Executive Summary

The concept to replace the existing Lake Parkway freeway along Lake Michigan with an arterial facility, including replacing Hoan Bridge with a moveable structure was analyzed to determine travel impacts. This cursory study of the project's potential impacts resulted in the initial findings shown in Figure 1.

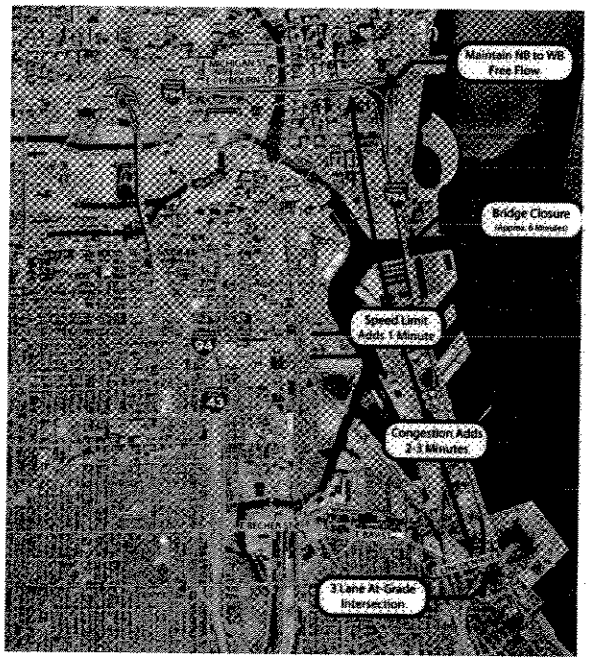
The Lake Interchange, connecting I-794 with Lincoln Memorial and Lake Parkway, serves downtown Milwaukee. Downtown is a significant destination, resulting in high volumes of traffic traveling northbound to westbound at the Lake interchange during the AM peak. These high volumes require the free-flow movements currently provided by the Lake interchange.

Traffic movements through the Bay Street/Carferry Drive interchange are primarily through movements, which could be accommodated with at-grade intersection with three lane approaches. The next access point south on Lake Parkway is at Oklahoma Avenue, which is already an at-grade intersection.

The modification of Lake Parkway and the Hoan Bridge could have travel time impacts for those motorists who currently use the facility. In the near term, three factors will impact travel time along Lake Parkway:

- Speed reduction (55 mph to 40 mph) adds one minute
- Congestion, primarily at proposed Bay/Carferry intersection adds one to two minutes
- Bridge opening of six minutes on average, about once per day

Figure 1 Executive Summary Findings



Future conditions in the study area will have significant impacts on the use of Lake Parkway. Specifically, the following factors will need to be reviewed in more detail to assess travel patterns and travel times along Lake Parkway:

- peak spreading
- modal shifts, including new service and transit oriented development
- changes in routes, including diversion from I-43/94
- refined estimates of traffic growth
- capacity expansion on other facilities
- operations at Lake Parkway and Oklahoma Avenue intersection
- level of redevelopment along Lake Parkway
- number and location of additional access points along Lake Parkway

Introduction

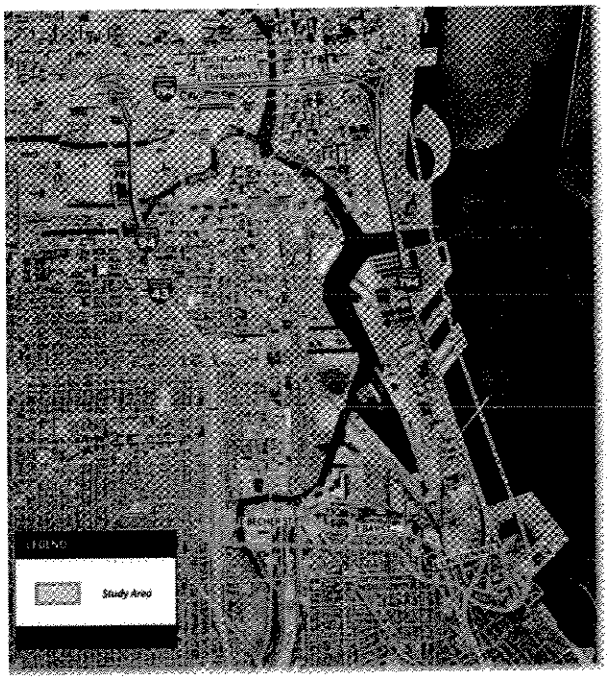
The Wisconsin Department of Transportation is considering a project that would rebuild the Hoan Bridge, modify Lake Parkway and allow for redevelopment of the Milwaukee harbor area. The modified Lake Parkway would be lowered to serve as an arterial, allowing controlled access to the adjacent land parcels. This lower roadway profile would require a lift or bascule bridge in order to maintain shipping functions within the harbor. The proposed project would have three primary impacts to motorists:

- Reduced speed due to conversion from interstate to arterial
- Reduced speed due to additional traffic from new developments
- Additional delay during bridge operations

Study Area

The proposed project along Lake Parkway extends from the Lincoln Memorial interchange to south of the Carferry interchange as shown in Figure 2. Parcels considered for redevelopment as part of this project are located around the harbor, including those along Lake Parkway, north of Bay Street and east of 1st Street.

Figure 2 Study Area



Existing Conditions

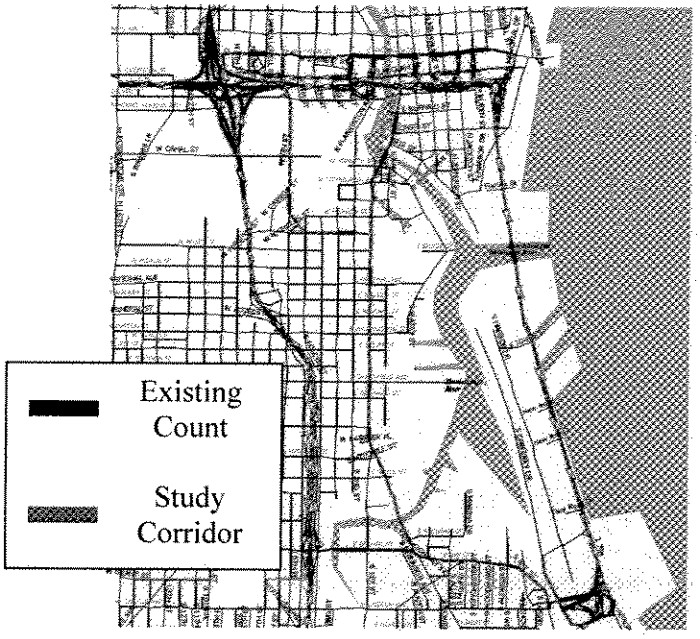
A cursory traffic analysis was conducted to estimate potential effects of the proposed project. The study analyzes traffic impacts only on the major roadways within the study area. Additional travel time is the primary traffic measure being considered as part of this study. Traffic volumes along the major roadways were collected or estimated to support the travel time analysis. Further consideration of this project should include a more detailed traffic analysis including refinement of traffic volume estimates post-Marquette interchange construction, analysis of intersection operations and consideration of effects on other roadways.

Traffic Volumes

The traffic volumes in the study area have been affected by the recent completion of the Marquette interchange. Therefore, traffic volume data used for this project is a combination of historic traffic data previous to Marquette

interchange construction (pre-2005) and very recent counts conducted after Marquette interchange construction (October 2008). The available traffic volume data was collected from various sources including WisDOT tube counts (October 2008), WisDOT daily traffic volume books (pre-2005), WisDOT peak hour counts (2004) and City of Milwaukee tube counts (pre-2005). Figure 3 shows locations were peak hour and daily traffic volume data was available. Traffic volumes were estimated based on nearby traffic data for the remaining roadway segments in the study area.

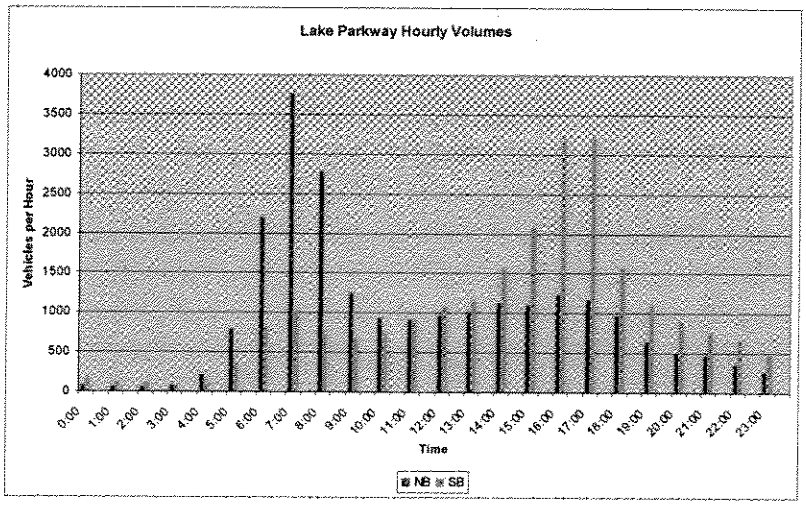
Figure 3 Available Traffic Volume Data



Source: WisDOT, Monthly Hourly Day of Week Summary for October 2008

Traffic patterns along Lake Parkway show very high peaking as shown in Figure 4. The October 2008 data indicates a peak hour factor of 19.4 percent for AM inbound, and 16.7 percent for PM outbound. These high peak factors are inconsistent with other freeway facilities in the area, with values typically 8 to 10 percent. This high peaking factor on Lake Parkway indicates the facility is underutilized through most of the day and may be taking diverted traffic from other regional facilities, primarily I-43/94. It is reasonable to believe that the peaking characteristics along Lake Parkway would be more consistent with other area facilities if there was less unused capacity on Lake Parkway.

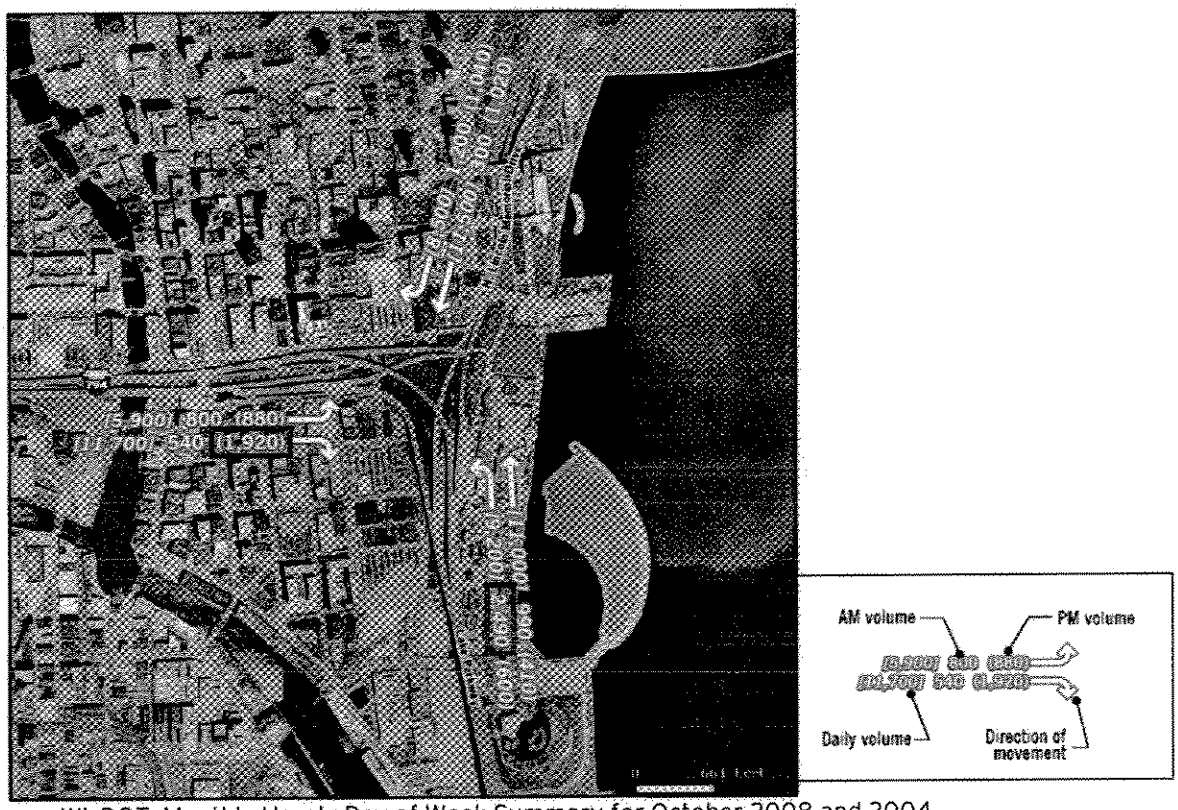
Figure 4 Lake Parkway Hourly Volumes



Lake Interchange

The major traffic operational constraints to modifying Lake Parkway in the harbor area are the interchanges at either end of the viaduct. The northern interchange, or Lake Interchange, is the intersection of I-794 with Lincoln Memorial Drive. The 2008 peak hour traffic volumes for Lake Interchange are shown in Figure 5. The high volume of AM traffic northbound to westbound (2,490) requires free flow accommodations, consistent with the existing two-lane free-flow ramp. The return PM volume, eastbound to southbound, similarly requires considerable priority. Modifications to Lake Parkway should maintain the priority of these two critical movements and provide the northbound to westbound movement as a grade separated free-flow movement.

Figure 5 2008 Peak Hour Traffic Volumes at Lake Interchange

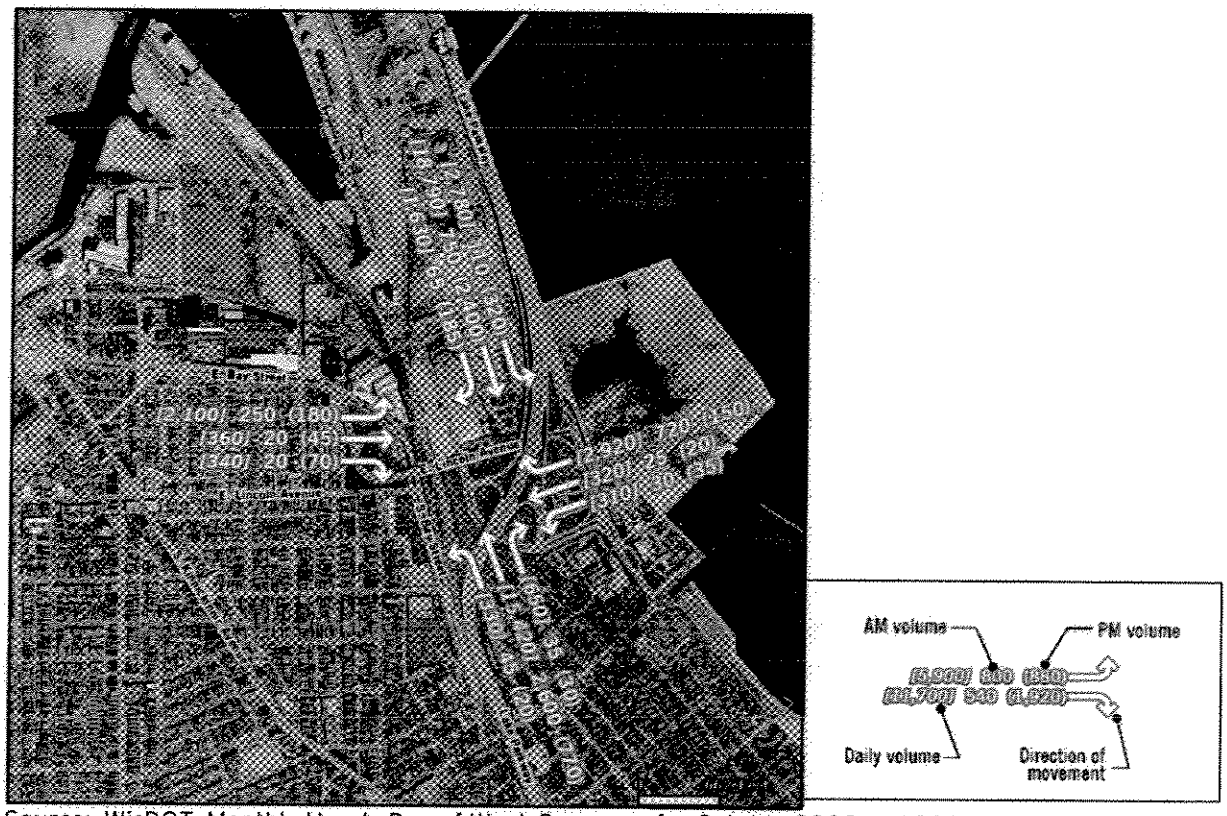


Source: WisDOT, Monthly Hourly Day of Week Summary for October 2008 and 2004 Milwaukee Area Freeway System Traffic Volume Summary Map

Bay Street/Carferry Drive Interchange

The Bay Street and Carferry Drive interchange with Lake Parkway is the southern limit of the project. The peak hour traffic through this location, shown in Figure 6, has a predominant north-south pattern, with ramp movements primarily to and from the north

Figure 6 2008 Peak Hour Traffic Volumes at Bay Street/Carferry Drive Interchange



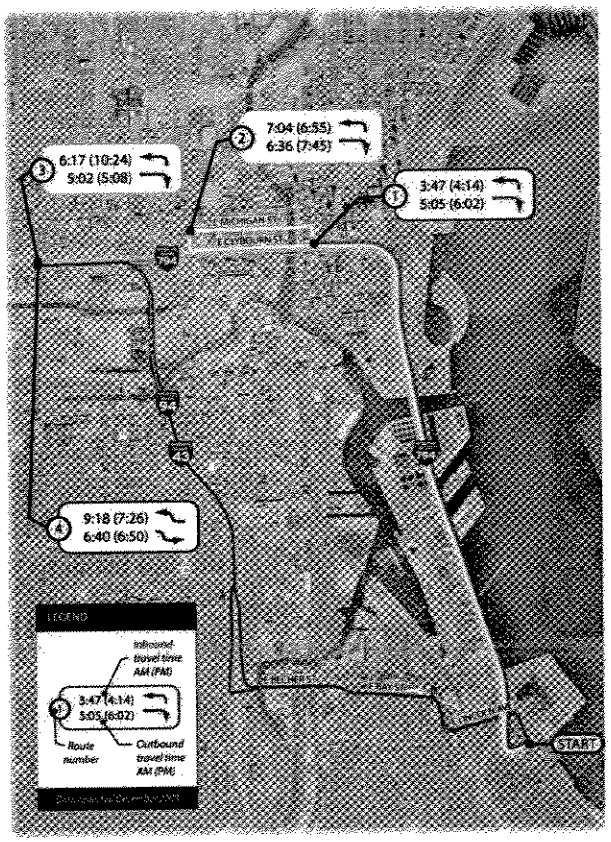
Source: WisDOT, Monthly Hourly Day of Week Summary for October 2008 and 2004 Milwaukee Area Freeway System Traffic Volume Summary Map

Preliminary traffic analysis of this location indicates that the existing peak hour traffic volumes could be adequately served with a three lane signalized intersection. The higher AM northbound volumes result in an overall intersection level of service of D, while the PM peak volumes can be served with level of service B. These levels of service would provide some additional capacity for growth in traffic volumes in the future. However, the intersection of Lake Parkway and Oklahoma Avenue to the south is currently experiencing operational issues. A more detailed study of operations considering both the proposed Bay Street/Carferry Drive intersection and the Oklahoma Avenue intersection is required to provide more detailed recommendations for the area.

Travel Time Collection

Travel time data was collected along four corridors within the study area as shown in Figure 7. The collection was done using a floating car method, in which the vehicle driver attempts to keep pace with the average flow of traffic. Data was collected during peak periods during the dates shown in Table 1.

Figure 7 Existing Travel Times



Data was collected for four to six collection runs for most corridors. The average travel time for each corridor is shown by peak period and direction in Table 2.

Table 1 - Travel Time Collection

AM Runs	PM Runs
Friday, December 12, 2008	Thursday, December 11, 2008
Tuesday, December 16, 2008	Wednesday, December 17, 2008

Table 2 - Average Travel Time (Minutes:Seconds)

Period/Direction	1	2	3	4
AM Inbound	3:47	7:04	6:17	9:18
AM Outbound	5:05	6:36	5:02	6:40
PM Inbound	4:14	6:55	10:24	7:26 *
PM Outbound	6:02	7:45	5:08	6:50 *

* Limited data, only one travel time run conducted.

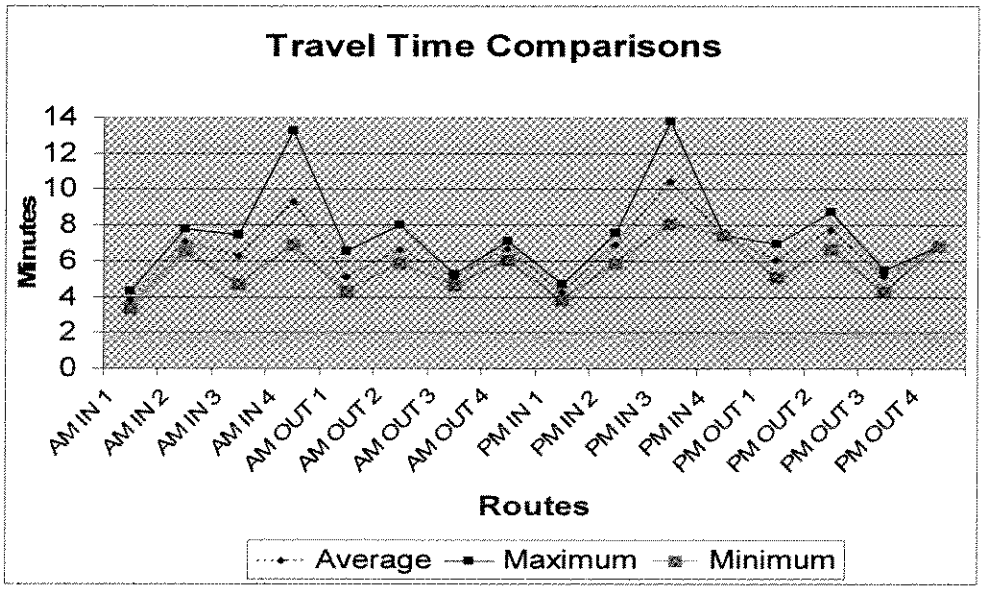
The range of travel times is shown in Table 3. Inbound travel times for Routes 3 and 4 were impacted by westbound traffic backups from points west of the Marquette interchange. Routes that did not pass through the Marquette interchange such as Routes 1 and 2 and all outbound routes had more consistent travel times, as shown in Figure 8.

Table 3 - Travel Time Range (Minutes:Seconds)

Period/Direction	1	2	3	4
AM Inbound	+/- 0:28	+/- 0:36	+/- 1:22	+/- 3:13
AM Outbound	+/- 1:08	+/- 1:05	+/- 0:18	+/- 0:32
PM Inbound	+/- 0:26	+/- 0:50	+/- 2:51	*
PM Outbound	+/- 0:56	+/- 1:02	+/- 0:35	*

* Limited data, only one travel time run conducted.

Figure 8 Range of Observed Travel Times along Lake Parkway



Port Activity

The potential project includes the construction of a lift or bascule bridge at the current location of the Hoan Bridge. In order to estimate the frequency and duration of a bridge opening event, the historic archive data of the Great Lake Water Institute's Milwaukee Inner Harbor webcam[1] was reviewed for the months of July and November, 2008. It is assumed any ship extending above the surface by 30 feet or more would require the bridge to open. Table 4 shows the frequency and duration of ships that would require the bridge to open.

Table 4 - Frequency and Duration of Large Ships in the Inner Harbor

Ship Activity	Month	
	July, 2008	November, 2008
Number of Ship Trips (>30')	31	31
Average Duration	4 minutes 15 seconds	3 minutes 55 seconds
Maximum Duration	9 minutes 35 seconds	7 minutes 30 seconds
Number in AM Period	1	5
Number in PM Period	4	1

The average duration for a ship to pass under the Hoan Bridge would be approximately 4 minutes and 5 seconds. Approximately seventy-five percent of all ships would be able to pass under the Hoan Bridge in 5 minutes and 10 seconds. Two instances of ships taking more than 5 minutes to pass under the Hoan Bridge during peak hours occurred in the two months of observation. It is assumed that bridge operations would require an additional 45 seconds to open and an additional 45 seconds to close, resulting in an average bridge closure of approximately six minutes..

Sketch Routing Tool

A sketch routing analysis tool was developed using TransCAD, a GIS-based transportation analysis software. The sketch routing tool identifies the shortest travel time path between two points and provides the cumulative travel time to complete the trip. The sketch routing tool was developed to consider two types of vehicle delay, intersection based and link based. The intersection based delay was estimated based on the specific type of movement within each intersection control type, with signalized intersections having greater delays than stop controlled movements.

The sketch routing tool also estimates delay at the link level based on volume of traffic on the link compared to a general capacity of the roadway segment. For purposes of this study, all study area roadways were classified into one of seven facility types. The facility type identifies the average free-flow speed and general hourly capacity per lane for the roadway as shown in Table 5.

[1] http://www.glwi.uwm.edu/features/webcam/

Table 5 - Roadway Attributes by Facility Type

Facility Type	Free-Flow Speed (MPH)	Per Lane Capacity (Hourly)
Interstate	55	2100
Principal Arterial	35	1000
Minor Arterial	30	900
Collector	25	800
Frontage Road	40	1000
Super Arterial	40	1550

The available traffic volume data was input into the sketch routing tool. Traffic volumes were estimated for all major roadway segments were traffic count information was not available. The interaction between roadway congestion and reduced travel speed is also a function of the facility type, using the Bureau of Public Roads (BPR) equation.

Equation 1 Bureau of Public Roads Equation

$$TT_f = TT_o*(1+\alpha* (^{volume}/_{capacity}) \wedge \beta)$$

TT_f = Final Travel Time
TT_o = Original Travel Time
α = Alpha β = Beta

The sketch routing tool then calculated a travel time for each roadway segment based on the segment's volume of traffic, the available capacity and the BPR equation. The intersection delays outlined in were also incorporated. A route was selected by the sketch routing tool to coincide with three routes for which travel time data was collected. The intersection delay values and BPR factors were calibrated to replicate the observed travel time conditions. Figure 9 compares the observed travel times along the four routes to those calculated by the sketch routing tool.

Figure 9 Sketch Routing Tool Travel Times Compared to Observed Data

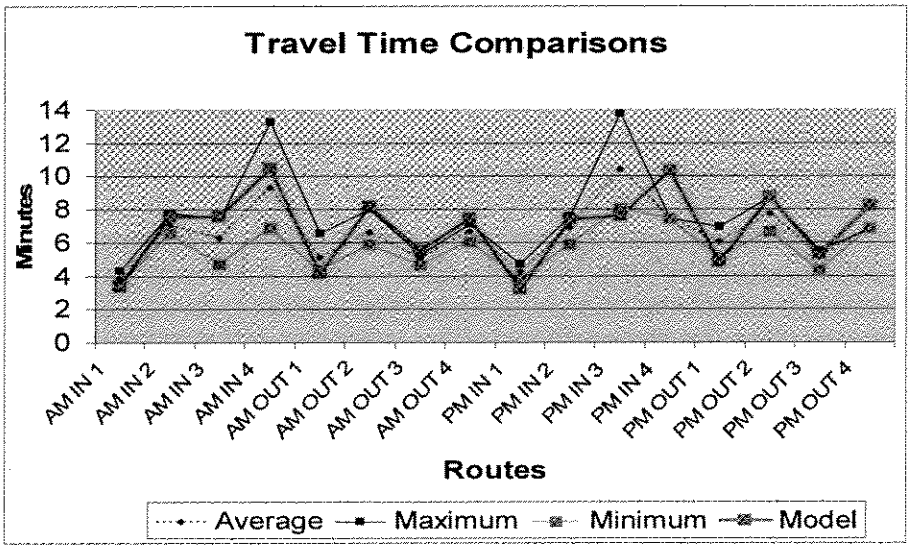
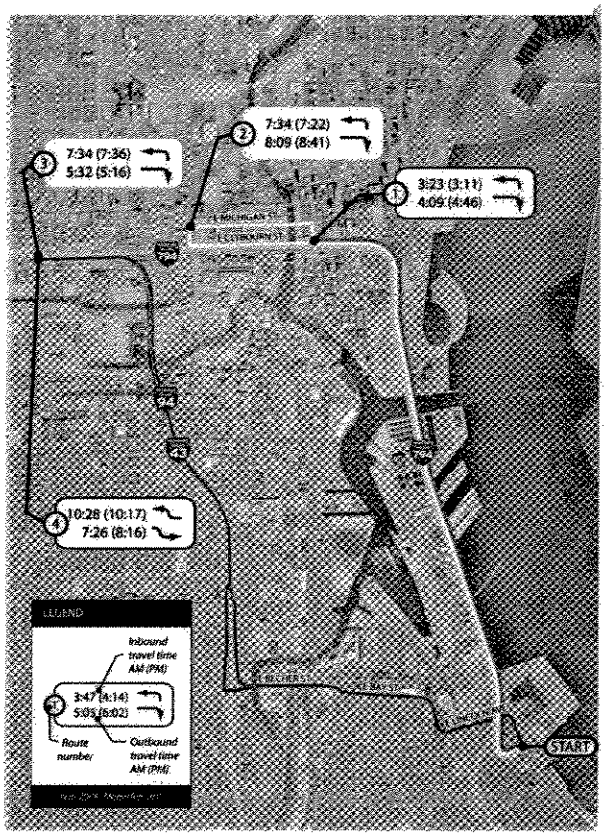


Figure 10 shows the inbound and outbound travel times for each route as calculated by the sketch routing tool for the existing condition.

Figure 10 Modeled Existing Travel Times

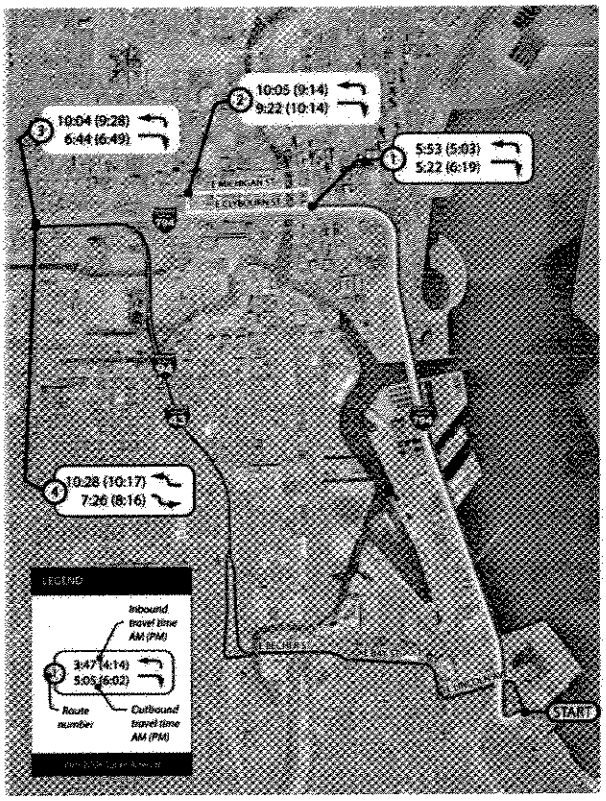


Rebuilt Lake Parkway Year 2008 Travel Times

The proposed project would modify the cross-section of Lake Parkway from interstate to arterial standards. For the rebuild Lake Parkway scenario, the sketch routing tool was modified to change the facility type of Lake Parkway from an six-lane interstate to a six-lane principal arterial (referred to as Super Arterial in Table 5), convert the interchange at Carferry to a signalized intersection and provide no additional access between the intersections. The speed on the facility is reduced from 55 miles per hour to 40 miles per hour. ,

The reduction in speed would increase the travel time along the facility by approximately one minute. The reduction in capacity from a freeway to an arterial would result in additional peak hour congestion, adding an additional two to three minutes. This figure is supported by the intersection operations analysis, which indicated approach delay of ninety seconds at the northbound AM approach to the Bay Street/Carferry Drive intersection. Figure 11 shows the estimated inbound and outbound travel times for a rebuilt Lake Parkway with no additional access for year 2008.

Figure 11 Rebuilt Lake Parkway Year 2008 Travel Times



Impacts of Additional Access Points

A major benefit of rebuilding Lake Parkway as an arterial is the increased access to adjacent parcels. This access would likely require signalized intersection, pending site-specific development plans. Additional signals to Lake Parkway would reduce the hourly per lane capacity. The capacity of 1,200 vehicles per hour per lane assumes very optimal intersection spacing and high green times for the Lake Parkway movements.

The delays associated with the additional signalized intersections would increase year 2008 travel time along the facility. The additional delay would be a function of the number of additional intersections, along with the magnitude of traffic accessing Lake Parkway at each respective access point. Refinement is required to the corridor plan with respect to access points and level of development before assessing travel time implications.

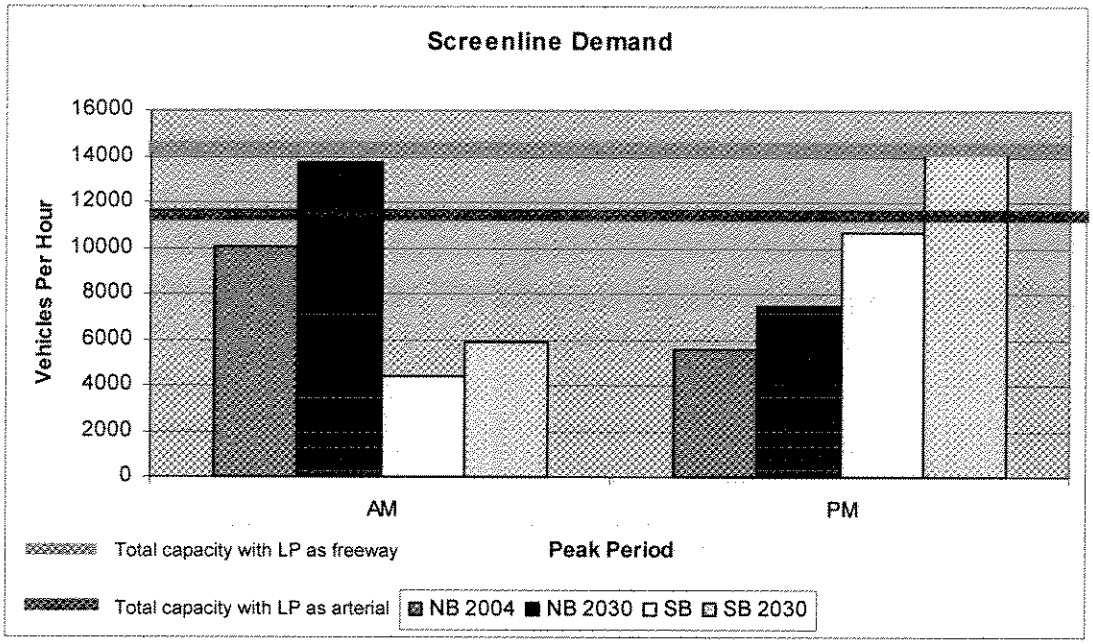
Future Conditions

Year 2030 Traffic Demands

Traffic volumes within the study area are anticipated to grow through year 2030. The Marquette Interchange Environmental Assessment indicated traffic to grow at approximately one-half to one percent through year 2025. Historic traffic counts in the area showed more aggressive growth, ranging from 1.1 percent along I-41/94 to 1.6 percent along Lake Parkway. The annual growth rates were applied to existing peak hour traffic volumes to establish the future baseline traffic demands.

Figure 12 shows that year 2030 traffic demand northbound in the AM and southbound in the PM will approximately equal available capacity within the study area with Lake Parkway as a freeway.

Figure 12 Peak Hour Traffic Demand Growth in Study Area



The capacity reduction of converting Lake Parkway to an arterial will result in peak demands exceeding available capacities, without considering the various factors that will influence future traffic demands such as:

- peak spreading,
- modal shifts,
- changes in routes
- refined estimates of traffic growth
- expansion of capacity to other facilities
- operations at Lake Parkway and Oklahoma Avenue intersection

The Interstate 43/94 corridor between Marquette and Mitchell interchanges has been identified by Southeast Wisconsin Regional Planning Commission (SEWRPC) as needing expansion by year 2025 [2].

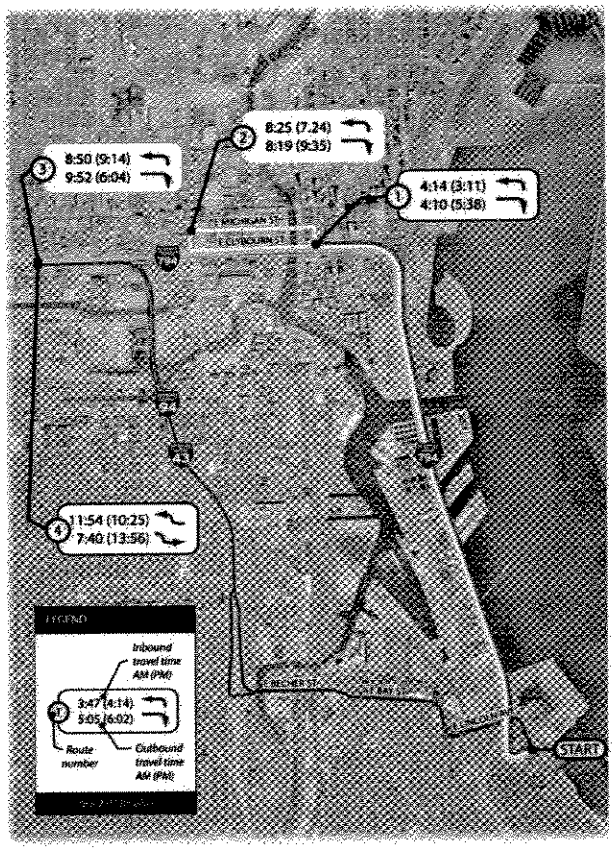
Future Baseline Travel Times

Travel time analysis was conducted for year 2030 baseline travel conditions. The 2030 baseline assumes no modifications to Lake Parkway or Hoan Bridge and no redevelopment of parcels along Lake Parkway.

The year 2030 baseline traffic volumes were input into the sketch routing tool. The travel time for each route was estimated for the future baseline condition. shows the inbound and outbound travel times for each route as calculated by the sketch routing tool for the future baseline condition.

[2] A Regional Freeway System Reconstruction Plan for Southeastern Wisconsin, published by Southeast Wisconsin Regional Planning Commission, Map 79, http://www.sewrpc.org/publications/pr/pr-047_regional_freeway_system_reconstruction.pdf

Figure 13 Year 2030 Baseline Travel Times



Comparing to , the travel time along Lake Parkway is anticipated to increase by approximately one minute by year 2030 due to growth in traffic demand, regardless of the geometric configuration of the corridor.

Impacts of Adjacent Redevelopment

Parcels adjacent to Lake Parkway would be accessible as part of the proposed project. The developments that may occur would place additional traffic on Lake Parkway. Two concepts for redevelopment have been proposed. Concept A, shown in Figure 14 provides open space along Lake Parkway, with redevelopment opportunities focused in the southern and western areas of the harbor. For purposes of this study, Concept B of the Hoan Bridge and Harbor Redevelopment Sketch Book was assumed to be fully built by year 2030. Concept B is shown in Figure 15, and is anticipated to have higher traffic impacts due to the higher density of development along Lake Parkway.

The number of vehicle trips generated from Concept B was developed using Institute of Transportation Engineers Trip Generation Manual Version 8[3] . A fully build Concept B would equate to over eight-two thousand (82,700) new vehicle trips per day. A majority of these trips, over seventy-thousand (71, 700), may access Lake Parkway depending upon local roadway connections. Further refinement of the adjacent parcel development and corresponding access points is required to provide a more detailed estimate of traffic and travel time impacts along Lake Parkway.

[3] Trip Generation, 8th Edition, Institute of Transportation Engineers, 1099 14th St. NW, Suite 300 West, Washington, CD 20005-3438

Figure 14 Concept A Schematic

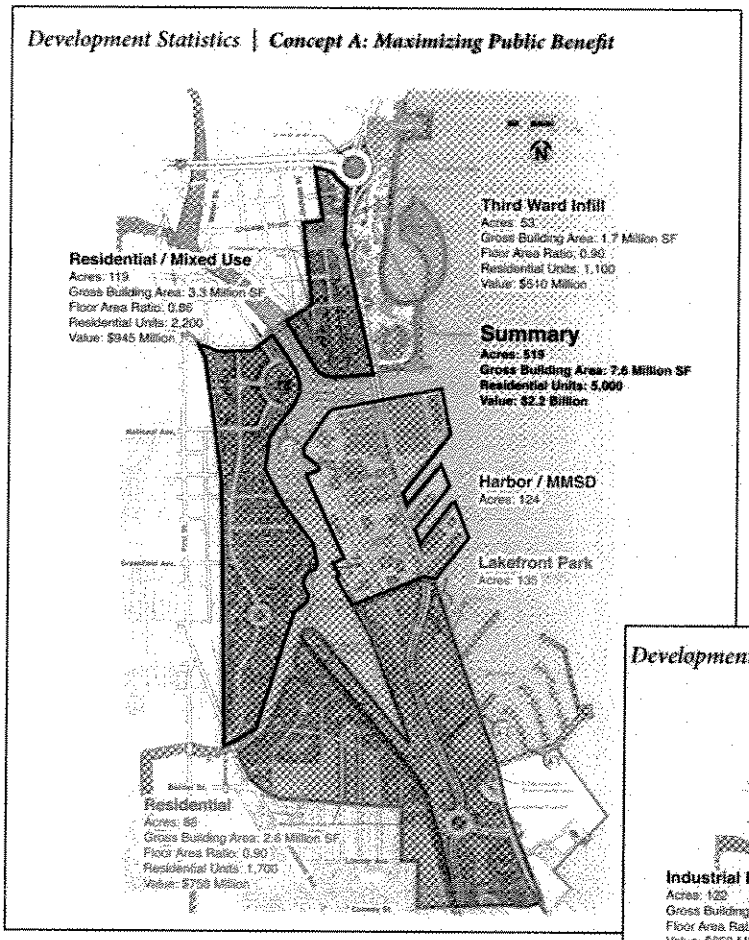
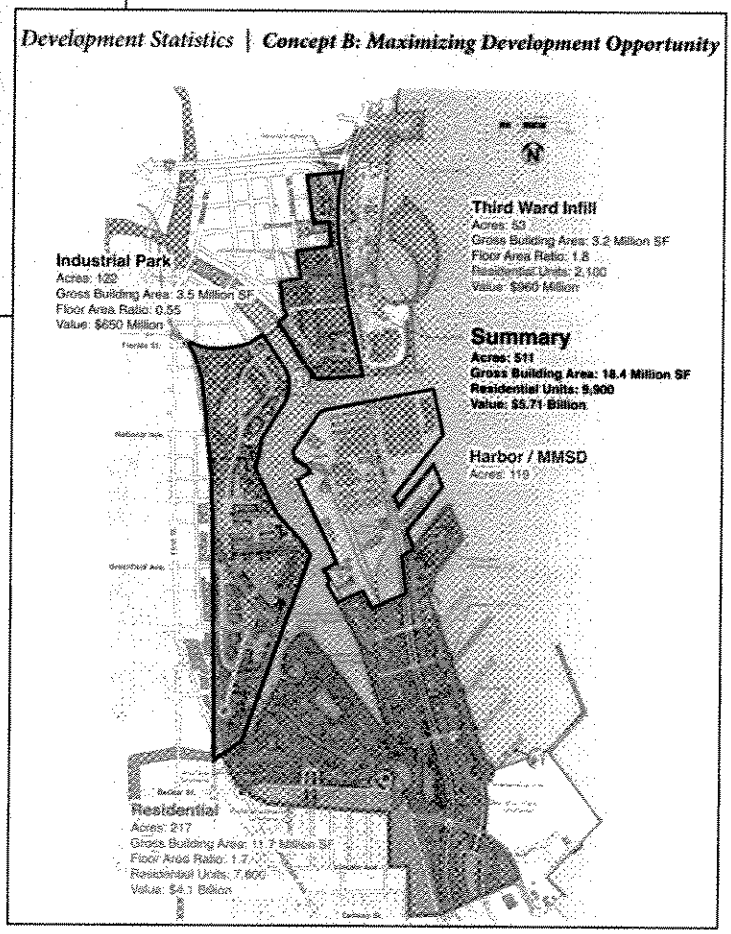


Figure 15 Concept B Schematic



Summary

Downtown Milwaukee is the primary destination for the Lake Parkway traffic, resulting in high volumes of traffic traveling northbound to westbound at the Lake interchange in the AM peak. These high volumes require the free-flow movements currently provided by the Lake interchange.

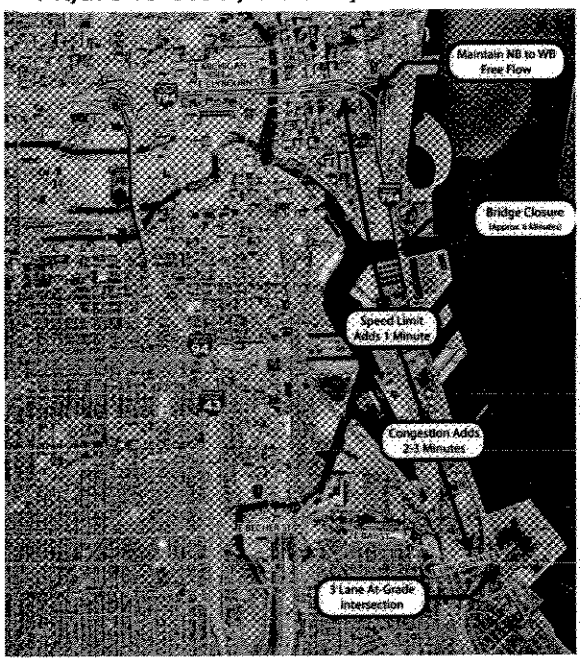
Traffic movements through the Bay Street/Carferry Drive interchange are primarily through movements, which could be accommodated with a three lane at-grade intersection. The next access point on Lake Parkway is at Oklahoma Avenue, which is already a two-lane at-grade intersection.

The modification of Lake Parkway and Hoan Bridge could have travel time impacts for those motorists who currently use the facility.
In the near term, three factors will impact travel time along Lake Parkway:

- Speed reduction (55 mph to 40 mph) adds one minute
- Congestion, primarily at proposed Bay/Carferry intersection adds one to two minutes
- Bridge opening of six minutes on average, about once per day

These preliminary findings are highlighted in Figure 16.

Figure 16 Study Findings



Future conditions in the study area will have significant impacts on the use of Lake Parkway. Specifically, the following factors will need to be reviewed in more detail to assess travel patterns and travel times along Lake Parkway:

- peak spreading
- modal shifts, including new service and transit oriented development
- changes in routes, including diversion from I-43/94
- refined estimates of traffic growth
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- operations at Lake Parkway and Oklahoma Avenue intersection
- level of redevelopment along Lake Parkway
- number and location of additional access points along Lake Parkway