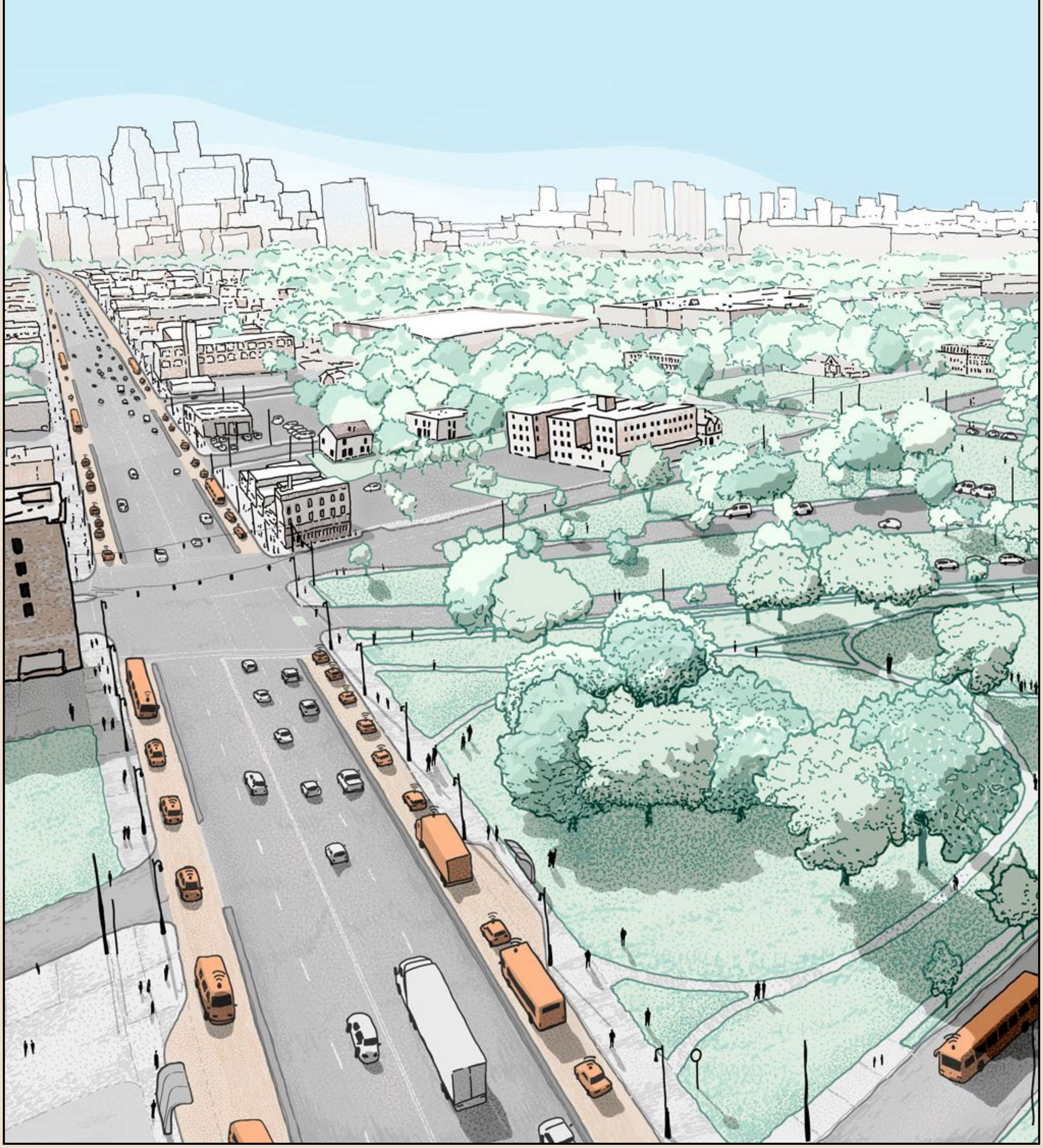
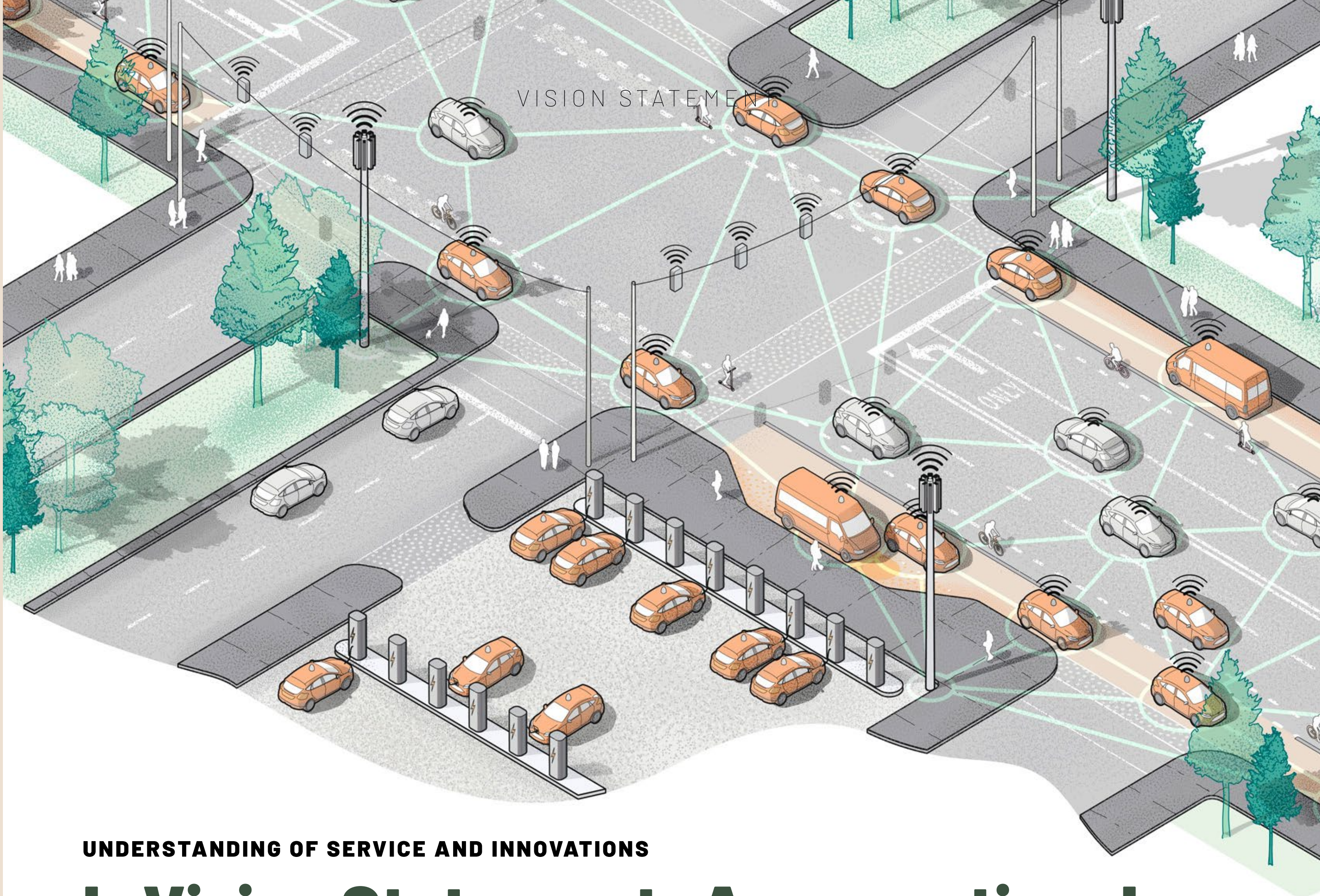
RESPONSE TO REQUEST FOR PROPOSAL:

Connected & Automated Vehicle Corridor Concept



SIDEWALK INFRASTRUCTURE PARTNERS

UNDERSTANDING OF SERVICE AND INNOVATIONS



UNDERSTANDING OF SERVICE AND INNOVATIONS

I. Vision Statement: A generational investment for Michigan

The Connected and Automated Vehicle Corridor (the "CAV-C" or "Project") seeks to catalyze the use of connected and autonomous vehicles ("CAVs") and supporting infrastructure, as a practical model for safe, efficient, and adaptable mobility options.

The Connected and Automated Vehicle Corridor (the "CAV-C" or "Project") seeks to catalyze the use of connected and autonomous vehicles ("CAVs") and supporting infrastructure, as a practical model for safe, efficient, and adaptable mobility options. The Project would evolve over time into a dedicated CAV right-of-way, combining (i) physical infrastructure, (ii) digital infrastructure, (iii) coordination infrastructure, and (iv) operational infrastructure. Connecting vehicles to one another and roadway infrastructure, creating a digital twin of the road environment, and ultimately dedicating lanes to CAVs can enable high performance of even lower-level autonomous vehicles. A primary, or "anchor-use," of such a corridor would be to provide a public transit alternative – an autonomous shuttle service that may offer greater safety, throughput, and system-level efficiency than otherwise possible when compared with conventional vehicle or transit services, such as bus rapid transit ("BRT") or light rail transit ("LRT"). This way, the Project may dramatically achieve key policy goals on accessibility, affordability, and sustainability. Sidewalk Infrastructure Partners, LLC ("SIP") – a company that seeks to improve infrastructure through the application of technology – formed **CAVnue, LLC** (the "Master Developer" or "CAVnue") to develop technology and infrastructure for projects of this kind. CAVnue, as Master Developer of the Project – along with the Project Partners, including Ford Motor Company ("Ford") and the University of Michigan – is uniquely positioned to deliver this vision – to MDOT.

Overview

A first-of-its-kind connected corridor can shape the future of transportation.

America is beginning a profound mobility transformation with autonomous vehicles ("AVs") at the forefront. AVs have the potential to reduce thousands of traffic accidents caused by human error, cut the growing hours commuters spend stuck in traffic, and vastly increase access to personal and shared mobility. The U.S. automobile industry was born in Michigan, and the state is poised to continue to shape its future, with the leadership of the Michigan Department of Transportation ("MDOT") as one the most forward-thinking transportation departments in the world. The Project offers the potential to envision and implement pathbreaking physical and digital infrastructure that will integrate CAVs into roadways and support the larger cooperative automated transportation landscape. Just as the interstate highway system shaped transportation in the 20th Century, the Project can shape that of the 21st Century, while also seeking solutions that "future-proof" new infrastructure.

SIP solves generational infrastructure challenges and founded a dedicated company, CAVnue, to develop and integrate technology to accelerate CAV deployment.

SIP is an independent holding company that aims to transform infrastructure by harnessing the power of technology. SIP was formed by Alphabet Inc. ("Alphabet"), Google's parent company and a world leader in technology; Sidewalk Labs, Alphabet's leading "smart cities" innovator; and Ontario Teachers' Pension Plan ("OTPP"), one of the world's most respected institutional investors in infrastructure. In every project it pursues, SIP seeks to leverage these entities' deep reservoir of expertise in technology, capital, infrastructure, and urban innovation.

To deliver first-of-its-kind connected corridor technology, SIP founded CAVnue. Its mission is to pioneer advanced roadway infrastructure and related technology for an autonomous mobility future. The Master Developer will provide the technology development and integration to design, build, finance, operate, and maintain a world-class connected corridor in Michigan.

The team brings unparalleled capabilities, with compelling management and partners.

The SIP team supporting the Master Developer brings deep public-private partnership ("P3") experience and has deployed over $6 billion in capital toward infrastructure projects. Through SIP's shared services agreement with Sidewalk Labs, CAVnue can draw on the innovative master-development experience of Sidewalk Labs' CEO Dan Doctoroff, who formerly served as Deputy Mayor for Economic Development of New York, as well as over 100 planners, developers, designers, technologists, engineers, and policy and community outreach leaders.

The Master Developer also expects to draw on an unparalleled ecosystem of partner firms ("Project Partners") that bring global and Michigan-based capabilities in infrastructure and technology, planning and development, design and engineering, research, testing, financing and operations, and policy, legal, and community engagement, as well as other resources relevant to the Project. Initial Project Partners include Ford, which has pioneered mobility innovation in Michigan for more than 100 years and has a shared vision for a CAV corridor; the University of Michigan, the state's leading public university, with its world-class Mcity Test Facility, Transportation Research Institute ("UMTRI"), and campuses at both ends of the proposed corridor; and the American Center for Mobility ("ACM"), another world-class testing facility.

CAV infrastructure has unique challenges that require the specific expertise that the Master Developer possesses.

Despite $80 billion[1] invested in AV solutions, full autonomy is years, if not decades, away. However, this investment dwarfs the amount spent on supportive infrastructure that could accelerate the adoption of CAVs and allow them to operate even better than uncoordinated AVs. The Master Developer was founded to close this gap, by developing and implementing infrastructure for CAVs. **Implementing the Project requires capabilities that CAVnue is uniquely established to address:** a holistic approach to the systems integration challenge of combining digital, physical, coordination, and operational infrastructure, as well as the advisors, investors, Project Partners, and resources to apply digital innovation to large-scale roadway infrastructure.

Implementation of CAV corridor infrastructure builds on existing BRT concepts, and can evolve and expand over time, future-proofing infrastructure investments.

The Project builds on existing Southeast Michigan regional transit planning proposals to dedicate lanes to BRT. One potential deployment path is to initially utilize connected buses with current levels of autonomy as well as shared mobility. Over time, other AV types – public transit, shared mobility, freight, and private vehicles – can be introduced, with such lanes increasingly limited to vehicles that meet minimum, open standards as they become more widely adopted. Such a design offers many of the benefits of dedicated mass transit while optimizing considerations of cost, service, and future innovation.

Implementing the Project requires capabilities that CAVnue is uniquely established to address: *a holistic approach to the systems integration challenge of combining digital, physical, coordination, and operational infrastructure, and the advisors, investors, and resources to apply digital innovation to large-scale roadway infrastructure.*

The Project can achieve transformational outcomes aligned with stakeholder goals.

The Project can achieve key principles and policy goals, including improving safety, achieving neutrality among vehicle original equipment manufacturers ("OEMs"), enhancing accessibility, and aligning with regional planning, thus encouraging innovation, R&D, economic development, open data access and shared learnings, cybersecurity, and replicability. The Project can be both a highlight and cornerstone of Michigan Mobility 2045 ("MM2045"). In particular, a route from Detroit to Ann Arbor, connectivity to the airports and other key anchor destinations, represents a compelling potential location for the Project, given longstanding transit gaps, traffic congestion, and the ability to create replicable models. Further, the Master Developer would seek to engage Michigan-based partners wherever possible. It is expected that more than 50% of the work associated with the Project would be performed in Michigan.

Two Disparate Futures for CAVs:
Siloed and Integrated Approaches

There has been under-investment in the enabling infrastructure needed for integration of AVs.

There has been significant investment in self-driving technology,[2] and AVs have great potential to exceed human drivers in safety, throughput, and accessibility. However, there is now consensus that achieving high levels of autonomy (known as "Level 5" or "complete" autonomy) is more complicated than originally envisioned, and still many years away.[3]

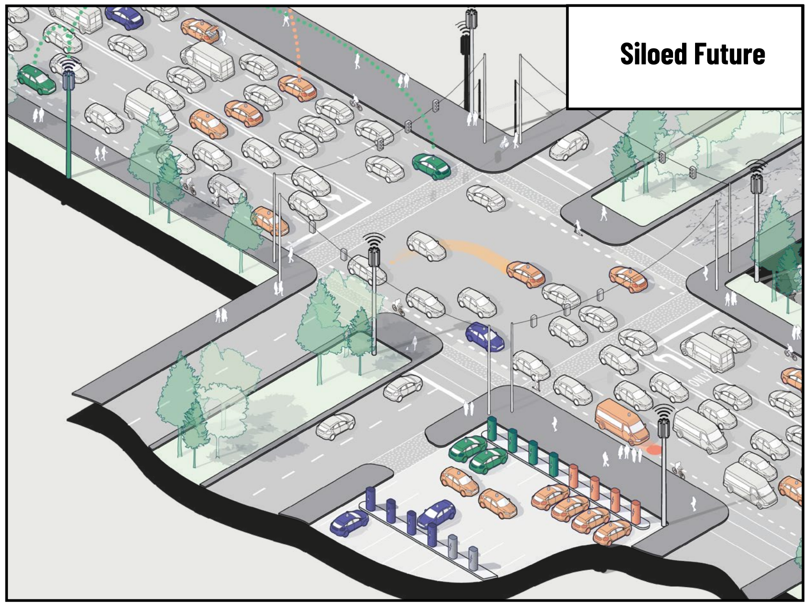
Additionally, despite the large amount invested in developing technology for greater vehicle autonomy, relatively little has been invested to date in developing supportive infrastructure that could help accelerate the scaled and efficient adoption of CAVs and allow them to operate even better than uncoordinated AVs. For example, use of on-board sensors like cameras or LiDAR to detect signage and traffic signals could be enhanced by having this information digitally transmitted from the roadway infrastructure, simplifying the problem.

Most AV companies make the assumption that the infrastructure is not evolving – and so do not plan for or invest in communications with infrastructure or other vehicles.

Given the gap between the benefits of CAV infrastructure and the comparative lack of investment in this field, there is a compelling need and an opportunity in the coming years for forward-thinking jurisdictions to prioritize such infrastructure for CAVs. There is an opportunity to build on MDOT's leadership in advanced infrastructure investment, including nearly 500 miles of connected roadways and one of the largest vehicle-to-infrastructure technology deployments in the U.S. Investing in enabling infrastructure for CAVs could be the difference between a "siloed future" – the course that we are on absent intervention – and an "integrated future" for mobility — the course that the Master Developer seeks to bring about, as described in the next sections.

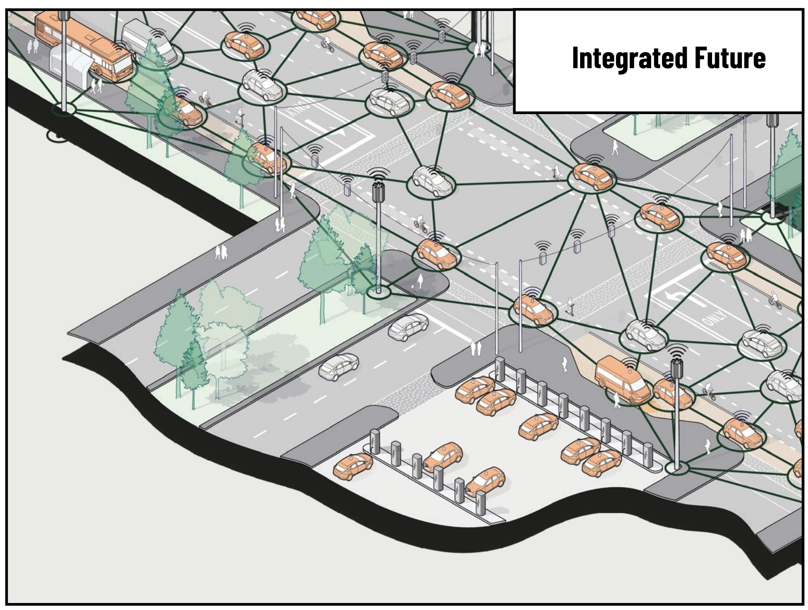
In a siloed future,CAVs are uncoordinated and may exacerbate certain transportation challenges.

The introduction of CAVs in mixed traffic may create unintended consequences, including induced demand without corresponding increases in road capacity, potentially leading to more traffic congestion and constrained road capacity.[4] Multiple, non-unified communications standards and data management challenges may prevent the adoption of valuable applications, such as coordinating braking or optimizing traffic intersections. There may be limited priority for transit and shared mobility.



In an integrated future, infrastructure supports the efficient and scaled deployment of CAVs to solve a range of mobility challenges.

In an integrated future, a combination of systems would support CAVs, in turn, improving the overall mobility environment. Ubiquitous, standardized connectivity can combine with more computational resources to enable real-time and secure sharing of information between vehicles themselves, and the infrastructure. This could, for example, enable alerting CAVs to nearby accidents, give certain modes signal priority to minimize congestion, or prioritize emergency vehicles.

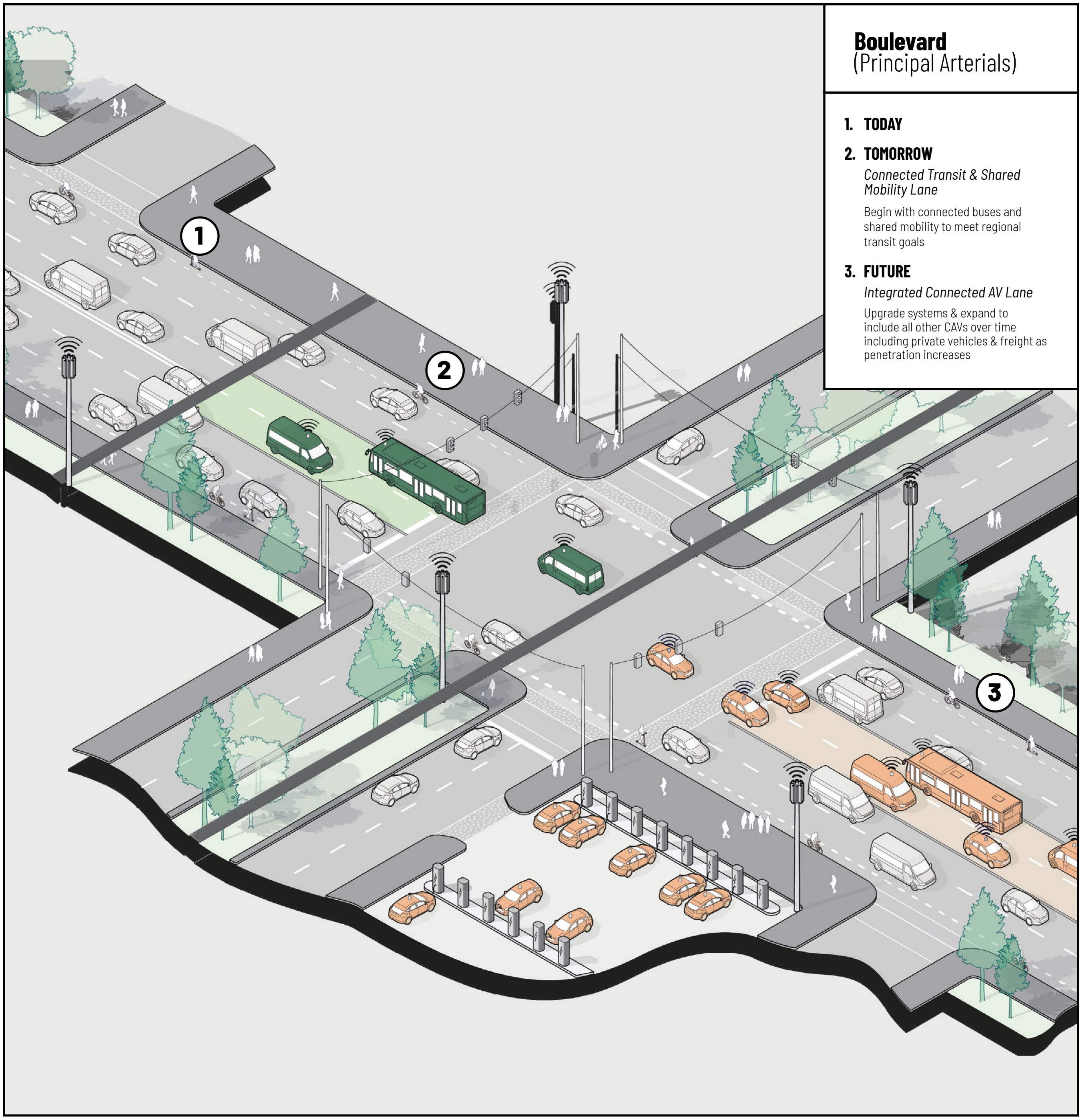


Such infrastructure systems can be combined to create dedicated lanes for CAVs. There are numerous benefits to having dedicated rights-of-way, such as reducing cut-ins and eliminating other corner cases. In addition, dedicated lanes can support high levels of coordinated driving. Coordination refers to the intelligent, shared decision making (otherwise known as path planning) between groups of vehicles to optimize execution of movements (e.g., steering and braking) and use of shared resources (e.g., intersections). Creating open standards, designed in an OEM-neutral manner, offers the opportunity for road operators to achieve key public policy goals.

Finally, these dedicated roadways would be better able to accommodate autonomous BRT and on-demand shared mobility. The public benefits of CAV corridors are described further in *"Key Benefits of the Project" on page 9*.

Implementation of CAV corridor infrastructure can evolve and expand over time, future-proofing long-lived infrastructure investments.

The Project could be delivered by either dedicating existing lanes to CAVs or adding new CAV lanes on existing rights-of-way to improve highways or high-throughput boulevards (principal arterials). Either upfront or over time, use of these lanes would be limited to vehicles that meet minimum, open standards for connectivity and autonomy.

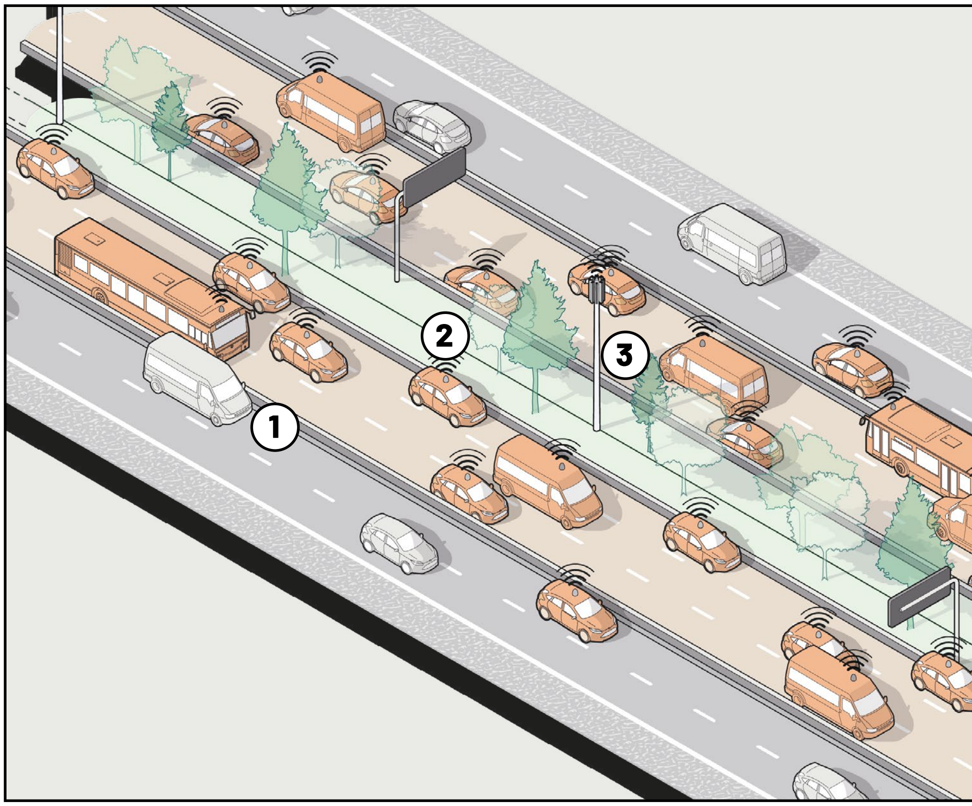


This can allow for higher vehicle density and narrower lanes, as well as higher average operating speeds – significantly increasing throughput potential for a given roadway.

In the highway context, a CAV laneway is similar to managed lanes that have access restrictions, such as express lanes or high-occupancy vehicle ("HOV") lanes. Examples of these can be found under *"Highway" on page 6*.

Research on the benefits of CAV laneways has indicated that, through advanced sensing, communications, and coordination, traffic throughput gains of over 200% are possible, while simultaneously increasing road safety.[5] Further, CAV- and technology-enabled infrastructure enable spatiotemporal intersection control and optimization, reducing vehicle delays and emissions by up to 24% and 14% respectively.[6] Such benefits, even with low CAV penetration rates (e.g., 10%), can create significant throughput increases.[7]

Example Components of Integrated Infrastructure Technology Framework for CAV Corridors



Highway

1. PHYSICAL INFRASTRUCTURE

Well-maintained roadways

Separation barriers to ensure efficiency and safety

Enhanced, machine-readable markings, digital signage and signaling

Enhanced maintenance to maximize pavement life, including levels of prediction and automation

2. DIGITAL INFRASTRUCTURE

Ubiquitous, highly reliable connectivity

High-definition ("HD") maps

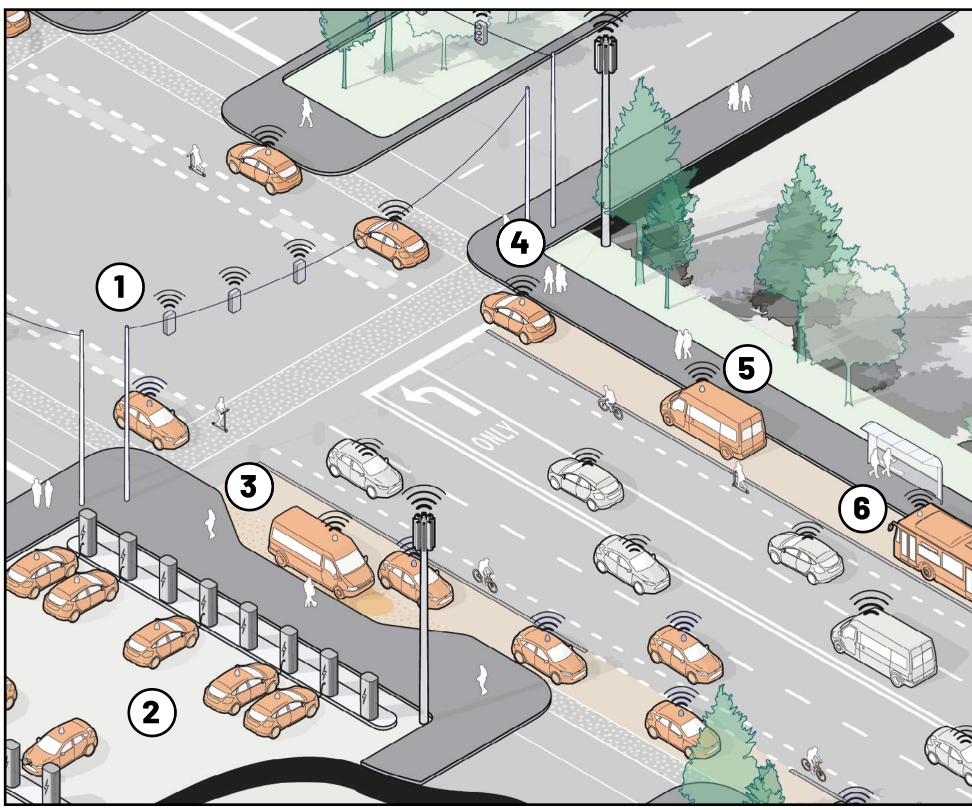
High accuracy ground-based GPS

Road sensors for traffic, weather, road conditions

3. COORDINATION INFRASTRUCTURE

System to manage vehicle coordination and interoperability

Ability for transportation authorities to set policy goals to maximize mobility and accessibility, and track their impact



Boulevard
(Principal Arterials)

1. PHYSICAL INFRASTRUCTURE

Adaptive traffic signals with intersection priority, particularly for transit and emergency services

Intersection designs optimized for pedestrian safety

2. SUPPORT INFRASTRUCTURE

High-speed EV chargers

High-speed wireless or tether vehicle data download

Maintenance and cleaning

3. SMART CURBS / STOPS

Smart curbs at milestones able to identify available time/space reservations

Consoles at smart curb locations for mobility functions

Dynamic, digital signage

4. COMPATIBLE CAVS

Vehicles with certified AV / ADAS systems

Ability to share information with other vehicles and infrastructure for navigation and safety

5. RIDE SHARING

Passenger app integration with superior booking and boarding experience

6. PUBLIC TRANSPORTATION

Buses operating autonomously on loops

Frequent stops using smart curbs and/or bus stops

The Infrastructure Technology "Stack" of CAV Corridors

The Master Developer will pursue the development and systems integration of key technologies required to achieve the Project goals.

The Master Developer will function systems integrator, combining best-in-class hardware, software, and operational components required to facilitate CAV corridor projects, as described in *"Highway" on page 6*.

This technology vision goes beyond the adoption of point solutions, such as adaptive traffic signals (an important sub-component). ***It is an integrated approach that results in increased safety, lower congestion, and improved accessibility and affordability of public transit.***

The solution is composed of four layers, which together compose the complete CAV corridor technology stack. As described below, this stack includes augmenting the physical roadway; installing and integrating digital systems, including sensors and connectivity; integrating a "digital twin" system as a real-time representation of the environment and to coordinate CAV driving; and creating operational infrastructure, such as shared mobility systems.

This technology vision goes beyond the adoption of point solutions, such as adaptive traffic signals (an important sub-component). Instead, it is an integrated approach that results in increased safety, lower congestion, and improved accessibility and affordability of public transit. Enabled by a digital twin and secure data exchange, this vision will enable road operators, such as MDOT, to better manage their roads, optimizing for – and measuring – policy goals.

Example Infrastructure Technology "Stack"

LAYER OF TECH STACK	DESCRIPTION
Physical Infrastructure	Simplify and optimize the driving environment for CAVs. This would include significantly reducing the number of edge cases that a CAV may encounter, such as cut-ins.
Digital Infrastructure	Highly reliable connectivity between vehicles ("V2V"), the infrastructure ("V2I"), and the cloud (collectively "V2X"), supporting signaling and sensing technology to collect and transmit information beyond the field-of-view of on-board sensors. Together with HD maps of CAV corridors, this can be used to augment the perception and planning algorithms of CAVs, better enabling them to understand the corridor and their surroundings.
Coordination Infrastructure (Cyber-Physical)	Enable CAVs to act in concert with each other, beyond what a human or on-board sensors alone could observe. This is enabled by a digital twin of the entire corridor providing guidance to individual CAVs and groups of CAVs, as well as secure, accessible application programming interfaces ("APIs").
Operational Infrastructure	Enable mobility services aligned with policy goals, including: (i) smart curbs; (ii) support facilities offering EV charging, cleaning, and maintenance to enable mass deployment of fleets of CAVs and enhanced sustainability; and (iii) modified or purpose-designed connected autonomous buses or pods to greatly enhance the performance and passenger experience.

Technology Development and Implementation Strategy

The Master Developer will iteratively test, develop, and deploy the technology stack needed for MDOT's CAV-C concept.

The Project requires significant systems integration, and the Master Developer will seek to significantly reduce the technology and operations risks with the approach detailed below. While the framework would deliver all Project elements, it is expected to involve a range of technology inputs that could be developed independently and modularly. This approach enables multiple use-cases and expense management and suits an iteratively planned Project.

The Master Developer will work collaboratively with MDOT to ensure that its systems build on existing MDOT and other public investments in advanced infrastructure.

Example Implementation & Risk Management Strategy

DETERMINATION OF REQUIREMENTS	PROCESS OVERVIEW
Determination of Requirements	The Master Developer will seek to develop technical product and engineering requirements, leveraging existing MDOT technologies where appropriate, for each layer of the stack for this specific implementation.
Evaluation of Commercially Available Solutions	The Master Developer plans to leverage state-of-the-art technology components that exist on the market today wherever appropriate.
Development Integration of Selected Systems	For areas in which there are not commercially available solutions, the Master Developer expects to undertake a development process or contract for them. Additionally, the Master Developer intends to undertake the systems integration work required to deploy a fully functional solution.
Iterative Build and Deploy Approach with Key Stake-holders	The Master Developer has developed a strategy to de-risk the technology and ensure all requirements are met, as shown below. The Master Developer envisions utilizing two of the world's leading testing facilities located in Michigan, namely Mcity and ACM.

CAV Corridor Iterative Build and Deploy Approach

MONTHS 6 - 12

INITIAL TEST

Test all components of the tech stack in a piecemeal manner in a "lab" setting to ensure they meet specifications.

MONTHS 12 - 18

FULL TEST

Integrate the stack together in a limited but realistic setting and ensure the overall system operates as designed over a multi-hour / multi-day period.

MONTHS 18 - 24

PROTOTYPE

Deploy and debug the stack over a longer length of road, under real-world conditions and multiple edge cases, to ensure safety and reliability standards are maintained over weeks / months.

MONTHS 24 - 36

PILOT DEPLOYMENT

Deploy the fully tested stack on a dedicated laneway sub-segment in Michigan, with limited vehicles in a "commercial pilot."

MONTHS 36+

FULL SCALE DEPLOYMENT

Begin development and deployment of fully operational, multi-mile, commercially validated dedicated laneway in Michigan, with full vehicle capacity.

THEREAFTER

MULTI-SITE DEPLOYMENT

Fully deployed dedicated laneways with multiple mobility use cases in multiple commercially validated geographies.

Key Benefits of the Project

The Project will provide key benefits and adhere to core principles.

The Master Developer is committed to developing a Project that meets the following key principles and benefits.[8,9,10]

PRINCIPLE / BENEFIT	OVERVIEW
Safety	Improve safety conditions on the corridor. There have been almost 10,000 fatal automobile crashes in Michigan, generally attributable to driver error, over a decade.
OEM Neutrality	Pursue open standards, including following best practices by engaging multi-stakeholder standards organizations, such as SAE International, and federal agencies, such as the National Highway Traffic Safety Administration ("NHTSA").
Mobility and Transit Access	Broaden access to shared and personal mobility – increased coordination increases shared mobility service frequency; connect key regional job centers; and provide accessible vehicles to support seniors and people with disabilities.
Reducing Congestion	Materially reduce traffic congestion by increasing throughput and coordinating traffic at macro and micro scales.
Providing Upfront Capital	Provide significant upfront capital from the Master Developer and SIP or its affiliates for the Project, as described in *"II. Business Case" on page 13*, filling public funding gaps for transportation improvements.
Alignment With Regional Planning	Undertake careful alignment with regional transit plans and, as necessary, air quality modeling required for regionally significant projects, as described in *"III. Work Scope and Schedule" on page 16*.
System Operations and Maintenance	Improve operations and maintenance by coordinating CAVs across multiple modes and instituting predictive maintenance of Project systems.
Innovation and R&D	Affirm Michigan as a leading innovation hub of the future of mobility by locating project resources in Michigan and partnering with the state's public and private sectors.
Economic Development	Unlock job creation and growth through capital investment, improved transportation, and technology development.
Privacy-Preserving Open Data Access	Implement secure, accessible platforms and APIs, consistent with robust privacy and cybersecurity protections.
Replicability	Establish replicable systems to introduce CAV corridors broadly in Michigan, and throughout the U.S. and world.
Accessibility and Equity	Undertake a stakeholder-led design process that addresses technical and other requirements to ensure accessibility by design, and that the benefits of the corridor fairly and equitably reach all affected residents.

Key Project Challenges and Key Mitigation Strategies

The Master Developer has identified key challenges and initial risk mitigation strategies to strengthen the Project.

TECHNOLOGICAL

The technology could prove more difficult to develop and integrate than expected. In particular, the coordination infrastructure layer of the stack has not been previously developed and implemented at scale in a public setting.

Mitigation: The Master Developer has proposed a 36-month plan to gradually test and integrate these technologies, beginning with minimum viable-product requirements, that engineers have vetted and believe to be an achievable timeline. The technology architecture would incorporate multiple redundancies.

PHYSICAL

The Project contemplates redesigns of existing infrastructure systems and design and planning work, which may prove uneconomical or operationally challenging.

Mitigation: The Master Developer seeks to design and plan the Project, as described in *"III. Work Scope and Schedule" on page 16*, to address these risks. It will engage WSP, a leading professional services firm with deep expertise in physical infrastructure, to help to institute a process to resolve physical infrastructure risks.

MARKET

Projected CAV usage rates and ridership are uncertain, and incorporating multiple OEMs may entail integration challenges or require broad adoption of novel standards.

Mitigation: As described in *"II. Business Case" on page 13*, the Master Developer will initially focus on contracting for "anchor-use" cases, including shared mobility for key economic stakeholders, to ensure usage. The Master Developer will seek to create OEM-neutral solutions with common standards by working with OEMs and standards bodies.

OPERATIONAL

The Project envisions previously undemonstrated non-technical operational coordination of multiple CAV form factors to achieve key policy goals.

Mitigation: The Master Developer expects to benefit from Michigan's test tracks – such as Mcity and ACM – to test and prototype key elements of the technology capabilities.

FINANCIAL

As a first-of-its-kind project, the Project has an unproven business and financial model, which will require incremental and iterative validation.

Mitigation: Financial risks can be reduced with long-term contracts with anchor-use cases (e.g., for shared mobility) and other creditworthy parties, and long-term offtake agreements.

DEVELOPMENT AND PHASING

The Project would require a number of permits, approvals, and potentially even legislative or regulatory changes at the federal, state, and local levels. Budgets must be carefully aligned with key milestones.

Mitigation: The Master Developer expects to engage in a Co-Creation Process with MDOT and other key stakeholders to evaluate, inventory, and address each step of the Project process.

COMMUNITY

The Project requires a clear value proposition for the public and key stakeholders, as well as addressing concerns around privacy, security, and job safety.

Mitigation: Anchor-use cases will include shared and accessible mobility, which is expected to increase transit service frequency and broaden access. The Master Developer is committed to ongoing stakeholder and community engagement.

Data Exchange and Security Considerations

Development of secure and transparent data governance standards in partnership with MDOT is critical to the successful design and implementation of the Project.

The Master Developer seeks to pursue best-in-class resiliency and cybersecurity by incorporating systems that prevent and protect against disruptions, enable ongoing audits to ensure integrity and reliability, and employ robust and thorough preparedness and response processes. The Master Developer would also work collaboratively to adopt robust privacy protections, including thorough reviews of, and transparency regarding, the purpose and impact of any data collection. The Project will draw on best practices involving data exchange in the public realm and consultation with stakeholders to ensure any data is used in a way that protects privacy, is beneficial to the public, and spurs innovation. Additionally, where possible and consistent with privacy protections, the Master Developer expects to utilize appropriate open standards and APIs to enable the ecosystem of participants, including residents, companies, organizations, and public entities, to develop technologies and policies that enhance mobility.

CAV Policy and Regulation

Michigan is one of the most forward-thinking jurisdictions to enable CAVs, with 2016 laws enabling Phase 1 of the Project.

Allowing for CAVs on Michigan roads without drivers or other standard automobile components, as well as encouraging platooning, limiting liability, and preempting local restrictions, puts Michigan in the lead for fostering AV innovation. There is a need for careful consideration of laws (at the federal, state, and local level), regulations, permits, and approvals necessary to make the Project viable and in the public interest. As described in *"III. Work Scope and Schedule" on page 16*, the Master Developer would collaborate with MDOT and other key public stakeholders to identify, inventory, and carefully address key policy and regulatory issues.

Routes

The Master Developer plans to focus initially in Phase 1 on a route from Detroit to Ann Arbor.

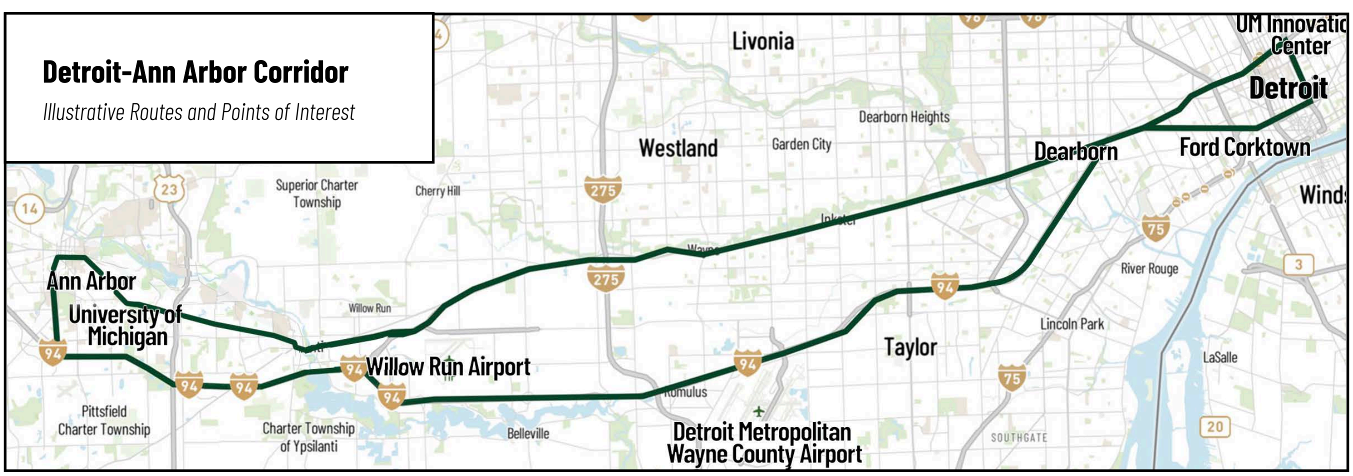
This corridor is a compelling location for the Project. Both Michigan Avenue and Interstate 94 could serve as key routes. The corridor includes up to a dozen Opportunity Zones, where expanded mobility and economic development opportunities would connect individuals and small businesses to Michigan's most important industrial, technological, and academic clusters. The corridor provides the ability to leverage the existing resources of leading test tracks, universities, automotive companies, and key economic anchors.

A number of proposals to improve these transit gaps have been considered over the last several decades, but have yet to be implemented. The Project seeks to build upon and improve such proposals. Indicative segments and points of interest could include the following:

Detroit-Metro Airport: Connecting downtown Detroit to Detroit Metropolitan Wayne County Airport. This area is currently served by limited bus transit, which is much less reliable and time efficient than automobiles. Key points of interest include Ford's Corktown innovation campus, the University of Michigan's Detroit Center for Innovation, Ford's headquarters, and Waymo's production facility.

Metro Airport-Ann Arbor: Even with recent pilots, Ann Arbor residents have limited public transit connections to the Airport, downtown Detroit, and other points of interest, which could be expanded by the Project.

As described in *"III. Work Scope and Schedule" on page 16*, an extensive evaluation of any route would be required in Phase 1.



Detroit-Ann Arbor Corridor

Illustrative Routes and Points of Interest

Stakeholder Engagement

A robust community and stakeholder engagement and feedback process is key to the Project.

The Master Developer has already carried out a range of engagements to understand the priorities of key stakeholders in Southeast Michigan and expects to continue to engage broadly across stakeholders and the public-at-large, including as it relates to relevant permitting and environmental processes.

STAKEHOLDER	OVERVIEW
Local & Federal Government Agencies	Engage with public entities to understand key policy goals and priorities for potential routes. Federal agencies include: The Federal Highway Administration ("FHWA"), Federal Transit Administration ("FTA"). Local agencies include: state – MDOT, and relevant state agencies; county – Washtenaw County and Wayne County; city – all cities and townships along and affected by the Project corridor.
Infrastructure Owners and Operators	Understand the mobility needs of and connecting to key infrastructure owners and operators, such as the Wayne County Airport Authority, and others.
Law Enforcement Agencies	Work with the Michigan State Police and other agencies to ensure comprehensive safety and enforcement of laws related to the Project.
Transit Providers	Build on the capabilities of key transit providers, including the Ann Arbor Area Transportation Authority ("AAATA"), Detroit Department of Transportation ("DDOT"), and Suburban Mobility Authority for Regional Transportation ("SMART"), and others.
Transit and Vulnerable Road User Representatives	Engage and work with residents of communities in transit and mobility gaps, people with disabilities, seniors, and other vulnerable road users and their representatives, to ensure the Project fairly and equitably meets their needs.
OEMs	Establish a consultation process involving a range of OEMs on standards and interoperability, including engaging with consortia such as the Automated Vehicle Safety Consortium, a program of SAE ITC that also includes Ford.
Academic	Engage with the academic community such as the University of Michigan, Michigan State University, Wayne State University, and others in research and analysis, testing, and connecting workforces and key points of interest.
Testing Facilities	Conduct initial testing, prototyping, and demonstrations at Mcity and ACM.
Communications and Technology Providers	Engage with leading communications and technology providers in order to understand and form relevant partnerships.
Business and Community Representatives	Engage with key stakeholders in business, labor, and local communities to understand key economic, workforce, fairness, and equity considerations in the Project.
Regional Planning Agencies	Build on the planning and analysis work of planning agencies including the Regional Transit Authority of Southeast Michigan ("RTA"), the Southeast Michigan Council of Governments ("SEMCOG"), and others.

The Master Developer will continue to update this list over time, and as described in *"III. Work Scope and Schedule" on page 16*, the Master Developer plans to engage individuals with Michigan-specific success in stakeholder and community engagement and will attend informational and community meetings related to the project.

Design, Engineering, and Environmental Status

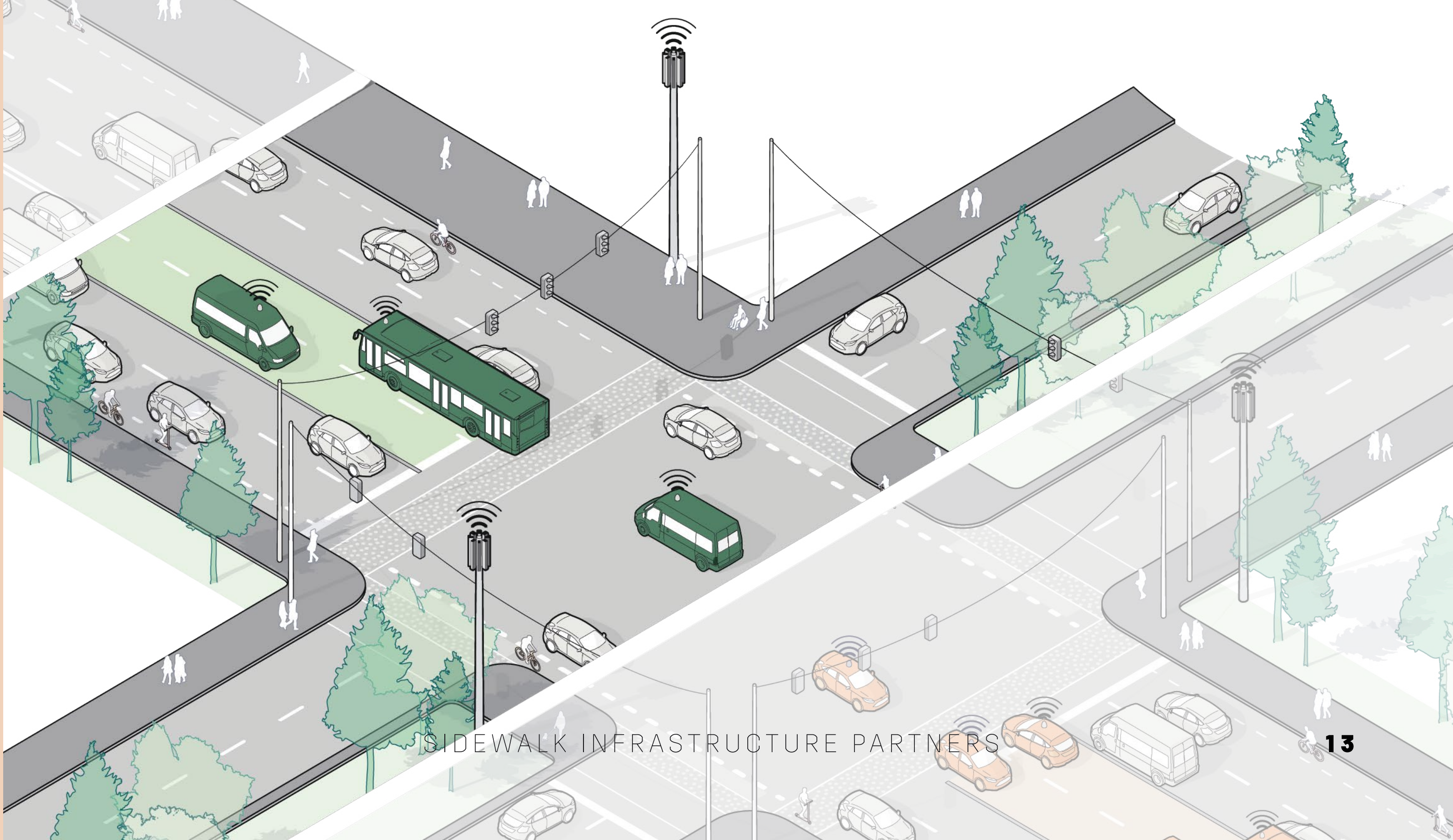
The Master Developer and its backers have active relationships with a range of leading design, engineering, and planning firms from executing on prior large-scale, complex infrastructure projects incorporating advanced innovations.[11]

To support initial planning and design efforts at the onset of Phase 1, including the preliminary design-level documents for Project engineering, the Master Developer would retain WSP, a leading architectural, engineering, and construction services provider ("AEC"), as a technical subconsultant. Additionally, the Master Developer has the potential to partner with other AECs at later stages of Phase 1 or beyond. These AEC resources can help to provide the technical expertise to support initial Project needs outlined in Section 2.2 of the RFP.

II. Business Case

The Project is expected to incorporate innovative elements, such as offering public transit and shared mobility options as anchor demand.

Increasing utilization of rights-of-way over time may be possible through providing access to otherwise unused space between transit shuttles to other CAVs. This is anticipated to be an efficient alternative to road expansion or investments in traditional mass transit that require dedicated rights-of-way such as BRT or LRT. As part of a multi-stage process, the Master Developer plans to invest in Phase 1 in order to enable subsequent phases.



Business Case Framework

CAV corridors may offer many of the benefits of dedicated mass transit while optimizing considerations of cost and service.

The Master Developer seeks to build on years of proposals for improvements in transit in Southeast Michigan, notably for dedicated BRT lanes. One such proposal studied as part of a regional transit plan[12] contemplated running buses from Detroit Metropolitan Wayne County Airport to downtown Detroit during peak periods every 10-20 minutes, and during off-peak periods every 20-60 minutes, with peak-hour BRT travel times of 69 minutes compared to peak-hour automotive travel times of 40-70 minutes. Such a BRT proposal, at an estimated capital cost per mile of $5.9 million, is significantly lower than equivalent commuter rail or LRT projects.[13] For instance, a new light rail is estimated to cost more than $1.5 billion between downtown Detroit and Detroit Metropolitan Wayne County Airport (approximately $65 million per mile).[14] As with most transit projects, BRT typically operates at a significant deficit – whereby ridership and farebox revenues are supplemented by federal, state, or local operational investment.[15]

While such proposals represent significant improvement over the status quo, deploying innovative or future-proofed infrastructure offers the potential – initially or over time – to achieve LRT-like levels of throughput and better service at a modest premium to BRT.

As part of a multi-stage process, the Master Developer plans to invest in Phase 1 in order to enable subsequent phases, including revenue from transit and shared mobility, baseload utilization, and excess capacity.

The Master Developer plans to invest in Phase 1 (development and design) to enable and subsequently pursue the development, design, testing, evaluation, implementation, financing, operations, and maintenance of the Project. The Master Developer (or an affiliated special purpose vehicle) envisions providing capital to finance development expenses and capital expenditures for the Project and would seek commercial viability across the Project's lifecycle. The Project, a first-of-its-kind CAV corridor, may face higher financing and operational costs, as well as technological and other risks, with less visibility into near-term commercial returns. As a result, the Master Developer is pursuing the Project in part to demonstrate its future benefit, which may also be utilized in subsequent deployments.

SOURCES	OVERVIEW
Project Finance Equity	A significant component of the investment is anticipated to come from project finance equity investments from SIP or an affiliated entity.
Grants	As noted in Section 3.2 of the RFP, grants may be pursued to fund upfront or ongoing expenses as necessary and reasonable.
Debt Financing	A portion of CapEx may be financed by dedicated infrastructure financing programs or bank, loan, or bond offerings from federal or other sources.
Additional Sources	There may be potential to benefit from additional forms of creative financing, supported by regional mobility requirements or economic development initiatives.
USES	**OVERVIEW**
Project Expenses & Assets	Investment in an iteratively designed Project, which delivers key objectives in mobility after a collaborative planning process with MDOT, under a P3 framework.

Long-term return on upfront capital is premised on base utilization and expanding use cases over time as the Project evolves.

Traditional BRT – in which a bus may travel only every 15 minutes – leaves most of the capacity of a lane underutilized. ***A connected corridor may allow this significant unused space to be utilized by additional vehicles and form factors.***

The Master Developer would seek long-term return on investment based on several potential sources:

- **Transit and shared mobility.** The Project may increase ridership and revenues by deploying CAVs for transit and shared mobility, thus offering higher frequency and quality services. While providing services such as shared mobility, premium levels of service – such as direct, rapid transit between key points of interest – may generate incremental revenue. The delivery of these solutions would need to consider equity and accessibility.
- **Baseload utilization.** By serving partners with long-term transportation needs and defraying large fixed-cost investments (such as parking and commuting expenses), the Project can generate additional near- and medium-term demand, helping to bridge utilization until CAV penetration increases.
- **Excess capacity.** Traditional BRT – in which a bus may travel only every 15 minutes – leaves most of the capacity of a lane underutilized. A connected corridor may allow this significant unused space to be utilized by additional vehicles and form factors without degrading the core transit services. Providing access to compatible CAVs offers the potential to generate incremental revenues derived from dynamically priced road-usage charging of such excess space. This is anticipated to be a longer-term revenue stream as the penetration rates of CAVs increase.

The Project is anticipated to address the following ongoing costs:

- **Operational and technology expenses.** The Project would incur operating expenses such as traffic management and routine maintenance. Through new digital tools, these expenses may be reduced compared to traditional traffic management and road management frameworks. The Master Developer also anticipates entering into long-term contracts to provide operations support and license technology to the Project.
- **Major maintenance capital expenditures and incremental investment.** The Master Developer also would make periodic investments into upgrades and rehabilitation of infrastructure systems in order to maintain high levels of service throughout the Project's duration.

Business Case Development

The Master Developer will collaborate with MDOT to develop a detailed and innovative business case.

During Phase 1 of the Project, the Master Developer will coordinate with the Financing and Operations and the Routes, Community Engagement, and Economic Development Working Groups noted in *"III. Work Scope and Schedule" on page 16* to scope and evaluate different business case alternatives, taking into account the routes, engineering, and operations, as well as the anticipated upfront and ongoing costs and benefits, and the needs of stakeholders across Southeast Michigan.

Given the unique nature of the Project, this may be an excellent opportunity to demonstrate the crowding in of private capital to deliver best-in-class mobility innovation.

MONTHS 6 - 12

INITIAL TEST

Test all components of the tech stack in a piecemeal manner in a "lab" setting to ensure they meet specifications.

MONTHS 12 - 18

FULL TEST

Integrate the stack together in a limited but realistic setting and ensure the overall system operates as designed over a multi-hour / multi-day period.

MONTHS 18 - 24

PROTOTYPE

Deploy and debug the stack over a longer length of road, under real-world conditions and multiple edge cases, to ensure safety and reliability standards are maintained over weeks / months.

MONTHS 24 - 36

PILOT DEPLOYMENT

Deploy the fully tested stack on a dedicated laneway sub-segment in Michigan, with limited vehicles in a "commercial pilot."

MONTHS 36+

FULL SCALE DEPLOYMENT

Begin development and deployment of fully operational, multi-mile, commercially validated dedicated laneway in Michigan, with full vehicle capacity.

THEREAFTER

MULTI-SITE DEPLOYMENT

Fully deployed dedicated laneways with multiple mobility use cases in multiple commercially validated geographies.

III. Work Scope and Schedule

The Master Developer can deliver the key Project outcomes through an iterative process co-defined with MDOT.

The initial work of Phase 1 would be to convene with MDOT, the key stakeholder of this milestone-based process. The Master Developer expects to execute on deliverables identified in the process, informed by the working groups and its partnership with MDOT. Ultimately, should the Project proceed, the Master Developer would seek to execute Master Developer Agreements for future phases.

Co-Creation Process

The Co-Creation Process will include key stakeholders.

In order to perform Phase 1, the Master Developer, working closely with its Project Partners, expects to engage MDOT, key stakeholders ("Stakeholders"), and users in a collaborative Co-Creation Process ("Co-Creation Process") to iteratively identify and respond to important questions across all key work streams of the Project, and establish a timeline for key actions (each a "Deliverable") and milestones. This includes coordination with MDOT on an initial public announcement of the mutual intent to pursue the Project.

Stakeholders include relevant state and government agencies, infrastructure owners and operators, motor vehicle regulators and administrators, law enforcement agencies, OEMs, communications and technology firms, business and community representatives, testing facilities, academic institutions, regional planning agencies, and transit riders, bicyclists, pedestrians, and individuals with disabilities who use the corridor.

Establishment of Working Groups

The Co-Creation Process will establish Working Groups in key workstreams.

Within one month of finalizing the Master Developer Agreement ("MDA"), the Master Developer, working closely with MDOT, proposes to establish and lead five issue-specific working groups (each a "Working Group"). The Master Developer would determine a frequency of Working Group meetings to achieve Deliverables, working with MDOT. The Working Groups will include:

1. **Technology and Infrastructure. Responsible for:** (i) identifying the physical, digital, cyber-physical/coordination, and operational infrastructure necessary to support effective Project implementation, including an evaluation of current infrastructure and planned future investments to ensure safe and efficient operation of CAVs; and (ii) identifying data exchange and security requirements and solutions for what public and personal data is necessary to be captured, shared, and utilized to allow for the desired mobility functions. This includes how that data and its transfer are made secure against threats that harm public safety and welfare, preserving individuals' personal privacy and security commensurate with expectations of conduct within public spaces.
2. **Policy and Regulation. Responsible for:** (i) aligning on key principles and goals, including for safety, throughput, transit access, affordability, economic development, accessibility, fairness, and equity (including alignment with regional transit plans), thus accelerating autonomous BRT and shared mobility; (ii) reviewing the current federal, state, and local policies, enabling legislation affecting the implementation of the Project, and identifying and inventorying necessary policy and regulatory considerations at the federal, state, and local levels as necessary to enable a safe and equitable implementation; and (iii) developing a framework for securing intellectual property, data privacy, and cybersecurity.
3. **Routes, Community Engagement, and Economic Development. Responsible for:** (i) identifying potential route opportunities for implementation of the Project that have the greatest impact on the movement of people and goods or potential to demonstrate a broad range of infrastructure technology and operations; (ii) considering the communities and industries served, as well as the opportunity to complement current mobility options, including identifying key points of interest along potential Project routes and engaging with businesses, landowners, developers, and others to understand their needs and ensure their support for the Project; and (iii) establishing and carrying out a community engagement process to ensure fairness and equity, and to hear the perspectives of all communities and residents along and affected by the Project.
4. **Financing and Operations. Responsible for:** (i) identifying operational capabilities that can be leveraged to improve the functional or cost effectiveness of existing and future operational investments, including providing for the equitable utilization of CAV technologies to fully realize the potential of the Project in support of personal mobility and accessibility; and (ii) identifying the potential business cases and funding models to support implementation and operation of the Project, including capital infrastructure investment, corridor operations, and life-cycle maintenance, P3s, and alternative innovative financing approaches.
5. **Planning and Design. Responsible for:** (i) determining the staging and phasing of the planning, construction, and development of potential routes; and (ii) identifying and inventorying necessary permits and approvals at the federal, state, and local level, and as otherwise necessary to proceed on the Project.

The Master Developer, working closely with its Project Partners, expects to engage MDOT, key stakeholders, and users in a collaborative Co-Creation Process to iteratively identify and respond to important questions.

Six-Month Deliverables

Within six months of the formation of the Working Groups, the Master Developer proposes working to produce the following Deliverables, as part of the Co-Creation Process.

DELIVERABLE	OVERVIEW
Technology and Infrastructure	• Develop an initial draft scope and product roadmap for necessary technology and infrastructure. • Develop the technical requirements, initial draft architecture, engineering designs, and implementation plan for the initial-test and full-test phases. • Complete an initial evaluation of technologies to inform detailed technical architecture, which could take place at Mcity or ACM.
Policy and Regulation	• Finalize a set of key public principles and goals for the Project. • Develop a comprehensive inventory of necessary legislation and regulation required for advancing the Project. • Develop an initial framework for securing privacy, cybersecurity, and intellectual property.
Routes, Community Engagement, and Economic Development	• Finalize a set of key points of interest and route options. • Develop a process for community engagement with residents along and affected by the Project, including evaluating the need to engage an advisor or firm with a track record of success in Michigan community engagement. • Provide an initial analysis of critical factors on potential routes, including traffic patterns, demographics, physical characteristics, utility and contamination surveys, redevelopment, and land assemblage activities. • Identify key economic development objectives and opportunities.
Financing and Operations	• Provide an initial viable Project business case and financing model. • Analyze financing options to provide commercial viability for the Project, including those described in the business case. • Engage additional Project Partners as needed.
Planning and Design	• Inventory necessary permits and approvals at the federal, state, and local levels, and as otherwise necessary. • Provide illustrative renderings of the street-level plan for the initial CAV-C concept, including elevations and cross-sections. • Compose a roadmap for subsequent planning and engineering activities, which considers project phasing and the ultimate need for NEPA compliance, including the potential use of the Planning and Environmental Linkages ("PEL") process. • Based on initial roadmap, add or adjust Deliverables to ensure meeting the work scope, including the planning and design activities outlined in Section 2.2 of the RFP.

12-Month Deliverables

Within 12 months of the formation of the Working Groups, the Master Developer proposes working to produce the following deliverables, as part of the Co-Creation Process.

DELIVERABLE	OVERVIEW
Technology and Infrastructure	• Demonstrate in a test setting (Mcity or ACM) the individual components of the physical and digital infrastructure and technology. • Develop a system architecture and technology implementation plan for deployment in a limited public setting.
Policy and Regulation	• As identified as necessary, establish roadmap to progress relevant legislation and regulation for moving forward on the Project, including safety, enforcement, and financing. • Finalize a framework for data privacy, cybersecurity, and intellectual property.
Routes, Community Engagement, and Economic Development	• Begin an ongoing community and public engagement process to garner feedback and align on support by stakeholders. • Based on engagement with stakeholders, identify key opportunities for encouraging economic development.
Financing and Operations	• Provide an updated, detailed business and financing model, which will include an analysis of improved functionality and cost-effectiveness of operations. • Onboard additional Project Partners as needed for Project's development and evaluate suitability of existing partners for additional phases of work.
Planning and Design	• Contract for a traffic operations and travel demand analysis to include (i) high-level travel capacity and congestion analysis of routes, (ii) forecasted travel demand and associated operational conditions, and (iii) anticipated transit and shared mobility ridership forecasting. • Contract for preliminary engineering services to include (i) inventory and assessment of existing infrastructure conditions, (ii) preliminary identification of project constraints, and (iii) development of conceptual-level layouts of CAV-C concepts. • Prepare order-of-magnitude cost estimates. • Contract for a preliminary environmental analysis to include (i) assessment of property impacts, (ii) assessment of impacts to historic or environmentally sensitive areas, and (iii) qualitative assessment of environmental justice implications of the Project. • Contract for an economic impact analysis of the Project.

24 Month Deliverables

Within 24 months of the formation of the Working Groups, the Master Developer proposes working to produce the following Deliverables, as part of the Co-Creation Process.

DELIVERABLE	OVERVIEW
Technology and Infrastructure	• Demonstrate in a test setting the individual components of the physical and digital infrastructure and technology. • Deploy a prototype under real-world conditions with multiple edge cases to demonstrate safety and reliability standards are maintained over time. • Develop detailed technical designs and implementation plans for a commercial pilot deployment on a dedicated sub-segment of the Project within 12 months of the end of Phase 1, and full-scale deployment thereafter.
Policy and Regulation	• Make proposals regarding any potential changes to legislation, regulation or policy to implement the Project. • Continue compliance with safety and good driving standards on the Project.
Routes, Community Engagement, and Economic Development	• Complete Phase 1 community engagement, supporting alignment with residents along and affected by the Project. • Complete analysis of economic development opportunities. • Finalize a route and phasing proposal for the Project, drawing on civil engineering, environmental, and other key analyses.
Financing and Operations	• Finalize the business case and financing model for the Project. • Finalize the staging of capital commitments and financing by the Master Developer or its affiliates and other relevant parties. • Provide the ability of the Master Developer to utilize the right-of-way for initial implementation of the Project and its business model.
Planning and Design	• Complete a PEL-type process, which describes the overall preferred alternative, defines the infrastructure requirements, and identifies potential impacts and mitigation strategies. This information will be used to advance the subsequent NEPA process in phases. • Secure NEPA clearance (as required) for infrastructure modifications associated with the pilot deployment, and other permits and clearances as identified in the Co-Creation Process. • Complete a preliminary design for the pilot deployment area, including performing design surveys (as required). • Request that SEMCOG amend its long-range plan and Transportation Improvement Program to include the Project with required air quality modeling (as a regionally significant project) as necessary.

MDA and Implementation Agreements

The Master Developer and MDOT will negotiate an MDA, as well as Implementation Agreements governing subsequent phases of the Project.

The Master Developer, and/or certain of its affiliates and special-purpose vehicles, and MDOT will negotiate the terms of an MDA regarding the Co-Creation Process during Phase 1 of the Project as described above, and, if MDOT determines to pursue the Project, will have the opportunity to bilaterally negotiate one or more Implementation Agreement(s) and/or other Definitive Agreements (the "Implementation Agreements") for subsequent stages of development after Phase 1. The Implementation Agreements are expected to incorporate sufficient approvals, commitments, and clarity with respect to the business model to unlock any capital commitment for financing from the Master Developer and its Equity Member(s) or affiliates, and informed by the foregoing Co-Creation Process.

As part of the Implementation Agreements, the necessary public stakeholders would provide the ability for the Master Developer to develop and implement the Project in a manner consistent with the agreed business model and on the route chosen for the CAV Project. The Master Developer and its Equity Member(s) or their affiliates and any other co-investors would then begin to make capital commitments according to the budget and capital commitment schedule in the Implementation Agreements.

By submitting this response to the RFP, the Master Developer reserves and retains any and all rights to negotiate with MDOT regarding the protection and preservation of the Master Developer's and SIP's rights related to the intellectual property it, or any of its Project Partners, has developed or may develop in connection with the Project. Specifically, subject to negotiation with MDOT, each of the Master Developer and SIP and each of its affiliates: (1) intends to retain and preserve its entire right, title, and interest, in and to all intellectual property arising out of or relating to its work related to the RFP; and (2) expects neither MDOT nor any other government agency or body will acquire any ownership of its intellectual property developed as a result of or in connection with the Project.

1 The Brookings Institution, *Gauging Investment in Self-driving Cars*, 2018.

2 McKinsey, *Start Me Up: Where Mobility Investments are Going*, 2019; The Brookings Institution, *Gauging Investment in Self-driving Cars*, 2018.

3 Gartner, *Gartner Hype Cycle for Emerging Technologies*, 2019; JD Power, *Mobility Confidence Index Study*, 2019; Green Tech Media, *Not So Fast. Fully Autonomous Vehicles Are More Than a Decade Away*, Experts Say, 2018.

4 Robin Chase, *Will a World of Self-Driving Cars be Heaven or Hell?*, 2014; Sam Schwartz, No One at the Wheel, 2018; NACTO, *Blueprint for Autonomous Urbanism*, 2019.

5 Zachary Vander Laan et al., *Operational Performance of a Congested Corridor with Lanes Dedicated to Autonomous Vehicle Traffic*, 2017; Lanhang Ye et al., *Impact of Dedicated Lanes for Connected and Autonomous Vehicles on Traffic Flow Throughput*, 2017; Steven Shladover et al., Impacts of Cooperative Adaptive Cruise Control on Freeway Traffic Flow, 2012.

6 Yiheng Feng, Chunhui Yu, Henry X. Liu, *Spatiotemporal Intersection Control in a Connected and Automated Vehicle Environment*, 2018.

7 Yiheng Feng, Jianfeng Zheng, Henry X. Liu, *Real-Time Detector-Free Adaptive Signal Control with Low Penetration of Connected Vehicles*, 2018.

8 Regional Transit Authority of Southeast Michigan, Michigan Avenue Corridor Study, Locally Preferred Alternative Report, 2016.

9 Zachary Vander Laan et al., *Operational Performance of a Congested Corridor with Lanes Dedicated to Autonomous Vehicle Traffic*, 2017; Lanhang Ye et al., *Impact of Dedicated Lanes for Connected and Autonomous Vehicles on Traffic Flow Throughput*, 2017; Steven Shladover et al., *Impacts of Cooperative Adaptive Cruise Control on Freeway Traffic Flow*, 2012.

10 On prior projects, the SIP team has engaged Black & Veatch, Arup, WSP, AECOM, Stantec, and Leidos, the majority of the top ten technical advisors in league tables maintained by Inframation, for example, which tracks major infrastructure financing.

11 Criminal Justice Information Center, *Michigan Traffic Crash Decade-At-A-Glance*, 2019.

12 Regional Transit Authority of Southeast Michigan, Michigan Avenue Corridor Study, Locally Preferred Alternative Report, 2016.

13 Of note is that this proposal contemplates utilizing existing right-of-way without reconstruction of the existing road surface and does not include dedicated rights-of-way for the entirety of the route. Depending on the specific route and configuration, the capital costs could be significantly higher or lower. For instance, the Federal Transit Administration's Capital Costs database suggests that a median to 75th percentile BRT project can cost $11 to $33 million per mile, whereas LRT can cost $51 to $88 million per mile.

14 WSP internal analysis.

15 U.S. Department of Transportation, Federal Transit Agency, 2018 National Transit Summaries and Trends, 2019.