Appendix F: Scenario Planning

This technical memorandum discusses scenario planning, a visioning tool for the future of Missouri freight and freight planning.

Why scenario planning?

Before one can begin any sort of plan, a future must be defined to plan towards. Traditionally, this has meant looking at past data trends to predict the future. However, this does not work for freight plans. Unlike traditional plans, which are driven by population and job growth, statewide freight growth is largely a function of global trends which are much more volatile and unpredictable. Essentially, a decision made half-way around the world can have a dramatic effect on roadway volumes in rural Missouri.

Scenario planning is an alternative to the traditional planning method, which utilizes global trends to develop various future scenarios that allow MoDOT leaders and freight stakeholders to evaluate and plan for likely futures. Unlike the traditional quantitative methods, this process allows an open dialog that result in more informed decision-making. Namely, it allows planners including stakeholders such as modal and operational experts and public officials to discuss trade-offs, nuances and cause/effect relationships that the traditional methods would not identify. By working through the alternate futures described in each scenario, stakeholders were able to extract common needs that are likely to be relevant no matter what the future may hold.

Scenario Development

The project team began this process by identifying probable future trends based on lessons learned during stakeholder outreach, known industry trends and the MoDOT LRTP. **Table F-1 i**dentifies the key trends identified that served as the framework for the development of the future scenarios.

Table F-1: Trends Driving Future Freight Movement in Missouri

Identified Trend	Description
Increase/Reduction in Global Trade	Sustained increases or reductions in global imports and exports
Alternative Fuel Trends	Increases in production and usage of alternative fuel sources
Transportation Network Conditions	Travel time and reliability is severely impeded by poor system conditions
Panama Canal Expansion	Widening of the Panama Canal could dramatically change freight flows
Science and Technology Advances	Advances in science and technology, such as advanced agricultural pesticides or machinery
Aging of the Missouri Population	Average life expectancy continues to increase
Increase in Population	Continued increases in the population of Missouri, the US and the World
High and Volatile Fuel Prices	Increase in price and volatility of all oil based fuels
Increase in Climate Regulations	Increasing air quality concerns and increasingly stringent environment regulations
Low-cost Batch Manufacturing	Widespread adoption of technologies enabling efficient and low-cost small batch manufacturing
Online Retailing	Shift towards online purchase and point of use delivery leading to reduction of physical retail stores
Re-domestication of Manufacturing	Rebound of US manufacturing jobs returning from overseas
Security Threats	Large increase in the number and magnitude of threats (domestic and abroad)
Increase/Reduction in Funding	Increases or reductions in funding for freight transportation
The "Sensible Network"	Widespread ability to capture and monetize real-time sensing data on all products, vehicles, and facilities across a supply chain at essentially no cost

Defining Future Scenarios

Consideration of the future trends and impacts, listed in **Table F-1**, led the following three future scenarios:

Hungry World

Missouri will play a major role in feeding the ever-increasing world population (35% increase by 2050). As a top 10 agricultural producer in the United States, Missouri's role in feeding the world will continue to require changes in how freight moves.

Global Market

The current global trend of re-shoring manufacturing will continue. Given Missouri's manufacturing sector's history, this would elevate Missouri's position in the global marketplace.

Convenient Living

Missourians travel and freight movements will change as people drive considerably less - seeking to work from home and live in communities where they can walk to jobs, schools, and other services - more shopping will be done online with increasing residential deliveries resulting in the decrease of traditional shopping trips.

Initial Reaction to the Scenarios

Regardless of the scenario, future supply chains will be very different than today. These changes will be visible to Missouri as distribution networks adapt and demands on the freight system shift. Scenario planning helps Missouri to be more flexible and able to adapt to capture future economic development opportunities. Each of the following impacts describes how trends and scenarios could impact the supply chain/distribution network:

Table F-2: Potential Supply Chain Changes [1]

Impacts	Description
Origin (Sourcing)	Sustained increases or reductions in global imports and exports
Destination	Increases in production and usage of alternative fuel sources
Routing	Travel time and reliability is severely impeded by poor system conditions
Volume	Widening of the Panama Canal could dramatically change freight flows
Value Density	Advances in science and technology, such as advanced agricultural pesticides or machinery

A scenario planning workshop was held during the March 2014 Freight Steering Committee meeting. During the workshop, members discussed the potential scenarios and what Missouri would have to do to successfully capture the unique opportunities presented by each scenario.

To prepare for the workshop, stakeholders were provided with an overview of the scenario planning process and alternative future scenario descriptions and each participant was asked the following questions via electronic survey:

[1] "Strategic Issues Facing Transportation: Volume 1 Scenario Planning for Freight Transportation Infrastructure Investment" NCHRP 750 Report, 2013, http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_750v1.pdf

- Question 1: In the future, if agricultural demand significantly increases in Missouri due to dramatically increasing populations all over the world, which of the following two things would be most impacted?
- Question 2: In the future, if manufacturing significantly increases in Missouri due, perhaps, to rising costs overseas and if trade is more open globally, which of the following two things would be most impacted?
- Question 3: In the future, if Missourians across the state continually seek the convenience of working from home (traveling less for work during peak hours, easing congestion) and online shopping is used more and more (increasing the last mile delivery, box trucks and vans) and "livable" communities are an increasing trend in urban areas (more trips are made by walking or biking, easing roadway congestion), which of the following two things would be most impacted?

For each question, the respondents were asked to identify which of the distribution impacts, were likely to take place (see **Table F-2** for impact definitions). Results of the survey are shown in **Table F-3**. Many of the results were somewhat expected. The Hungry World scenario identified routing and volume as the largest impacts on distribution network. This is logical as Missouri imports agriculture inputs and exports the resulting product. The Global Market scenario identified impact to flow origins, volume, and routing, which would coincide with in-state manufacturing growth. Flow destinations and routing were selected for the "Convenient Living in a High Tech Missouri" scenario as freight moves away from big box retailers to more home delivery.

Table F-3: Initial Scenario Survey Results

	Impacts						
Scenarios	Flow Origins	Flow Destinations	Routing	Volume	Value Density	Not Sure	Other
Hungry World	2	1	10	12	0	0	1
Global Market	5	3	7	6	2	0	1
Convenient Living	2	10	6	3	2	0	0

Steering Committee Workshop

After presenting an overview of the scenario planning process, committee members were broken out into three groups for more in-depth discussions on the three alternative futures. The following questions were asked of each group for each scenario:

- How does this impact freight planning in Missouri?
- Will a more multimodal transportation system be needed?
- What kind of risk does this pose to Missouri's Transportation?
- Does this future require more emphasis on preservation, modernization or expansion type projects?
- Are current funding trends adequate or require higher or less funding?

- Are policy, procedure or regulation changes necessary?
- What partnerships would help lead to success?
- Is there something that we need to include in this future that may present an impact?

Feeding a Hungry World

Participants agreed that this scenario would stress the state's transportation network and impact bridge conditions, particularly in rural areas. However, urban areas would be impacted as well. The group predicted that with continued funding limitations, solutions to these impacts would be limited.

The group identified transportation connectivity as a major limitation to the ability of Missouri to capture this opportunity. In particular, navigability of the Missouri River, farm-to-market road conditions, and the ability of the interstate system to handle the volume of agricultural products exported beyond the state's borders. Committee members also agreed a more robust multimodal transportation system would be needed to move agriculturally based freight under this scenario.

As a result, the group encouraged the state to track agricultural trends, to increase and diversify funding opportunities, and to continue relationship building with the private sector.

Changing Access to a Global Market

Under this scenario, the Missouri transportation system would be severely taxed by the dramatic increase in imports (raw materials) and exports (manufactured goods). Particularly challenging, will be the scenario's effect on suburban and urban areas where most of the state's workforce and transportation centers are located.

Committee members suggested that additional intermodal facilities would need to be built to capitalize on the existing multimodal freight system. In particular, road-to-rail connectivity is particularly important to link near-sourced Mexican suppliers to Missouri manufacturers. Additional north-south capacity (whether physical or operational) will allow better utilization of ports and rivers. However, MoDOT will have to work with USACE to continue to stress the importance of maintaining channel depth and infrastructure (locks and dams) on the Mississippi and Missouri Rivers to truly capitalize on the significant capacity available on the inland waterway system. While the steering committee identified many needs, it identified available air cargo capacity as a huge strength for Missouri under this scenario.

To appropriately prepare for a "Global Market" scenario, the committee all agreed that more funding must be provided no matter the mode, but especially for waterways, highways and rail. Without infrastructure investments, Missouri's location advantages will be meaningless. Current funding processes and incentives need to be changed in order to compete with other states.

Convenient Living in a High Tech Missouri

Committee members quickly recognized that this scenario was very different than the others. It would require a fundamental shift in not only MoDOT operations, but of most (if not all) supply chains in Missouri.

While commuter volumes would decrease, freight flows would increase. These increases would take place on local road networks that were not designed to handle the weight or the geometrics involved with a heavy volume of delivery vehicles. Additionally, this scenario significantly threatens two revenue streams: fuel and sales taxes. The fuel tax would be significantly reduced by the reduction of personal vehicle trips. A decrease in sales tax revenue would occur as more sales happen online.

On the private side, this shift could realign and require the need for additional distribution centers. Additionally, committee members suggested private industries could partner with a company/agency like the United States Postal Service to cross-dock (a logistics practice of unloading materials from an incoming truck or railroad car and loading directly into outbound trucks or rail cars, with little or no storage in between) and consolidate neighborhood deliveries. The group discussed that of all of the scenarios, partnership will be a critical aspect to the success of Missouri adapting and capturing the opportunities associated with this scenario.

Overall Recommendations

While each of the scenarios has key takeaways and lessons learned, there are several commonalities that could reasonably be expected to drive the success of the Missouri Freight System, no matter what scenario. These recommendations will provide critical inputs to the project selection and policy development sections of the *Freight on the Move* effort:

- **Proactive Partnership**: Collaboration within and between the public and private sectors will be critical.
- **Strategic Investment**: Decisions must be made in the context of supporting economic growth through emerging opportunities.
- **Flexibility**: MoDOT processes must be responsive to private sector needs.
- **State of Good Repair**: Focus on road, waterway, rail and bridge improvements.
- **Multimodalism and Connectivity:** The current highway network cannot handle future freight needs. In order to continue the state's economic prominence, new and improved intermodal connectivity points and linkages must take place.
- **Funding:** More infrastructure funding is needed and increased flexibility to allow allocation to solve complex freight challenges across modes.