



# TECHNICAL MEMORANDUM #1

## Review of Previous Studies

EO2852

Work Order #1

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Final



**PARSONS  
BRINCKERHOFF**

## SUMMARY OF PREVIOUS REPORTS

As part of the Parkway East Corridor Transportation Network project, Parsons Brinckerhoff has reviewed four studies that were previously done for the Parkway East corridor. The studies that were reviewed are as follows: The Parkway East Initiative Study – December 1991 by SPRPC (currently known as SPC), Squirrel Hill Traffic Study – July 1994 by Frederick R. Harris, Inc. (for PennDOT), Eastern Corridor Transit Study, Transitional Analysis to Locally Preferred Alternatives – September 2006 by STV, Inc. (for SPC), and Freeway Ramp Management in Pennsylvania – March 2011 by the University of Pittsburgh (for PennDOT). All of these studies analyzed ways to relieve the recurring congestion along the Parkway East. This memorandum will summarize the findings and recommendations from each of these studies. For the purposes of this memorandum, the Parkway East is considered the section of I-376 from the Fort Pitt Bridge to the eastern limit at US Route 22 and the Pennsylvania Turnpike.

### The Parkway East Initiative Study (1991)

The purpose of this study was to determine low cost strategies for improving safety and mobility along the Parkway East. The recommendations from this report are as follows:

#### Incident Management

This is a program to remove breakdowns, crashes, and other random incidents from the freeway as soon as possible.

The study documented 360 crashes and 836 breakdowns reported annually on the Parkway East. The study further estimated that as many as 70% of all incidents may be unreported, and that such non-recurring events may be the cause of up to 60% of motorist delay on highways.

#### Ramp Metering

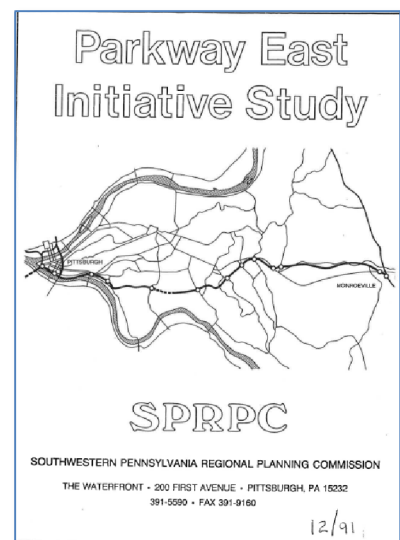
This consists of the signaling of freeway entrance ramps to regulate the entrance of vehicles into the mainline traffic flow. Ramp metering can improve mainline traffic flow as well as reducing accident rates considerably.

The study determined that congestion during the morning peak period is caused by an excess demand of 1,700 to 2,000 vehicles during the first two hours of that period. The study estimated that with metering, ramps would be able to store about 1,000 of these vehicles, thus reducing congestion at the tunnel by about 50%.

#### Interchange Improvements

This would consist of improving existing interchange geometry to meet current design standards.

The study noted that in the eastbound direction 20% of crashes on the Parkway East occurred at the Edgewood interchange, 20% at the Squirrel Hill interchange, and 10% at the Bates Street



on-ramp. In the westbound direction, 21% occurred at the Edgewood/Swissvale interchange, 16% at the downtown interchanges, and 7% at the Squirrel Hill interchange.

The study then recommended extending acceleration lanes at the Bates Street, Squirrel Hill, Edgewood/Swissvale and Churchill interchanges. It also recommended reconfiguring the eastbound ramps at the Squirrel Hill interchange to eliminate the weave area by moving the off-ramp before the on-ramp. The study did not appear to include any geometric plans or cost estimate for these recommended improvements.

#### Tunnel Enhancements

The study proposed a range of enhancements to make the tunnels appear less confining and therefore improve capacity.

The study noted that based on Highway Capacity Manual methodology, the westbound tunnel has a capacity of about 3,700 vehicles per hour, while the eastbound tunnel has a capacity of about 4,500 vehicles per hour. It attributed the difference to the upgrade in the westbound direction and the downgrade in the eastbound direction, since otherwise the tunnels have the same geometric design. The tunnel capacity is less than the parkway mainline, leading to congestion, although the study noted that the eastbound merge at Squirrel Hill actually has a lower capacity than the outbound tunnel.

Among the improvements recommended were:

- Widening (included removing the existing walkway)
- Lighting and marking enhancements
- Congestion control upstream (ramp metering)

The study concluded that removing the existing walkway would increase tunnel capacity by 50-100 vehicles per hour. Lighting and marking enhancements would not significantly improve traffic capacity, but would marginally improve flow and safety. The study noted that controlling flow through ramp metering would not increase capacity of the tunnels, but by limiting traffic entering the Parkway to the capacity of the bottleneck, it would improve traffic operations on the highway.

#### Transit/Ridesharing Improvements

The study proposed a range of strategies to lower demand on the Parkway East by making transit, vanpool and carpool more attractive.

Among the improvements recommended were:

- Park and Ride Lots (Improve/Expand/Construct)
- HOV bypass ramps (if ramp metering were implemented)
- East Busway Extension
- Traffic operation improvements in Wilkinsburg

Benefits and impacts of these improvements were not quantified, although it was noted that improved park and ride facilities were the subject of a separate SPC study, and that the East Busway extension to Swissvale was under study by the Port Authority of Allegheny County.

#### Operational Improvements on Alternate Routes

The study proposed capacity improvements on alternate routes thus reducing travel times. This would divert traffic from the Parkway East to the alternate routes. The improvements could include traffic signal improvement, removal of on-street parking, and one-way streets, although it was noted that some of these strategies could meet opposition from the affected communities. The alternate routes suggested for further evaluation included:

- Ardmore Boulevard/Route 30
- Penn Avenue
- Baum Boulevard
- Forbes Avenue
- Fifth Avenue
- Allegheny River Boulevard
- Braddock Avenue
- Second Avenue
- Wilkesburg Terminus Area (to improve bus flow).

The study noted that a similar program in California covering 3,172 signals has seen a 15% reduction in vehicular delays and a 7.2% improvement in travel times.

#### New Construction Projects

Finally, the study reviewed options for new capacity in the corridor. It acknowledged that these would not be low-cost options, but they were considered in response to public input. Among the possible roadways they considered were the Mon-Fayette Expressway; a Southern Beltway from the Airport to Monroeville through Collier, Mount Lebanon, and West Mifflin; the Glenwood Connector from Bates Street to Braddock Avenue along the Monongahela River, and an extension of the Tri-Boro Expressway from the Glenwood Connector to Westmoreland County.

Of these, only the Glenwood Connector was analyzed in detail. The study determined that the connector would reduce peak-period travel times from Bates to Braddock Avenue from the then-current 13 minutes to 7.2 minutes, while in the opposite direction the connector would actually take slightly longer, at 7.3 minutes, than the Parkway East would take at 6.6 minutes. The study assumed an average travel speed on the Glenwood Connector of 50 mph, but did not appear to address the design of the roadway or the connections at either end. It did note that bypassing the Squirrel Hill tunnel would increase the westbound throughput, and if the number of vehicles diverted exceeded 800 to 1500 vph, this would exceed the capacity of the Parkway between Bates Street and Grant Street, causing congestion to occur in this area.

### Squirrel Hill Traffic Study (1994)

The purpose of this study was to analyze four (4) improvement alternatives to the Beechwood Boulevard eastbound on-ramp (Ramp B) to the Parkway East. These improvements were investigated due to long queues on this ramp that occasionally back up onto Beechwood Boulevard. The alternatives that were investigated are as follows:

- Ramp Metering;
- Restrict PM peak hour usage to vehicles with 2 or more occupants (HOV-2);
- Restrict PM peak hour usage to vehicles with 3 or more occupants (HOV-3); and
- Closure of the ramp.

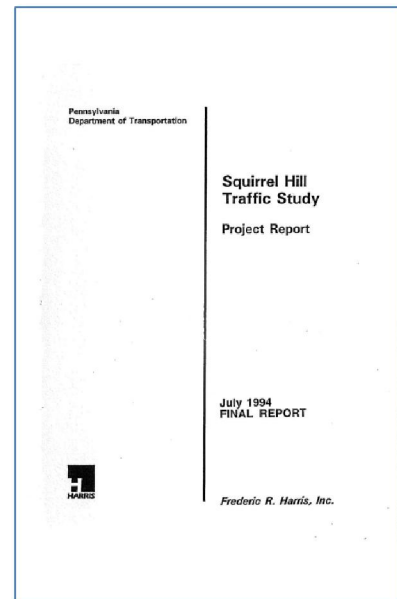
The study identified a relatively consistent pattern of crashes near the Squirrel Hill on-ramp for the period from 1988-1992. However, of the 19 crashes, only 3 actually occurred in the merge/weave area on I-376, with the others occurring on Beechwood Boulevard.

A mailback survey was conducted of peak-hour ramp users which achieved a 36.71% response rate. 47% indicated that if the ramp were closed, Bates Street would be their alternate route, while 40% would use Edgewood/Swissvale. Very few users expressed a willingness to carpool if HOV facilities were available.

The study found that closure of the ramp would result in no significant improvement in level of service. While the elimination of entering traffic would improve weave operation, this would be offset by the number of vehicles which would divert to enter the Parkway at Bates Street and thus increase mainline demand.

The study noted that ramp metering is typically used to distribute entering traffic within gaps on the mainline. Due to the heavy mainline volume during peak periods at this location, few gaps exist and ramp metering was not recommended.

Finally, the study noted that all of these modifications to Ramp B would provide some improvements to the Squirrel Hill Interchange. However, traffic problems would be diverted to other key roadways in the surrounding neighborhoods. While certain routes would appear to provide reasonable alternatives, congestion exists on these routes at key locations such as the Bates Street interchange, the intersection of Bates Street with the Boulevard of the Allies, the intersection of Shady Avenue with Forbes Avenue, etc, and thus a cascading affect of diverted traffic could affect many other roadways. Therefore, the no build alternative was recommended by this study.

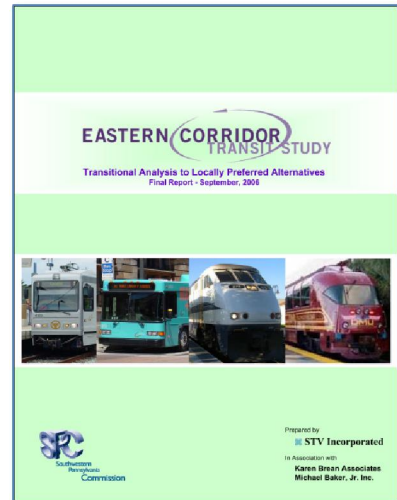


### Eastern Corridor Transit Study, Transitional Analysis to Locally Preferred Alternatives (2006)

The purpose of this study was to update the recommendations from the original Eastern Corridor Transit Study and conduct the public involvement to select Locally Preferred Alternatives to place on the Long Range Plan for the region. 29 potential transit investments in five corridors were considered. Of the study corridors, Downtown Pittsburgh to Greensburg, Downtown to Oakland and East, and Swissvale to Monroeville most clearly overlap the Parkway East Corridor.

The Locally Preferred Alternatives that were chosen from this process were as follows:

- Allegheny Valley and Norfolk Southern Commuter Rail – This project would provide commuter rail service from 21st Street in Pittsburgh heading north along the Allegheny River to Arnold.
- East Busway Extension – This project would extend the East Busway from Swissvale to East Pittsburgh and then onward to Monroeville.
- Downtown Pittsburgh to Oakland Transit Investment – This recommendation contains two (2) different alternatives. The first alternative would be to provide a light rail connection from the existing Steel Plaza Station in Pittsburgh to Oakland. The other alternative would be to provide a Bus Rapid Transit system utilizing the existing Port Authority bus routes on Forbes Avenue and Fifth Avenue.



The first of the recommended Locally Preferred Alternatives would not directly influence the Parkway East corridor. However, the other alternatives are significant.

The study concluded that extending the East Busway to Monroeville would reduce travel time to Downtown Pittsburgh time by 49% compared to existing local buses and 13% compared to existing express buses, and by 21% compared to drive. Travel time from Monroeville to Oakland would reduce by 15% compared to existing local buses and by 43% compared to driving. Total bus boardings to Monroeville were estimated to rise to 41,500 at a capital cost estimated in 2006 dollars from \$390 to \$480 M.

Constructing the Spine Line light rail to Wilksburg would reduce travel time from Wilksburg to Downtown by 43% compared to local buses, but would not improve on driving or existing express buses. Travel time from Wilksburg to Oakland would reduce by 45% over existing local buses and 39% compared to driving. Total daily boardings would be 39,400, at a capital cost estimated at \$2.7 B to \$3.2 B. An alternate configuration to Homestead was also evaluated, which would have similar benefits but a slightly lower capital cost.

A Downtown to Oakland Bus Rapid Transit system was evaluated, with an estimated 5% improvement in travel time over conventional buses. Ridership and capital cost were not estimated.

The next step in the process to advance these projects would be to enter them into the Southwestern Pennsylvania Commission's (SPC) Long Range Plan. This will allow for the next study phases for each alternative to be initiated.

### Freeway Ramp Management in Pennsylvania (2011)

The purpose of this report was to determine the best practices available in ramp management and to determine the feasibility of use in Pennsylvania. The study recommended that a ramp management screening policy be adopted and then utilize this policy to screen candidate corridors identified by local MPO's.

Based on the proposed methodology, the study identified 275 miles of congested freeways in Pennsylvania by 2035. It also estimated that it would cost \$8.74 billion to mitigate the recurring congestion in Pennsylvania.

The study determined that ramp management can be a cost-effective tool for addressing freeway congestion. Ramp management can improve safety and mobility along freeways and it can also reduce emissions. However, ramp management can also cause increased traffic on arterials (diversion), queue spillback onto arterials, and increased ramp emissions.

The study used the Parkway East as a case study to evaluate the proposed ramp management criteria. It determined that the Parkway East has the appropriate volume and congestion levels to consider ramp management as an alternative solution for reducing congestions. The study then conducted a detailed benefit-cost estimate of ramp management in this corridor.

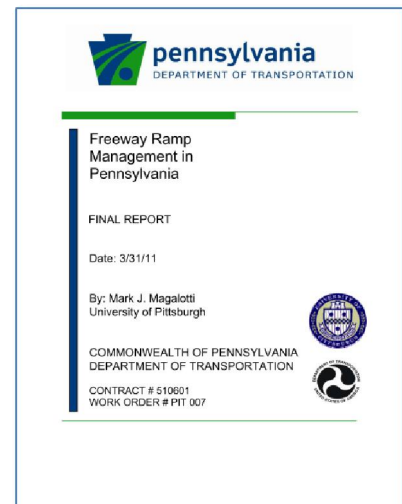
The following options were considered:

- Metering peak-directional on-ramps at Braddock Avenue, Ardmore Boulevard, Greensburg Pike, Bates Street and Squirrel Hill;
- Close peak-directional on-ramps at Braddock Avenue, Ardmore Boulevard, and Beechwood Boulevard, and meter Bates Street and Greensburg Pike; or
- Close the Eastbound Beechwood Boulevard on-ramp during the PM peak.

A detailed analysis was conducted for these three alternatives. A travel demand model was developed of the study area using the VISUM software package. A microscopic simulation model was developed for the Parkway East using the related VISSIM simulation model. Based upon the projected traffic impacts of the three options, a wide range of mitigation strategies were developed to mitigate traffic impacts on local roads.

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This study determined that ramp management concepts can be provided at a relatively low cost while providing a significant amount of user benefit. This usually results in high benefit-cost ratios. This report analyzed three ramp management options for the Parkway East. The benefit/cost ratios for these three options ranged from 12:1 to 58:1. However, it was noted that the benefit/cost ratio calculation was primarily based on improved traffic flow on the Parkway East and did not take the increased congestion on side streets into account.

The study recommended advancing the second option, with closure of certain ramps and metering at other ramps, which would have an estimated benefit/cost ratio of 34:1. This did not take into account increased congestion elsewhere in the roadway network, or the increased travel time for drivers diverting on surface streets. It estimated the total capital cost to implement this option at about \$4.6 M. It recognized that the third option, peak hour closure of the Beechwood Boulevard ramp, could be an interim measure.

## SUMMARY

Three of these studies, conducted over a period of twenty years, looked at the Parkway east in the vicinity of the Squirrel Hill and adjacent interchanges. These studies have consistently found that ramp closures and ramp metering could improve traffic flow on the Parkway East mainline, but at the cost of increased travel time and congestion on alternate arterial routes. The studies differed in whether there would be a significant reduction in congestion on the Parkway mainline. In particular, the 1991 Parkway East Initiative Study and the 2011 Freeway Ramp Management Study both determined that ramp metering had the potential to reduce some, but not all of the peak period congestion at the Squirrel Hill tunnels. However, these studies did not quantify the additional delay that would be incurred by vehicles on the ramps and the arterial roadways. The one study that attempted to do this, the 1994 Squirrel Hill Traffic Study, found that many drivers would divert to unmetered ramps, resulting in little net change in Parkway queues, and that the available alternate arterial roadways had significant bottlenecks at key intersections.

A number of improvements and initiatives have been implemented following the recommendations of these studies, particularly the 1991 Parkway East Initiative Study. The first recommendation of this study, for an incident management program, was implemented with the Parkway Service Patrol which began operation on September 26, 1996. In the most recent years, this service has responded to between 200 and 600 incidents per year, consistent with the number of crashes and breakdowns projected in the study. The response of the patrol to incidents has been enhanced by the Western Regional Traffic Management Center (TMC) which also began operation in 1996.

The 1991 study also called for geometric improvements to be made to a number of ramps along the parkway, as well as geometric modifications to the Squirrel Hill Tunnel. Improvements were made to the westbound Squirrel Hill exit ramp and the westbound Edgewood/Swissvale entrance ramps as part of reconstruction of the Parkway in 2007, and the westbound Churchill



on-ramp was extended in 2008 as part of a later phase of the project. Work began in 2013 and is continuing in 2014 to improve lighting in the Squirrel Hill tunnel and to remove the lowered ceiling providing a brighter, more open space.

Little has been accomplished in terms of new highway capacity as proposed in the 1991 Parkway East Initiative Study. A Glenwood bypass and a southern beltway were proposed as part of the Mon/Fayette Expressway into Pittsburgh, under the auspices of the Pennsylvania Turnpike Commission. Although construction of the western portion of the Southern Beltway has been completed near Pittsburgh International Airport, the prospect of the Glenwood Connector appears uncertain.

Transit improvements were called for in the 1991 Parkway East Initiative Study and in the 2006 Eastern Corridors Transit Study. The extension of the East Busway to Swissvale called out in the first study was completed in 2003. Various changes in park-and-ride facilities and bus routes have been implemented in the eastern suburbs, but these have been mixed due to funding constraints. The Port Authority of Allegheny County is moving ahead with an evaluation of bus rapid transit (BRT) between Downtown Pittsburgh, Oakland and the eastern communities, as was recommended in the Eastern Corridors study.

Finally, the 2011 Freeway Ramp Management study showed that ramp metering had the potential to reduce congestion on the portions of the Parkway. However, the Department recognized that rather than advancing any particular alternative, there was a need to look comprehensively at traffic conditions in the entire Parkway East corridor and to develop options and ideas for improvements. Accordingly, the current study was initiated to provide that detailed assessment and opportunities for input.

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