



**1. Who we are – Missouri Department of Transportation (MoDOT) – and why we are submitting this entry**

Where better to debut Hyperloop than in Missouri, a state that since its earliest days, has been at the leading edge of transportation innovation and exploration.

Bounded and bisected by the nation’s two mightiest rivers, our location provided the jumping off point for America’s westward expansion. That movement of settlers and their provisions touched off the need for a national transportation system.

Pioneers came forward and answered the call with innovations that have played an important part in Missouri’s history, its character, its pride and its success: Lewis & Clark ... riverboats, the Oregon Trail and railroads ... the Pony Express ... James Eads and his famous bridge ... Charles Lindbergh ... the first section of the nation’s interstate highway system on I-70 ... the automobile and aeronautics industries ... the space program ... the list goes on and on.

The motivation for early transportation was exploration and finding ways for people to get to where they could stake their claim and make a new start. And so, we blazed the trail, crossed the streams, and eventually we got Missouri out of the mud and led the nation in the construction of the interstate system.

Today, transportation is an essential component of health care, education, employment, recreation, culture, maintenance of ties with family and friends, and all that makes life worthwhile. Transportation is what enables individuals to become full-fledged, participating, contributing members of society and what enables communities to flourish. Missouri is strategically located at the multimodal crossroads of North America.

Transportation is the heartbeat of everyday life – pumping energy throughout the state. It drives our economy and gives us the freedom and flexibility to go wherever we want whenever we

want. It's a conduit between rural and urban Missouri, enabling us to put food on the table, to get to the doctor, to go to school, to go to work.

Hyperloop will be a transformative next step for Missouri's transportation system at the crossroads of America, uniting our two largest cities and creating opportunities for Missouri residents and businesses never before imagined. The interface of truck, rail, air and marine freight in Missouri make it a logical starting point for a national Hyperloop network.

The culture of innovation has existed at MoDOT from its very beginning.

On March 22, 1913, the Missouri Legislature created the Missouri State Highway Department. Almost immediately afterwards, construction began across the state to link adjoining county seats with paved and maintained roadways.

By the beginning of the next decade, a \$60 million bond issue was passed to "get Missouri out of the mud" with Missourians and lawmakers realizing that transportation was integral to economic prosperity and growth. In 1952, the Department took over responsibility for almost 12,000 miles of county roads, a move that brought 95 percent of all Missourians to within two miles of a hard-surfaced road.

Missouri has always been at the heart of highway transportation – not only because of the state's geographic location at the nation's center – but because of the role it's played in the creation of the nation's interstate highway system. After President Dwight D. Eisenhower signed the legislation authorizing the interstate highway system in 1956, Missouri became the first state to award an interstate construction contract for a section of I-44 in Laclede County, and several months later became the first state to begin interstate construction when work began on I-70 in St. Charles County.

The man most credited with overseeing the realization of Eisenhower's dream was Rex Whitton who began his career with the Missouri Highway Department in 1920 as a surveyor. Whitton rose to chief engineer in 1951, served as president of the American Association of State Highway and Transportation Officials in the historic year of 1956, and then led the effort to build out the network during its critical years as administrator of the Federal Highway Administration from 1961-66. Today, Missouri has 1,380 miles of interstate highways; the fifth highest total in the nation, and the nation's seventh largest state transportation system with nearly 34,000 miles of highways and 10,400 bridges.

The transportation crossroads for the entire nation, Missouri's strategic location puts it within 500 miles of 43 percent of the U.S. population, 44 percent of all U.S. manufacturing plants and seven of the top 25 international cargo hubs in the U.S.

The state transportation network includes 4,800 miles of railroad tracks, 123 public-use airports and 15 public ports. Kansas City and St. Louis are the nation's second and third largest freight rail hubs. St. Louis is the nation's third largest inland port. Trucks, planes, barges and trains move 1.1 billion tons of freight each year valued at \$1.3 trillion.

MoDOT has a strong history of innovation in designing, building, operating and maintaining its large transportation network while bringing the greatest possible value to every project it undertakes.

In the last decade alone, Missouri has moved boldly to improve its system, challenging its engineers to look for new and better ways to do things better, faster and cheaper and reinforcing its position as one of the nation's leading DOTs.

The concept of "Practical Design" became the department's mantra in 2005, calling for the design and construction of good, not great, projects that when implemented across the system would result in a great system of roads and bridges. Since that time, the condition of Missouri's roads and bridges has risen dramatically, and with it has come a customer satisfaction rate nearing 85 percent, unheard of for a government agency.

MoDOT's entrance into the design-build arena in 2006 resulted in unqualified success on some large and complicated projects: the reconstruction of I-64 in St. Louis; the construction of the iconic Christopher S. Bond Bridge in Kansas City; and the improvement of more than 800 bridges statewide with the Safe & Sound Bridge Improvement Program. What's become known as the "Missouri Model" for design-build – setting a fixed budget and allowing design-build teams to bid project scope – has become a national standard emulated by many others.

MoDOT's early commitment to performance management and utilization of its "[Tracker](#)" tool over the last decade has resulted in MoDOT delivering more than \$12 billion in transportation improvements more than six percent under budget and on time.

MoDOT's latest commitment to innovation came a year ago. In June 2015, the Missouri Highways and Transportation Commission, the six-member appointed board that governs MoDOT, announced its intention to make I-70 across the midsection of the state available to the nation and the world as the laboratory to construct the next generation of highways. Called "[Road to Tomorrow](#)," the Commission issued a call for private industry, entrepreneurs and innovators to bring their products and ideas to the birthplace of the interstate highway and collaborate with MoDOT to build the first section of the transportation system of the future. It's only appropriate that the re-birth of the nation's transportation system begin at its birthplace.

Missouri has no preconceived plan; no ideas are bad ones. Just as alternative project delivery methods such as design-build have produced insights and innovations that could not have

previously been imagined, the Commission is confident that offering free reign to human creativity and a designated site for implementation will generate the very best in American ingenuity. The “Road to Tomorrow” will drive economic development and prosperity far into the 21<sup>st</sup> Century and beyond, just like the interstate highway system did in the second half of the 20<sup>th</sup> Century.

As the next mode, Hyperloop will be THE transformative element of our transportation future. The “Road to Tomorrow” offers an unmatched opportunity to implement this mode in the “real world,” to connect the nation’s second and third largest freight rail hubs, interface with all existing modes at the transportation crossroads of America, and create the nexus of the transcontinental Hyperloop system. I-70 across Missouri provides the roadbed upon which Hyperloop will pave the “Road to Tomorrow.”

## **Our Corridor: “The Road to Tomorrow”**

### **2. A description of the corridor**

I-70 in Missouri runs 251 miles across the state’s midsection, connecting the state’s two largest cities: Kansas City on the west and St. Louis on the east. Halfway in between is Columbia, the state’s fourth largest city and home of the University of Missouri.

It offers an optimal route for implementation of the Hyperloop technology to unite two major metropolises into one powerful economic and logistical market. For nearly two decades MoDOT has been looking at how to rebuild and improve the aging interstate. The project has proven to be unaffordable but Hyperloop could change that by pulling traffic and cargo off the facility and reducing the scope of future rehabilitation and reconstruction.

I-70 was designed and constructed between 1956 and 1965. Its oldest sections are 60 years old and its youngest are 51 years old. The interstate was intended to carry 12,000-18,000 vehicles per day. Today, it carries an average of 34,000 vehicles per day in rural sections, with 10,000-15,000 trucks. At Independence near the interchange with I-470 on the west side of the state, I-70 carries more than 100,000 vehicles per day with 23,000 trucks. On the east side at Wentzville near the interchange with I-64, daily traffic is nearly 80,000 vehicles per day with 15,000 trucks.

The corridor is well beyond its design capacity and needs to be expanded to allow I-70 to continue to be the east-west conduit for the interstate movement of goods and people.

I-70 also has preservation needs to ensure it is a viable facility for many years to come. Its original pavement has deteriorated under decades of mounting traffic to such a degree that

surface treatments last for shorter and shorter periods. While what is on top may not look bad and provides an acceptable ride, what is underneath is far worse, eroding the overall stability of the roadway. Additionally, the majority of I-70’s mainline and crossroad bridges are nearing the end of their useful lives and will soon need to be replaced.

MoDOT has the necessary [environmental approvals](#) to reconstruct and expand 200 miles of I-70 from the Route 7 interchange in Blue Springs to the Lake St. Louis interchange near Wentzville. MoDOT also has “conditional provisional” approval from the Federal Highway Administration to rebuild I-70 as a toll road within the environmentally cleared limits. That approval will expire by the end of 2016 if not acted upon, however.

I-70 is the most important transportation corridor in Missouri, connecting the state’s two largest cities and carrying more rural daily traffic than any other route. The interstate has been an engine of economic growth and prosperity for the state and nation since the 1950s. The safety and economic prosperity of Missourians depends; in part, on an I-70 that grows along with the state and nation. Further, I-70 serves as one of the corridors for moving Missouri’s \$9.2 billion in agricultural products, produced on 27.5 million acres of land, to market each year.

<p><b>1950s &amp; '60s</b> – Parts of I-70 in Missouri were first designed and constructed during the Eisenhower administration of the 1950s, and the balance constructed in the 1960s. The interstate at that time had a planned design life of approximately 20 years. In the decades since, through ongoing care and maintenance, MoDOT has been able to extend the effective life of this highway. However, it remains apparent that a long-term solution is needed to ensure that Missouri’s “Main Street” continues to support Missouri’s economy and position as the transportation crossroads for the entire nation.</p>	<p><b>1999-2001</b> – The Improve I-70 First Tier Study identified the state-wide need for reconstruction and additional capacity. Leading up to that recommendation, MoDOT evaluated a range of options, including building additional lanes in the median and alternative transportation modes. Based on an evaluation of costs, impacts, needs and effectiveness, MoDOT made an initial recommendation to reconstruct and widen I-70.</p>
<p><b>2002-2006</b> – The Second Tier Studies; known collectively as Improve I-70, looked more specifically at the recommended strategies and their local impacts. In order to ensure an appropriate level of detail, the Improve I-70 Second Tier program divided the interstate into seven different geographic sections, each with their own environmental study and recommendations. The Second Tier Environmental Studies wrapped up in 2006.</p>	<p><b>2007-2009</b> – After I-70 in Missouri, Illinois, Indiana and Ohio was selected as a federal “Corridor of the Future,” MoDOT received a federal grant to conduct a Supplemental Environmental Impact Statement to compare rebuilding and widening the existing highway to six lanes with the strategy of rebuilding and widening I-70 with separate truck-only lanes.</p>

## 2. Major traffic generators on or near “The Road to Tomorrow”

Within 30 miles of I-70 in Missouri, are:

- 49 percent of Missouri’s employers
- 63 percent of Missouri’s jobs, and
- 61 percent of Missouri’s population

Within 10 miles of I-70 in Missouri, are:

- 67,535 Census Blocks
- 1,540 churches
- 1,506 schools (public and private)
- 364 public-use buildings
- 337 cemeteries
- 220 interchanges with other interstates, U.S. routes, state and county routes and city streets
- 220 parks
- 77 radio towers
- 74 U.S. Post Offices
- Cargo and commercial passenger service airports at Kansas City,
- St. Louis and Columbia as well as 66 public-use airports
- 3 public river ports
- KC and StL rail hubs – the nation’s 2<sup>nd</sup> and 3<sup>rd</sup> largest
- 66 hospitals
- 39 colleges and universities
- 38 lakes
- GM assembly plant in Wentzville that employs 3,500 people and produces Chevy Express and GMC Savanna full-size vans, as well as Chevy Colorado and GMC Canyon pickup trucks

The Missouri I-70 corridor carries more than 31,500,000 tons of freight annually, with a value of more than \$59 billion.

<b>MAJOR DISTRIBUTION CENTERS &amp; 3<sup>rd</sup>-PARTY LOGISTICS COMPANIES</b>		
<b><u>Kansas City</u></b>	<b><u>Out-State on/near I-70</u></b>	<b><u>St. Louis</u></b>
Associated Wholesale Grocers, Blount International, Ceva Animal Health, FedEx, Flex-N-Gate, FoodServiceWarehouse.com, Hallmark, Johnson Controls, Musician’s Friend, O’Reilly Auto Parts, QuikTrip, ReallyGoodStuff.com, Toys R Us, Vistar, C.H. Robinson, Commonwelath Inc., Exel, Freightquote, Murphy Warehouse, OHL, Wagner Logistics, XPO Logistics, Amazon	<b>Grain Valley</b> – Kohl’s <b>Sedalia</b> – Ditzfeld Transfer <b>Moberly</b> – Walmart <b>Fulton</b> – Dollar General <b>Jefferson City</b> – Scholastic <b>Mexico</b> – Home Depot, Brookstone <b>Montgomery City</b> – Tyson Foods <b>Vandalia</b> – Green Supply <b>St. Peters</b> – Aldi	American Red Cross, Coca-Cola, FedEx, Macy’s, Rawlings Sporting Goods, Schnuck Markets Inc., SuperValu, SYSCO Corporation, Trane, UPS, ViJon, C.H. Robinson, Cheyenne Logistics, Davidson Surface/Air, Exel, Fastrans Logistics, Graybar, The Hub Group, Materialogic, Mid America Logistics, PLS Logistics, Total Quality Logistics, Transplace, World Wide Technology , Amazon

**3. Distances between points along the “Road to Tomorrow” and**

**4. How Hyperloop can link these nodal points**

MoDOT has completed environmental studies of I-70 for the 200 miles between Independence and Wentzville, although from border to border the full corridor runs for 251 miles.

Within 30 miles of the previously studied termini are multiple options for the Hyperloop to connect significant cargo and passenger nodes.

• Independence to Columbia – 110 miles	• Columbia to Lake St. Louis – 90 miles
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Hyperloop could link these nodal points by utilizing the 200 miles from Independence to Lake St. Louis as the “mainline.” At either end, and in the middle at Columbia, Hyperloop “feeder spurs” could link up to connect Kansas City International Airport and significant intermodal facilities at Edgerton, Kan. and Grandview, Mo; to University of Missouri research facilities in Columbia as well as Columbia’s transload facility; and in St. Louis to St. Louis-Lambert International Airport, major life science research centers in Weldon Spring and in the heart of St. Louis. These are just a few of the possibilities for urban connections to a Hyperloop mainline.

The previously studied portion of the I-70 corridor connects with four significant north-south highways at U.S. Route 65, U.S. Route 63, U.S. Route 54 and U.S. Route 61, as well as interstate connections at I-470 on the western end and I-64 on the eastern end.

[NOTE: There are also existing and abandoned rail lines that connect Kansas City and St. Louis and could also be considered as Hyperloop corridors. MoDOT, however, has no control over those facilities.]

**5. Existing ROW**

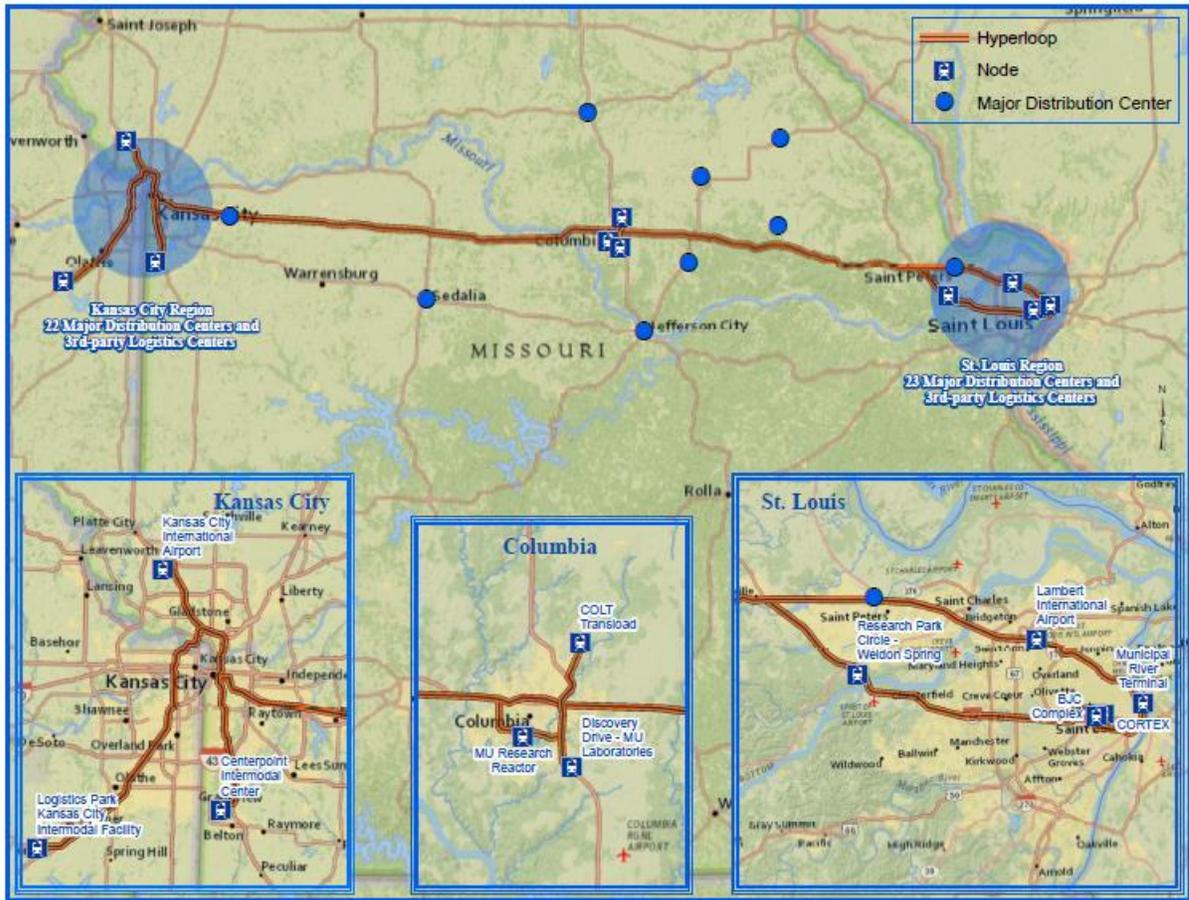
The existing I-70 ROW is generally 250-300 feet wide, including a 40-foot median. Previously developed widening strategies identified the need for an additional 150 feet of ROW on one side of the highway or the other, with 75 feet needed on both sides in urban areas. Most recently, MoDOT has developed strategies to add an additional lane in each direction to I-70 utilizing the existing ROW as much as possible to minimize cost and impacts.

The ROW is heavily developed through the urban areas of Kansas City, Columbia and St. Louis. Significant topographical features in the corridor include Missouri River crossings at Rocheport and St. Charles, and the Mineola Hill/Loutre River Valley. However, the majority of the corridor traverses relatively undeveloped rural and agricultural landscapes.

**6. Proposed “Road to Tomorrow” Hyperloop network**

See answer to number 4 above.

7. Need map of proposed Hyperloop network along corridor and accompanying kmz files.



### MoDOT's Hyperloop Strategic Transformation

MoDOT is 'best at' providing outstanding personal customer service to our residents and North American stakeholders operating in the global economy, as well as delivering transportation projects on time and on budget. MoDOT 'has a passion for' embracing innovation and new technologies that help us provide a world-class transportation experience that delights our customers and promotes a prosperous Missouri. I-70 is a critical centrally located transportation corridor spanning the middle of North America and connecting the Midwest to the rest of the world with connections to major rail hubs, international airports, and the Missouri and Mississippi Rivers. I-70 across Missouri also connects to six other major interstate highways.

MoDOT's strengths and passion combined with the critical I-70 corridor provides an unmatched opportunity for Hyperloop One.

8a. What happens when hours become minutes? Will you travel more or make different kinds of journeys?

We envision great opportunities for Missouri and the Midwest when travel that traditionally takes a day will be accomplished in an hour or less. We believe this new mode will add to our existing travel demand by creating journeys that are not taken today – journeys that connect people, opportunity and commerce.

A personal example: Stan and Karen have a date night, traveling from Kansas City to St. Louis on a weeknight, to enjoy a theatre or concert event at the Muny Theater in Forest Park (or vice versa, from St. Louis to Kansas City for an event at the Starlight Theater). These trips are not taken today given the five-hour drive time combined with show times but will become possible given the option of a 30-minute Hyperloop trip.

This is a very simple example of the almost unimaginable and endless possibilities to link people with goods, services and public and private institutions across Missouri and; eventually, across the country.

### **8b. What happens when Hyperloop makes trips to remote cities shorter than trips to the suburbs by traditional modes?**

We forecast many great things from connecting our remote town and cities to our urban centers. This opens a wider range of products and services for consumers (healthcare, education, emergency response and residence) and allows freight distribution centers to be placed in rural areas; thereby liberating our urban land for the highest and best use. We have seen a glimpse of this transformation before, as we moved from walking and wagons to trains and jet planes.

Rural communities will realize economic benefits by retaining residents who can now easily commute to remote/urban job centers. No more will people have to migrate to urban job centers. Barriers to employer access to employees is eliminated while maintaining and strengthening the character, vitality and economy of rural communities. Job growth in one area of the state is no longer detrimental to economic opportunities in other parts; nor is job growth limited to areas of existing employee populations.

A personal example: Bob, a resident in mid-Missouri, will have quick access to the top-rated health care facilities located in St Louis and Kansas City, or to job opportunities that don't exist today because of unreasonable *commute* times or the inability to relocate.

### **8c. What happens when you can capture the value of new development to contribute to the capital cost of a Hyperloop network?**

Capturing the value of new development caused by new and expanded transportation corridors has always been a struggle for the segments of government responsible for delivering transportation infrastructure and services. At MoDOT we are excited about the possibility of attracting private industry funding via such strategies as:

- Reverse TIF – Traditionally local governments grant tax incentives to attract and spur commercial development; Hyperloop will spur developers to invest in the Hyperloop, municipal and transportation infrastructure necessary to develop and utilize their valuable properties surrounding Hyperloop nodes and along the adjacent “feeder routes.”
- Competition to procure and develop land at the Hyperloop nodes and along the adjacent “feeder routes” will drive up property values and resultant taxes, providing additional public resources for the public-private partnership that is necessary to construct Hyperloop.
- Similarly, special taxing districts, user fees, “feeder route” tolls and/or access charges can provide additional public funding for Hyperloop capital costs.

**8d. What happens when prime waterfront land currently covered by ports is liberated by a Hyperloop container-shifter link to an inland container distribution hub?**

Although Missouri’s I-70 corridor does not directly touch ocean waterfront, it does connect our nation’s two largest rivers: the Mississippi and the Missouri. A Hyperloop connection of these rivers will greatly enhance the inland freight capacity of the middle of our country, a truly sustainable approach. Transportation speed also changes inventory management, as well as reducing the numbers of passengers needed to fill a plane to make the trip economical.

An economic example: an auto parts manufacturer is able to locate in mid-Missouri, taking advantage of lower land costs and cost of living, because their access to Hyperloop allows their products to efficiently be transported to the St Louis GM and Kansas City Ford assembly plants in a timely manner. This brings needed jobs and economic development to rural Missouri versus the hardship of commuting to faraway jobs.

**8e. How do your supply chains in the vicinity of your corridor evolve and benefit from Hyperloop?**

Hyperloop creates a “supply web” instead of a single supply chain that connects vast numbers of employees, customers and suppliers efficiently like never before. The combinations of existing distribution networks, growth in inland freight due to expansion of the Panama Canal and Hyperloop create an amazing number of accelerators for a supply web.

The ability to quickly and efficiently short-haul freight from rural areas to access centralized Hyperloop nodes; given our large sections of open land, will extend the Missouri supply web even further. We expect many businesses would no longer need to be located in urban settings in order to access employees, customers and suppliers; allowing better utilization of that much sought after urban land. We do foresee increased demand for trucking – away from long haul toward short haul; instead of shipping from Kansas City to St. Louis, focus will shift to shipping to/from the centralized Hyperloop nodes and local supply and delivery points. This would allow for a smaller, more fuel efficient fleet that is staffed by individuals who can sleep in their own

bed every night. Additionally, inventory costs drop since transit velocity and reliability will improve. Finally, this will allow a shift in existing transportation funding away from interstate expansion for long-haul freight movement to other modes (Hyperloop, urban and rural mass transit, etc.) and the accommodation of other emerging transportation technologies such as connected and autonomous vehicles. It is expected that rail would continue to be focused on bulk agriculture and energy products and Hyperloop would become the preferred transporter for smaller, more time-sensitive freight.

**8f. What happens when just-in-time deliveries can be made within minutes along your corridor?**

With the increased speed and efficiency of Hyperloop, we expect shipping costs to decrease dramatically and the options for business partnerships and consumer choices to increase exponentially. Manufacturers will no longer be tied to supply chain driven production schedules which will increase both employee morale and overall profitability. Hyperloop will facilitate all resources along the corridor to be used and marketed together as if they were in one geographical place. Land, and shelf space in stores, becomes freed up as well. Ultimately, we conceive a Midwestern inland port connected by existing freight corridors and enhanced by Hyperloop and the Panama Canal expansion.

A freight example: an existing nuclear imaging technology company, based in Columbia (mid-Missouri), is constrained due to the short ½-life of its product and access to only existing air flights at the nearby Columbia Regional Airport. Hyperloop will expand their distribution to air traffic hubs in both Kansas City and St. Louis, effectively giving them the ability to reach anywhere in our continent with their heavily in-demand product.

**8g. What happens when two or more major airports are linked via Hyperloop, essentially creating a single multi-runway super-hub and optimizing capacity?**

A Midwest Airport Hub at the geographic heart of the country would result by combining the facilities, resources and capacity of the three existing commercial airports – MCI, COU and STL – along the I-70 corridor. This will position these existing disparate air travel assets to provide more value to our cargo and passenger economy. On the passenger side, we take advantage of the value in connecting to current transportation options at our airports. Hyperloop will increase the access of people and businesses in rural Missouri to air travel and the larger national and global economy. On the freight side, these airports have hundreds of acres of adjacent land available to leverage the Hyperloop/airport interface (individual termini for air cargo and people; cargo handling, collection and distribution facilities; customs, etc.). Recently, MCI and STL have made great strides in growing their air cargo economy. Hyperloop married to air cargo will expand Missouri's distribution of time-sensitive medical production/distribution, greatly enhancing the value of jobs in rural Missouri and providing new markets to industry.

## **8h. What happens when Hyperloop connections build powerhouse economies by combining populations, labor markets, cultural assets, and community services of separate cities into supercities?**

Hyperloop's potential to build 'powerhouse economies' is the NEXT BIG THING. Although our entry is focused on the 251 miles of I-70 across Missouri, we envision the connection of resources across the middle of the United States. At over 2,100 miles in length, I-70 is a major corridor for goods, people and services that runs from I-15 near Cove Fort, Utah, to I-695 near Baltimore, Maryland. I-70 passes through 10 states and many major cities, including Denver, Kansas City, St. Louis, Indianapolis, Columbus, Pittsburgh and Baltimore. Along I-70 we would be able to link widely spaced neighborhoods as a "Super City" without the congestions and air emissions.

Given the opportunity to work with Hyperloop One, MoDOT expects to reach out to other states along the I-70 corridor to gain support for partnering with the private sector to build upon the existing I-70 economy with Hyperloop. The opportunities are virtually unlimited, expanding beyond an east-west corridor to a supply web that includes north-south destinations that have resulted from NAFTA. We see many possibilities, such as connecting Amazon's multiple distribution centers located near I-70. Missouri biosciences, plant/agriculture technology, animal sciences and biomedical industries, would be able to expand their research and production given the ability to quickly transport time-sensitive materials.

The University of Missouri System could truly become a unified higher education option with students taking classes on multiple campuses in one day. Redundancies are minimized, enabling resources to be focused on enhancing the educational opportunities for citizens throughout Missouri and the Midwest to create the workforce of the future.

### **Our Concluding Strategic Thoughts**

With your selection of our entry, we look forward to the opportunity to perfect the best strategies with Hyperloop One and our many public and private partners whose participation is necessary for success. As we move forward, we offer:

- MoDOT, a partner with a history of and passion for providing outstanding personal customer service, delivering transportation projects on time and on budget; and embracing new innovation and technologies.
- I-70, where the interstate system began, is a well-known and centrally located transportation corridor spanning the middle of the United States and connecting to east- and west-coast markets and beyond.
- We understand that a true public-private partnership will engage and identify benefits to existing stakeholders: railroads, the trucking industry, Amtrak, airports and airlines, while also creating new partnerships.

- A true high-speed connection of Kansas City, Columbia and St Louis provides endless economic potential by creating a true mega-city that will make our large state more efficient and effective within the global economy.
- Hyperloop in Missouri creates the core for a national “supply web” instead of multiple single, redundant, intersecting supply chains.
- The ‘death of distance’ will enable private sector businesses and public sector institutions to leverage people and facilities throughout the state and; eventually, the country.
- The ‘rural’ vs. ‘urban’ divide that is common in Missouri and other states is transformed; ‘us’ vs. ‘them’ becomes ‘we.’
- Missouri is within one day’s drive of 43 percent of U.S. households, 44 percent of U.S. manufacturing establishments and seven of the nation’s top 25 fastest growing metro populations. One-day drives could become hours or minutes.

MoDOT is excited about creating a new transportation mode that brings with it an opportunity for new and sustainable transportation revenue streams. MoDOT’s proven successes, passion for innovation and strong desire to find new ways to invest in our transportation system will galvanize Missourians and create team spirit. Like the 1960’s NASA moon mission, this BIG AUDACIOUS GOAL captures our imagination and grabs us by our souls. We look forward to creating that future with the Hyperloop One team.

## **Passenger & Cargo Flows**

### **9. Historical, current and projected population and economic output**

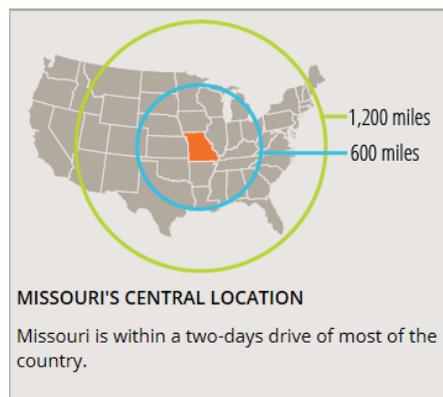
Missouri is the nation’s 18<sup>th</sup> most populous state with six million people as of July 2015. The population is expected to reach 6.8 million by 2030. Columbia, Kansas City and St. Louis along the I-70 corridor anticipate 51 percent, 63 percent and 75 percent growth respectively. The I-70 corridor is served by interstate, rail, air and water connecting St. Louis to Columbia to Kansas City. The corridor is a crucial part of Missouri’s economy with 61 percent of Missourians, 49 percent of the state’s employers and 63 percent of jobs located within 30 miles of the roadway.

Over the last ten years, national and state economies have experienced exuberant growth, financial crisis and rocky recovery. The Missouri economy navigated the early part of the recession with few disruptions and minor losses. The state rebounded in economic activity between 2012 and 2015, producing nearly \$10 billion in economic activity. Missouri’s Gross Domestic Product totaled \$261.5 billion in 2015, a 1.3 percent increase over the previous year. The U.S. has a \$16.4 trillion economy, with an average two percent growth annually since 2012. The strength of the Missouri economy lies in its diverse regions: from an agricultural belt north of I-70, to the medical-education-government complexes in the Central region (Columbia), to the

cosmopolitan and economic centers of St. Louis and Kansas City. Thanks to the economic diversity, Missouri is well-positioned to continue its recent economic growth.

## 10. Passenger Demand

Rural portions of I-70 carry approximately 34,000 vehicles daily including 10,000 – 15,000 trucks. This volume rises dramatically within the urban areas with Kansas City and St. Louis metro areas reaching as high as 166,000 vehicles and 23,000 trucks. In Columbia, daily volume exceeds 70,000 vehicles with 17,000 trucks. The increased volume in the urban areas is attributed predominantly to commuters and intracity freight movement. Rural passenger travel is tourist-related, cross-country or serving local commuting purposes to healthcare, higher education or jobs. Significant increases in traffic along the corridor spike in connection with events at the multiple colleges and universities in the corridor, national holidays, summer vacations, etc.



Travel from St. Louis to Kansas City by road is approximately a five-hour trip, with Columbia at the mid point. I-70 is at the limits of its design capacity, functioning for the current traffic unless there is an incident involving a crash, work zone, or weather that instantly causes lengthy traffic backs up with few redundant routes available to relieve the volume.

Three Class 1 railroads, Union Pacific, Norfolk Southern and Kansas City Southern, are located within the corridor. The Union Pacific rail line paralleling I-70 carries a state-sponsored Amtrak passenger train with 188,000 passengers annually on two scheduled daily departures for the six-hour trip from Kansas City to St. Louis. Fees for this route vary from \$30 to \$100 depending on the number of remaining available seats at time of reservation. General Revenue from Missouri of approximately \$9 million annually supports this passenger train. The Amtrak route has significantly more potential and anecdotal evidence suggests that more frequent daily departures allowing single-day trips to St. Louis, Columbia or Kansas City for professional sports, theater, festivals, medical or business meetings are desired. Bottlenecks for the rail lines occur along the UP line where the single track is shared by both freight and passenger rail.

The Columbia, Kansas City and St. Louis airports have approximately 12 million annual passengers. More than 75 percent of them originate or are destined for the locations along the I-70 corridor. Ticket prices vary according to destination. A ticket from St. Louis to Kansas City by air would cost each passenger \$200 plus parking at \$11 per day and require at least one hour to clear TSA plus one hour of flight time. Flying from Columbia to either St. Louis or Kansas City requires a layover in Chicago with flight time exceeding five hours at a cost of \$700 per

person with no parking fees charged at Columbia. Subsidies are not offered for airport operations, however, capital funds are provided annually from FAA and the state of Missouri for capital improvements at all general aviation airports.

## 11. Cargo Demand

Missouri’s central location provides efficient access to all coasts and international borders in the United States. It is located within 500 miles of 43 percent of the U.S. households and 44 percent of U.S. manufacturing establishments. Missouri is just one day’s drive from seven of the fastest-growing metros in the country and borders eight states, providing quick access to even more markets and customers.

This central location and diverse infrastructure has made Missouri a logistics hub for the nation. Large volumes of people and goods are carried by this diverse, interconnected system that includes:

- Interstate highways crisscrossing the state;
- second and third largest rail hubs in the country, Kansas City and St. Louis, respectively;
- cargo-carrying Missouri and Mississippi Rivers have the most northern year-round shipping in the U.S. with a direct connection to the Gulf of Mexico and freight opportunities from the newly expanded Panama Canal; and
- three of the top cargo airports in the U.S. at St. Louis (56), Kansas City (37) and Springfield (106).

As noted above, rural portions of I-70 carry 10,000 – 15,000 trucks daily. The volume rises to over 23,000 trucks within the very urbanized areas of Kansas City and St. Louis. Three Class 1 railroads, Union Pacific, Norfolk Southern, and Kansas City Southern, are located within the corridor carrying over 105 million tons of cargo. According to the [Missouri State Rail Plan](#), these lines are nearing

Direction	Air	Pipe	Rail	Truck	Water	Total
<b>Tons</b>						
Outbound	34,313	#N/A	21,510,433	75,301,621	19,973,291	116,819,658
Inbound	38,249	932,258	92,326,793	89,250,507	5,093,847	187,641,654
Intrastate	370	#N/A	2,436,087	105,627,915	4,941,503	113,005,875
Through	71	7,412,827	341,805,597	230,212,488	19,850,043	599,281,026
<b>Total</b>	<b>73,003</b>	<b>8,345,085</b>	<b>458,078,910</b>	<b>500,392,531</b>	<b>49,858,684</b>	<b>1,016,748,213</b>
<b>Value, in millions</b>						
Outbound	\$7,620	#N/A	\$40,364	\$95,005	\$3,479	\$146,468
Inbound	\$3,656	\$643	\$39,647	\$119,731	\$3,083	\$166,760
Intrastate	\$100	#N/A	\$1,616	\$62,346	\$117	\$64,179
Through	\$10	\$5,117	\$383,409	\$433,794	\$5,870	\$828,200
<b>Total</b>	<b>\$11,387</b>	<b>\$5,761</b>	<b>\$465,035</b>	<b>\$710,876</b>	<b>\$12,549</b>	<b>\$1,205,607</b>

*Source: Prepared by CDM Smith, based on TRANSEARCH® data for 2011*

Table 1. 2011 Missouri Freight Flow. Tonnage and Value by Mode

capacity. The Columbia, Kansas City and St. Louis airports also handle freight exceeding 415,000 tons in 2015.

The Missouri River annually moves four million tons of cargo: mostly bulk products of grain, fertilizer and coal. The Mississippi River at St. Louis moves over 500 million tons of cargo per year to the Gulf of Mexico for export. The St. Louis river industry recently completed a pilot project demonstrating that container-on-barge was a viable mode of transportation on the inland waterway. St. Louis is working with the industry to develop a larger market to initiate this mode of travel and expand freight choices in the St. Louis region.

Operational subsidies are not provided to any mode for freight movement in Missouri. However, federal and state funding is available to assist with capital improvements to airports and water ports, grade crossing safety improvements for rail, and state owned highways and bridges.

Table 1 provides a breakdown of the recent tonnage and value of cargo moving through the state. 59 percent of freight is moving through, not starting or stopping, Missouri. This is indicative of the central location and critical nature of Missouri’s transportation infrastructure to the national economy. Currently rail and truck are the predominant modes of freight movement. However, Missouri River industry and cargo at the St. Louis and Kansas City airports has been revitalized in recent years and growth is expected in those industries as well. Overall, Missouri is anticipated to have a 46 percent increase in freight by the year 2040.

Missouri’s major trading partners, shown in Table 2, include neighboring states, energy supply states and large coastal population centers.

Outbound Freight 2011	Inbound Freight 2011
Illinois	Wyoming
Texas	Illinois
Kansas	Kansas
California	Iowa
Arkansas	Arkansas
Iowa	Texas
Oklahoma	North Dakota
Arizona	California

Source: Prepared by CDM Smith based on TRANSEARCH® data for 2011

**Table 2. Domestic Trade Partners**

The state exports \$13.6 billion in goods to other countries. Its largest international trading partners, Canada and Mexico, jointly purchased \$6.9 billion of goods in 2015. Pharmaceuticals and medicines are the fastest growing export of the chemical industry with over 10.6 percent annual growth. Electrical equipment and computer products exports brought over \$1.3 billion into the economy with an increase of \$116.6 million between 2014 and 2015. Food products export valued at \$634 million are exported from the state as well.

**11e. Future Demand**

Missouri focuses on seven target industry clusters for economic development in the state. All these industries serve large segments of the population either through employment or services needed with five also having a strong freight connection. Each of these clusters was chosen

based on Missouri's natural resources, employment training, higher education programs and increased global need in the future. These industry clusters include:

- **Advanced Manufacturing** with niche industries of transportation equipment, aerospace, automotive suppliers and defense. Notable existing manufacturers along the I-70 corridor with large employee base and also inbound and outbound freight needs include Boeing, Harley Davidson, 3M, Ford, Eaton Cooper Bussman, Emerson Electric, Honeywell National Security Campus and General Motors. Missouri is also home to multiple military bases including Whiteman AFB and Fort Leonard Wood.
- **Energy Solutions** focusing on solar industry, biofuel industry and research and development for developing long-term, low-impact, high-value energy solutions to reduce consumption of coal and oil. The U.S. Department of Energy has designated the area from the I-70 corridor north to Iowa as one of the nation's top areas for biomass resources. These products are pelletized for shipment all over the world. The I-70 corridor is home to many of the R&D efforts on energy solutions as well with The University of Missouri, University of Central Missouri and Washington University located nearby.
- **Biosciences** with niche industries of plant and agricultural technology, animal sciences, and biomedical fields. Missouri is becoming the AgTech capital of the world through research developed here by the University System and private companies such as Monsanto, Nestle-Purina, Teva Pharmaceuticals and Mars Petcare – all of which are located along the I-70 corridor.
- **Health and Science and Services** with niche areas of health care innovations, health sciences and health services. Missouri, and in particular the I-70 corridor, has seven prestigious research hospitals that attract students, patients, researchers and innovative products. Barnes-Jewish is located in St. Louis and Columbia, Children's Mercy Hospital in Kansas City, Missouri Baptist in St. Louis, St. Louis Children's Hospital, St. Louis University Hospital, St. Luke's Hospital in Kansas City and University of Missouri Health Care in Columbia.
- **Information Technology** with niche areas of software and hardware design, data centers and technology resource centers. Notable companies who are large employers along the I-70 corridor include Cass Information Systems, Emerson Electric and IBM.
- **Financial and Professional Services** with notable companies along I-70 including Federal Reserve Bank, Bank of America, Edward Jones, Scottrade, PricewaterhouseCoopers (accounting) and Burns and McDonnell (engineering). These firms are major employers with employees and customers typically traversing from suburbs or other communities for their services.
- **Transportation and Logistics** with niche industries of freight haulers, warehousing and wholesalers. Notable companies along the I-70 corridor include Graybar, LMS 3<sup>rd</sup>-party logistics firm, Excel (a division of DHL freight), FedEx, Phoenix International freight

forwarder, Prime Trucking, XPO Logistics, underground warehousing and multiple distribution centers.

This strategy is successful as demonstrated by the Missouri's Purchasing Managers' Index (PMI). In July 2016 it was 52.3, according to the monthly Mid-America Business Conditions Survey, conducted by Creighton University. Economists consider the index, which measures such factors as new orders, production, supplier delivery times, backlogs, inventories, prices, employment, import order and exports, a key economic indicator for a state. A score greater than 50 indicates an expansion economy. Missouri's PMI index is still at an expansionary level and leading the Midwest for the third consecutive month. For comparison, the national PMI for manufacturing is 52.6 and for non-manufacturing it is 55.5 for July 2016.

Much like the interstate highway system, Hyperloop can begin in Missouri and branched out to cover the entire nation.

## **Government & Policy**

### **12. How Missouri normally invests in infrastructure**

- Missouri's highway infrastructure projects use direct funding of 100 percent of the capital cost by the state, with 100 percent of the operational cost of the project borne by MoDOT. The capital costs are primarily funded with 80 percent federal sources and 20 percent state sources. Occasionally, local governments and private entities also provide funding for specific infrastructure projects. The operational costs are generally 100 percent state-funded. In 2016, the Missouri General Assembly approved an additional \$20 million in state general revenue for cost-sharing projects across the state. City and county governments were to provide a 50 percent match to build projects with regional interests that are not on the existing state construction schedule. In September, however, the Governor withheld those funds over concerns that other actions taken by the Legislature stood to reduce state general revenue.

### **13. Examples of completed infrastructure projects**

- MoDOT partnered with the Illinois Department of Transportation to build a new I-70 Mississippi River bridge (the Stan Musial Veterans Memorial Bridge) to create a new gateway between Illinois and Missouri that provided better connections to and through St. Louis. The \$670 million project included a landmark bridge structure, and the realignment and reconstruction of I-70 and numerous local roads on both sides of the state line. The project provided needed traffic capacity, improved system linkages and

community access, reduced traffic crashes, improved travel times and enhanced economic growth.

- The New I-64 project – the largest, single highway construction project in MoDOT history – involved rebuilding 10 miles of I-64 from west of Spoeede Road in St. Louis County to Kingshighway Boulevard in St. Louis City, including about one-half mile of I-170 as it approaches the I-170/I-64 interchange. The \$535 million project was completed on Dec. 7, 2009 – three weeks early and \$11 million under budget. The completed project handles 150,000 vehicles per day and serves as a major east-west corridor for local and long-distance freight and passenger travel.
- The kcICON design-build project improved 4.7 miles of I-29/35 in Kansas City, from just north of Route 210 (Armour Road) to the northeast corner of the downtown freeway loop. The project included the replacement of the Paseo Bridge with a landmark Missouri River crossing – the Christopher S. Bond Bridge. The project was completed in December 2010, on budget and six months ahead of schedule. The \$247.9 million project carries 102,000 vehicles per day and serves as a major connector route within the greater Kansas City area.
- Safe & Sound Bridge Improvement Program repaired or replaced more than 800 of Missouri’s worst bridges. The program was completed in October 2012 under its \$685 million budget and 14 months ahead of schedule. Accelerated design and construction processes resulted in 1.5 bridges being repaired or replaced each day of the program. Average bridge closure time was only 42 days – less than half the length of a conventional bridge replacement. There was at least one bridge project in each of the state’s 114 counties, impacting virtually all six million Missourians.

#### **14. Risk mitigations or guarantees typically offered to private sector investors in major infrastructure projects**

- A risk assessment process occurs with each complex or large-scale project undertaken by MoDOT. Project goals are identified along with determining project risks and mitigation strategies. MoDOT’s process uses partnering teams comprised of executives, regional managers and project staffs from the department and private sector to identify and address project issues proactively and as they arise. Local governments also are often involved in the partnering sessions.

#### **15. Transport appraisal model used by MoDOT to assess transport investment proposals**

- MoDOT uses the [Missouri Economic Research and Information Center](#) to conduct economic impact studies for transportation investments using the Transportation

Economic Development Impact System. The model addresses a project's economic impact on mobility for commuters and freight haulers along with changes to regional workforces and employers.

- Through MoDOT's ITTS partnership, we have the SHIFT model that looks at freight only on our interstates. It is based on freight flows and travel demand throughout the region.

#### **16. Effectiveness in capturing the radical impacts on time, spatial geography, and macro-economics due to Hyperloop**

- The available models will provide estimates of travel time savings and economic benefits associated with Hyperloop.

#### **17. Value of Time typically employed by MoDOT**

- For roadway detour cost calculations, MoDOT assumes \$22.70 per hour for truck delay and \$10.80 per hour for car delay.

#### **18. Top 3 socioeconomic benefits from constructing a Hyperloop**

- Expanded Economic Opportunities
- Improved Quality of Life
- Regional Cohesion

#### **19. Policy measures planned to stimulate modal-shift towards sustainable modes, energy efficiency programs, improved congestion methods, innovation and open data collection**

- MoDOT's [long-range transportation plan](#) includes four policy goals, two of which are investing in projects that spur economic development and provide better transportation choices.
- Funding for highway improvements is regulated by the Missouri Constitution and state statutes and governed by the Missouri Highways and Transportation Commission. Funding comes from state highway user taxes and fees and federal funds. Funding for non-highway modes of transportation that are administered by MoDOT is primarily from federal sources with limited state funding appropriated annually by the Missouri legislature (\$14 million in each of the last two state fiscal years). One of MoDOT's seven performance areas is to advance economic development. Performance measures include the economic return from transportation investments, jobs created by economic development program projects and goods movement competitiveness.

## **20. How Missouri supports or incentivizes inward investment**

### **20a. What other types of financing resources, such as sovereign wealth funds, strategic investment funds, or CDFIs (community development financial institutions) are available to you?**

- MoDOT annually receives in excess of \$2 billion of state and federal revenue that stands appropriated for highway uses. The Commission has authority to leverage these funds to issue state road bonds. In addition, Missouri has numerous avenues to raise local funds, including transportation development districts, transportation corporations, community improvement districts, neighborhood improvement districts and tax increment financing. These entities have authority to issue bonds and assess special taxes, fees and tolls.

### **20b. How does Government in your region underwrite, de-risk, guarantee, or otherwise participate in, PPP deals to deliver infrastructure projects?**

- [Missouri statutes](#) include the Missouri Public-Private Partnerships Transportation Act in sections 227.600 to 227.669. This act provides the specific processes for public-private partnerships, which could include Hyperloop.
- MoDOT enters into contracts with private entities to deliver infrastructure design-build projects. These projects are commitments of the MHTC, which maintains AAA credit ratings on its debt.

## **21. Legislative process for Governmental approval and typical rough timeline for infrastructure projects**

- MoDOT is governed by a six-member, bi-partisan Commission that is appointed by the Governor and confirmed by the Missouri Senate. It has the sole responsibility for the state transportation system, choosing projects and for letting contracts. The Missouri General Assembly and the Governor have no authority in the project selection process.
- MoDOT's construction program is established in the five-year Statewide Transportation Improvement Program (STIP). It covers a rolling five-year period of time. As each year is completed, the STIP is updated and a new year is added.
- The projects are identified using a collaborative process that involves metropolitan planning organizations, regional planning commissions, local citizens and the general public. Through public involvement, all Missourians have a say in how transportation dollars are spent.

**21a. Which government agencies provide advice to legislature in you region? Please list and describe their level of involvement.**

- MoDOT and local governments routinely provide information to the legislature to aid them in making favorable laws and investments for improving transportation in Missouri.

**21b. Which independent expert bodies provide advice to your policy makers?**

- A diverse group of testimony is received for legislative proposals, including universities, contractors, lobbyists and state agencies.

**21c. What lobby groups actively represent current modes of transport in your region?**

- Owners of the transportation mode, including transit providers, railroads, river ports, the trucking industry and the bicycle/pedestrian community. Transportation stakeholders from the engineering and contracting communities, business and safety interests are motivated advocates for additional transportation investment.

**22. Regulatory bodies responsible for current modes of transport in Missouri**

- MoDOT regulates/owns state roads and bridges. MoDOT administers federal funding and Missouri legislative appropriations for other modes of transportation, but they are owned by private companies and local governments.

**22a. Are there innovation or research branches of your regulatory bodies that are typically the first touch point for new technologies? Please provide a brief commentary.**

- MoDOT’s “Road to Tomorrow” initiative is exploring all options, while also searching for sustainable revenue streams that can fund the transportation system of tomorrow. After a year of discovery, we are identifying pilot projects that would enable us to test the effectiveness of various innovations in advancing our vision. MoDOT is a member of the Transportation Research Board, which conducts national transportation research projects. The department also administers an annual \$1.7 million research program for state transportation research projects.

**Acceleration Plan**

Please explain how you would:

**23a. Accelerate the necessary Government legislation to permit Hyperloop to be constructed on your corridor**

- [Missouri statutes](#) include the Missouri Public-Private Partnerships Transportation Act in sections 227.600 to 227.669. This act provides the specific processes for public-private partnerships, which could include Hyperloop.
- Missouri legislators have shown support for port capital and freight projects in recent years by providing General Revenue funds.

**23b. Accelerate the necessary regulatory approval to operate Hyperloop on your corridor**

- MoDOT has used a partnering process within Design-Build process to bring regulatory authorities to the decision-making table, which has greatly accelerated project approvals.

**23c. Establish or adopt a procurement regime with enables Hyperloop to be delivered within procurement rules applicable to your region**

- Recently, MoDOT has successfully used a new right-of-way procurement process within a Design-Build project. The purchases were entirely handled by the private partners, which reduced the time to clear needed right of way.

**23d. Secure Government support for the project via public sector co-investment, investment guarantees, downstream participation in PPP-style regimes, etc.**

- MoDOT is a governmental entity that is leading the initiative.

**23e. Secure government inward investment incentives**

- MoDOT would work with state legislators and the Missouri Department of Economic Development to identify tax incentives and economic development funds for the project.

**23f. Align economic development policy to maximize the benefits of Hyperloop on your corridor**

- Utilize existing network of Missouri's economic development industry, chambers of commerce and the Missouri Department of Economic Development.

**23g. Align spatial development policy to maximize the benefits of Hyperloop on your corridor**

- See response to f.

**23h. Develop a project finance structure which is likely to attract maximum commercial investor participation**

- See response to f.

#### **24. Opportunities to partner with other region(s)**

- Develop public-private partnership(s) between MoDOT and our transportation counterparts: railroads, trucking industry, Amtrak, StL and KC transit authorities, airports and airlines.
- MoDOT will collaborate with metropolitan planning organizations, local governments, Kansas City SmartPort and the St. Louis freight district.
- MoDOT can utilize existing relationships with utility and permitting agencies along the corridor to streamline the project.
- MoDOT has a long history of successfully partnering with neighboring states to deliver transportation improvements.
- (May be able to partner with Illinois or Kansas depending on the location of the project.)

#### **24a. What is the envisioned structure of partnership?**

- Missouri is uniquely located in the center of the United States with access to the 7<sup>th</sup> largest state highway system in the nation, along with the 2<sup>nd</sup> and 3<sup>rd</sup> largest rail hubs in the nation in Kansas City and St. Louis. St. Louis is also home to the nation's 3<sup>rd</sup> largest inland port. In total, this existing transportation network moves over 1.1 billion tons of freight each year through the state on highways, rail, rivers and airports. The hyperloop will provide a key additional mode to this existing network that would increase the speed and reliability.

#### **24b. If your corridor crosses jurisdictions, what regulatory body is responsible for oversight and what types of approvals would be needed for this project to succeed? Who would be responsible for build, operate, maintain in this scenario?**

- MoDOT would be responsible for coordinating oversight and approvals that cross jurisdictions. A private entity/consortium contracted through MoDOT would be responsible for building, operating and maintaining the system.

#### **25. Are there potential investors in your project group? If so, please provide details such as nature of entity, investment focus (utilities, infrastructure, innovation, property and real estate), typical quantum of investment, links to last published report and accounts for public corporations or financial information for private entities, and a list of recent investments most relevant to the proposed Hyperloop project.**

- MoDOT would collaborate with its transportation counterparts: railroads, trucking industry, Amtrak, St. Louis and Kansas City transit authorities, port authorities, airports and airlines.

**26. Please identify any expertise that you would like to contribute to further study and provide contact information:**

- Civil engineering and alignment selection
- Project management and delivery
- Demand forecasting in collaboration with East-West Gateway Council of Governments and Mid-America Regional Council