Appendix A: Preliminary Alternative Concepts Dismissed from Consideration

A.1 TDM Alternative

TDM strategies are relatively low-cost measures that reduce travel demand to improve traffic flow. Common TDM strategies include:

- Implementing carpooling programs to reduce the total number of vehicle trips by increasing the number of occupants in some vehicles.
- Improving pedestrian and cyclist facilities to reduce the total number of vehicle trips by converting some short distance trips to non-motorized modes.
- Charging a level of toll on the existing bridge that would discourage unnecessary trips. Fee systems can be set up to vary throughout the day so that trips during peak travel times have a higher cost.
- Coordinating with local employers to institute flexible work schedules or telecommuting programs. This helps to reduce the total number of trips and/or distribute trips beyond the most congested periods.

The TDM Alternative does not address the project purpose of replacing the functionally obsolete and structurally deficient bridge, providing cross-river mobility, and improving safety. This alternative was dismissed from further consideration.

A.2 TSM Alternative

TSM strategies are relatively low-cost measures that improve traffic flow by increasing network efficiency. Common TSM strategies include:

- Applying Intelligent Transportation Systems (ITS) to the existing network employs technology to improve network performance. ITS strategies help pass traffic information to the public so motorists can make informed decisions about trips and route choices.
- Coordinating traffic signals increases vehicle throughput by reducing delay at a series of intersections.
- Creating high occupancy vehicle (HOV) lanes rewards vehicles with multiple passengers by decreasing trip times. This can help to increase vehicle occupancy rates and decrease the total number of vehicles on the road.
- Establishing reversible lanes during peak hours increases system flexibility to handle high volumes of directional traffic during peak periods.

The TSM Alternative does not address the project purpose of replacing the functionally obsolete and structurally deficient bridge, providing cross-river mobility, and improving safety. This alternative was dismissed from further consideration.

A.3 Transit Alternative

No transit services are currently offered within the project area. Consideration was given to initiating a fixed-route transit service; however, this strategy would not address the project purpose of rehabilitating or replacing the functionally obsolete and structurally deficient bridge, providing cross-river mobility, and improving safety. This alternative was dismissed from further consideration. It should be noted that a ferry service – a waterway-based transit option – was considered separately and is addressed in the next section.

A.4 Ferry Alternative

Although a ferry operation could address cross-river mobility and improve safety on the bridge, it is not a practical long-term solution for the US 421 Bridge between Milton, Kentucky and Madison, Indiana. Negative impacts on emergency response time, negative impacts on truck traffic, and the combination of inadequate capacity and excessive cost are three fatal flaws identified that dismiss a long-term ferry service from further consideration. Each flaw is explained below.

A.4.1 Emergency Response

The additional time required to traverse the Ohio River on a ferry boat compared to the US 421 Bridge would be detrimental to emergency responders. Milton and Trimble County in Kentucky rely on the hospital in Madison for medical treatment. Ferry service could add 15 minutes or more to emergency response times. The impact to emergency response time was considered to be a fatal flaw for ferry service as a long-term solution.

A.4.2 Capacity and Cost

The cost and complexity of a ferry system designed to meet the capacity of cross-river traffic between Milton and Madison would be extreme. The link would need to carry 126 vehicles in a 15-minute peak period per direction[1].

Assuming a ferry boat could traverse the river (approximately 2,000 feet wide) at this location in 5 minutes, the ferry system would then have to load and unload in approximately 10 minutes to accommodate 126 vehicles in 15 minutes, the constraint outlined above.

A variety of vehicle size combinations were analyzed for feasibility. Loading and unloading a 126-vehicle capacity ferry would take longer than the acceptable 10-minute limit (allowing for a 5-minute crossing). More ferries would be necessary to decrease travel time for vehicles. Even employing five medium-sized ferries with a 25-vehicle capacity each, loading and unloading in 10 minutes is unlikely. Both of these examples represent extremely expensive options. Based on a preliminary estimate from Captain Nolan of Inland Marine Service, one medium size ferry (approximately 25 vehicle capacity) could cost between $3 million for an acceptable used boat (if one were available) to $10 million if a new one had to be constructed.

Aside from loading/unloading issues and costs to buy the ferries, securing land and constructing appropriate terminals on both sides of the river to handle five medium-capacity ferries is not practical due to costs and environmental impacts. The limit on development in both communities would be detrimental to the economies and quality of life. Significant costs would be incurred for the necessary infrastructure, including passenger shelter, office space for employees, a designated access lane for emergency response vehicles, parking spaces, and drop off and pick up area. Additional ferries also increase expenses for additional crew and operation and maintenance.

[1] The existing US 421 Bridge carries 870 vehicles per hour in the PM Peak. Given a Peak Hour Factor of 0.88, the peak 15 minute volume is 248. Given a 51-49 directional split, the peak one-way 15 minute volume is 126 vehicles. Therefore, the system should be able to move 126 people one way in 15 minutes. Note, this number is based on existing volumes and does not consider future traffic growth.

Last, it should be mentioned that competition with barge traffic on the Ohio River (daily approximately 8 to 10 commercial) presents another operational challenge and would further reduce capacity.

A.4.3 Truck Traffic

Ferryboats could not effectively transport the 428 trucks per day (4% of total traffic) currently using the US 421 Bridge between Milton and Madison. Replacing the US 421 Bridge with ferry service as a long-term solution would increase shipping times and costs for goods transported to and through this area. The nearest bridges are 46 miles downstream between Louisville, KY and Jeffersonville, IN and 26 miles upstream between Vevay, IN and Warsaw, KY. Traffic analysis completed for this study shows that 55% of truck trips are regional, ending within 5 miles of the bridge. A 50+ mile detour route would increase shipping costs significantly. The impact on truck traffic and the businesses they serve was considered a fatal flaw for ferry service as a long-term solution.

A.4.4 Ferry Service as a Short-term Solution

However, ferry service could be considered as a temporary solution during construction of a superstructure on existing piers. Travelers would likely be more accepting of the significant travel delays in exchange for a long-term improvement.

Purchasing two ferry barges (15-vehicle capacity) and hiring tugs to run the service might be a lower cost approach to such a temporary service. With two ferries running simultaneously (3-4 round trips per hour per ferry) as many as 120 vehicles could be transported per hour. The ferry barges could be resold after construction of the bridge. However, environmental impacts and investments for infrastructure to set up the service (passenger shelters, office space, a dedicated EMT access lane, parking areas, roadway connections, and loading/unloading areas) and operational/maintenance costs would still apply.

If ferry service is utilized temporarily during construction, air service should be available for emergency transport to the hospital in Madison, Indiana.

A.5 Tunnel Alternative

Consideration was given to construction of a tunnel, with associated highway approaches, under the Ohio River. A preliminary cost estimate for constructing a tunnel was developed. The Ted Williams Tunnel in Boston was the last tunnel underwater that has been constructed in the United States. Preliminary estimates, based on actual construction cost of the Ted Williams Tunnel indicate that such a tunnel would cost approximately $800 million (2008 dollars) to construct. Significant additional costs would be incurred to construct the necessary highway approaches on both sides of the river and for the additional operating and maintenance expenses associated with a tunnel. The construction cost estimate for the tunnel alone is more than five times the estimated cost of any other alternatives considered.

Due to the necessary depth of the tunnel under the water level (approximately 100 feet), it may not be possible to achieve acceptable grades on the approaches to the tunnel and stay within the communities of Milton and Madison. If the tunnel is not easily accessed from Milton/Madison, it has little value for local trips. It also does not meet the identified project purpose to maintain community connectivity. Therefore, the cost of this alternative was considered to be fatally flawed. As a result, this alternative was not carried forward for further evaluation.