispatch (CAD)/Automatic Vehicle Location (AVL)	The goal of this effort is to implement Computer Aided Dispatch using Automatic Vehicle Location technology for GCRTA, including: Automatic Passenger Counters, Closed Caption Television (CCTV) surveillance systems, automated stop announcements, and an enhanced Radio Communication system.	PT1 PT3	**Regional (NOACA)**	●○○	**Medium**
30	Laketran CAD/AVL	The goal of this effort is to implement Computer Aided Dispatch using Automatic Vehicle Location technology for Laketran, including: Automatic Passenger Counters, Closed Caption Television (CCTV) surveillance systems, automated stop announcements, and an enhanced Radio Communication system.	PT1 PT3	**Regional (NOACA)**	●○○	**Medium**

		Regional Projects				
ID	**Name**	**Description**	**Related Need (by ID)**	**Stakeholders**	**Timeframe**	**Cost**
31	County Transit Agency ITS Updates	The objective of this effort is to update county transit vehicle ITS, including AVL systems for vehicles for Lorain and Medina counties as well as upgraded vehicle radios for Medina County. Medina County is also looking to install Mobile Data Terminals to communicate, track, and record vehicle and operational data.	PT1 PT3	**Lorain County** **Medina County**	●●●	**Low**
32	GCRTA / Laketran Transit Vehicle Wi-Fi	This effort will install wireless internet (Wi-Fi) on GCRTA/Laketran buses.	TS1	**Regional (NOACA)**	●●●	**Low**
ITS Function —Public Transportation						
33	Enhance and expand GCRTA and Laketran Paratransit services	This effort will implement an advanced para-transit scheduling and dispatch system at Laketran, coordinated with GCRTA.	PT2	**Regional (NOACA)**	●●●	**Medium**
34	Transit Signal Priority	Study key transit corridors for applicability of bus traffic signal priority to improve transit travel time. Implement transit signal priority on traffic signals on identified corridor.	TM4	Regional (NOACA), City of Cleveland	●●●	**High**
35	GCRTA Kiosks at Transfer Points	This project will install kiosks inside key transfer points such as airports to assist out of town users in finding their way using public transit.	IM1	Regional (NOACA), City of Cleveland	●●●	**Low**
ITS Function —Emerging Technologies						
36	Hyperloop Feasibility	NOACA and Hyperloop Transportation Technologies, Inc. (Hyperloop TT) have entered into a Public-Private Partnership (P3) to explore the feasibility of development of an ultra-high-speed Hyperloop transportation system in the Great Lakes Megaregion.	TM1	Regional (NOACA), State (ODOT)	●●●	**High**

6.3 Local Projects

Table 6.3   Local ITS Projects Identified

Local Projects						
ID	**Name**	**Description**	**Related Need (by ID)**	**Stakeholders**	**Timeframe**	**Cost**
ITS Function —Arterial Management						
37	Signal Timing Optimization Program	This effort will re-time traffic signals on arterial roadways of regional significance. NOACA will lead the effort to update signal operations across key corridors in the region, and across jurisdictional boundaries, seeking to minimize stops and delays, reduce fuel consumption and air pollution, maximize traffic flow along arterial roadways, and improve safety by reducing rear end crashes.	TM3	**Regional (NOACA)** Cuyahoga County Geauga County Lake County Lorain County Medina County Cleveland	●●●	**Low**
38	Automated Traffic Signal Performance Measures (ATSPMs)	This project will collect data at signalized intersections and develop performance measures using ATSPMS technologies to proactively manage signals in the region.	TM1 TM3	**Regional (NOACA)** Cuyahoga County Geauga County Lake County Lorain County Medina County Cleveland	●●●	**Medium**
39	Municipal Signal Preemption	This effort will explore traffic signal preemption for emergency vehicles, which makes use of connected vehicle technology to preempt traffic signals so that emergency vehicle may safely and efficiently move through intersections.	TM4	**Cuyahoga County** **Geauga County** **Lake County** **Lorain County** **Medina County** **Cleveland**	●●●	**Medium**
40	Upgrade Traffic Signals in East Cleveland	This project will upgrade traffic signals and signal systems along Euclid Avenue, Superior Avenue, Terrace Road, Noble Road, and Hayden Drive in East Cleveland.	TM3	**Cuyahoga County**	●●●	**Low**
41	Upgrade traffic signals along US-20 and US-322	This project will upgrade traffic signals along US-20 (Center Ridge Road), from west of Stoney Ridge Road to Lear Nagle Road, in North Ridgeville as well as traffic signal improvements along US-322 (Mayfield Road), from Kenilworth Road to Warrensville Center Road, in Cleveland Heights	TM3	**Lorain County**	●●●	**Low**

| Local Projects						
ID	**Name**	**Description**	**Related Need (by ID)**	**Stakeholders**	**Timeframe**	**Cost**
ITS Function —Arterial Management						
42	Rocky River Signals	This project will upgrade traffic and pedestrian signals at 6 intersections along Center Ridge Road (US-20) from Pease Drive to Northview Road/Linden Road in the City of Rocky River.	TM3	**Cuyahoga County**	●○○	**Low**
43	Strongsville Signals	This city-wide signal upgrade project will upgrade signals along SR-82 and US-42 in the City of Strongsville.	TM3	**Cuyahoga County**	●○○	**Low**
44	Lorain Traffic Signals	This Lorain County project will replace nine signals throughout project limits as well as upgrade ADA ramps.	TM3	**Lorain County**	●○○	**Low**
45	Mayfield Heights Signals	This Cuyahoga County project will upgrade signals along the Mayfield Road corridor, from Iroquois Avenue to Gates Mills Towers Drive. It will replace four signals, partially upgrade 13 traffic signals, and install an advanced central control system.	TM3	**Cuyahoga County**	●○○	**Low**
46	Beachwood Signals	This project will upgrade signals primarily along SR175 and Cedar Road in the City of Beachwood, north of the Chagrin Boulevard corridor.	TM3	**Cuyahoga County**	●○○	**Low**
47	Cleveland Heights Signals	This project will reconstruct 12 signals in northern Cleveland Heights along Monticello Boulevard, Taylor Road, and Noble Road, as well as remove four unwarranted signals.	TM3	**Cuyahoga County**	●○○	**Low**
48	Painesville Signals	This Lorain County project will replace signal controllers and vehicle detection at 14 intersections along the two corridors, Richmond Street (SR 283) and Mentor Avenue (US 20), and remove three unwarranted traffic signals.	TM3	**Lake County**	●○○	**Low**
49	University Heights	This project will upgrade twenty-one traffic signals within University Heights along Cedar Road, Warrensville-Center Road, Washington Boulevard, and S. Green Road, including complete reconstruction at four intersections.	TM3	**Cuyahoga County**	●○○	**Low**
50	City of Cleveland Special Event Traffic Planning	This effort will develop plans, procedures, and systems to improve traffic conditions associated with special events such as concerts, sporting events, and festivals.	EM2	**Cleveland**	●○○	**Low**

		Local Projects				
ID	**Name**	**Description**	**Related Need (by ID)**	**Stakeholders**	**Timeframe**	**Cost**
ITS Function —Parking Management						
51	Cuyahoga County Port Authority Automated Parking Facilities	This project will implement automated parking facilities to show available parking at the airport as well as automated payment collection. The project will also install DMS signs in allocated parking locations to provide incoming flight information to people picking up travelers.	--	**Cuyahoga County**	●●○	**Medium**
52	City of Cleveland Automated Parking Facilities	This project will evaluate possible connected vehicle applications to provider travelers with parking information and assistance, and to automate features of parking systems. Includes the installation of parking meters that allow app-based payment.	--	**Cleveland**	●●○	**Medium**
ITS Function —Incident and Emergency Management						
53	Cuyahoga County Evacuation Plan Updates	This project will study and develop a plan to evacuate Cuyahoga County in case of an emergency affecting a mass area.	EM1 EM4 TS2	**Cuyahoga County**	●○○	**Low**
54	Municipal Computer Aided Dispatch to Emergency Vehicle	This effort will integrate computer aided dispatch in to the emergency management center, allowing operators to dispatch emergency response vehicles to the scene more rapidly.	EM5	**Regional (NOACA) Cuyahoga County Geauga County Lake County Lorain County Medina County Cleveland**	●●○	**Medium**
ITS Function —Public Safety						
55	City of Cleveland / Cuyahoga County Port Security Camera Installation including Vehicle Tracking System (VTS)	With the aid of Homeland Security Funding, this effort will install cameras underneath existing bridges along the Cuyahoga River to monitor river traffic. There is also interest in cameras to monitor the position of lift bridges across the Cuyahoga River for both vehicular travel and boat traffic. These cameras could be part of the regional Traffic Management Center.	TS1	**Cuyahoga County Cleveland**	●●○	**Medium**

7.0   Project Analysis and Prioritization

The 45 state, regional, and local ITS projects profiled in Section 6.0 cover a wide array of ITS functions, geographic scopes, and regional needs. The discussion below summarizes the extent to which these projects cover various areas; highlights strengths and gaps, and outlines an approach for prioritizing projects.

Figure 7.1   Number of Projects by ITS Area
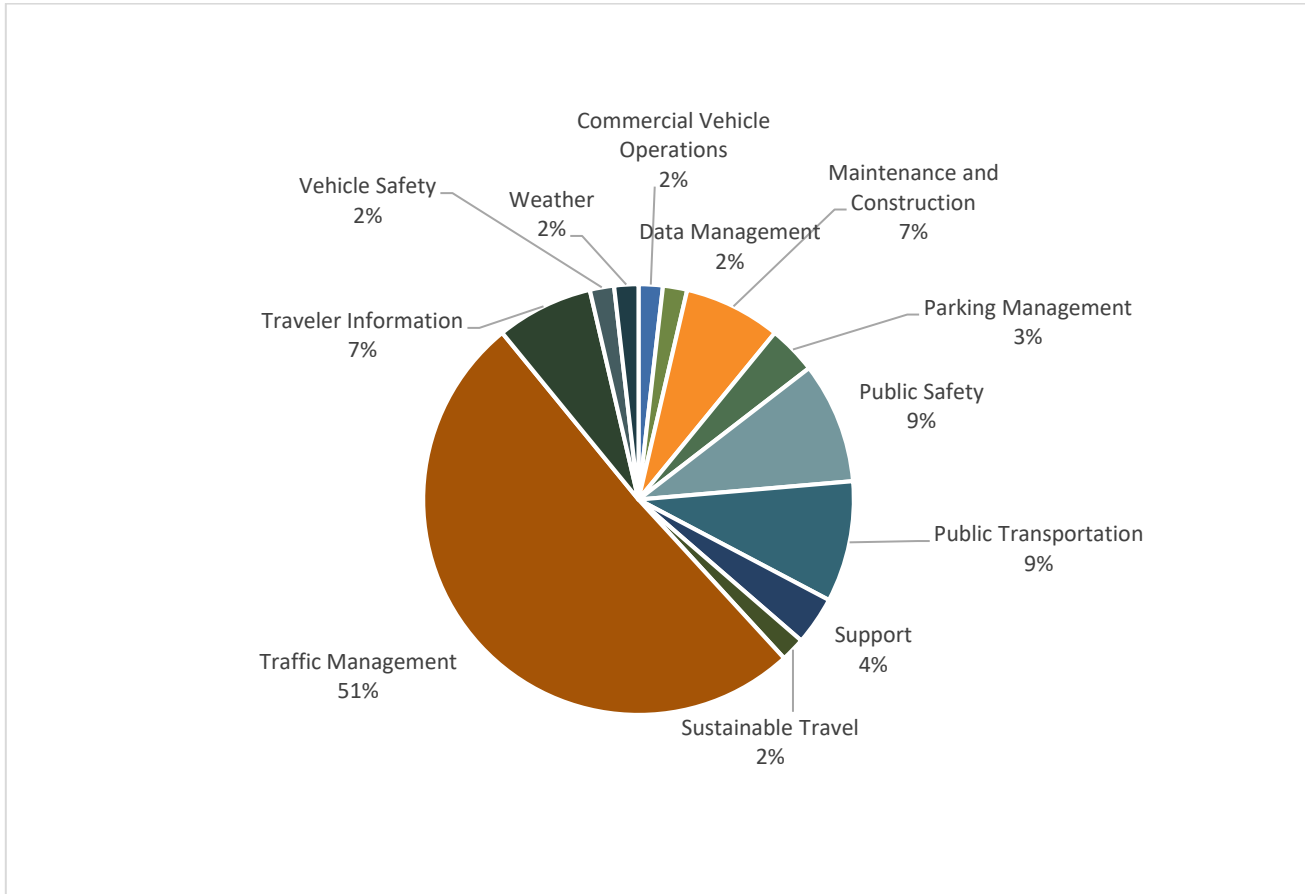
Source: AECOM, Cambridge Systematics, Inc. and NOACA.

Figure 7.1 shows the percentage of projects according to the ITS areas identified. To assign each project to a specific ITS area, the National ITS Reference Architecture[7] was consulted. A list of all twelve ITS areas identified was developed, and each project was assigned to a specific area based on the project characteristics. Figure 7.1 shows that the projects considered cover all of the ITS areas currently identified, with a majority of projects (23 projects) focused on Traffic Management.

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[7] United States Department of Transportation ARC-IT v.8.2, The National ITS Reference Architecture, https://local.iteris.com/arc-it/html/servicepackages/servicepackages-areaspsort.html accessed 03/2019.

Figure 7.2   Number of Projects by Stakeholder and Geographic Scope
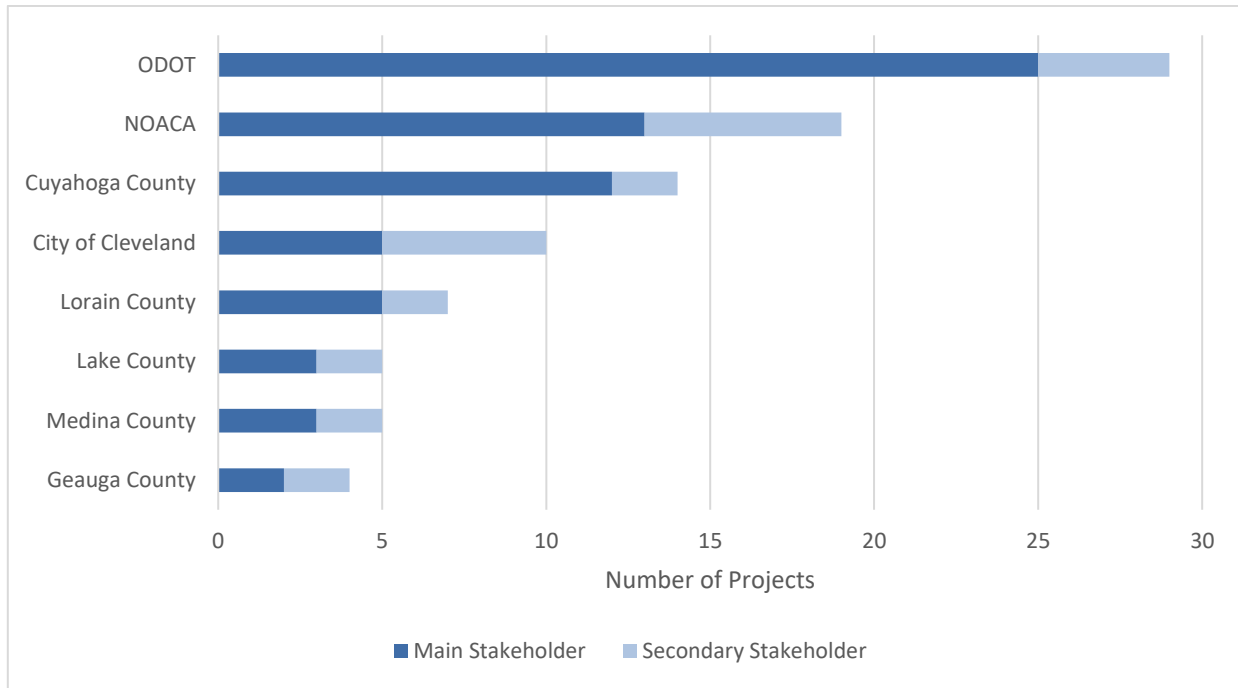
Source: AECOM, Cambridge Systematics, Inc. and NOACA.

Figure 7.2 shows a summary of all projects identified by stakeholder. As part of the project definitions, stakeholders were assigned as principal and secondary stakeholders. Principal stakeholders would most likely lead the project implementation. Secondary stakeholders would support project planning or implementation. Figure 7.2 shows that all regions considered have at least one project as primary and secondary stakeholder. This analysis helps reaffirm that ITS projects considered have representation throughout the NOACA region.

Table 7.1   NOACA ITS Gaps and Needs

ID	High Priority Need	Number of Projects Addressing this Need
	ITS Area—Information Management	
IM1	Need to enhance communications and information sharing among transportation agencies at all levels of government	7
	ITS Area—Traffic Management	
TM1	Need to improve traffic congestion mitigation	11
TM2	Need to provide early warning of poor visibility conditions (snow squalls, sun, fog, heavy rains, etc.)	2
TM3	Need to improve traffic signal interconnect and coordination to improve mobility	13
TM4	Need to provide expanded traffic signal preemption for emergency vehicles	2
TM5	Need to know incidents on major routes	1
	ITS Area—Public Transportation	
PT1	Need to improve on-time performance of transit services	3

ID	High Priority Need	Number of Projects Addressing this Need
PT2	Need to improve efficiency of demand-responsive transit operations	2
PT3	Need to improve transit connections for travelers	9
PT4	Need to improve event, incident, and/or construction coordination with transit providers	1
	ITS Area—Traveler Information	
TI1	Need to provide travel times / delays on freeways / turnpike to the public	2
TI2	Need to provide incident information for freeways / turnpike to the public	3
TI3	Need to provide road closure / lane restriction information for freeways / turnpike to the public	4
TI4	Need to provide road closure / lane restriction information for arterial roadways to the public	2
	ITS Area—Commercial Vehicle Operations and Freight Management	
CV1	Need to improve hazardous cargo tracking and routing	0
CV2	Need to improve intermodal freight management	1
CV3	Need to provide real-time truck parking availability	1
	ITS Area—Maintenance and Construction	
MC1	Need to improve temporary maintenance work zone safety for travelers and maintenance staff	1
MC2	Need advanced and up-to- date road closure and temporary maintenance work zone information	2
MC3	Need to collect roadway surface conditions data, such as icing, from vehicle sensors	3
	ITS Area—Incident and Emergency Management	
EM1	Need to identify alternate routes for the traveling public during major incidents on freeways	2
EM2	Need to improve alternate route traffic management, including the communication of detour information	2
EM3	Need improved incident detection on major routes	1
EM4	Need improved incident management and coordination	2
EM5	Need to improve emergency notification / dispatch and response times	2
	ITS Area—Transportation Security	
TS1	Need for security and safety monitoring in public spaces (for public safety / crime deterrent)	2
TS2	Need to improve evacuation plan implementation using technology	1

Source: NOACA ITS Architecture Task 4 Tech Memo: Needs Analysis and Gap Assessment. AECOM.

We can observe that there are 26 regional needs being addressed with the project list considered. Only the need to improve hazardous cargo tracking and routing is not being fully addressed.

The results of this project analysis show that the project list considered fully represent the different ITS areas. Furthermore, the project list is representative of all NOACA's geographic areas, and addresses over 90 percent of the region ITS needs identified.

8.0   Implementation Plan

One of the objectives set for the ITS Strategic Plan was to develop an initial assessment of projects and a proposed project implementation strategy. This section builds upon the projects identified and their analysis, to define a strategic path towards implementation.

The ITS projects identified and described in this report respond to a variety of needs in the region, from short term solutions to current problems to long term visions for the region. As such, projects may have different levels of detail in concept definition, making it challenging to compare these projects among each other to define a path for implementation. This section presents a strategy to compare and prioritize the projects identified, to define a strategic approach towards an implementation strategy.

The Strategic Plan implementation strategy is based on a project scoring analysis. In order to score the different types of projects fairly, it was important to identify scoring criteria that could be comparable among the different projects and the stages they currently are in. For this purpose, the following evaluation criteria were considered:

- **Relationship between projects** – Some of the ITS projects identified can be related among each other. For example, the first project considered "Freeway Management System (FMS) Expansion" may include other projects such as "Freeway Managed Lanes" and "Ramp Metering". Meanwhile, there are other projects that may be more isolated, and may not help the implementation of other projects considered, like the "Work Zones Safety Improvements" or the "Highway-Rail Intersection Advanced Safety Systems". To score the relationship between projects, each project was related to each other, and the number of projects related was added for each project. A score of 7 points was given to the project with the most projects related to it, and no points were given to independent projects.

- **Project relevance in the region** – To make sure that projects that are addressing regional ITS needs are given a higher priority, 5 points were given to the project that addresses the most ITS needs identified, while 0 points were given to projects that do not address any need.

- **Potential project costs** – An important characteristic to consider for project prioritization is the potential cost. Given that the project costs are not highly defined at this stage, a lower score of 3 points were given through this criteria, 3 points were given to projects considered as low cost, 2 points were given for medium cost projects, and 1 point was given to high cost projects.

- **Project maturity** – Finally, the project maturity was also considered, to make sure that projects that are already under consideration get a higher priority over projects that are still in concept design stage. If a project was found in the State or NOACA's TIP, it was given 1 point, projects not being considered were not awarded points in this criterion.

Through this prioritization strategy, it was possible to score the projects and order them in order of relevance and importance to develop the implementation strategy. For this purpose all the scores were added for each project, and normalized by the total of all scores (16 points). The end result is a metric that can be used to compare and evaluate the projects for the development of the implementation strategy.

8.1   State Projects Implementation Strategy

Table 8.1 shows the total number of ITS projects considered in the ITS Strategic Plan at the State level. The projects are ordered according to the prioritization score, and bundled according to their expected time frame for implementation.

Table 8.1   State ITS Project Prioritization

Time Frame	Project ID	Project Name	Score
Short term	2	ODOT Advanced Traffic Management System (ATMS)	0.58
	10	Expand Traveler Information Delivery Methods	0.52
	1	Freeway Management System (FMS) Expansion	0.42
	22	I-90 Lake Effect Corridor	0.41
	11	Maintenance Vehicle Upgrade	0.36
	3	Traffic Monitoring Management System Enhancements	0.35
	12	Expand Road Weather Information System (RWIS)	0.35
	24	ODOT Traffic Monitoring Permanent Count Program	0.25
	21	DriveOhio City Use Cases	0.19
	20	Ohio Turnpike ACV Testing	0.19
	25	Creation of a GIS Data Centralization Center	0.16
Medium term	4	Transportation Systems Management and Operations (TSMO)	0.43
	9	Fiber Optic Connectivity	0.30
	8	Dynamic Message Signs	0.27
	14	Work Zone Reservation and Traveler Information System	0.22
	15	Work Zone Safety Improvements	0.22
	16	Highway-Rail Intersection Advanced Safety Systems	0.19
	13	Winter Maintenance	0.19
Long term	19	Deploy a Truck Parking Information Management System (TPIMS)	0.24
	5	Freeway Managed Lanes	0.23
	7	Freeway Speed Harmonization	0.23
	6	Freeway Ramp Metering	0.21
	17	Intersection Collision Warning Systems	0.19
	18	Speed Radar-activated Chevrons	0.19
	23	Increase Electric Vehicle Infrastructure	0.14

Source: AECOM, Cambridge Systematics, Inc., NOACA.

8.2 Regional Projects Implementation Strategy

Table 8.2 shows the total number of ITS projects considered in the ITS Strategic Plan at the Regional level. The projects are ordered according to the prioritization score, and bundled according to their expected time frame for implementation.

Table 8.2 Regional ITS Projects Prioritization

Time Frame	Project ID	Project Name	Score
Short term	28	Regional Alternate Routes Planning	0.53
	31	County Transit ITS Updates	0.33
	29	GCRTA CAD/AVL	0.31
	30	Laketran CAD/AVL	0.25
	32	GCRTA / Laketran Transit Vehicle WiFi	0.25
	33	Enhance and expand GCRTA and Laketran Paratransit services	0.16
Medium term	26	Regional Traffic Management Center (TMC)	0.72
	27	Regional Traveler Information System (TIS)	0.52
	35	GCRTA Kiosks at Transfer Points	0.25
	34	Transit Signal Priority	0.14
Long term	36	Hyperloop Feasibility	0.25

Source: AECOM, Cambridge Systematics, Inc., NOACA.

8.3   Local Projects Implementation Strategy

Table 8.3 shows the total number of ITS projects considered in the ITS Strategic Plan at the Local level. The projects are ordered according to the prioritization score, and bundled according to their expected time frame for implementation.

Table 8.3   Local ITS Projects Prioritization

Time Frame	Project ID	Project Name	Table Header
Short term	37	Signal Timing Optimization Program	0.45
	53	Cuyahoga County Evacuation Plan Updates	0.44
	38	Automated Traffic Signal Performance Measures (ATSPMs)	0.42
	40	Upgrade Traffic Signals in East Cleveland	0.33
	41	Upgrade traffic signals along US-20 and US-322	0.33
	42	Rocky River Signals	0.33
	43	Strongsville Signals	0.33
	44	Lorain Traffic Signals	0.33
	45	Mayfield Heights Signals	0.33
	46	Beachwood Signals	0.33
	47	Cleveland Heights Signals	0.33
	48	Painesville Signals	0.33
	49	University Heights	0.33
	50	City of Cleveland Special Event Traffic Planning	0.27
	39	Municipal Signal Preemption	0.19
Medium term	54	Municipal Computer Aided Dispatch to Emergency Vehicle	0.17
	55	City of Cleveland / Cuyahoga County Port Security Camera Installation including Vehicle Tracking System (VTS)	0.16
	51	Cuyahoga County Port Authority Automated Parking Facilities	0.11
	52	City of Cleveland Automated Parking Facilities	0.09

Source: AECOM, Cambridge Systematics, Inc., NOACA.

8.4   ITS Projects Implementation Strategy

Based on the results obtained from the project prioritization analysis, it is possible to define recommendations to promote the implementation of these projects according to their expected implementation time frame. The following insights were identified to define an implementation strategy for the region.

8.4.1   Short term implementation (1 to 3 years)

In a short term, the region could focus on more on local projects, with low cost projects such as Signal Timing Optimization Program and the Automated Traffic Signal Performance Measures projects scoring the highest in the region. There are also plenty of signal implementation projects that could benefit the region at a low cost and fast implementation.

At the State level, there are projects that can have significant impact in the region that may be considered as an expansion of current solutions, such as "ODOT Advanced Traffic Management System (ATMS)", "Expand Traveler Information Delivery Methods" and "Freeway Management System (FMS) Expansion" projects. These projects are already operating at the State level, and could be considered in the short term for the NOACA region.

At the regional level, it is important to continue promoting ITS solutions in public transportation services, promoting the implementation of projects such as CAD/AVL on GCRTA, Laketran, and other municipal transit agencies' vehicles.

8.4.2   Medium term implementation (3 to 6 years)

In the medium term implementation, the project with the highest score was the Regional Traffic Management Center (TMC). This project, although it could represent a significant investment, could help promote other ITS solutions in the region. A regional TMC would also enhance communication within regional agencies, and allow traffic operators to implement strategies to address recurrent and non-recurrent congestion in the region.

At the state level, the project with the highest score was the Transportation Systems Management and Operations (TSMO) project. This project is currently being implemented, and it is suggested to continue promoting its implementation to enhance coordination among regional stakeholder, and improve mobility in the region.

8.4.3   Long term implementation (6 to 9 years)

In the long term, the projects with the highest scores were all State projects. In a long term future, and considering that short and medium term projects have been implemented, it is possible to consider projects and strategies that rely heavily on new technology. These projects include the "Truck Parking Information Management System (TPIMS)", "Freeway Managed Lanes", and "Freeway Speed Harmonization.

Appendix A.   Lists of ITS Projects Considered

Table A.1   NOACA AIM Forward 2040 – ITS Projects

Project Number	Project Name
1	GCRTA Passenger Management System
2	Rail Transit Operations - Light Rail Operations Center
3	City of Cleveland Automated Parking Facilities
4	City of Cleveland Special Event Traffic Planning
5	Municipal Signal Pre-emption
6	NOACA Signal System Upgrades
7	ODOT 511 Information System
8	Cuyahoga County Evacuation Plan Updates
9	GCRTA Bus Traffic Signal Priority
10	County Commercial Vehicle Operations
11	Cuyahoga County Port Authority Automated Parking Facilities
12	Cuyahoga County Port Authority DMS
13	Cuyahoga County Port Authority Electronic Payment Collection
14	City of Cleveland / Cuyahoga County Port Security Camera Installation including Vehicle Tracking System (VTS)
15	Municipal Computer Aided Dispatch to Emergency Vehicles
16	Computer Aided Dispatch Integration with ODOT FMS
17	Connected and Autonomous Vehicles (formerly IntelliDrive)
18	GCRTA / Laketran AVL System
19	GCRTA Clifton Corridor
20	GCRTA Kiosks at Transfer Points
21	GCRTA / Laketran Transit Vehicle Updates
22	GCRTA Passenger Management System
23	GCRTA Surveillance Control
24	Laketran Advanced Para-Transit Scheduling and Dispatch System
25	Laketran Metro Vehicle Updates
26	Laketran Google Transit
27	NOACA Animal Detection System
28	Connection of Private Providers
29	ODOT FMS Expansion
30	ODOT Freeway Lane Control
31	ODOT Install Information Kiosks
32	ODOT Maintenance Vehicle Upgrade
33	ODOT Winter Maintenance

Project Number	Project Name
34	ODOT DMS
35	ODOT Highway Advisory Radio Signs
36	ODOT Public Radio Station
37	ODOT Work Zone Safety Improvements
38	Regional ODOT Freeway Management System
39	CSU Research Program
40	ODOT Expand Traveler Information Delivery Methods
41	ODOT Highway-Rail Intersection Advanced Safety Systems
42	ODOT Increase Service Patrols

Source: NOACA AIM Forward 2040, https://www.dropbox.com/s/1pvfvhx8xszgdlo/AIM%20Forward%202040.pdf?dl=0.

Table A.2   NOACA Programs and Plans – ITS Projects Considered

Project Number	Project Name	Source
1	Laketran CAD/AVL Upgrade	NOACA website
2	Laketran Electric Vehicle Upgrade	NOACA website
3	Laketran Paratransit Vehicle Replacement	NOACA website
4	EAST CLEVELAND SIGNALS (RW)	NOACA TIP 2018
5	MAYFIELD RD SIGNALS (CUY US322-0578)	NOACA TIP 2018
6	US 20-2219 (CENTER RIDGE RD) SIGNALS	NOACA TIP 2018
7	GCRTA BUS IMPROVEMENT PROGRAM SFY 2018	NOACA TIP 2018
8	LAKETRAN 2018 LIGHT TRANSIT VEHICLES	NOACA TIP 2018
9	LAKETRAN 2018 MCI COMMUTER BUSES	NOACA TIP 2018
10	LAKETRAN MARKET ST PARK & RIDE LOT	NOACA TIP 2018
11	NOACA SFY 2019 RIDESHARE PROGRAM	NOACA TIP 2019
12	EAST CLEVELAND SIGNALS	NOACA TIP 2019
13	LAKETRAN 2019 LIGHT TRANSIT VEHICLES	NOACA TIP 2019
14	SIGNAL TIMING OPTIMIZATION PROGRAM	NOACA OWP 2019
15	HYPERLOOP FEASIBILITY STUDY	NOACA OWP 2019

Source: NOACA website, http://www.noaca.org/index.aspx?page=7615.
            NOACA TIP 2018 http://www.noaca.org/modules/showdocument.aspx?documentid=21256.
            NOACA TIP 2019 http://www.noaca.org/modules/showdocument.aspx?documentid=22347.
            NOACA OWP 2019 http://www.noaca.org/modules/showdocument.aspx?documentid=22372

Table A.3 STIP – ITS Projects Considered

PID	Project Name	Project Description	Search Term
105438	LOG/UNI/FRA-33-Smart Mobil Ph2	Description: Develop Smart Mobility Technology by installing fiber optic cable along various local roadways, roadside detection units, and traffic signal upgrades Work Type: Intelligent Vehicle Systems Termini: From SR 347 (Log Co) to Avery Rd (Fra Co) using various local county roads and city streets	ITS/Smart
105946	FRA-Smart Cols Elec Veh Infrastr	Description: Smart Columbus Electric Vehicle Infrastructure, Intelligent Vehicle Systems, includes design and construction of public fleet electric vehicle charging stations and public fleet electric vehicle purchases for year 1 of the 3- Work Type: Intelligent Vehicle Systems Termini: City of Columbus	ITS/Smart
104548	GCRTA Radio CAD/AVL System	Description: Radio CAD/AVL System Replacement Work Type: Transit Termini: Cleveland	AVL
105374	Research - TMC Pooled Fund	Description: Transportation Management Center Pooled Fund Study. This is a Pooled Fund;.Lead: FHWA; TL: John MacAdam. Work Type: Planning & Research Termini: Transportation Management Center Pooled Fund Study	TMC
99879	POR Streetsboro Signals	Description: Upgrade signals along various intersections on SR 14, SR 43 and SR 303 in the city of Streetsboro. The signals will be connected through fiber optic cables to a central control center with pan cameras and include opticom pre Work Type: Signals Termini: SR 14, SR 43 and SR 303 in the City of Streetsboro	Camera
103358	HAM Banks Variable Message Signs	Description: Installation of cantilever style dynamic message signs in four interstate locations. Signs will be connected into the central control system by tying into existing fiber optic cable and coordinated with OHGO system to ensure Work Type: Misc. Traffic Cont. Termini: IR-75 NB at MM 191; IR-75 SB at MM 1.5; IR-71 SB at MM 2.7; IR-471 NB at MM 4.2	Dynamic
103906	GCRTA SCADA System Replacement	Description: SCADA System Replacement Work Type: Transit Termini: Cleveland	CAD
96540	Traffic Monitoring Mgmt System	Description: Creation of a Traffic Monitoring Management System Work Type: Planning & Research Termini: Statewide	Management
97997	SPR GIS Centralization	Description: The GIS Centralization Project will focus on an enterprise wide approach to managing geospatial resources providing for the development and integration of spatial data and GIS technology throughout ODOT while avoiding redu Work Type: Planning & Research Termini: Statewide	Management
97924	SFY15-SFY17 Permanent Count	Description: Funding for the ODOT Traffic Monitoring Permanent Count Program (SFY15-SFY17). Funding includes supplies, utilities, software, counter maintenance, and an upgrade to the existing non-intrusive sensors and accessories. Work Type: Planning & Research Termini: Statewide	Data
103442	Data Collection Vehicle Purchase	Description: Purchase two new data collection vehicles used by the Office of Technical Services. Work Type: Planning & Research Termini: Statewide	Data

Source: Statewide Transportation Improvement Program 2018-2021, http://www.dot.state.oh.us/Divisions/Planning/STIP/Pages/default.aspx.