Bus on Shoulders — Freeway Transit Lane Monitoring Program

Final Report

September, 2009
FY 2005-2006 Statewide Transit Planning Studies

Bus on Shoulders - Freeway Transit Lane Monitoring Program

Final Report

Executive Summary

In 2005, the San Diego Association of Governments (SANDAG) received a Caltrans Planning Grant to implement and monitor a pilot project that would evaluate the feasibility of converting freeway shoulder lanes to transit-only lanes to improve reliability and reduce travel time. These lanes are used as a low-speed, low-cost transit priority measure when the regular freeway lanes are congested. The pilot project has proved successful and the work effort has evolved to evaluate and develop conceptual designs for additional high-priority freeway transit lane projects. This report summarizes the results of the Freeway Transit Lane Monitoring Program Caltrans Planning Grant and further projects involving the bus-on-shoulder program.

SANDAG, in partnership with the Metropolitan Transit System (MTS), California Department of Transportation (Caltrans), and the California Highway Patrol (CHP), implemented a demonstration pilot project to evaluate the effectiveness of using the freeway shoulder for transit lanes. This two-year pilot project was implemented on SR-52 (between Convoy and I-805) and I-805 (between SR-52 and Nobel Drive) using MTS Express Route 960 starting December 5, 2005.

Since 2005, MTS Route 960 has used the freeway shoulder as a transit-only lane during morning and evening rush hours when freeway speeds drop below 35 miles per hour. The pilot project has proven successful in terms of a strategy to use transit along freeway to bypass congested areas. The pilot project measured safety, benefits to transit operations, bus driver and passenger perceptions, freeway level-of-service, maintenance, and shoulder lane pavement structural sufficiency issues. In October 2007, a report was prepared to document the success of the project, which can be found in Section 1 (page 2) of this report. Since that report, the route has been continually monitored to examine its effectiveness and measure time savings. A summary of the monitoring activities can be found in Section 2 (page 31) of this report.

Following the success of the pilot program, SANDAG explored the possibility of expanding the pilot project to other locations along the County freeway system. Staff from SANDAG, Caltrans District 11, MTS, and NCTD collaboratively identified 11 sites throughout San Diego County as potential locations for additional bus-on-shoulder projects. Staff evaluated and prioritized the potential locations into tiers based on a number of factors including existing shoulder width, congestion, potential transit travel time savings and patronage, safety concerns, construction, and anticipated cost. The results of the site selection process can be found in Section 3 (page 32) of this report.

The top-ranking potential location was identified as southbound I-805 between Mira Mesa Blvd. and La Jolla Village Drive, which is the key connector between Sorrento Mesa and University Towne Centre. Currently SANDAG, MTS, and Caltrans are in the design and engineering phase for this new bus-on-shoulders project. Conceptual designs for the I-805/Mira Mesa Blvd. project are included in Section 4 (page 39) of this report.

The bus-on-shoulders project is important to SANDAG and work will continue past the completion of the Caltrans planning grant. The future activities for the bus-on-shoulders program include continued monitoring of the Route 960 Pilot Project, pursuing policy and legislative changes that will make bus-on-shoulder operations permanent, and expanding bus-on-shoulder operations to other freeways throughout the region.
Section 1  Technical Report

Transit Lane Demonstration Pilot

California Department of Transportation CALTRANS and
San Diego Association of Governments’ SANDAG
San Diego, California

October 2007
This report was prepared under the direction of

Jesus Vargas, Caltrans Project Manager
Roy Santos, Caltrans Project Engineer
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Danny Veeh, SANDAG Project Team
Scott Strelecki, SANDAG Project Team

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Executive Summary

SANDAG, in partnership with the Metropolitan Transit System (MTS), California Department of Transportation (Caltrans), and the California Highway Patrol (CHP), has performed a demonstration pilot project to evaluate the effectiveness of using the freeway shoulder for transit lanes. These lanes are used as a low-speed transit priority measure when the regular freeway lanes are congested. This two-year pilot project was implemented on State Route 52 (SR-52)/Interstate 805 (I-805) between Kearny Mesa and Nobel Drive OC (University City) using MTS Express Route 960 starting December 5, 2005. (See Attachment A and B.)

The pilot project has proven successful in terms of a strategy to use transit along freeway to bypass congested areas. The unit of measure for this pilot strategy are as follows: safety, benefits to transit operations, bus driver and passenger perceptions, freeway level-of-service/maintenance, and shoulder lane pavement structural sufficiency issues.

Introduction

Increased congestion on arterial streets and freeways has impacted public transportation operations in the following problems; added travel time, reduced on-time performance, and increased operating costs. A proposed solution is to bypass congestion through the use of shoulders as transit priority measures. This measure may potentially increase the interest of the public to use the bus service as an alternative transportation method.

The freeway system is used by express bus and commuter express bus services, and will be used for future Bus Rapid Transit (BRT) lines. In the future, the regional managed lanes/high occupancy vehicle (HOV) lanes system, in Mobility 2030, will offer high-speed transit priority travel, along with direct access ramps to adjacent freeway and BRT stations. While managed lanes projects are longer-term solutions, SANDAG feels that there is a need for short-term priority measures to facilitate existing express services and additional routes planned for implementation in the next several years. Use of freeway shoulder lanes as a low-speed bypass of congested freeway lanes by transit vehicles offer that potential. Freeway shoulder lanes projects have successfully been used in Minneapolis since 1992, and have been implemented in several other cities in recent years.

The intent of the freeway transit lane demonstration pilot project is to gain local experience in the use of existing shoulder (transit only) lanes during the peak periods. SR-52 and I-805 were chosen for the pilot project because of the standard 10’ shoulder widths and heavy peak-period congestion levels.

On December 5, 2005, the pilot project was implemented on Route 960, a commuter express bus route operating between the Euclid Trolley Station/Mid-City and job centers in Kearny Mesa and University City. This report provides an update on the performance of the pilot project through its first year of operation.
Background

The pilot program was conducted to evaluate three major performance measures below:

- Operational Guidelines and Requirements
- Highway Modifications
- Performance Measures / Success Criteria for Pilot

Operational Guidelines and Requirements

- The pilot program is in effect for 24 months. This allowed for a 12-month re-evaluation period to decide if the pilot should continue.
- Buses traveled in a Transit-Only lane created from the existing shoulder.
- The maximum speed of the buses was 35 mph.
- Based on existing congestion, operation hours are from 6:00 AM to 9:00 AM and 3:00 PM to 6:00 PM. The Transit Lane, however, will be available on a 24-hour period and bus drivers will be told they can use it anytime that speeds drop below 35 mph.
- Buses are allowed to drive on the Transit-Only lanes only when mainline traffic speeds drop below 35 MPH. If the shoulder is obstructed in any way, the bus driver will merge back into the mainlane to avoid the obstruction. Bus drivers must yield to any vehicle that enters the transit-only lane as well as any vehicle merging or exiting an interchange.
- Buses will not be permitted to travel in the transit lane during periods of rain or when the potential for flooding is present.
- At the Request of the California Highway Patrol (CHP), the speed differential between buses and mainline traffic should be limited to 10 miles per hour.
- Training for the bus drivers will address the program requirements as well as how to handle obstructions such as stalled vehicles.
- An extensive public outreach program aimed to inform motorists and transit riders was conducted by SANDAG in the weeks prior to implementation of the pilot. The campaign included newspaper and radio ads.
- Metropolitan Transit System (MTS), who will operate the transit buses, is self-insured and carries the necessary liability insurance.
- Only transit buses operated by MTS will be permitted to use the transit lane.

Highway Modifications

Through the eight miles of the pilot project, buses used a mixture of existing auxiliary lanes and converted shoulders. Approximately half of that distance was converted shoulder and the other half was on either the mainlane or existing auxiliary lanes (see Attachment A). The use of these converted shoulders require the buses merging into the mainlanes at interchange access points to yield to cars.

Highway signs at the edge of the on and off ramps are placed approximately every half-mile throughout the route to inform motorists that the lane is for authorized buses only (see Attachment C). Additionally, pavement markings that read “Transit Buses Only” were painted in the lane at intermittent locations (see Attachment A for approximate
locations). New pavement markings, different shoulder stripe, and signs indicating fines were discussed but not used. For the pilot project, adding overhead signs were not recommended at this time.

Other modifications included:

- The freeway ramp meter at Nobel Drive was set as 2 cars per green to allow HOV priority.

- A sign has been installed on the back of each bus warning drivers to not follow the bus while in the transit lane.

**Performance Measures / Success Criteria for Pilot**

At the direction of Caltrans and CHP, SANDAG prepared an assessment report that monitored the effects of the pilot project against the existing baseline performance measures. The baseline conditions for this pilot project are outlined below. Performance measures were used to determine the pilot’s success, to establish or modify guidelines, to propose additional capital improvements, to address additional maintenance, enforcement costs and responsibilities for future projects. The performance measures are:

1. Safety
2. Freeway Operations
3. Transit Travel-time Reliability and Savings.

(Note: Since the pilot project was intended to test the feasibility of using the shoulder for transit priority from an operational perspective, transit ridership was not included as a primary performance measure. However, it would be included as criteria for selection of future projects.)

The pilot assessment evaluated all the factors above and calculated a cost vs. benefit analysis. This determined the benefits of the project in terms of travel time reliability, safety, and changes in freeway service and driver/passengers perception. It also documents benefits to the region in the amount of capital costs associated with the project. If deemed feasible by the criteria and performance measures discussed throughout this report, then the next objective would be to establish criteria for future projects.
Information / Data Collection

The data collected below is based on the three major performance measures and their individual outcomes as follows:

1. **Safety (PERFORMANCE MEASURE)**

   A. Question: Are any accidents attributed to the transit lane operation?

      Answer: After a 12-month evaluation, there were no transit-related accidents.

   B. Question: Are any accidents related to emergency stopping of vehicle in transit lane?

      Answer: No accidents involving emergency stopping vehicles were reported during the 12-month evaluation.

   C. Question: What are the frequency and/or severity of “near misses” when buses transition to/from the transit lanes?

      Answer: MTS has reported no issues related to conflicts between buses and private vehicles related to transit lane operations.

   D. Question: Do CHP, Caltrans maintenance, or freeway patrol crews experience any safety issues due to transit lane operations?

      Answer: Per the 12-month evaluation, both partnering agencies and contractor have indicated no safety and operational issues associated with the pilot project.

   E. Via data collection and data analysis; total collisions and collision severity are standard performance indicators. (Refer to Tables (1-3) TASAS Table“B” as shown below.).

   **TABLE 1 (ORIGINAL TASAS DATA) 3 YEARS**

<table>
<thead>
<tr>
<th>Location</th>
<th>Total # of Accidents</th>
<th>Location</th>
<th>Total # of Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Total # of Accidents</td>
<td>Actual Rates</td>
<td>Average Rates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(per million vehicle miles)</td>
<td>(per million vehicle miles)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>F</strong></td>
<td><strong>F+I</strong></td>
</tr>
<tr>
<td>State Route 52</td>
<td>95</td>
<td>0.003</td>
<td>0.13</td>
</tr>
<tr>
<td>(PM 4.050 to 6.925)</td>
<td></td>
<td>197</td>
<td>0.000</td>
</tr>
<tr>
<td>Interstate 805</td>
<td>(PM 23.800 to 25.475)</td>
<td>197</td>
<td>0.000</td>
</tr>
</tbody>
</table>
**TABLE 2 (3 YEAR TASAS INCLUDING PILOT) 3 YEARS**

<table>
<thead>
<tr>
<th>Location</th>
<th>Total # of Accidents</th>
<th>Actual Rates (per million vehicle miles)</th>
<th>Average Rates (per million vehicle miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>F+I</td>
</tr>
<tr>
<td>State Route 52 (PM 4.050 to 6.925)</td>
<td>98</td>
<td>0.006</td>
<td>0.12</td>
</tr>
<tr>
<td>Interstate 805 (PM 23.800 to 25.475)</td>
<td>221</td>
<td>0.000</td>
<td>0.24</td>
</tr>
</tbody>
</table>

**TABLE 3 (PILOT TASAS PERIOD) 1 YEAR**

<table>
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<th>Location</th>
<th>Total # of Accidents</th>
<th>Actual Rates (per million vehicle miles)</th>
<th>Average Rates (per million vehicle miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>F+I</td>
</tr>
<tr>
<td>State Route 52 (PM 4.050 to 6.925)</td>
<td>32</td>
<td>0.000</td>
<td>0.08</td>
</tr>
<tr>
<td>Interstate 805 (PM 23.800 to 25.475)</td>
<td>74</td>
<td>0.000</td>
<td>0.27</td>
</tr>
</tbody>
</table>

**F.** Via observations: On-board video and roadside photographic documentation was collected in December 2006 showing the freeway shoulder operation.

Answer: SANDAG has a video on file for viewing.

**G.** Perception of State Highway System (SHS) users (includes bus drivers, passengers, and other SHS users) survey and collect data –

Answer: Bus drivers and passengers were surveyed before project implementation and after the project had been in place for six months. Both bus drivers and passengers expressed a positive perception towards public safety. (Refer to Table 4 – Passengers & Drivers’ Survey Page 10)

**2. Freeway Operations (Performance Measure)**

Given that the bus frequency is low (approximately 30 minute headways) and that the transit lanes are used only during congested periods, the impact of the pilot on traditional measurements such as mainline speeds and densities was not easily measured. Consequently, the assessment report relies on observational information that includes videotape of the mainline traffic during operations. (Refer to Safety topics listed above under F.)
A. Question: Is there a reduction in freeway level-of-service/effective capacity due to transit lane?

Answer: Within the 12-month period of the pilot project, Caltrans Traffic Operations has not detected any change in freeway level of service based on visual surveys.

B. Question: Do bus transitions to/from transit lane cause any notable disruption to the mainlane traffic flow?

Answer: 1. No notable disruptions were observed by Caltrans Traffic Operations due to low usage of the shoulders during field observations.
2. Buses encroached into the mainlane specifically at the bridge structure approach.

C. Question: Do any non-standard freeway features introduced by the transit lane cause disruption to the mainlane traffic flow?

Answer: There was no disruption to the mainlane traffic flow due to non-standard freeway features. As mentioned by MTS, drivers did exercise caution at specific locations of existing narrow shoulders while passing larger vehicles. But driver reactions did not disrupt the mainlane traffic flow.

D. Question: Do Caltrans maintenance and freeway patrol crews experience increased work efforts or disruption due to transit lane operation?

Answer: Caltrans Maintenance did not report any increase in work efforts during the 12-month observation period. Short-term, the structural pavement section was adequate for the bus volume and low speeds. Long-term, the structural pavement section may need to be reinforced to support the increase in bus volume and speed (see Attachment D).

3. Transit Travel Time Reliability Criteria (Bus Route 960)(Performance Measure)

A. Action: Comparison of travel time and *ridership including survey of transit passengers.

Result: All of the trips on Route 960 reported a ninety-nine percent on time performance, meaning nearly all buses operating along the freeway shoulder lane demonstration project got to the terminal at Westfield UTC at or before the time shown on the timetable. In addition, a test of the travel time savings between buses versus a car resulted in a five-minute faster travel time for the bus using the shoulder lane to bypass congestion as opposed to the automobile trip.

The pilot project was implemented primarily to evaluate the impact of the bus on shoulder program in terms of safety and operations. Because of the limited frequency of the current service (30 minute), the limited duration of service (peak
period and peak direction only), the short duration of the priority treatment (4 miles out of a one-direction route total of 16 miles) relative to the entire route length, and the low total ridership the ability to credit the increase in total route boardings (18%) between August 2005 and December 2006 is not possible. However, the positive perception of passengers indicates that riders were highly satisfied.

* Note: The pilot project never specifically pursued a goal of increased ridership as the service level is extremely low (30-minute frequency) and the portion of the route through which the transit travel time savings are possible is a small proportion of the entire route length.

B. Action: An additional survey of transit drivers travels time perception and general feedback on success or failure of the route.

Result: Refer to Table 4 (Drivers and Passengers' Survey) Page 10. Note that the result of the survey is a success.

C. Action: Determine base travel time and ridership (include congestion points and hot spots) where bus currently travels in stop-and-go traffic.

Result: Base travel time was estimated to be roughly sixteen minutes from the Clairemont Mesa & Complex Dr stop to UTC. Average ridership at this point was thirty patrons. Total ridership has increased from 2005 to 2006 by roughly eighteen percent.

D. Action: Compare August –November 2005 baseline transit data to pilot data collected.

Result: The pilot data that was collected displayed overall positive results when compared to the 2005 baseline transit condition table (see Transit Travel Time Reliability, Section A). Route 960's efficient on-time-performance and competitive timesavings versus the automobile provided a dramatic example of the benefits that a freeway shoulder lane program can offer to transit operations during significant traffic congestion.
4. Driver / Passenger Perception

A. Action: Surveys taken by transit passengers and transit drivers

Result: Refer to table below.

<table>
<thead>
<tr>
<th>TABLE 4 (TRANSIT PASSENGERS’ AND TRANSIT DRIVERS’ SURVEY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit Passengers</td>
</tr>
<tr>
<td>This route generally runs on time</td>
</tr>
<tr>
<td>Before</td>
</tr>
<tr>
<td>After</td>
</tr>
<tr>
<td>Traffic congestion is a daily problem for this route</td>
</tr>
<tr>
<td>Before</td>
</tr>
<tr>
<td>After</td>
</tr>
<tr>
<td>Drivers do a good job on this route</td>
</tr>
<tr>
<td>Before</td>
</tr>
<tr>
<td>After</td>
</tr>
<tr>
<td>Using the freeway shoulder is a good idea</td>
</tr>
<tr>
<td>Before</td>
</tr>
<tr>
<td>After</td>
</tr>
<tr>
<td>Using the freeway shoulder (will) saves time</td>
</tr>
<tr>
<td>Before</td>
</tr>
<tr>
<td>After</td>
</tr>
<tr>
<td>I (will) feel safe with the bus driving on the shoulder</td>
</tr>
<tr>
<td>Before</td>
</tr>
<tr>
<td>After</td>
</tr>
</tbody>
</table>

Transit Drivers

| Passengers can count on route being on time              | 51%   | 41%      | 8%        |
| Before                                                   | 78%   | 22%      | 0%        |
| After                                                    | 78%   | 22%      | 0%        |
| Traffic congestion is a problem on route                 | 79%   | 17%      | 4%        |
| Before                                                   | 89%   | 11%      | 0%        |
| After                                                    | 89%   | 11%      | 0%        |
| This is a good route to drive                            | 63%   | 24%      | 14%       |
| Before                                                   | 86%   | 8%       | 6%        |
| After                                                    | 86%   | 8%       | 6%        |
| Using the freeway shoulder is a good idea                | 63%   | 20%      | 17%       |
| Before                                                   | 86%   | 8%       | 6%        |
| After                                                    | 86%   | 8%       | 6%        |
| Using the freeway shoulder is safe                       | 53%   | 25%      | 22%       |
| Before                                                   | 72%   | 25%      | 22%       |
| After                                                    | 72%   | 25%      | 22%       |
| Using the freeway shoulder (will) improve travel time    | 59%   | 16%      | 24%       |
| Before                                                   | 75%   | 14%      | 11%       |
| After                                                    | 75%   | 14%      | 11%       |
| I have been adequately trained to operate on the freeway shoulder | 30%   | 30%      | 39%       |
| Before                                                   | 74%   | 17%      | 9%        |
| After                                                    | 74%   | 17%      | 9%        |

Notes:

- Driver training on the route was done after the implementation of the survey.
  Driver training involved eight hours of classroom training and two hours of field training.
- Freeway mainlane commuters were not surveyed.

California Highway Patrol (CHP) Review

The California Highway Patrol reported that there is no negative impact experienced by the San Diego Service Patrol (FSP) and stated that CHP did not have problems/issues incurred due to the pilot project. (See Attachment E and F.)
Cost vs. Benefit Analysis

Given the limited scope of this pilot project (low frequency route with limited service - four morning and four afternoon trips) the ability to determine cost benefit is limited. However, the five-minute travel timesavings over a four-mile one-direction section would suggest that time savings could be in the area of one minute per mile. MTS costs their operations by the hour ($75). In the case of the current limited (eight daily trips) pilot project, the five-minute savings per trip could result in an annual operational savings of approximately $13,000. A corridor with a larger timesavings and more service would likely see even more operational savings.

The current project was implemented at a limited cost to Caltrans, which included only signage and painted shoulder markings.

Conclusion

- Overall, the Transit Lanes Demonstration Pilot Project has achieved positive results with the performance measures and transit criteria on the highway; yielding strong benefits for transit operations; receiving positive perceptions from transit drivers and transit passengers; maintaining desired goals for freeway level of service and maintenance; and maintaining safety on the highway.

- All partnered agencies including SANDAG, MTS, Caltrans and the CHP agreed that the demonstration project (viability of transit vehicles using the shoulder lanes as low-speed priority measures) has been successful.
"Transit Lane" Demonstration Pilot Program

- Buses Traveling on Transit-Only Lane
- Buses Traveling on Auxiliary Lane
- Buses Traveling on Ramp Lane
- Limits of Mainline Restriping/Westbound Only
- Sign
- Pavement Markings

ONLY BUSES TRANSIT

ATTACHMENT A

CALIFORNIA DEPARTMENT OF TRANSPORTATION
DISTRICT 11 ADVANCED PLANNING
OCTOBER 2005
SR-52/I-805
Typical Section
Memorandum

To: JESUS VARGAS (MS 255)  Chief
   Advanced Planning Branch

From: DEPARTMENT OF TRANSPORTATION - DISTRICT 11
       MATERIALS ENGINEERING BRANCH

Date: June 1, 2007

File: 11-SD-805, 52
       PM 23.7/25.9 (805)
       PM 3.8/6.9 (52)
       EA 11-335801

Subject: RECOMMENDATIONS FOR OUTSIDE SHOULDER STRUCTURAL SECTIONS

In accordance with your request dated April 9, 2007, a field condition assessment was conducted on April 10, 2007. The following recommendations are based on the assessment.

NB Rte. 805 PM 23.7 to 25.9 - The majority of the shoulder is in good condition with no visible cracks. There is a 1-foot strip where the edge of the shoulder next to the PCC (traffic side) is in poor condition. The location of the strip is on the north side of the Governor Dr. undercrossing. It does not appear to be caused by the transit buses. Removal of this strip is recommended.

SB Rte. 805 PM 23.7 to 25.9 - The shoulder is in good condition with no visible cracks. There is shoving of the AC where the shoulder terminates and the traffic lane begins. The shoving has created a hump of AC at that location. Removal of the AC hump is recommended.

EB Rte. 52 PM 3.8 to 6.9 - The shoulder is in good condition with no visible cracks. It appears to be recently flex-sealed. No rehabilitation is required at this time.

WB Rte. 52 PM 3.8 to 6.9 - The shoulder is in good condition with no visible cracks. It appears to be recently flex-sealed. No rehabilitation is required at this time.

The pavement rehabilitation strategy for shoulders to be used as bus lanes is to coldplane of the existing AC and base then place 0.50' AC in order to accommodate the wheel loads of the buses.

If you have questions or comments, please telephone me at (858) 467-4056, or FAX at (858) 467-4063.

David Evans
District Pavement Engineer
District 11 Materials Lab

Cc: P File
April 30, 2007

File No.: 07.645.12678.SANDAG-BUSES

Mr. Gary Gallegos, Executive Director
San Diego Association of Governments (SANDAG)
401 B Street, Suite 800
San Diego, CA 92101-4231

Attention: Mr. Barrow Emerson, Senior Transportation Planner

The purpose of this letter is to declare that, to our knowledge, there have been no issues or problems associated with the Buses on Shoulders Demonstration Project, which has been operational for the past year on Interstate 805 and State Route 52.

From the beginning, SANDAG has sought input and opinions from the California Highway Patrol relative to the safety aspects and potential hazards of this project. We are grateful for the opportunity to provide comments during the planning and operational phases, and are pleased to report no incidents involving the project.

We understand plans are underway to expand the project to an additional section of Interstate 805 in the south part of the County, and we support your efforts. We respectfully request participation as a member of the committee planning this expansion so that we may continue to offer comments and ideas which will contribute to the safety of the community. Should you have any questions, or if I can be of further assistance, please feel free to call me at (619) 220-5492.

Very truly yours,

C. M. McGAGIN, Captain
Commander
San Diego Area
May 21, 2007

File No.: 618.A13706. SANDAG-BUSES / FSP

Mr. Barrow Emerson, Senior Transportation Planner
San Diego Association of Governments (SANDAG)
401 B Street, Suite 800
San Diego, CA 92101-4231

Attention: Mr. Barrow Emerson, Senior Transportation Planner

Recently, I met with the San Diego Freeway Service Patrol (FSP) coordinators to discuss what impact (if any) the "Buses on Shoulder Demonstration Project" has had on our operations. No negative impact has been experienced to date, however, the limited scope of the current project affects a very small portion of the area's of responsibility associated with the FSP program.

If I can be of any further assistance in this matter, please feel free to call me at (858) 637-3870.

Sincerely,

P. SYMONDS, Lieutenant
Commander
Border Communications Center
SR-52 / I-805 TRANSIT LANE

AT: On SR-52 between I-805 and Kearny Villa Road, and on I-805 between SR-52 and Nobel Drive in the City of San Diego

IN: San Diego County, California

RECOMMENDED FOR APPROVAL:

Gary Gallegos Date
Executive Director, SANDAG

Pedro Orso - Delgado Date
District Director, Caltrans D-11

APPROVED BY:

Mark Leja Date
Division Chief, Design

Kris Balaji Date
Division Chief, Traffic Operations

ATTACHMENT G
**Introduction**

This proposal recommends a two-year pilot program to provide 8 miles of priority bus service on a segment of State Route 52 San Diego County between the westbound off-ramp to Interstate 805 (PM 4.050, KP 6.518) and Kearny Villa Road (PM 6.926, KP 11.146) and on I-805 between the northbound on-ramp from westbound SR-52 (PM 23.800, KP 38.302) and Nobel Drive (PM 25.476, KP 41.000). To provide this priority service, existing freeway shoulders on SR-52 and I-805 would be converted into Transit-Only lanes so that buses can bypass existing freeway congestion to provide faster more reliable service. It is anticipated that one bus every 30 minutes will use this route during the peak period.

**Need and Purpose of Pilot**

A key element of the San Diego Association of Governments’ (SANDAG) Transit First strategy is the use of transit priority measures along freeways and arterials to bypass congested areas that will result in higher transit speeds and improved schedule reliability. The 2030 Regional Transportation Plan (RTP) calls for a system of managed lanes and high occupancy vehicles (HOV) lanes along San Diego freeways to provide this priority. Based on the success of a similar program in Minneapolis/Saint Paul, SANDAG requested the department investigate the feasibility of allowing buses to use the existing shoulder area during peak periods until managed lanes and high occupancy vehicle lane system could be constructed over the next 10 to 15 years. To that end the department initiated this pilot in partnership with California Highway Patrol (CHP), Federal Highway Administration (FHWA), and SANDAG. Since these are projects with long implementation lead times, there is a need for short-term priority measures for existing express routes and early action Bus Rapid Transit (BRT) lines.

The purpose of this pilot is to demonstrate the operational feasibility of using existing shoulders as Transit-Only Lanes, as well as to investigate and identify:

- Lessons learned from other programs
- Potential safety, operational, enforcement, maintenance and legal issues.
- Pilot Operational Guidelines
- Location for a pilot
- Highway Improvements necessary to implement
- Performance measures/Success criteria for pilot

**Background Regarding Similar Programs**

In 1992 the Minnesota Department of Transportation began converting shoulders to transit only lanes. Fifteen lane miles were added the first year and by 2002 over 150 lane miles of shoulder were converted to transit only lanes. Only non-injury accidents involving buses on transit lanes were reported and the accident rate was less than three per year per route. In those ten years no serious injuries or fatalities have been reported involving buses on transit lanes.

Miami’s Dade County recently approved a three-year pilot program with similar geometric and speed requirements as those outlined in this document. Dade County plans to use existing 10-foot wide shoulders and speed limit of 35 mph. No physical improvements aside from signing and striping are proposed.
**Background Regarding San Diego Pilot**

During the initial discussion regarding the feasibility of this pilot a series of issues were discussed including:

- Legality of allowing part time use of shoulders
- Impact of speed differential between buses and mainlane traffic
- Impact to emergency vehicles & breakdowns
- Enforcement of mainlane violations and transit lane violations
- Impact of oversize loads, obstructions, storm runoff, and interchange ingress and egress
- Off peak operation
- Structural Sufficiency of Shoulder
- Geometric constraints
- Driver confusion
- Impact to mainlane traffic

Since it is not clear if the pilot will be effective in encouraging bus ridership and the impact of these lanes on mainline traffic, it was important to locate the pilot at a location that required minimal capital improvements to implement, interfaced with an existing transit route, and did not have existing operational characteristics that could detract from the results of the study. After looking at several locations the SR 52/1-805 location was selected.

Within the project limits, SR-52 is currently a 6-lane facility with additional auxiliary lanes positioned between interchanges. I-805 is an 8-lane facility, likewise with additional auxiliary lanes. Both facilities are located in an urban area with businesses and housing on the west and south sections along the freeway, and undeveloped, hilly-type, brush-vegetated land to the north and east.

The SANDAG Board of Directors has identified the Managed/HOV Lane project on SR-52 and I-805 as high regional priorities. Funds have already been allocated to conduct environmental studies as part of the Transnet 2 Early Action Projects (EAP). Studies on these projects are already underway with construction for this project tentatively scheduled to begin in 2009. These managed lane systems will provide the backbone of the region’s Bus Rapid Transit (BRT) system.

Route 960 is an existing express bus route that operates between the Euclid Avenue Trolley Station and University City. This route was selected because it represents an express service that will benefit from these freeway improvements.

As part of the development of this pilot, the issue regarding legislative authority to allow part time use of shoulders was investigated. The California Vehicle Code does not allow the shoulders to be used as traversable lanes. Consequently, the shoulders will be posted as full time Transit Lanes and technically the shoulders will not be available for emergency, maintenance, or enforcement activities during any part of the day.
**Pilot Proposal**
The proposal would provide priority service for 6 buses in each peak period. The proposal includes three elements:

- Operational Guidelines
- Highway modifications necessary to implement
- Performance measures/Success criteria for pilot

**Operational Guidelines & Requirements**
- The pilot program will be in effect for 24 months. This will allow for a 12-month re-evaluation period to decide if the pilot should continue.
- Buses will travel in a Transit-Only lane created from the existing shoulder.
- The maximum speed of the buses will be 35 mph.
- Based on existing congestion, operation hours are expected to be from 6:00 AM to 9:00 AM and 3:00 PM to 6:00 PM. The Transit Lane, however, will be available on a 24-hour period and bus drivers will be told they can use it anytime that speeds drop below 35 mph.
- Buses are allowed to drive on the Transit-Only lanes only when mainline traffic speeds drop below 35 MPH. If the shoulder is obstructed in any way, the bus driver will merge back into the main lane to avoid the obstruction. Bus drivers must yield to any vehicle that enters the transit-only lane as well as any vehicle merging or exiting an interchange.
- Buses will not be permitted to travel in the transit lane during periods of rain or when the potential for flooding is present.
- At the Request of the California Highway Patrol (CHP), the speed differential between buses and mainline traffic should be limited to 10 miles per hour.
- Training for the bus drivers will address the program requirements as well as how to handle obstructions such as stalled vehicles. Classroom training for the bus drivers has been completed and field training is scheduled to take place during the month of December 2005.
- An extensive public outreach program aimed to inform motorists and transit riders will be conducted by SANDAG in the weeks prior to implementation of the pilot. The campaign will include newspaper and radio ads.
- Metropolitan Transit System (MTS), who will operate the transit buses, like the Department, is self-insured and carries the necessary liability insurance.
- Only transit buses operated by MTS will be permitted to use the transit lane.

**Proposed Highway Modifications**
Through the eight miles of the pilot, buses will use a mixture of existing auxiliary lanes and converted shoulders. Approximately half of that distance will be on converted shoulders and the other half will be on either the mainlane or existing auxiliary lanes (see exhibit A). The use of these converted shoulders will require the buses merging into the mainlanes at interchange ingress and egress points - yielding to cars.

Highway signs at the edge of the transit lanes will be placed approximately every half-mile throughout the route to inform motorists that the lane is for authorized buses only.

Converting the westbound shoulders on SR-52 prior to the I-805 interchange requires restriping a half of a mile of mainlanes and shoulder (see exhibit A) to maintain 10-foot transit lane in areas...
of obstructions. Lanes number 1 and 2 will be striped to 11 feet in width and lanes 3 and 4 will remain at 12 feet in width. Additionally, pavement markings that read “Transit Buses Only” will be painted in the lane at intermittent locations (See Exhibit A for approximate locations).

Once the pilot program begins, pavements markings, different shoulder stripe, and signs indicating fines may be added as needed. For the pilot program overhead signs are not recommended at this time. SANDAG has agreed to install video cameras in areas of particular interest. These locations will be determined after a few weeks of operation.

Other modifications include:

- Signal timing at Nobel Drive ramp meter needs to be retimed to better allow HOV priority—suggest it allow 2 vehicles per green or to allow HOV meter to turn green after each SOV lane green cycle (currently the HOV meter turns green only after both SOV lanes have cycled)
- A sign has been installed on the back of each bus warning drivers to not follow the bus while in the transit lane.

**Performance measures/Success criteria for pilot**

At the direction of Caltrans and CHP, SANDAG will prepare an assessment report to monitor the effects of the pilot against the existing baseline performance measures. The baseline conditions are outlined below. Performance measures will be used to determine the pilot’s success and establish or modify guidelines, propose additional capital improvements, as well as address additional maintenance and enforcement costs and responsibilities for future projects. The measures will include:

1. Safety
2. Freeway Operations
3. Transit Travel-time Reliability and Savings.

Note: Since the pilot is intended to test the feasibility of using the shoulder for transit priority from an operational perspective transit ridership is not included as a primary performance measure. However it would be included as criteria for selection of future projects.

The pilot assessment will evaluate all the factors above and calculate a cost vs. benefit analysis that will determine if the benefits of the project in terms of travel time reliability, safety, changes in freeway service and driver/passengers perception is a benefit to the region compared to the amount of capital costs associated with the project. If deemed feasible by the criteria and performance measures discussed throughout this report, then the next objective would be to establish criteria for future projects. The pilot will address the following:

**Safety**: This task will review accident data for both the freeway operations and transit operations to determine the impacts associated with the addition of transit vehicles to freeway shoulders. The technical report to be completed by SANDAG will assess:
Are any accidents attributable to the transit lane operations?
Are any accidents related to emergency stopping of vehicles in the Transit Lane?
What is the frequency and severity of “near-misses” when buses transition to/from the transit lane?
Do Caltrans maintenance and freeway patrol crews experience safety-related issues due to transit lane operations?
Do CHP officers experience safety-related issues due to transit lane operations?

According to the TASAS Table B Accident Records between June 2001 and July 2004, three out of the 95 accidents that occurred on SR-52 within the project limits were shoulder related accidents, all of which were property damage only and injury type accidents and no fatalities. On I-805, two out of the 197 accidents occurred on shoulder. No fatalities occurred.

<table>
<thead>
<tr>
<th>Location</th>
<th>Total # of Accidents</th>
<th>Actual Rates (per million vehicle miles)</th>
<th>Average Rates (per million vehicle miles)</th>
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<tr>
<td></td>
<td></td>
<td>F</td>
<td>F+I</td>
</tr>
<tr>
<td>State Route 52 (PM 4.050 to 6.925)</td>
<td>95</td>
<td>0.003</td>
<td>0.13</td>
</tr>
<tr>
<td>Interstate 805 (PM 23.800 to 25.475)</td>
<td>197</td>
<td>0.000</td>
<td>0.20</td>
</tr>
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</table>

During the life of the pilot there will be ongoing monitoring of accident and observational data for both the freeway operations and transit operations to assess:

- Are any accidents attributable to the transit lane operations?
- What is the frequency and severity of “near-misses” when buses transition to/from the transit lane?
- Do Caltrans maintenance and freeway patrol crews experience safety-related issues due to transit lane operations?
- Do CHP officers experience safety-related issues due to transit lane operations. This assessment will include an independent formal review of the project and analyzing the data gathered to determine the increased work efforts, disruptions, and safety ramifications caused by the transit lane operations.

Public Safety will be evaluated in at least the following ways:

- Via data collection and data analysis: total collisions and collision severity are standard performance indicators.
- Via observation; e.g. Evaluators can ride buses, and/or video can be taken from cameras mounted on or within buses.

ATTACHMENT G
Perception of SHS users (including bus operators, passengers and other SHS users); surveys may be used to collect data.

This information will be used to not only assess the ultimate success of the pilot, but to also modify the conditions of the pilot and/or freeway features (such as the signing and striping package) on an ongoing/as needed basis throughout the life of the pilot. The pilot can be terminated at any time if either Caltrans or the CHP determine that the operations are unsafe and unmitigatable.

The District Traffic Safety Office shall make the final determination on the scope of the safety evaluation and criteria upon which the evaluation will be based. Additionally, The Department may terminate the pilot at any time if safety becomes a concern.

Freeway operations: This portion of the assessment would attempt to determine if freeway operations are degraded with the addition of the transit lanes. This report will address:

- Is there a reduction in freeway level-of-service/effective capacity due to the transit lane?
- Do bus transitions to/from the transit lane cause noticeable disturbances (abrupt changes in speed, flow) to main lane traffic?
- Do any non-standard freeway features introduced by the transit lane project cause noticeable disturbances (abrupt changes in speed, flow) to main lane traffic?
- Do Caltrans maintenance and freeway patrol crews experience increased work efforts or disruptions due to transit lane operations?

Given that the bus frequency is low (approximately 30 minute headways) and that the transit lanes will only be used during congested periods, the impact of the pilot on traditional measurements such as mainlane speeds and densities may not be easily measured. Consequently, the assessment report will rely on observational information that will include videotape of the mainlane traffic during operations.

Transit travel time reliability: The pilot will provide service to Bus Route 960. During the existing peak periods it is anticipated that 6 busses will travel through this segment.

In addition to the comparison of travel time and ridership, the assessment report will include a survey of bus passengers. Based on the Minnesota experience, passenger perceptions of travel time savings is typically double or triple of what is actually occurring. An additional survey will be conducted of drivers who are driving the route to determine if they also have the perception of increased travel timesavings and to achieve general feedback on their perceived success or failure of the route.

Data for Route 960 has been collected over several months to determine what the base travel time and ridership is. In addition, existing conditions on the freeway will be documented to determine congestion points and hot spots where the bus currently travels in stop-and-go traffic.

An example of baseline transit conditions is shown in the table below. The information represents one day during August 2005. The project files contain similar data for August,
September, October, and November of 2005 that will be compared to data collected during the pilot program to measure success.

**Starting Load:** 30

<table>
<thead>
<tr>
<th>STOP</th>
<th>Ons</th>
<th>Offs</th>
<th>Load</th>
<th>Arrival Time</th>
<th>Departing Time</th>
</tr>
</thead>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruffin Rd &amp; Clairemont Mesa</td>
<td>3</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruffin Rd &amp; Chesapeake Dr</td>
<td></td>
<td>19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judicial Dr &amp; Research Pl</td>
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<td>18</td>
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<td>5:56</td>
<td></td>
</tr>
<tr>
<td>Towne Centre &amp; Golden Haven Dr</td>
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<td></td>
<td></td>
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<tr>
<td>La Jolla Village &amp; Executive Wy</td>
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<td></td>
</tr>
<tr>
<td>Genesee Av &amp; La Jolla Village Dr</td>
<td>9</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>UTC</td>
<td></td>
<td>6</td>
<td>0</td>
<td>6:01</td>
<td>xxx</td>
</tr>
</tbody>
</table>

**Other Considerations**

**Traffic and transit vehicle operations:** A technical report to be completed jointly by Caltrans and SANDAG will be prepared to determine if freeway operations are degraded with the addition of the transit lanes. This report will address:

- Is there a reduction in freeway level-of-service/effective capacity due to the transit lane?
- Do bus transitions to/from the transit lane cause noticeable disturbances (abrupt changes in speed, flow) to main lane traffic?
- Do any non-standard freeway features introduced by the transit lane project cause noticeable disturbances (abrupt changes in speed, flow) to main lane traffic?
- Do Caltrans maintenance and freeway patrol crews experience increased work efforts or disruptions due to transit lane operations?

**Driver and passenger perceptions:** A survey of bus passengers will be conducted at the six and nine month mark. Based on the Minnesota experience, passenger perceptions of travel time
savings is typically double or triple of what is actually occurring. This survey will be done by SANDAG’s Assistance to Transit Operators (ATO) staff. An additional survey will be conducted of drivers who are driving the route to determine if they also have the perception of increased travel time savings and to achieve general feedback on their perceived success or failure of the route.

**CHP Review:** This task will involve CHP doing an independent formal review of the project and analyzing the data gathered to determine the increased work efforts, disruptions, and safety ramifications caused by the transit lane operations. This study will be funded by SANDAG.

**Cost vs. Benefit Analysis:** This analysis completed by SANDAG will evaluate all the factors above and calculate a cost vs. benefit analysis that will determine if the benefits of the project in terms of travel time reliability, safety, changes in freeway service and driver/passengers perception is a benefit to the region compared to the amount of capital costs and risks associated with the project.

**Criteria for Future Projects**

Assuming the program is a success, after the pilot, the final report will develop criteria for additional candidate locations for review and approval (as well as the potential continued use of the I-805/SR 52 site as a transit lane). Those criteria will include but not be limited to:

- Is a project planned to construct a permanent lane to carry buses, and is that project a regional priority?
- Is a permanent project funded?
- Is there a ridership need?
- Is there a potential for travel-time-savings?
- Is there multi-modal connectivity?
- Feasibility of other alternatives, including the use of City Streets

Approval and potential improvements will also be contingent on site specific characteristics include but not be limited to:

- Structural section adequacy.
- Drainage modifications.
- Transit lane width.
- Enforcement/maintenance/emergency pullouts.
- Signing and striping.
- Grade breaks and super elevation.
- Lateral obstructions in the clear recovery zone.
- Guardrail and dike modifications.
- Required design exceptions and potential improvements or mitigating measures to eliminate or reduce the impact of those exceptions.

Also, if it is determined that additional transit lanes warrant legislation to modify the California Vehicle Code allowing part time usage of the shoulders as Transit only lanes, should be considered. This could significantly reduce issues related to the loss of shoulders.
It is important to note that during construction projects where the shoulder is needed to perform the work, neither a shoulder or transit lane will be available for transit or enforcement.

**Design Standards**

There are six design standards features that will be impacted by this pilot. Two impact mainlane traffic and four impact the bus traffic.

**Mainlane Design Standards**

- At various locations the existing 10-foot right shoulder would be eliminated and converted into a transit-only lane. Consequently, there are no areas for vehicle emergency or enforcement (HDM Index 302.1 Shoulder Width)
- On SR-52 only - Reduce mainline No. 1 and 2 lanes from 12-feet to 11-feet, thus creating nonstandard lane widths. (HDM Index 301.1 Traveled Way Width)

**Bus Traffic Design Standards**

- As a result from Design Exception Feature #1, there would be little or no clear recovery zone for the buses. (HDM Index 309.1(2) Clear Recovery Zone)
- As a result from Design Exception Feature #1, there would be no horizontal clearance to fixed objects for the buses. (HDM Index 309.1(3)(a) Minimum Clearances)
- On I-805 only – The existing 10-feet right shoulder would be converted into a 10-foot transit-only lane, creating a nonstandard lane width for the buses. (HDM Index 301.1 Traveled Way Width)
- Convoy Street O.C. abutment is 10-feet from the edge of traveled way, and without safety shaped barriers for the buses. (HDM Index 309.1(3) Minimum Clearances)

**Concerns and Potential Mitigating Factors**

In 1995 the HQ Office of Traffic Operations and Office of Project Development issued a memorandum. The subject of that memorandum was “Guidelines: Part Time Use of Shoulders on Freeways for Traffic Lanes”. Those guidelines address the following items:

- **Structural section adequacy:**
  Four buses are expected to use the lane per direction per day. Shoulder section is adequate for a two-year pilot program. Monitoring will occur before, during, and after pilot top check for pavement damage.

- **Lack of area for enforcement, and maintenance:** Typical hours of operation will be from 6:00 AM to 9:00 AM and from 3:00 PM to 6:00 PM. Maintenance, if necessary, can occur outside of these times. The need for enforcement areas or pullouts will be determined by monitoring the pilot at the end of the 2-year program.

- **Need for drainage modification to avoid traffic in flooded areas:** For the pilot project no drainage modifications are proposed. Buses will not be permitted to travel in the transit lane during periods of rain or when the potential for flooding is present.

- **Removal or upgrading of features not designed for use under traffic (pull box covers):** No such features exist in the proposed route.

- **Bicycle usage:**
  None permitted in this portion of the route.
• **10-foot Transit lane width & resulting potential for buses width to extend into outside mixed use lane:**
  Minnesota experience demonstrated that vehicles naturally moved to inside of lane resulting in minimal operational impact to the main lane. In Minnesota, they indicated that cars tended to move over to give the buses more room. This will be verified as part of program monitoring.

• **Lack of area for emergency vehicle pull out or for a monitoring system and a disabled vehicle warning system:** Although not signed to allow emergency parking, in the event of an emergency, a disabled vehicle can occupy the transit lane until assistance is rendered. Buses can avoid disabled vehicles by merging into the general-purpose lanes. Moreover, the maximum operating speed of the Transit-Only lane is 35-mph, which will reduce any risk.

• **Provision of pullouts near Service Authority for Freeways and Expressways call boxes to accommodate disabled vehicles and CHP enforcement:** Same as previous issue.

• **Need to remove or protect roadside obstacles:** Maintenance forces can be used to remove obstacles. Additionally, SANDAG has agreed to provide funds for additional Freeway Service Patrol for the project area.

At the end of this pilot if it is recommended to maintain the Transit Lane or to pursue other locations, the issues listed above will be reevaluated to determine what further improvements are required. If it is determined that design standards cannot be met, a Design Exception Fact Sheet will be prepared justifying the nonstandard features. In addition, legislation to modify the California Vehicle Code allowing part time usage of the shoulders as Transit lanes should be considered.

**Environmental Status**
The pilot has been determined to be categorically exempt.

**Schedule and Cost**
The pilot will be in place for two years. Implementation is scheduled for late 2005. The cost of the project is approximately $100,000. The scope of the work is limited to signing and striping. There are additional costs for a public service campaign and for addition of Freeway Service Patrol, but this work will be done by and paid for by SANDAG.

Data from the first twelve months of the pilot program will be used to prepare a report that will address not only the program’s success but also make recommendations for future projects. The goal is to have a recommendation at the end of the 12-month pilot. Below is the anticipated schedule.

<table>
<thead>
<tr>
<th>Pilot Program Evaluation Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot Program</td>
</tr>
<tr>
<td>Dec ‘05 - Dec ‘07</td>
</tr>
</tbody>
</table>
Reviews
Federal Highway Administration – Jeff Lewis
Caltrans Headquarters Division of Design, Design Coordinator, District 8 & 11 - Luis Betancourt
Caltrans Headquarters Traffic Operations - Jerry Champa
California Highway Patrol -

Exhibits
A Layout identifying areas of reduced lane widths and converted shoulders
B Typical Cross Section
C Traffic Sign
D Typical Cross Section at Restripe
Section 2

Bus on Shoulders Route 960 Field Observations

Since 2005, the MTS Route 960 has been able to operate on the freeway shoulder as a transit-only lane on I-805 from Nobel Drive to SR 52 and on SR 52 from I-805 to Kearny Villa Road. The Route 960 operates five trips northbound in the morning peak-period and six trips southbound in the afternoon peak-period. There is no midday or off-peak service. This pilot project has been evaluated in terms of safety, benefits to transit operations, bus driver and passenger perceptions, freeway level-of-service, maintenance, and shoulder lane pavement structural sufficiency issues. Several stakeholders identified a need to quantify time savings for the pilot project.

Field observations took place to monitor the use of the bus-on-shoulders program with the goal of quantifying time savings when the bus uses the shoulder. Field observations were completed by following the 960 bus in a car while times were recorded at different time points along the route, and to identify when and where the bus used the shoulder and if there was any significant time savings. The focus of the observations was for the freeway portion of Route 960 from on-ramp to off-ramp. The observations took place on Tuesdays, Wednesdays, and Thursdays, when University of California-San Diego (UCSD) was in session. This methodology allows for typical traffic conditions on the freeway.

Field observations were conducted by SANDAG in September 2007, May 2008, and May 2009. A total of 36 trips were observed and buses were observed using the shoulder on six of those trips. The observed time savings ranged from a few seconds to a few minutes. As noted in Section 1, a test of the travel time savings between buses versus a car resulted in a five-minute faster travel time for the bus using the shoulder lane to bypass congestion as opposed to the automobile trip. The most frequent area of transit shoulder use and the most time savings occurred along the most congested segment of the route from the SR 52 connector to I-805 at Governor Drive. The lack of congestion was the overriding factor for each trip that the bus was not observed using the shoulder. The most common time to use the shoulder was in the afternoon when entering the freeway at Nobel Dr until the SR 52 connector and in the morning when approaching SR 52/I-805 connector until the exit at Nobel Drive.

The bus-on-shoulder lane maintains reliability for on-time performance in rare cases of severe traffic conditions caused by accidents, weather, or special events. Although no observations were made under these conditions, compared to general-purpose lanes, the bus-on-shoulder lanes provide considerable time savings. It allows the bus to stay on schedule regardless of the amount of congestion on the freeway.

The next steps of this project will be continued monitoring of the MTS 960 bus route for shoulder use and time savings.
Section 3

Bus on Shoulders Potential Site Selections

On September 4, 2008, staff from SANDAG, Caltrans, and MTS prioritized each of the potential locations for new bus-on-freeway-shoulder lane projects. Staff prioritized the potential locations into the following tiers based on a number of factors including, congestion, potential transit travel time savings, safety concerns, construction, and anticipated cost. The agencies are pursuing further analysis and implementation of the Tier 1A projects following conclusion of the bus-on-shoulders grant. If the Tier 1A projects prove unfeasible, other lower-tier projects will be pursued.

Tier 1A - Locations for further analysis and implementation
- Nobel Drive to I-805 South interchange/ramp improvements
- I-805 Southbound Shoulder (Mira Mesa to La Jolla Village Dr.)

Tier 1B – Existing project locations if Tier 1A projects don’t work
- SR-94 between I-5 and I-805
- SR-15 Mid-City

Tier 2 – Low-priority locations
- I-5 Middletown (Old Town to Downtown)
- I-5 Mid-Coast (Old Town to Gilman)
- SR-163 North of I-8 northbound

Tier 3 – Eliminated locations
- I-5 Genesee to Sorrento Valley
- SR-52 Summit (15 to 125)
- SR-163 North of I-8 southbound
- SR-905

Side Project
- Centre City Pkwy Onramp to I-15

The following pages provide more detailed information on each of the potential locations.
Tier 1A - Locations for further analysis and implementation

Nobel Drive to I-805 South interchange/ramp improvements

Bus Routes: 960, BOSS, South Bay BRT (680)

There is currently extremely heavy congestion on the Nobel Dr. ramp to southbound I-805 in the PM peak-period. There are 2 SOV lanes and 1 HOV lane on the ramp, all of which back up onto Nobel Drive because of the metering lights. The metering ramp is set equally among all three lanes due to high traffic volumes in both east and west turning moves at Nobel Dr. Currently, the 960 bus experiences delays up to 11 minutes waiting on the ramp to enter the freeway. There is a 30-foot-wide median on Nobel Dr. which could be used to widen the road to add a queue jump lane. There are no shoulders on the ramp so adding a transit shoulder lane on the ramp would require more intensive construction possibly with retaining walls. The Nobel Dr. median is on the City of San Diego right-of-way so SANDAG must coordinate with the city to make improvements on this section. It was also noted that direct access ramps (DAR)s will be constructed at Nobel Dr. as part of the 805 managed lanes project (2020).

Nobel Drive conceptual lane reconfiguration with queue jump lane in yellow.
The Mira Mesa Blvd. to La Jolla Village Dr. section of 805 experiences major congestion during the peak periods. The shoulder lane appears to be easy and inexpensive to implement with existing wide shoulders and only one mile in length while providing significant time savings to the bus. One consideration is that Caltrans has a new project just south of the Mira Mesa on ramp for the Carroll Canyon DAR and HOV lanes project (EA 2T0401) planned for the 805 median. The project will affect the shoulders for a distance of about 2000 feet south of the ramp. The bus-on-shoulder project in this area will need to be compatible with the Carroll Canyon DAR project since it is nearing the construction.

**Tier 1B – Existing project locations if Tier 1A projects don’t work**

**SR-94 between I-5 and I-805**

Bus Routes: 210, I-15 BRT (610), BOSS, South Bay BRT (628)

The SR 94 shoulder is a critical component of both the I-15 and South Bay BRT routes. Currently, CH2M Hill is working on a PSR for this corridor under the direction of SANDAG and Caltrans. The SR 94 PSR study will be focusing on the ultimate configuration of the freeway and is evaluating many alternatives including a shoulder alternative, fly-over facilities, and counter-flow options. One suggestion is to use the bus-on-shoulders grant to fund a study that will look at an interim shoulder option on the 94 by using the same methods of restriping that were recently used on I-805 for the BOSS project. A quick restripe study would cost approximately $35K-50K.
SANDAG and Caltrans are currently working on a project that will select the configuration of the BRT stations at El Cajon Blvd. and University Ave. Two of the four alternatives that are being considered would operate on the outside shoulder of I-15. The bus-on-shoulders grant could be used to fund the environmental document for the shoulder alternatives.

I-5 Middletown (Old Town to Downtown)
Bus Routes: 30, 50, 150

I-5 through Middletown was not considered a top priority due to light congestion, too many on/off ramps, and only the Route 50 bus uses the entire corridor. The 30 and 150 use primarily Pacific Highway, with only a short segment on I-5. The benefit in time savings for the bus would be minimal.
I-5 Mid-Coast (Old Town to Gilman)

Bus Routes: 30, 50, 150

The I-5 Mid-Coast corridor has slightly more congestion than I-5 Middletown but it appears that the congestion is localized around the Pacific Beach ramps. Most of the ramps through this corridor have auxiliary lanes, which could be used to link short segments of shoulder lanes together between each exit. The shoulder appears to be 10 feet wide except for the bridge over Rose Creek, which has no shoulder. Caltrans noted that there is a construction project that will be reconfiguring the I-8 west to I-5 north connector.

SR-163 North of I-8 northbound
Bus Routes: 20, 41, 810, 820, 850, 860

The 163 North out of Mission Valley experiences relatively heavy congestion. In most cases, the steep grades prohibit buses from attaining speeds that would be faster than the general traffic. An idea of a climbing lane on the shoulder was discussed but it would probably hinder the bus rather than help it since the bus would have to merge. The commuter express buses would not be able to use the shoulder lane since they would not be in the right lanes as they head north from downtown. The southbound direction was determined to have too many safety concerns as the traffic backs up from the Friars Rd.

off-ramp.
Tier 3 - Eliminated locations

I-5 Genesee to Sorrento Valley
Bus Routes: 89, 976, 977, 978

This short segment of I-5 would greatly benefit the Sorrento Valley COASTER connection routes. The shoulder appears to be wide enough and the shoulder lane would not require merging as it runs from on-ramp to off-ramp. The major issue with this location is that bicycles are permitted on the shoulder and joint bus/bike use would be extremely unlikely.

SR-52 Summit (15 to 125)
Bus Route: 870

The SR-52 over the summit corridor was eliminated because there are only two bus trips in each direction per day and the construction of the 52 managed lanes will eliminate the need for a shoulder lane.
SR-163 North of I-8 southbound
See 163 North of I-8 northbound section, above.

SR-905

Bus Route: 905

The construction of the new 905 freeway will bypass any improvements made to the current 905. The new freeway should eliminate the congestion that hinders the current bus operations.

Side Project

Centre City Pkwy Onramp to I-15

Bus Route: 810

In the AM peak period there is congestion on Centre City Pkwy. caused by the metering lights for the southbound on ramp to I-15. The HOV lane on the ramp does not allow the bus to fully bypass the traffic. There was discussion about a shoulder lane on the ramp to be used as a metering light queue jump. Since this shoulder location is within the construction zone of the I-15 managed lanes, it was suggested that this issue be addressed by construction mitigation until 2011. Any bus improvements would be unnecessary when the Hale St. DAR opens on the northern end of the managed lanes. Caltrans mentioned that the traffic department indicated some operational concerns for extending the turning pocket on Centre City Parkway. The raised median and the lack of shoulders in the area limit operation during this construction phase. Caltrans will revisit this area to see if other improvements could be made.
The segment of southbound I-805 between Mira Mesa Blvd. and La Jolla Village Dr. was selected as the top project from the freeway shoulder lane site selection process in Section 3. After preliminary discussions with Caltrans staff, it was identified that the Carroll Canyon Road Extension and Direct Access Ramp (DAR) project would start construction in 2009-2010. This project will re-stripe lanes on I-805 to make room for the DARs in the middle of the freeway thus reducing the shoulder width on the bridge over Carroll Canyon Rd. SANDAG is collaborating with Caltrans to include a freeway shoulder lane south of the Carroll Canyon Bridge to La Jolla Village Drive as part of the overall Carroll Canyon DAR project. The existing local MTS Route 921 and the planned I-15 BRT Route 470 would use the freeway shoulder lane to provide direct access between Sorrento Mesa and the UTC/UCSD area along La Jolla Village Drive.

The Carroll Canyon DAR project also includes a major realignment of the Mira Mesa Blvd/I-805 interchange. SANDAG staff identified this as an opportunity to include a transit priority treatment for buses that will enter the freeway into the proposed freeway shoulder lane. SANDAG and Caltrans developed six alternatives (Figure 4-1) that would provide transit priority using queue jumps, transit lanes, and alternative bus routings through this heavily congested area. A traffic analysis was completed that calculated travel time savings for each alternative (Figure 4-2). Alternative 3, which is a bus-only right-turn lane between the through lanes and right-turn lanes on Mira Mesa Blvd., was chosen as the recommended alternative based on feedback from stakeholders at Caltrans, SANDAG, and MTS.

As of August 2009, planning and engineering work are continuing on the Mira Mesa Blvd transit priority project and the freeway shoulder lane on I-805 southbound. Efforts are being made to advance the plans to a level that is acceptable to be included into the Carroll Canyon DAR project for cost and time savings.
Figure 4-2

Travel Time and Travel Time Savings

<table>
<thead>
<tr>
<th>Proposed Alternative</th>
<th>Travel Time (minutes)</th>
<th>Travel Time Savings (minutes)</th>
<th>Travel Time and Savings Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2012</td>
<td>2012</td>
<td>2030</td>
</tr>
<tr>
<td></td>
<td>AM</td>
<td>PM</td>
<td>AM</td>
</tr>
<tr>
<td>No Build (Mesa Mesa Boulevard)</td>
<td>5.2</td>
<td>8.9</td>
<td>5.4</td>
</tr>
<tr>
<td>No Build (Carroll Canyon Road)</td>
<td>4.8</td>
<td>9.7</td>
<td>5.6</td>
</tr>
<tr>
<td>Alt 1 - Westbound bus-only lane on northside of MMB</td>
<td>5.0</td>
<td>6.4</td>
<td>5.2</td>
</tr>
<tr>
<td>Alt 2 - Remove one thru lane on MMB</td>
<td>5.0</td>
<td>4.4</td>
<td>5.2</td>
</tr>
<tr>
<td>Alt 3 - Westbound bus-only lane between the thru and right-turn lanes</td>
<td>5.0</td>
<td>4.4</td>
<td>5.2</td>
</tr>
<tr>
<td>Alt 4 - Westbound Carroll Canyon bus-only lane between the rights and the lefts</td>
<td>4.7</td>
<td>7.7</td>
<td>5.5</td>
</tr>
<tr>
<td>Alt 5 - Westbound MMB cross over left-turn</td>
<td>4.3</td>
<td>3.1</td>
<td>4.3</td>
</tr>
<tr>
<td>Alt 6 - Bus-only access from westbound Carroll Canyon</td>
<td>4.1</td>
<td>5.5</td>
<td>4.5</td>
</tr>
</tbody>
</table>

**ASSUMPTIONS:**
1) The no build scenarios assume no BRT improvements along the bus route
2) The travel times for the alternatives assume a queue jump in place at the intersection of MMB and Scranton Road.
The queue jump varies in location depending on whether or not the bus takes a right onto MMB or continues thru on Scranton.
3) Queue jumps will not be provided at the intersections of Oberlin and Scranton and MMB and the I-805 NB Ramps.
4) The effects of the ramp meters were a judgment call
5) The delays and queue lengths at the intersections operating at level of service F were judgment calls

July 2009