OHIO DEPARTMENT OF TRANSPORTATION

OHIO INTEGRATED DATA EXCHANGE

Project Name	Ohio Integrated Data Exchange
Eligible Entity Applying to Receive Federal Funding	Ohio Department of Transportation
Total Project Cost (from all sources)	$ 9,000,000
ATCMTD Request	$ 9,000,000
Are matching funds restricted to a specific project component? If so, which one?	No
State(s) in which the project is located	Ohio
Is the project currently programmed in the: • Transportation Improvement Program (TIP) • Statewide Transportation Improvement Program (STIP) • MPO Long Range Transportation Plan • State Long Range Transportation Plan	No
Technologies Proposed to Be Deployed (briefly list)	Advanced transportation management technologies Transportation system performance data collection, analysis, and dissemination systems

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Project Description

1. Introduction:

The Ohio Department of Transportation (ODOT) is requesting ATCMTD funding to assist in creating a statewide Integrated Data Exchange (IDE) for Ohio IDE. The Ohio IDE is a large scale statewide installation and operation of an integrated transportation data exchange that aims to improve mobility, reduce congestion, and provide for more efficient and accessible transportation by improving the collection, dissemination, and use of real time transportation related information. The IDE will integrate data from transportation management systems across the state, offering an open-source information portal intended to facilitate better decision-making and problem solving for all users.

The Ohio IDE will generate performance metrics for program monitoring and evaluation. Additionally, it will serve the needs of public agencies, researchers, and entrepreneurs. Ohio's IDE will also provide practical guidance and lessons learned to other potential deployment sites. Deployment of the Ohio IDE will take advantage of the significant investments the State of Ohio is making in "Smart Corridors", including the US-33 Smart Corridor, the I-90 Smart Corridor, and the Ohio Turnpike Smart Highway. Additionally, the City of Columbus, US DOT, and private sector partners are making a large investment in Central Ohio as Columbus was the winner of USDOT's Smart City Challenge.

Ohio's IDE covers the following areas listed in the Notice of Funding Opportunity: Multimodal Integrated Corridor Management (ICM), Technologies to Support Connected Communities, and Rural Technology Deployments. The Ohio IDE uses ICM to safely and efficiently improve the movement of people and goods by coordinating transportation network operations across Ohio. The Ohio IDE will support connected communities by improving the collection, dissemination, and use of real time transportation related information. The Ohio IDE will be deployed to enhance safety, mobility, and economic vitality in rural areas.

2. Applicant - The Ohio Department of Transportation:

The Ohio Department of Transportation (ODOT) is the applicant and the entity that will be entering into the federal funding agreement with FHWA should the project be selected for an ATCMTD grant. ODOT will manage the project funding through our existing federal funding management procedures. ODOT has years of experience managing federal transportation funding. This includes both formula funding as well as other discretionary funding such as TIGER.

3. Project Geography:

The Ohio Integrated Data Exchange Initiative will focus on transportation data to service the entire State of Ohio. Ohio has an extensive multimodal transportation system that is owned and maintained by an interconnected combination of state and local governments and private industry transportation stakeholders. The Integrated Data Exchange (IDE) will contain data from this myriad of stakeholders consistent with USDOT's Research Data Exchange (RDE) concept. The IDE is a large scale statewide installation and operation of an integrated transportation data exchange to improve the collection, dissemination, and use of real time transportation related information. The IDE will generate performance metrics for program monitoring and evaluation, serve the needs of public agencies, researchers, and entrepreneurs, and provide practical guidance and lessons learned to other potential deployment sites. This effort requires ongoing collaboration among the wide variety of public and private transportation stakeholders. Additionally, strong interagency partnerships are essential to ensure the coordination of statewide and regional visions. These regional visions help provide for a multimodal transportation system that is safe and operationally efficient.

The Ohio Integrated Data Exchange will provide real-time sharing of information between systems and the coordination of management activities between transportation agencies, thereby enabling a statewide view

of the transportation network. These systems and agencies provide for the management and operation of a variety of transportation facilities and functions, including freeways, arterial streets, transit operations, toll facilities, airports and seaports, emergency service providers, commercial vehicle operators, and information service providers.

4. Challenges Addressed:

The transportation organizations in the State of Ohio collect numerous sources of data that impact transportation. Speed data is utilized to provide real time travel time information to the motoring public. Traffic incident data is used to support real time traffic incident management. Weather data is available to prepare for and react to adverse impacts to normal traffic flow. Traffic count data is used to plan and design the transportation system. Each source of data is limited in application, usually reserved for implementation through one agency. In order to efficiently improve mobility, reduce congestion, and increase safety of the transportation system in Ohio the data should be made available for other organizations to leverage. The IDE will provide this data for all transportation agencies to encourage more regional consistency and collaboration.

The data is often utilized to track performance measures. This data analysis has proven to be labor intensive and programs are set up in a very ad-hoc method. Each data source often has unique and incompatible formats, sources, and availability. In order to establish a mature traffic management program based on multiple performance measures, with appropriate targets, the data available must be made more consistent and reliable.

The IDE will generate performance metrics for program monitoring and evaluation, serving the needs of public agencies, researchers, and entrepreneurs. The IDE will also be able to provide real time reporting and analysis, drastically reducing the resources required to analyze impacts of traffic management programs.

5. Transportation Systems and Services:

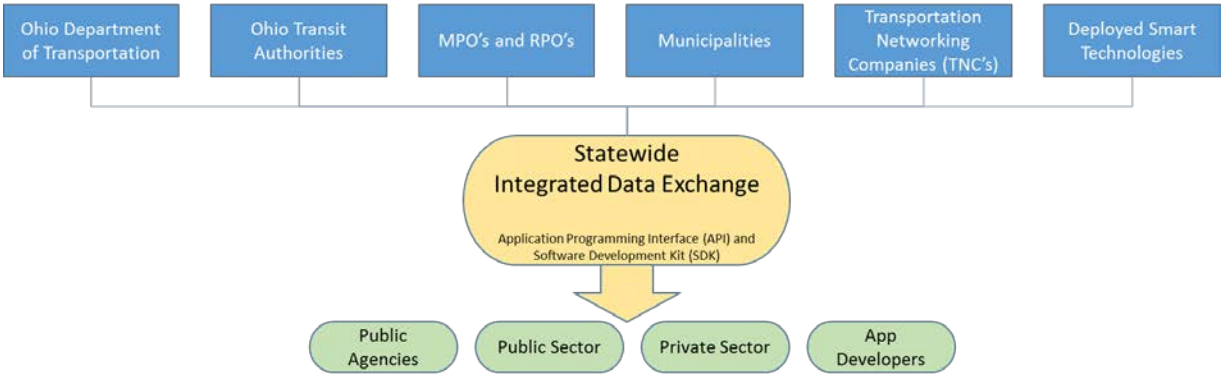
Ohio's Integrated Data Exchange will integrate data from transportation management systems across the state, existing deployed smart technologies, and other data from state agencies, municipal and local governments, Metropolitan Planning Organizations (MPOs) and Regional Transportation Planning Organizations (RTPOs), and other public and private stakeholders. The IDE will generate performance metrics for program monitoring and evaluation as well as provide practical guidance and lessons learned to other potential deployment sites. Additionally, the IDE will serve the needs of public agencies, researchers, and entrepreneurs.

Initially data will be integrated from the traffic management center, the US-33 Smart Corridor, Columbus Smart City project, Ohio Turnpike Smart Highway, and Interstate 270 and Interstate 90 smart highways projects. The IDE will be open to locals and other agencies, integrating transportation data from various regions around Ohio.

6. Deployment Plan:

Ohio's Integrated Data Exchange is a new platform that integrates data from transportation management systems across the state, deployed smart technologies (including the State investments in smart corridors and smart highways), and data from state agencies, municipal and local governments, Metropolitan Planning Organizations and Regional Transportation Planning Organizations, and other public and private stakeholders. It will offer an open-source information portal intended to facilitate better decision-making and problem solving for all users. The collaborative culture and data analytics landscape in Ohio makes us uniquely capable of building a cutting-edge data exchange that will set the standard of excellence for states to emulate around the country.

As a public entity, we recognize the importance of maintaining data integrity and protecting the public's interest, as well as providing a critical resource to measuring and understanding the benefits, costs, issues, and potential resolutions for replication elsewhere. Additionally, we recognize the importance of protecting data privacy and security.



End-users of the statewide Information Data Exchange

IDE Architecture Framework

The IDE will consist of a set of data repositories that will be created to support data discovery, analytics, ad hoc investigations, and reporting. The IDE will contain data from many different sources while being consistent with USDOT's Research Data Exchange (RDE) concept—authorized stakeholders will be free to add data to the data exchange and access updates as necessary. The IDE will include capabilities to ensure the data is documented, cataloged, and protected so end-users have access to the data they need for their work. The IDE will classify data to support both privacy principles and user needs. For example, when data is classified as highly sensitive, the IDE will enforce dynamic security of the data on ingestion into the IDE. Less sensitive data may be stored in secured repositories in the IDE, so it can be used for production analytics. When data is used for analytical discovery, it will be masked to prevent data scientists from seeing the values. The IDE will log access to data to detect if users are accessing more data than is reasonable for their role. The IDE will open access to the defined user community of the system and the associated approved partners and developers, for legitimate and approved purposes.

Cloud Hosting Platform

Deploying a statewide IDE combines a significant amount of data and requires application hosting and content delivery infrastructure. The Ohio IDE will be hosted on one of the public cloud hosting platforms (AWS, Microsoft Azure, Google Cloud, etc.) as they offer comprehensive cloud-computing platforms designed to address these needs while being as scalable and elastic as possible. Where applicable and economically responsible, the public cloud hosting platform will be used to provide the storage and content delivery infrastructure necessary to support the statewide IDE, as well as application hosting services, management identification, and integration services to connect disparate data sources with real-time information and analytics.

Analytics

The IDE will provide an analytics platform that will allow the State to collaborate with stakeholder organizations in the capture and integration of current and future forms of structured and unstructured data. To support advanced analytics, the IDE will leverage standards based integration of traffic and road information capture systems from various technologies and other Intelligent Transportation Systems (ITS) detection devices and support the Traffic Management Data Dictionary (TMDD) data format. Additionally, the IDE will support geospatial data and image based data (including satellite, video, and photographic data). Utilizing Artificial Intelligence (AI) and machine learning facilities available in the public clouds, significant strides in analyzing this unstructured data is now possible. Finally, the IDE will provide a Service Oriented Architecture-based platform for any involved stakeholder to engage in big data analytical efforts on both real-time and archived data.

IDE Developer Network

A Developer Network will be created that promotes use of the IDE by both the public and private sectors. The State will encourage third-party developer participation from the wider technology community to create innovative applications and services that leverage the IDE. The developer network will include tools

and resources including software development kits (SDK), interfaces, sample code, and full documentation to support the developer community. The Developer Network is critical to ensuring data availability to entrepreneurs, residents, evaluators, and researchers, along with the local, regional and statewide agencies involved.

Deployment Approach

The State of Ohio is making significant investments in Smart Corridors, including the US-33 Smart Corridor, the I-90 Smart Corridor, and the Ohio Turnpike Smart Highway. In addition, the City of Columbus, along with US DOT is making a large investment in Smart Columbus. Deployment of the statewide Integrated Data Exchange will initially be focused to take advantage of these investments.

Phase 1

Phase 1 will be focused on integrating data from the US-33 Smart Corridor. Continuing to build its reputation as a world leader in smart mobility, including autonomous and connected vehicle research, Ohio is investing $15 million to install advanced highway technology along the Smart Mobility Corridor, a 35-mile stretch of U.S. Route 33 in Central Ohio.

The Smart Mobility Corridor, 35 miles of four-lane, limited access highway northwest of Columbus, will be equipped by the Ohio Department of Transportation (ODOT) with high-capacity fiber optic cable to instantaneously link researchers and traffic monitors with data from embedded and wireless sensors along the roadway. These links will allow the premier automotive testing, research, and manufacturing facilities to test smart transportation technologies on a highway that carries up to 50,000 vehicles per day through rural and urban settings in a full range of weather conditions. This data will also provide more frequent and accurate traffic counts, weather and surface condition monitoring, and incident management improvements.

The Smart Mobility Corridor is a key component of the state's new Smart Mobility Initiative, a collaborative effort between ODOT, the Ohio Department of Public Safety, Wright-Patterson Air Force Base, Case Western Reserve University, University of Cincinnati, University of Dayton, Wright State University, The Ohio State University, Transportation Research Center, and the Ohio Turnpike and Infrastructure Commission.

Phase 2

Phase 2 will be focused on integrating data from the Columbus Smart City project. The City of Columbus has aligned around a unified vision to lead the way in moving our country forward with the deployment of Smart City technologies. With the leadership of our public and private sectors, our community will leverage the investments of the US Department of Transportation (USDOT) and Vulcan into a total investment of more than $550 million. This financial investment, coupled with industry leading expertise, will ensure effective deployment that can be shared with the world.

Columbus strives to be the nation's epicenter for Intelligent Transportation Systems (ITS) research, development, and implementation. Our investment in ITS will create opportunities for economic development and job creation as well as provide ladders of opportunity for residents to better access jobs, fresh food, services, education, healthcare, and recreation.

Phase 3

Phase 3 will focus on integrating data from the Ohio Turnpike's Smart Highway.

Phase 4

Phase 4 will be focused on integrating data from the Interstate 270 and Interstate 90 smart highways projects.

Future Phases

Future phases will be regionally focused, integrating data from various regions around Ohio.

Data Management Approach

The State has a wealth of information and data that is captured, analyzed, and maintained, both by ourselves and our partners. However, at the same time, a critical aspect of this data that has not been widely adopted is the consolidation and synthesis of data from these disparate sources into a single, comprehensive location. This consolidation, along with significant advances in AI and machine learning, creates opportunities for advanced analytics and the development and targeting of new services, products, and mobilization of resources to address issues that previously have been undetected.

Types of Data to be produced

The State and our partners already collect a significant amount of information and data. We plan on developing an information exchange where information from disparate sources will be combined with traditional transportation data. As part of the Ohio IDE Program, all data generated through the project will be stored in this IDE and processed using cloud-based analytical tools. Application Programming Interfaces (APIs) and Software Development Kits (SDKs) will be developed and made available so that private and public software developers, service providers, and others can access and build apps and conduct analytics using the data.

Policies for Data Access and Sharing

It is our intention that all data captured and included in the IDE be made available to the public, to the extent that this is possible under privacy laws. To promote this information exchange, we will provide software tools to extract and access the data directly. Data made available through the IDE to the public will follow an open data format following technical formats that meet the State of Ohio and Project Open Data Metadata Schema v1.1 standards and support of two-way APIs.

Access to the raw data will be restricted to protect privacy and confidentiality. Industry standard credentialing and multi-level authentication will be utilized. Public entities will only have access to processed data for analysis and extraction. Private organizations may access the raw data in accordance with the State's privacy policy.

The Ohio IDE will be designed using an overall data governance model that will be driven through automation using the public cloud hosted platform services. This automated governance will allow for overall control by the State of the IDE platform, while minimizing manual information technology actions.

Archiving Data and Preserving Access

The data governance model will drive automated archival rules and processes. The Ohio IDE will leverage the public cloud hosted platform web services capabilities for archival and flexible retrieval policies. As the deployment progresses, the State will evaluate alternatives for long-term sustainment of the data management and hosting, maintenance, hardware, and support.

The use of these the public cloud hosted platform services will allow for long-term data retention and disposition with low cost and minimal labor necessary to retrieve and use any data assets that have been archived.

Disaster Recovery

The IDE will utilize public cloud hosted platforms for both its primary processing and disaster recovery. The public cloud hosted platforms support distribution of data and processing across multiple data centers in the U.S. The IDE will take advantage of this functionality to support disaster recovery.

Data the State Currently Collects

The State and our partner agencies already collect a significant amount of traditional transportation information such as traffic counts, transit ridership, and information on work zones, incidents/accidents, and ridesharing metrics. Additionally, the State collects enormous amounts of image based data including satellite images, street view type images, and images from traffic and dashboard cameras. For example, ODOT and neighboring municipalities collect data from more than 1,000 traffic cameras that can be

recorded, analyzed, and used to create maps of traffic congestion and incidents, origin/destination data, and other transportation planning and performance metrics.

Using Current and Newly Collected Data to Address Challenges

We are planning an information exchange where information from many sources across the State will be combined with traditional transportation data using data fusion techniques, AI and machine learning, to key upon common characteristics. As part of the program, data generated through the project will be stored in this IDE and processed using a variety of cloud based analytical tools. Linkages between the different data sources will be created and tagged. Application Programming Interfaces (APIs) and Software Development Kits (SDKs) will be developed and made available so that private and public software developers, service providers, and others can build apps and conduct analytics using the data.

One core component of the data management approach for the program will be to develop and define standards and guidelines for data integration into the Integrated Data Exchange as well as preparing APIs and SDKs for accessing the data from the exchange.

There are incredible opportunities to leverage the investments ODOT has made in the development and implementation of a transportation asset management system that plays a critical role in the planning, development, preservation and construction of Ohio's transportation system. The use of these data as well as the use of data collected by other initiatives can help to refine and enhance infrastructure investment decisions. Through data fusion techniques, AI and machine learning, and geographic based analysis, we will link the transportation data with non-transportation data. This will enable the State and our partners to have a one-stop-shop for data visualization of information across Ohio. We will facilitate the identification of emerging issues as well as track performance and improvements over time.

Integrating Transportation Data with Other Functions or Services to Improve Management and Operations

The Ohio IDE will enable both public and private providers to visualize and coordinate services. Data made available through the IDE APIs will be consumed by other entities and applications to enhance their value by using tools and methods posted in public resources. Through an analytics approach, the IDE will enable easy correlations of the transportation data with non-transportation data. One source of data that will provide information that can be used to assess performance of the overall transportation system includes data from INRIX, some of which is currently being purchased by ODOT. These data, along with data from the instrumented Smart Corridor will facilitate an independent evaluation of the impact of the technology in reducing congestion at a corridor-wide level similar to the national evaluation framework used to evaluate the impacts of the Integrated Corridor Management deployments.

Integrating Data from Other Sectors with Transportation Data to Improve Transportation Operations

By building out the Ohio IDE and applying analytics, we see many applications for improvement such as:

- Identify factors affecting road congestion evaluated in real-time, and advisories issued before congestion develops to reroute traffic or shift commuters to alternate modes of transportation.
- Provide analytics for transit authorities, airports, and cities to better predict demand and optimize their capacity, schedules, pricing models, and staff plans.
- Optimize schedules based on actual demand in real-time, while vehicles and routes will be managed to minimize congestion, fuel use and carbon emissions.
- Coordinate communications across channels will provide an integrated and unified data source.
- Detect operational inefficiencies, theft, and fraud.
- Forecast transport demand to construct price and schedule structures.
- Reduce congestion and avoid major risks through performing what-if analyses and policy change scenarios.

Applicable Policies

Bringing data together creates a higher risk of loss or misuse of information if the security of the system is compromised. The IDE will address this issue with its information governance and security capabilities.

Data Policy is a key to the success of the IDE:

- Federal, State, and local governments recognizing data is a strategic asset.
- Policies support open-sharing, machine-readable data with the public, service providers, and other agencies.
- Policies support developing and maintaining systems and connections to share these data.

Using and Sharing Data from Other Partners

The IDE will have capabilities that ensure the data is properly cataloged and protected so subject matter experts (SMEs) have access to the data they need for their work. This design point is critical because SMEs play a crucial role in ensuring that analytics provide worthwhile and valuable insights at appropriate points in the organization's operation. With access to the Ohio IDE, line-of-business teams can take advantage of the data in the IDE to make decisions with confidence.

7. Project Challenges:

Existing statutes authorize ODOT's development in planning and programming to advance technologies for improving safety, mobility, transportation facilities, roadways, construction techniques and the conservation of energy.

Ohio Revised Code (ORC) 5501.03 directs the department to (a) coordinate and develop, in cooperation with local, regional, state, and federal planning agencies and authorities, comprehensive and balanced state policy and planning to meet present and future needs for adequate transportation facilities in this state, including recommendations for adequate funding of the implementation of such planning; and (b) in its research and development program, consider technologies for improving safety, mobility, transportation facilities, roadways, including construction techniques and materials to prolong project life. Ohio Revised Code 5501.031 provides that the department shall, among other actions, "consider energy conservation as an integral factor along with economics, engineering, safety, and the environment in the planning, design, and utilization of transportation facilities."

Development of a large scale and statewide data collection and integration system which relies on participation from private providers as well as the traveling public may present issues of confidentiality and disclosure. Existing statutes require protection control over access and dissemination of confidential personal identifying data (ORC 1347.15). As to release of data made available from private providers, ORC 5501.03 (F) provides that "any materials or data submitted to, made available to, or received by the director of transportation, to the extent that the materials or data consist of trade secrets, as defined in section 1333.61 of the Revised Code, or commercial or financial information, are confidential and are not public records for the purposes of section 149.43 of the Revised Code (Ohio's Public Records Act)."

"Trade secret" definition is "information, including the whole or any portion or phase of any scientific or technical information, design, process, procedure, formula, pattern, compilation, program, device, method, technique, or improvement, or any business information or plans, financial information, or listing of names, addresses, or telephone numbers, that satisfies both of the following: (1) It derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use. (2) It is the subject of efforts that are reasonable under the circumstances to maintain its secrecy."

These existing statutes provide a balance of authority to develop and operate the integrated transportation data system with safeguards over confidential private information and trade secrets without challenges or obstacles to deployment of such system.

8. System Performance Improvements:

Multiple sources of data will be made available through the IDE and include:

- Real time traffic speeds
- Road weather information
- Traffic Incidents and road closures

- Active work zones
- Interstate truck parking availability
- Freeway Service Patrol assists
- CV/AV basic safety messages
- Traffic counts
- Etc.

Providing access to these data sources will allow public agencies and entrepreneurs alike to implement strategies and technologies that directly improve the transportation system. Motorists will be provided with real time traffic information across multiple technologies including but not limited to road side devices, personal technologies, and in-car technologies. Any technology or system that provides information could leverage the data made available. Saturating these systems with real time traffic information will make all users of the transportation smarter. Secondary crashes will be drastically reduced as fewer motorists will be surprised to encounter the end of a queue. Travel times will become more reliable as the quickest route will be readily obvious and available. Incident management programs will have access to accurate real time data, reducing the duration of roadway closures. All of these benefits will result in increased system efficiency.

9. Quantifiable Project Benefits:

The Ohio Department of Transportation has utilized the FHWA Tool for Operations Benefit Cost (TOPS-BC) tool to quantify operational benefits. Recent years have seen these results:

- Over $653 million in delay savings
- Over $15 million in emissions savings
- Over $43 million in fuel savings
- An overall benefit to cost ratio of 41:1

These benefits were realized from the following programs:

- The OHGO real time travel information system
- Statewide roadside Dynamic Message Signs
- Rural roadside Destination Dynamic Message Signs
- Statewide roadside Highway Advisory Radios
- A Statewide Traffic Management Center
- Statewide Towing and Recovery Incentive Payment program
- Statewide urban Freeway Service Patrol program

The benefits realized through these programs will continue to increase as programs can be targeted utilizing a more comprehensive IDE. Additional programs can be started (at ODOT or otherwise) to take advantage of real time data to increase safety, reduce delay, increase travel time reliability, and reduce emissions.

10. Project Vision, Goals, and Objectives:

The goal of the Ohio IDE Program is a large scale statewide installation and operation of an integrated transportation data exchange to improve the collection, dissemination, and use of real time transportation related information to improve mobility, reduce congestion, and provide for more efficient and accessible transportation, including access to safe, reliable, and affordable connections to employment, education, healthcare, freight facilities, and other services.

This deployment is expected to provide benefits in the form of:

- Reduced traffic-related fatalities and injuries;
- Reduced traffic congestion and improved travel time reliability;
- Reduced transportation-related emissions;
- Optimized multimodal system performance;
- Improved access to transportation options for visually and hearing impaired individuals;
- Improved access to transportation alternatives, including for underserved populations;

- Public access to real time integrated traffic, transit, and multimodal transportation information to make informed travel decisions;
- Cost savings to transportation agencies, businesses, and the traveling public; or
- Other benefits to transportation users and the general public.

The Ohio IDE program will integrate data and enable deployment and improvement of advanced transportation and congestion management technologies, including:

- **Advanced traveler information systems** – Systems that provide real time, predicted, and individualized information about travel choices.
- **Advanced transportation management technologies** – Technologies that assist transportation system operators in managing and controlling the performance of their systems to provide optimal services or respond to dynamic conditions.
- **Infrastructure maintenance, monitoring, and condition assessment** – Technologies and systems that monitor the behavior or assess the condition of transportation infrastructure to allow agencies to better manage their transportation assets.
- **Advanced public transportation systems** – Technologies that assist public transportation system operators or other shared mobility entities in managing and optimizing the provision of public transportation and mobility services.
- **Integration of intelligent transportation systems with the Smart Grid and other energy distribution and charging systems** – Technologies that link information from ITS and other transportation systems with information from Smart Grid and other energy distribution and charging systems to provide users with better information related to opportunities for recharging electric vehicles, and to provide energy distribution agencies with better information related to potential transportation-user demand.
- **Advanced mobility and access technologies, such as dynamic ridesharing and information systems to support human services for elderly and disabled individuals** – Technologies and systems that leverage data and communications systems to allow public agencies and human service organizations to provide improved mobility services to at-risk users such as elderly, disabled, or other individuals that require transportation assistance.

11. Project Partnerships:

Collaboration with regional and local governments occurs through ODOT's statewide transportation planning program. ODOT works with its principal regional planning partners ((Metropolitan Planning Organizations (MPOs) and Regional Transportation Planning Organizations (RTPOs)) throughout the planning process to align priorities. Additionally, ODOT is working with the NW 33 Innovation Council of Governments on the US 33 Smart Mobility Corridor. MPOs and RTPOs provide forums for collaborative transportation decision-making among regional stakeholders, including local governments, public transit operators, freight operators, citizens, and state DOT representatives. A core function of the MPOs and RTPOs is to identify optimal transportation investments needed to advance the regional economic, social, and natural environments. Ohio MPO and ODOT's partners in the project include Honda R&D Americas, the Transportation Research Center at East Liberty, The Ohio State University's Center for Automotive Research, and local governments – the City of Dublin, City of Marysville and Union County – along the route. The Smart Mobility Corridor will also align with work underway to develop the City of Columbus as a hub for intelligent transportation, spurred by a $40 million Smart City grant from the U.S. Department of Transportation and more than $500 million committed to date by other public and private-sector partners.

Ohio MPO and RTPO geographies collectively encompass more than 75% of the state's roadway lane miles, 90% of the businesses, and 88% of the population, making partnerships between these agencies and ODOT critical.

Ohio Planning Organizations—Metropolitan and Regional

12. Leveraging Investments:

The Ohio Integrated Data Exchange will be the keystone that connects several other projects and investments. The list below describes other efforts which are underway to manage traffic and congestion in Ohio.

- **Statewide TSMO Plan:**
  ODOT is finalizing a statewide Transportation System Management & Operations plan that is calling for 36 recommended actions in six different categories. These recommendations are prioritized into three different tiers and include:
  - Develop Traffic Operations Assessment System Tool (TOAST) - As part of developing Ohio's TSMO plan, an immediate need was been identified to systematically assess operationally sensitive highway segments to assist in prioritizing, planning and programming future TSMO strategies. These strategies include detection, surveillance, freeway service patrols, hard shoulder running, ramp metering, variable speeds limits, signal systems and traveler information. TOAST will facilitate this by compiling and analyzing data on bottleneck occurrences (for all vehicles), freight bottleneck occurrences, traffic incident frequency, traffic incident clearance time, crash rate, travel time reliability, snow & ice control, performance, and average annual daily traffic (AADT). This tool would "sit" on top of an IDE and consume information from the exchange.
  - Traffic Management Center (TMC) upgrades including an upgraded Automated Traffic Management System (ATMS) software – As ODOT's TSMO program grows more sophisticated, a TMC that can monitor and manage increasingly complex operations will play a critical role. There is a growing need to expand the existing TMC's footprint, current coverage, and

functionality. There is no room available in the current TMC to add work stations and functionality for proposed ATDM installations or to support CV/AV pilot projects. In addition, upgraded ATMS will be necessary to ensure TMC and field staff are working off the same information encompassing new data feeds from CCTV, DMS, RWIS, and onboard vehicle sensors. These feeds into and out of the ATMS would be structured into standardized formats and also published through an IDE.

- Performance Measures – The plan includes 32 program objectives and 43 associated performance measures. These measures will require multiple data feeds and sources. An IDE will be the source for real time and historic operational data to facilitate measuring performance with minimal manual manipulation of the data.

- **Statewide Asset Management/GIS Tool:**
  The management of a transportation system requires countless datasets that fall into two main categories: asset condition and asset performance. ODOT has already created a state of the art system for recording and querying asset conditions and publishing asset condition data to the public. ODOT's Transportation Information Management system (TIMS) has quickly become an indispensable tool for transportation planners in Ohio providing a single location for asset conditions. However, Ohio lacks the same sort of system which records and published asset performance data. This is what Ohio wants to create with an IDE. An IDE, along with TIMS, will provide transportation planners and users with comprehensive data and improve mobility for all Ohioans.

- **US 33 Smart Mobility Corridor:**
  Ohio was fortunate to receive a 2016 ATCMTD grant for the US 33 Smart Mobility Corridor. This project creates one of the premier test facilities for connected and autonomous vehicles on US 33 between Columbus and the Transportation Research Center. The project will install 35 miles of fiber conduit that connect 87 roadside Dedicated Short Range Communication (DSRC) units. Once complete, the corridor will facilitate a broad range of technology testing. An IDE will enable the collection and distribution of data collected on the US 33 Smart Mobility Corridor and allow greater use and benefit from the US DOT investment.

- **Smart City:**
  The Smart Columbus program includes multiple projects in four different districts. The City of Columbus understands the importance of leveraging the investments made by the US DOT and its partners. Therefore, the City is developing its own IDE to manage and publish the data from its various smart projects. The scope of data in the City's IDE does include some transportation data, however it also includes non-transportation data specific to the Central Ohio region.

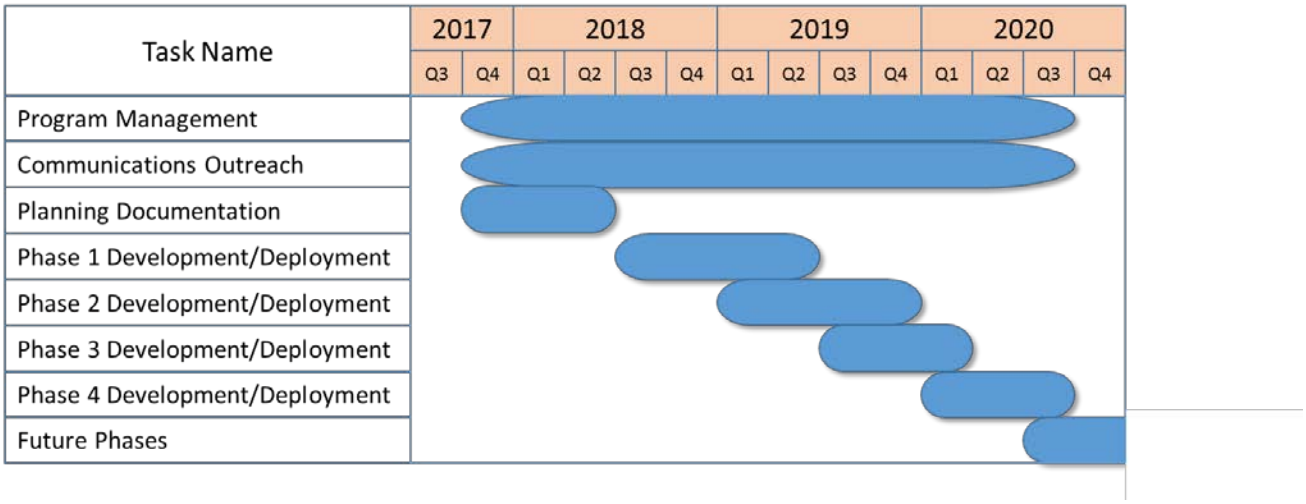
  ODOT wants to create a statewide IDE housing transportation datasets that apply to the entire state. We will collaborate with regional and city level IDE's to ensure there are no redundant efforts or contradictory operational data. ODOT believes there will be synergy between the proposed Ohio Integrated Data Exchange and local IDEs, including the work within the Smart Columbus program.

- **Other "Smart" initiatives:**
  ODOT has several other smart projects that it is advancing within the next 12 months. First is Ohio's first ever hard shoulder running project on I-670 in Columbus. This project will increase capacity on a congested urban interstate during peak periods. At the same time, ODOT is advancing a variable speed limit project on I-90 east of Cleveland that will reduce speed limits during snow squalls produced by lake effect snow from Lake Erie. Both projects will produce data streams that could be published by an IDE to increase the projects effectiveness.

Ohio's Statewide IDE will become the hub of operational data for a host of on-going initiatives in Ohio. It will be the keystone of Ohio's efforts to advance TSMO, CV/AV initiatives, and local smart transportation projects.

13. Project Schedule:

The Ohio Integrated Data Exchange baseline schedule is our roadmap to success. The IDE application writing team has prepared a baseline schedule using Microsoft Project. The following figure shows a summary version, which will be expanded and refined for the kick-off meeting.



We will flag and develop a risk management plan for items that present a schedule risk, such as agency procurement, partnering or contracting issues, or intellectual property disclosures during concept development. When tasks are not keeping pace with the baseline schedule, mitigation efforts will be undertaken to bring the task back in line.

Risk Management Plan

The Ohio IDE Team will maintain a risk register, derived from the risk register used for other projects. Possible risks will be identified and presented at the kick-off meeting with USDOT. This identification of risks will offer an early opportunity to discuss collaborative ways to mitigate such risks. A plan will then be defined to develop mitigation actions based on the potential impact.

Communications Management

Clear lines of communication are necessary between single points of contact on the Ohio IDE Team and at USDOT for important decision-making.

Milestones and Deliverables

The Ohio IDE Team anticipates a start date as early as January 1, 2018. Anticipating this date, the State will seek to have the technical deployment team in place by October 2017. Following completion of assignment of the deployment team and a signed grant agreement with USDOT, the team will commence immediately upon notice to proceed (NTP) with development of the Project Management Plan (PMP) and refinement of the project schedule.

Systems Engineering and Planning (SEMP)

Our high-level schedule calls for the Systems Engineering and Planning (SEMP) to be completed within three months of NTP. At the same time, the Ohio IDE Team will begin development of the Concept of Operations, which is expected to be completed within the first six months of the contract. When user needs are understood, high-level requirements will be defined and the Systems Requirements Specification process will be completed in early 2018, followed by the System Design Document (SDD). It is anticipated that all systems engineering documents will be completed within 12 months of NTP. Other plans, including the Performance Measurement Plan, Data Privacy Plan, Data Management Plan, Safety Management Plan, and Communications and Outreach Plan will be completed in that same timeframe.

Design, Deployment, Testing, Operations, and Evaluation Support

Upon USDOT approval of the systems engineering documents and plans, the Ohio IDE Team will commence design and deployment activities for the projects.

Design and development of the IDE will take a multi-phase approach, with multiple phases occurring simultaneously. Phase 1 integration will occur beginning in mid-2018 with completion expected within 12 months. Phase 2 integration will begin six months later, with completion expected within 12 months of the start. As these elements are developed, they can be rolled out to the various partners.

Applying Lessons Learned from Other Federal Programs

The Ohio IDE Team will incorporate lessons learned from other Federal programs to complete the documentation for the Ohio IDE Program and to lay the foundation for requirements definition, design, deployment, and continuing operations.

Elements of our approach include:

- Concept of Operations – The Ohio IDE approach is focused on the users of the system and their needs. This principle is core for Ohio IDE and thus, the Concept of Operations will be user focused.
- System Requirements – The system requirements will focus on five key system attributes: functions, interfaces, data, performance (including reliability), and security.
- Architecture – The Ohio IDE Team will leverage federal investments in existing ITS standards, architectures, and certification processes for ITS and connected vehicle based technologies to the maximum extent possible. These processes include the CVRIA and SET-IT tools.
- System Design Document – The system design documentation will provide the level of detail needed to implement the system and to document its configuration with drawings and photos for future operation and maintenance.
- Test Plans and Documentation – For each requirement, the Ohio IDE Team will identify and describe a test procedure and criteria to describe how the test verifies that the requirement has been met. The test plan will be a compilation of these test procedures. They will be mapped back to the system requirements.
- Operations and Maintenance Plans – The Operations and Maintenance Plans will be based on the Concept of Operations document and will be documented in MOUs among partner organizations. The Ohio IDE Program Office will continue to be the governing body for ongoing O&M of the system, but also for execution of the policies and procedures established for long-term sustainability of the system.

Other Systems Engineering Documents

A Comprehensive Deployment Plan will be completed for this program. The schedule, cost estimates, and scope for the Ohio IDE Program will be presented in the document, which will lay the ground work for the successful design, deployment, integration, operation and maintenance of the program, as well as demonstrate a comprehensive and integrated approach.

In addition to the Comprehensive Deployment Plan, we will also prepare a Deployment Readiness Summary (DRS) to ensure that we have satisfied all the required elements of the program, and that we are able to design, build, test, and operate the proposed systems.

System Management and Operations

The Ohio IDE Program Office will be responsible for ongoing system management and operations. The team will employ a Systems Manager Approach for execution of the SEMP and longer-term operation and maintenance of the Ohio IDE Program. This approach, used by the Ohio IDE Team members for other complex projects, provides continuing systems engineering rigor for future upgrades and replacement cycles while offering flexibility in procurement techniques.

14. ITS Program Support:

The proposed IDE will both completely support and fully leverage Ohio's existing ITS program. The overwhelming majority of data sources immediately available for the IDE are being collected and utilized through the existing Intelligent Transportation System. Upcoming installation of roadside devices, such as DSRC units for Connected Vehicles, will be established as part of the existing ITS program.

The data provided through the IDE will enhance current offerings and improve effectiveness of all roadside devices (Dynamic Message Signs, Queue Warning Systems, Dynamic Destination Message Signs, Highway Advisory Radio, etc.). The IDE itself is a recommended technology initiative to support the existing ITS program.

Project Staffing

1. Staff Organization and Key Personnel:

The staffing necessary to manage this project will come from multiple offices within ODOT. The primary

2. Primary Contact:

The primary point of contact for the project is Andrew Bremer, ODOT's Deputy Director of Strategic Initiatives and Programs. His phone number is 614-387-5179 and his email is Andrew.Bremer@dot.ohio.gov.