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MAY 26, 2015

TO: **BOARD OF DIRECTORS**

THROUGH: **PHILLIP A. WASHINGTON**
CHIEF EXECUTIVE OFFICER

FROM: **BRYAN PENNINGTON, EXECUTIVE DIRECTOR, ENGINEERING AND CONSTRUCTION**

MARTHA WELBORNE, CHIEF PLANNING OFFICER, COUNTYWIDE PLANNING & DEVELOPMENT

SUBJECT: **I-405 SEPULVEDA PASS IMPROVEMENTS PROJECT EVALUATION**

ISSUE

Freeway traffic has now normalized to the new northbound I-405 carpool lane configuration between I-10 and U.S. 101. Metro, in partnership with Caltrans, is now in a position to take measure of the benefits of the I-405 Sepulveda Pass Improvements project on multimodal transportation, including transit, carpools, freeway and arterial traffic, pedestrians and bicyclists, as well as to analyze the project's overall impact on the Southern California economy. A recently conducted evaluation study finds that this project generated significant improvements for the I-405 corridor, which includes both the mainline freeway and local arterials. The study found the project generated notable public benefits in the form of improved travel times, a reduction of the p.m. peak rush hour period and daily vehicle hours of delay, greater person throughput, fewer accidents and improved air quality.

Additionally, Metro also worked with the Los Angeles Economic Development Corporation (LAEDC) to better quantify the project's economic effects to the Southern California economy. The initial economic activity related to Metro's transportation projects is the purchase of goods and services from local vendors and the wages and benefits paid to local workers, as well as tax revenue generated.

The purpose of this memorandum is to provide a summary on the findings of these two reports.

BACKGROUND

In 2009, Metro awarded a design-build contract to Kiewit to build a 10-mile carpool lane between the I-10 and U.S. 101, which would complete the entire I-405 carpool lane network between Orange County and North Los Angeles County areas. The project scope included a number of additional significant freeway improvement elements, including:

- Removal and replacement of the half century-old Skirball Center Drive, Sunset Boulevard and Mulholland Drive bridges;
- Standardization of freeway lane and shoulder widths for improved safety and faster emergency vehicle response to accidents;
- Realignment of 27 on- and off-ramps;
- Widening of 13 existing underpasses and structures;
- Construction of approximately 18 miles of retaining walls and soundwalls for adjacent communities.

Following a five-year construction period, the new carpool lane opened just prior to the Memorial Day weekend in 2014.

In April 2015, Metro contracted with System Metrics Group to analyze arterial and freeway traffic, accident and other freeway data from Caltrans, Inrix, Metro Freeway Service Patrol and other sources. The purpose of the study was to specifically compare traffic conditions before the freeway project began in 2009 with traffic conditions following the opening of the 10-mile carpool lane on May 23, 2014. No-build projections from the project's environmental impact report from 2005/2006 were also utilized as a baseline.

DISCUSSION

Inrix, a traffic analysis firm based in Kirkland, Washington, examined the Northbound I-405 between I-10 and U.S. 101 freeways in September 2014. The firm compared the afternoon rush hour period for a two-week period between September 2013 when the carpool lane was still under construction, and September 2014 when the carpool lane was fully operational. The Inrix data found that the average travel time during the peak period of 5 p.m. to 6 p.m. increased by one minute compared to the previous time period a year earlier. The data provided appears to support critics of the project that allege that the additional traffic lane did not achieve its goal of reducing commuter travel times on the Northbound I-405. However, results from the System Metrics analysis demonstrates that the project does, in fact achieve travel time savings overall and actual shortens the afternoon peak period by two hours. The Inrix study fails to look at the holistic picture and does not analyze all factors related to mobility in this corridor.

For example, it should be noted that the Inrix data was collected within only a 1.7-mile stretch of the carpool lane then open in 2013, and data was collected in

September when UCLA, the corridor's largest educational institution and employment center, was not in session. September does not represent normal operating conditions of the freeway in the project area.

System Metrics Group performed its analysis on comparative performance measures before, during and after construction. The firm acquired selected samples of traffic data from Caltrans, Inrix, Metro Freeway Service Patrol and other data sources in order to compile and average a high-level evaluation of typical commute conditions during mid-weekday periods. Seasonal months where schools were not in session were avoided to better ensure statistical validity. The study also included an assessment of selected arterial intersections, including Sepulveda Boulevard, Sunset Boulevard, Wilshire Boulevard and others.

SUMMARY OF FINDINGS

The report's analysis includes the following key findings:

- **Travel Times**- Peak period congestion in Westwood has been shortened by two hours. Before construction of the project, the afternoon peak period was between 2 p.m. and 9 p.m. Following construction, the afternoon peak period is now about 3 p.m. to 8 p.m. Freeway travel times are slightly higher than 2009 at the peak rush hour period of 5-6 p.m., but less than during construction in 2013.
- **Daily Vehicle-Hours Delay-** If the project had never been built, motorists today would be experiencing 16,000 daily vehicle hours of delay based on Caltrans' environmental impact report. Comparing the two studies shows construction of the project may have eliminated 6,000 daily vehicle hours of delay, a 37% reduction down to 10,000 vehicle-hours of delay.
- **Capacity**- Vehicle capacity on the Northbound I-405 increased from 10,000 vehicles per hour to 11,700 vehicles per hour. There is 15 percent more vehicle capacity and more than 30 percent more person capacity as a result of the newly constructed HOV lane.
- **Arterials**- Arterial flow volumes for major streets such as Sepuleveda, Sawtelle, Sunset, Montana, Santa Monica, Pico, Ventura, Valley Vista and Skirball are 20-50 percent lower following construction of the project. There have been significant "Level of Service" improvements on major intersections throughout the corridor.
- **Transit Ridership-** Average daily ridership from the San Fernando Valley to Westwood has increased 35% from 2009 to 2015, due in part to the introduction of the Metro "Westside-Valley Express" that utilizes the I-405 carpool lanes. The new express service promises to save transit commuters up to 20 minutes commute time compared with previous bus service between Van Nuys and Westwood. Implemented in December 2014, Metro Rapid Line 734 was also extended from Ventura and Sepulveda Boulevards to Westwood, providing patrons a true "Sepulveda

Rapid" service from Sylmar to Westwood. Combined, these new services give Valley patrons more travel options to access Westwood.

- **HOV Utilization-** Prior to the completion of the I-405 carpool lane, carpools had no advantage in West Los Angeles and Sepulveda Pass. Now, there is a distinct incentive to carpool. The Northbound I-405 HOV lane and mainline speeds varied by location along the 10-mile corridor. Northbound freeway peak period person-throughput is significantly higher now. In addition, the new HOV lane provides connectivity between Orange County and North Los Angeles County areas, creating potential for increased transit services on the I-405.
- **Safety-** Reduction in peak period congestion and standardized freeway lane and shoulder widths has improved freeway safety. There are 25 percent fewer Freeway Service Patrol (FSP) assists and 35 percent fewer incidents on the I-405. There were 15 percent fewer FSP-reported accidents in February 2015 compared with February 2009.
- **Travel Time Reliability-** Average travel time reliability has improved. Less variability in travel time in 2015 compared to 2009 means motorists can expect to reach their destinations more predictably throughout the day, particularly in the northbound direction.
- **Air Quality-** The project is estimated to reduce 266,000 tons of carbon dioxide emissions compared to no-build projections over a 20-year project lifecycle period.
- **Freeway Speeds-** While there were lower travel times in the Westwood area, higher travel times were observed from Getty Center Drive to U.S. 101 due to downstream congestion and bottlenecks on the I-405 beyond U.S. 101 and along U.S. 101 from connectors. Caltrans has stated that additional operational benefits may be observed once the ramp metering system (RMS) between the SR-101 and I-5 are further streamlined. The RMS was affected last fall and winter due to ongoing pavement rehabilitation construction work on the mainline freeway and the ramps throughout that segment.

The report also cites multi-modal improvements such as expanded sidewalks and 4-foot shoulders on rebuilt bridges and interchanges in the project corridor as additional project benefits.

LAEDC ECONOMIC IMPACT ANALYSIS

Metro has also commissioned the Los Angeles Economic Development Corporation to perform an economic analysis on the I-405 project on the Southern California economy. The results of the economic analysis indicate that large capital construction projects can yield substantial economic benefits for the region. Results from the economic analysis found the following:

- Initial Spending: $1.2 billion
- Total Output (includes direct, indirect and induced business revenues): $2.5 billion

- Total Employment: 14,330 jobs
- Total Compensation: $901 million
- Total Tax Revenues:
  State/Local: $106 million
  Federal: $187 million

These economic benefits do not include, among others, travel time cost savings or allowance for reduced costs related to fewer accidents.

Taken in their entirety, the full complement of project deliverables has improved motorists' commute on the Northbound I-405 and made it safer, and the project's construction has contributed to the region's economic recovery, helping the region navigate through one of the worst economic recessions on record.

NEXT STEPS

Metro and Caltrans have additional mobility improvements planned for the I-405 project corridor that promise to capitalize on the completed carpool lane network and augment the efficiency gains now being obtained on the freeway. Metro's Sepulveda Pass Transit Corridor Project, for example, could potentially use the completed carpool lane network to introduce greater public transit vehicle access. Caltrans is now in the process of completing work on its freeway ramp metering system in order to more efficiently manage traffic flows onto the freeway.

The studies outlined in this report are informative for the Board of Directors and provide the benefits that derive from the billions of dollars of transportation infrastructure investment. Staff will also work to release this information to our key partners and the public.

Attachments:

A. Post I-405 Sepulveda Pass Improvements Project Evaluation Presentation
B. April 22, 2015 Post I-405 Sepulveda Pass Improvements Project Evaluation Report
C. Los Angeles Economic Development Corporation Economic Impact Analysis

Attachment A

POST I-405 SEPULVEDA PASS IMPROVEMENTS PROJECT EVALUATION

May 12, 2015

Before/After Periods

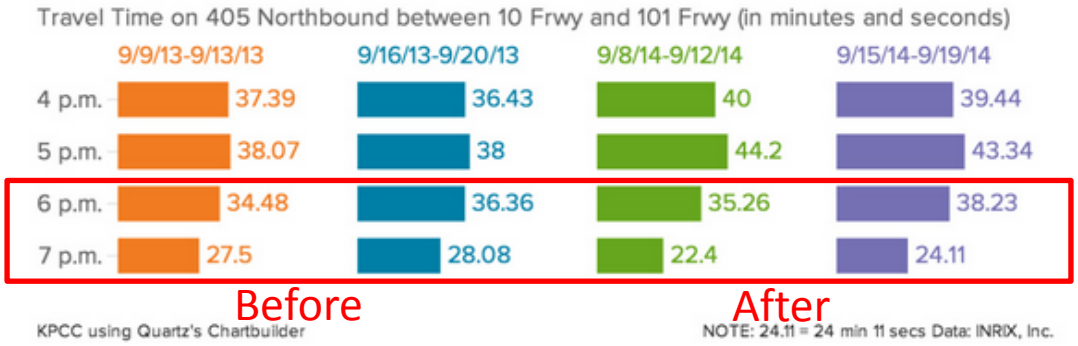
- **HOVL open to traffic on 5/23/2014**
- **Before**
  - 2005/2006 & 2015 projected No-Build (EIR/EIS)
  - 2009 before start of construction (recessionary period)

  - October 2013 to May 2014 during construction
    (note: UCLA Fall Quarter started 9/26/2013)

- **After**
  - October 2014 to April 2015
    (note: UCLA Fall Quarter started 10/2/2014)

Article

INRIX, a traffic analysis firm, examined the Northbound 405 between the 10 and 101 freeways, from 4 p.m. to 7 p.m. The study compared travel times from the middle two weeks of September, 2013 (with only a 1.7 mile stretch of the carpool lane open) to the same period this year (with the full 10-mile carpool lane in service for nearly five months.) The average travel time this September was 35 minutes, roughly a minute slower than last September.



There was some good news from INRIX. The worst congestion of rush hour appears to be ending earlier. A year ago, the average travel time from 7 p.m. to 8 p.m. on the northbound stretch was 28 minutes. Now, it's down to 22 minutes, according to Jim Bak, a director of INRIX in Kirkland, Washington.

"While travel times in the peak of rush hour – 5 p.m. to 6 p.m. have not gotten better or marginally worse, we are seeing travel times getting better towards the tail end of the rush hour period," Bak told KPCC.

Note: UCLA was not in session in September 2013 and September 2014 – does not represent typical commute pattern

I-405 Evaluation (Post Project)

Mobility & Productivity

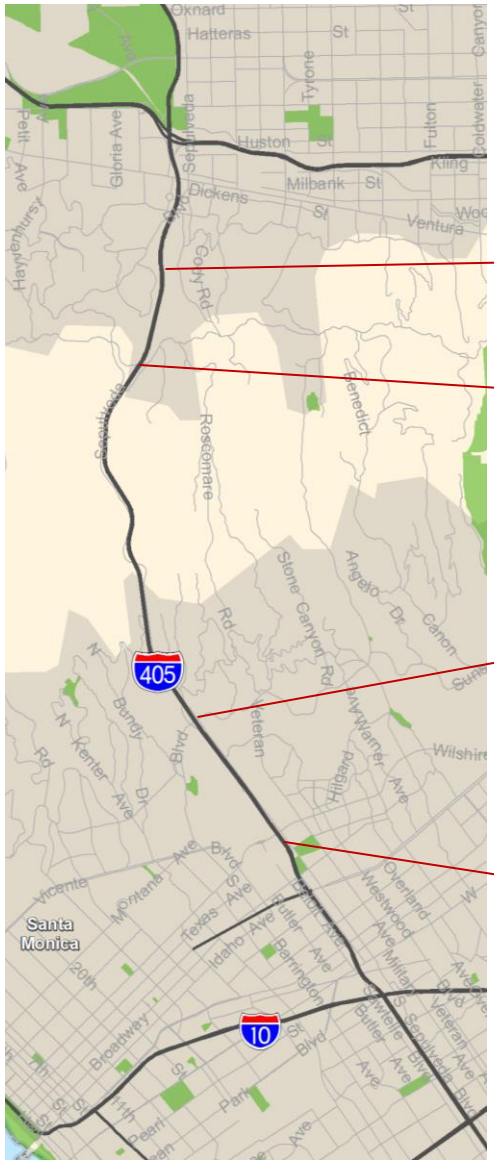
Mobility & Productivity

- **Before**, traffic avoided the freeway
  - Northbound freeway peak period volume was lower
  - Alternative routes (Sepulveda Blvd and Sawtelle Blvd) volumes were higher
  - Local intersections operations were poor
  - Corridor capacity was limited

- **After**, traffic went back to using the freeway
  - Northbound freeway peak period volume is now higher
  - Alternative routes volumes are now lower
  - Local intersection operations have improved
  - Corridor capacity is increased and can still go higher

Freeway Flow (Volumes)

about 5% to 15% higher after, especially off-peak hours



at Valley Vista

2009	2015
48,590	56,300

Data source: Caltrans VDS

at Sunset

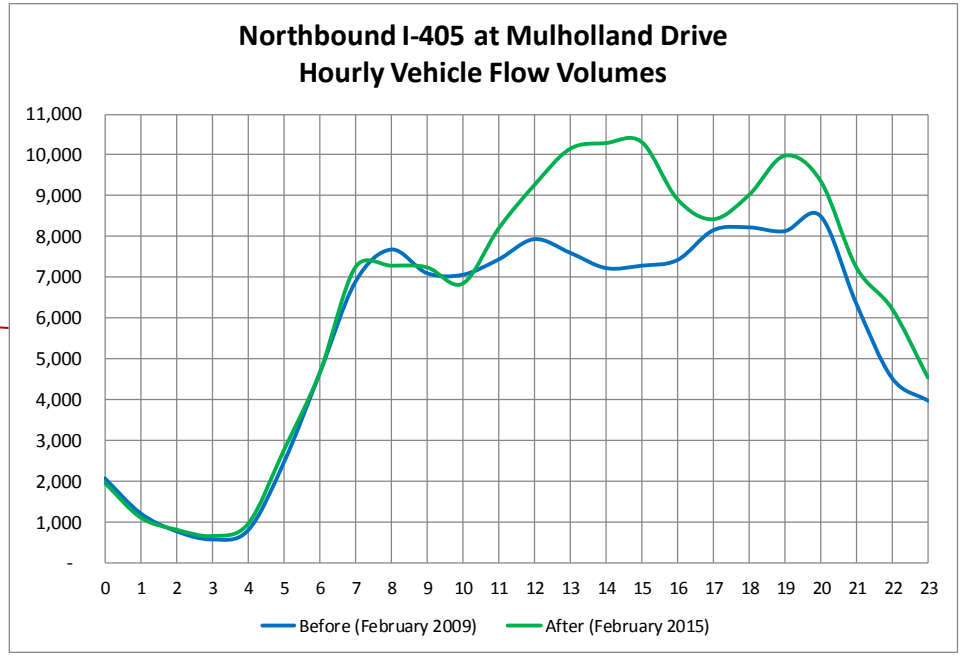
2009	2015
36,880	39,070

Data source: Caltrans VDS

at Wilshire

2009	2015
33,000	35,930

Data source: Caltrans VDS

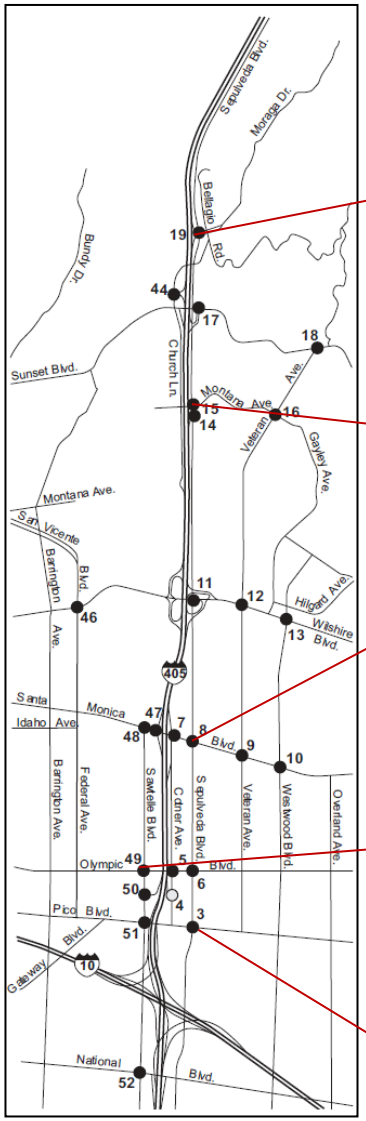


Northbound I-405

PM peak period (3pm - 8pm) volumes of a typical weekday in February 2009 (before) and February 2015 (after)

Arterial Flow (Volumes)

about 20% to 50% lower volumes on Sepulveda/ Sawtelle after



Data source: 2006 EIR/EIS, 2015 manual counts

at n/o Sunset

2005	2015
2,254	1,880

at Montana

2005	2015
1,687	1,192

at Santa Monica

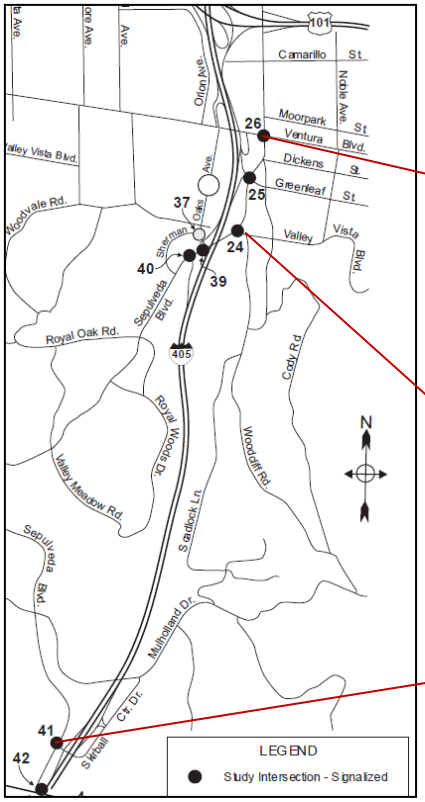
2005	2015
861	865

at Olympic (Sawtelle)

2005	2015
448	255

at Pico

2005	2015
1,599	864



Data source: 2006 EIR/EIS, 2015 manual counts

at Ventura

2005	2015
1,541	936

at Valley Vista

2005	2015
2,301	934

at Skirball

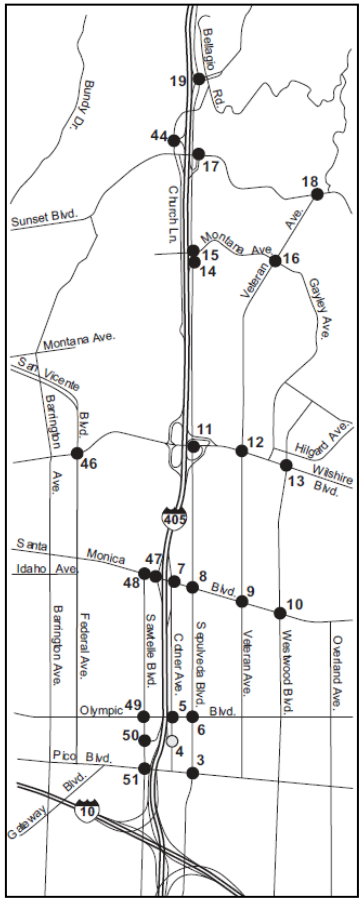
2005	2015
2,008	1,623

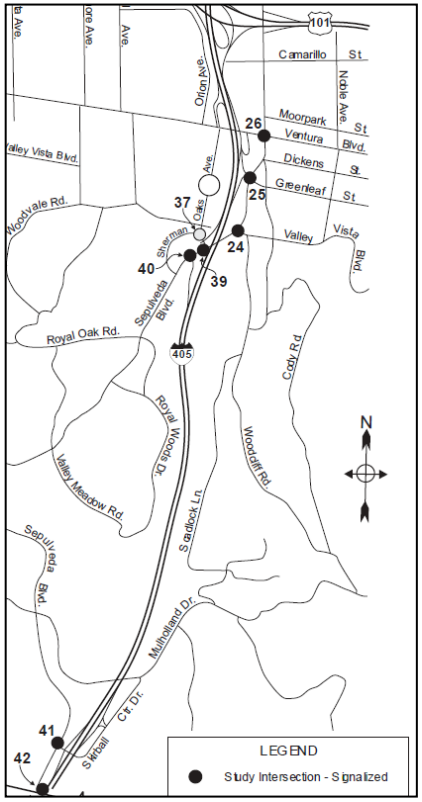
Northbound Sepulveda Blvd/Sawtelle Blvd

PM peak hour (5pm - 6pm) volumes of a typical weekday in 2005 (before) and February 2015 (after)

Arterial Operations

significant LOS improvements at intersections after





Weekday PM Peak Hour
Intersection Level of Service (LOS)

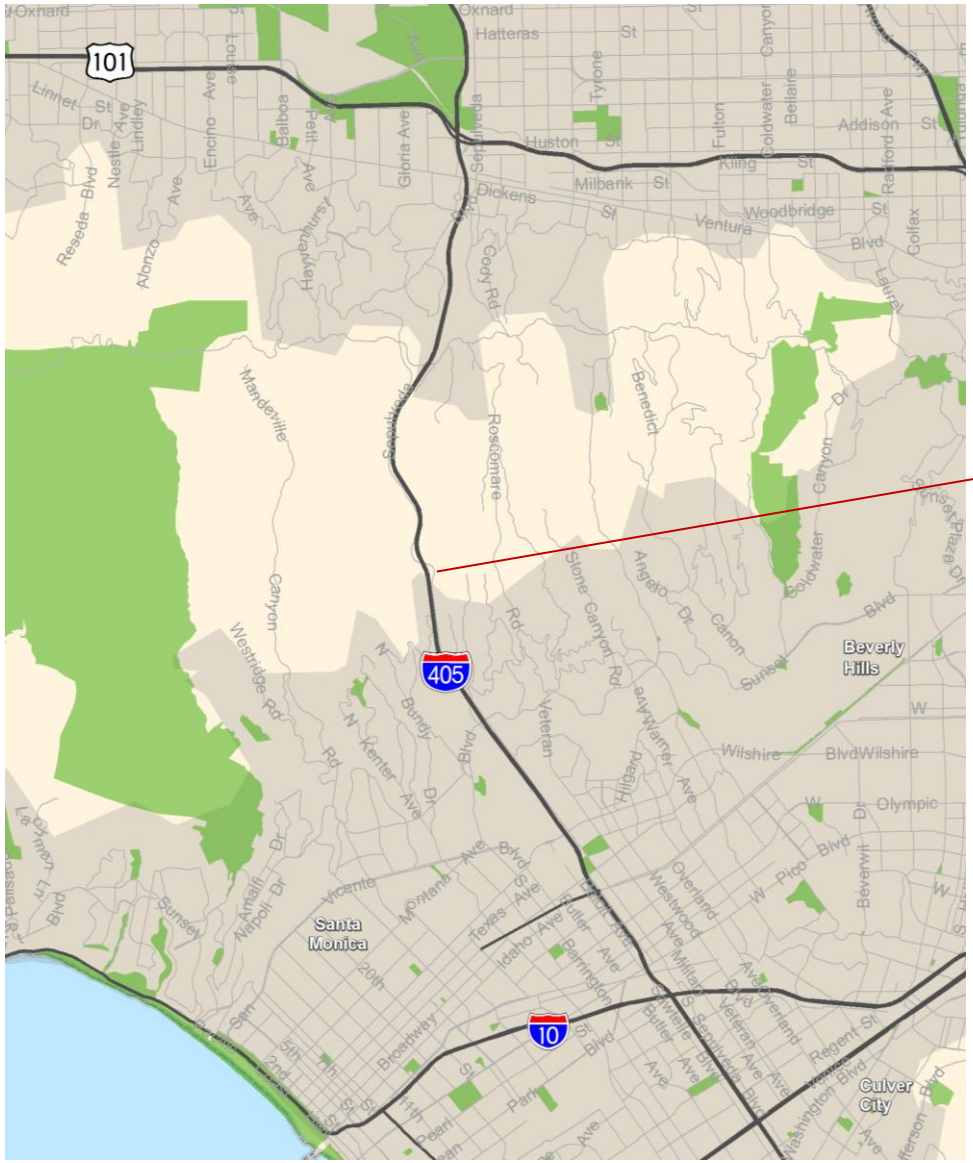
Location Number	Intersection Name		PM Peak (LOS) 2005	PM Peak (LOS) 2015
3	Sepulveda Blvd	Pico Blvd	F	E
6	Sepulveda Blvd	Olympic Blvd	F	C
8	Sepulveda Blvd	Santa Monica Blvd	F	D
11	Sepulveda Blvd	Wilshire Blvd	F	C
12	Veteran Ave	Wilshire Blvd	F	C
26	Sepulveda Blvd	Ventura Ave	E	E
41	Sepulveda Blvd	Skirball Center Dr	F	F
46	Federal Ave	Wilshire Blvd	F	D
48	Sawtelle Blvd	Santa Monica Blvd	F	E
49	Sawtelle Blvd	Olympic Blvd	E	C
51	Sawtelle Blvd	Pico Blvd	E	F

Source: 2006 EIR/EIS, ICU estimates using 2015 manual counts data

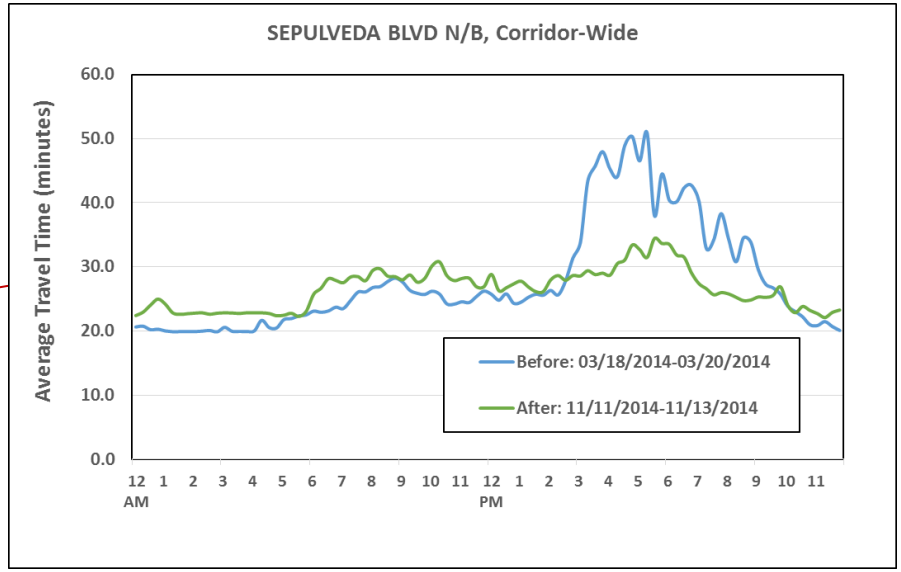
Select intersections with poor LOS in 2005, PM peak hour (5pm - 6pm) during typical weekday in 2005 (before) and April 2015 (after)

Arterial Travel Times

as much as 35% faster during the PM peak



NB Sepulveda Blvd (from I-10 to US-101)
Weekday Average Travel Times



Data source: INRIX

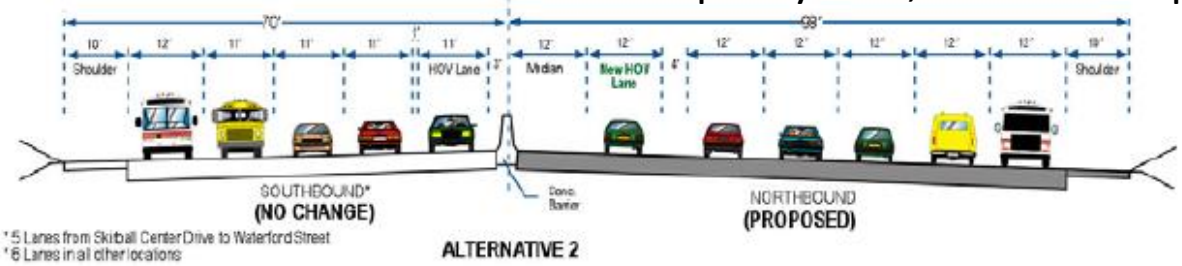
Northbound Sepulveda Boulevard
average travel times of mid-weekdays (Tuesday-Thursday) in March 2014 (before) and November 2014 (after)

Freeway Capacity

About 15% more vehicle capacity and 30%+ more person capacity

Before Vehicle capacity = 10,000 vehicles per hour

After Vehicle capacity = 11,700 vehicles per hour



Northbound I-405

- *Normal vehicle capacity is 2000 vehicles per hour per lane and HOVL capacity is 1700 vehicles per hour per lane.*
- *A 2+ HOVLs carry more than double the number of persons than regular lanes. HOVLs have the potential to have increasing person capacity over time, and is therefore limitless.*

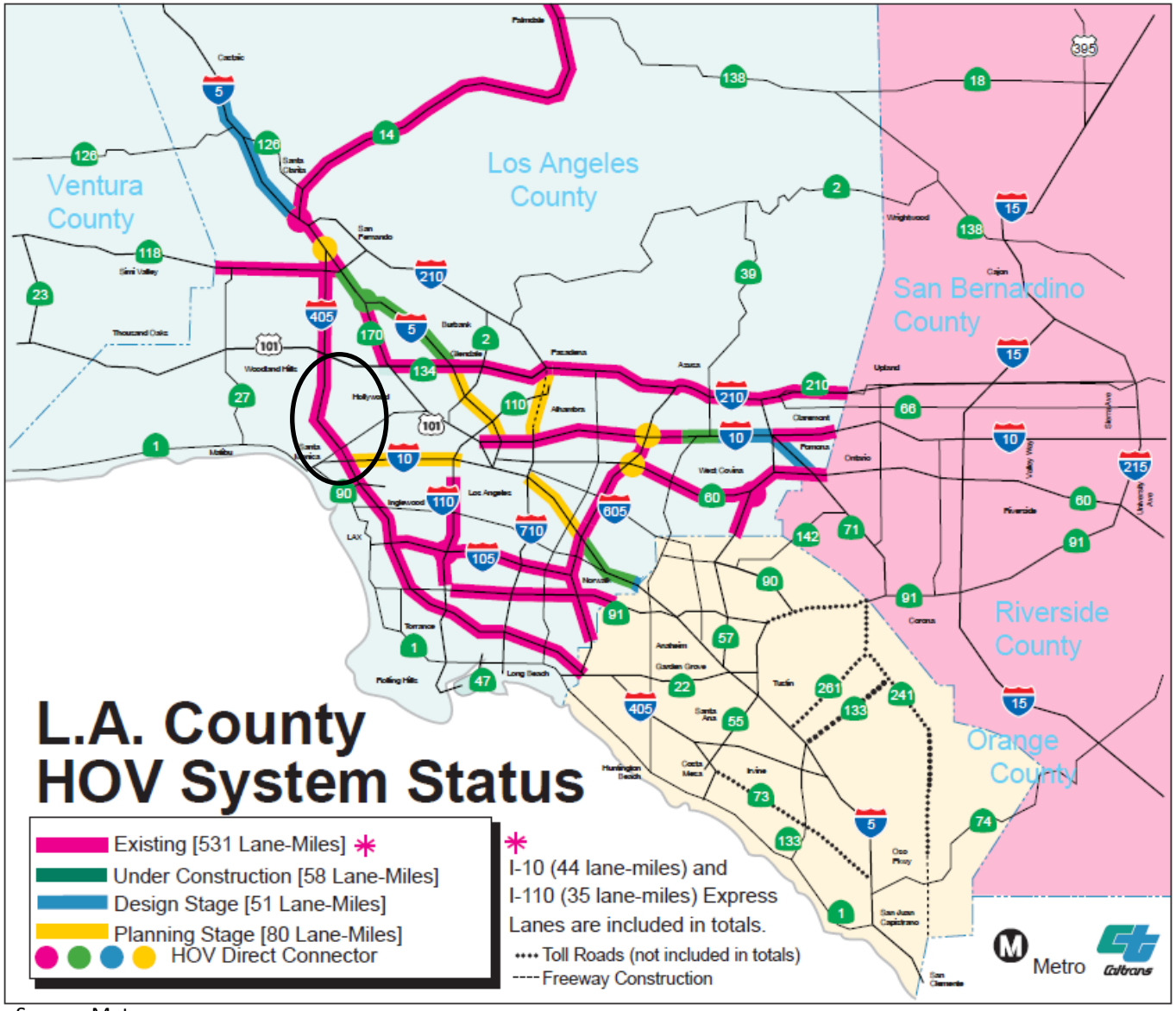
Freeway HOVL Utilization

- **Before**, carpools had no advantage
  - Northbound freeway carpools, vanpools, and buses were mixed with single occupant vehicles in mainline lanes
  - Modal choice was limited
  - Sustainability was not incentivized

- **After**, carpools now have distinct incentive
  - There is distinct incentive to carpool as part of network
  - Already significant use of the HOVL by carpools, buses, and vanpools (so much so that it is already at capacity)
  - Northbound freeway peak period person-throughput is significantly higher now

HOVL System Network

Project completes the system network providing incentives to carpools



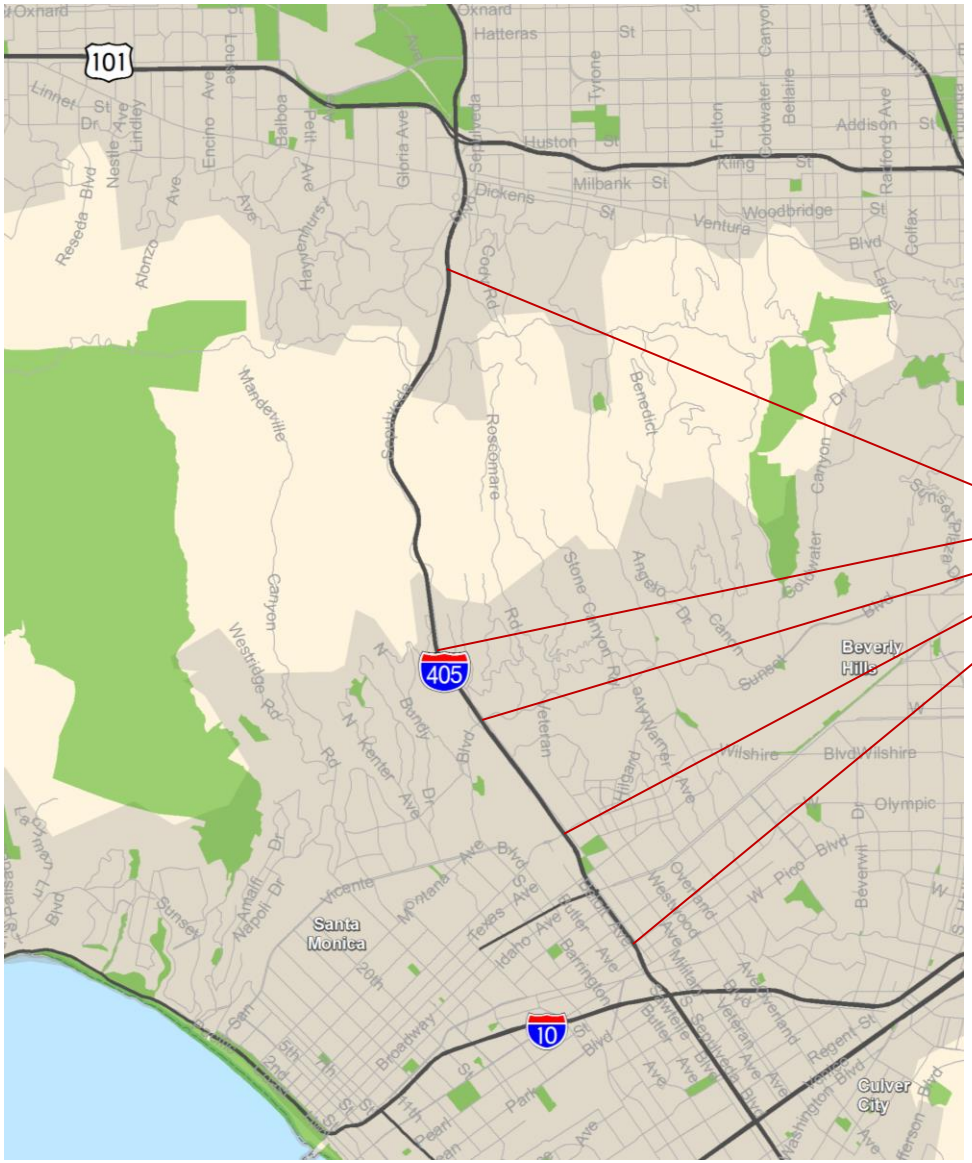
Northbound I-405

HOVL part of County HOV system network, now complete

Source: Metro

HOVL Flow (Volumes)

about 1,200 to 1,700 vph in HOVL during PM peak



Northbound I-405 HOV Lane Volumes
Weekday Peak Hour and Peak Period

	HOVL Vehicular Volumes	
NB-405 at:	**Peak Hour**	**Peak Period (3-8PM)**
Woodcrest	1,480	7,198
Getty Center	1,693	7,676
Sunset	1,392	6,391
Wilshire2	1,345	6,155
Pico/Olympic	1,168	5,070

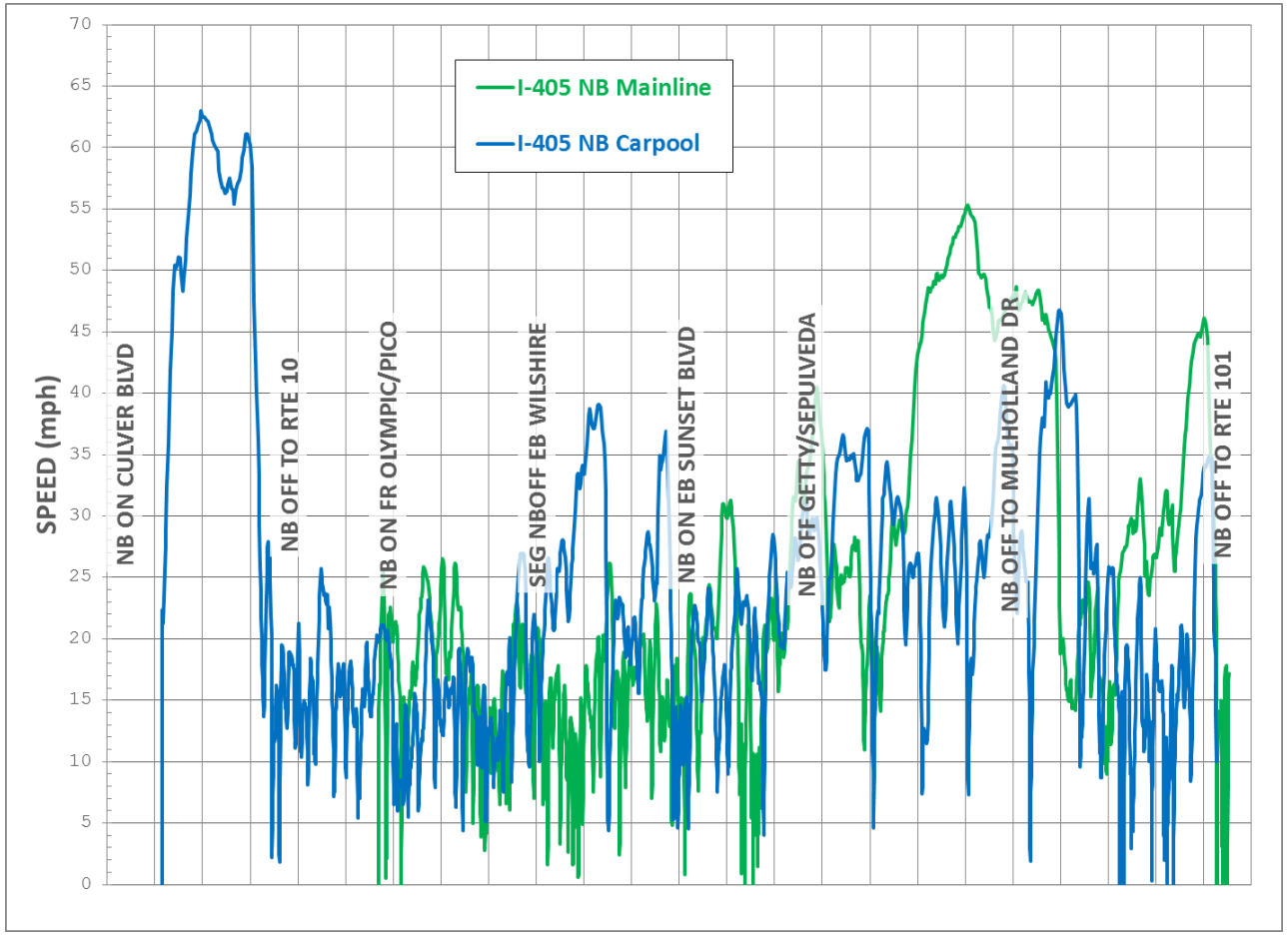
Data source: Caltrans VDS

Northbound I-405

HOVL already heavily used weekday in February 2015 (after)

HOVL Speeds

nearly full HOVL volumes mean congested speeds, still better than mainline



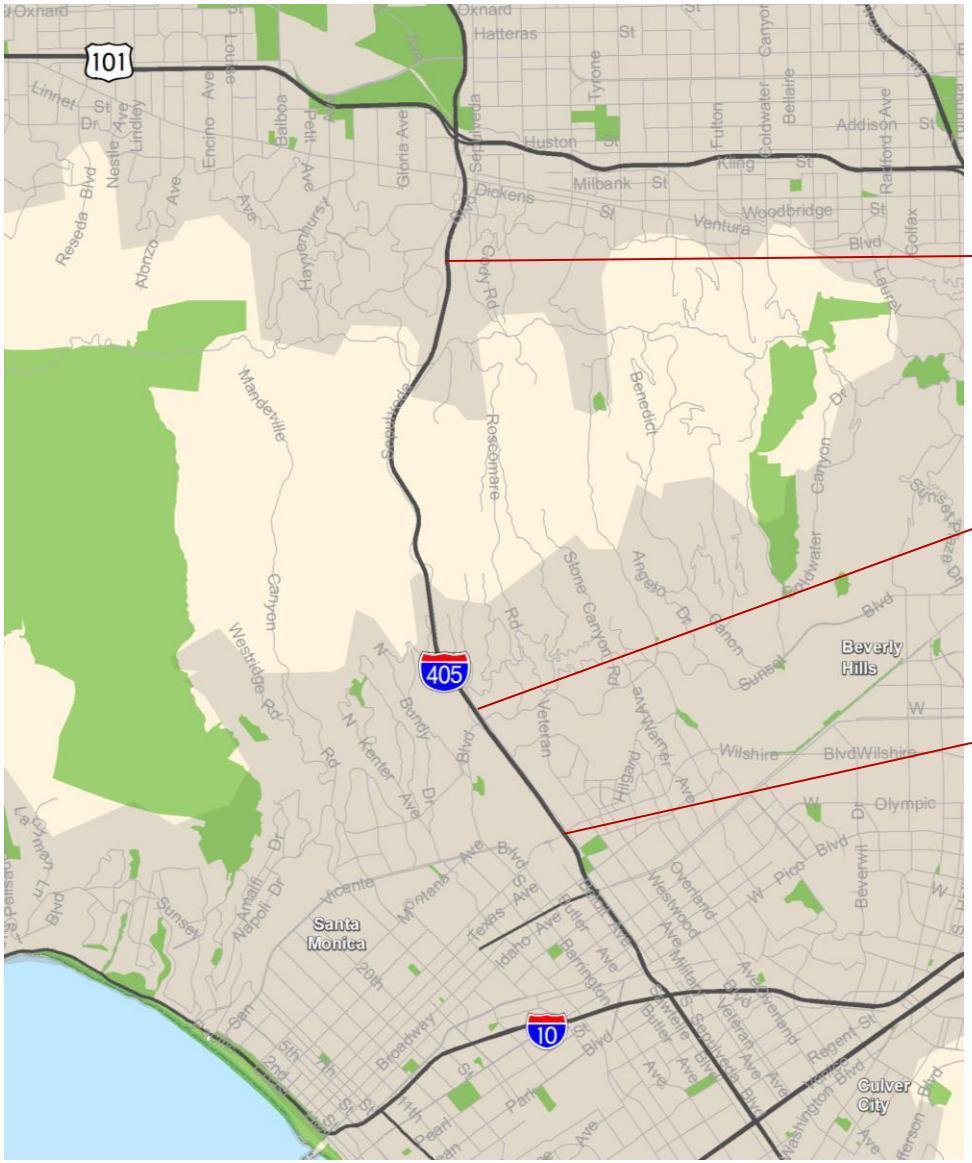
Data source: Manual probe vehicle GPS sample run (April 2015)

Northbound I-405 HOVL

HOVL flows are at near capacity levels and speeds are comparable to mainline speeds, but better than mainline

Freeway Person-Throughput

about 10% to 15% higher after



at Valley Vista

2009	2015
58,300	68,380

Data source: Caltrans VDS & AVO estimate

at Sunset

2009	2015
44,260	49,020

Data source: Caltrans VDS & AVO estimate

at Wilshire

2009	2015
39,600	45,400

Data source: Caltrans VDS & AVO estimate

Northbound I-405

PM peak period (3pm - 8pm) person-throughput of a typical weekday in February 2009 (before) and February 2015 (after)

Transit Ridership

ridership much higher after

Bus Route	Oct. - Dec. 2009	Jan.-Mar. 2014	Jan.-Mar. 2015
734	5183	3547	6238

Data source: Metro

Metro 734 Rapid Express

three month average daily ridership in 2009 and 2014 (before) and in 2015 (after)

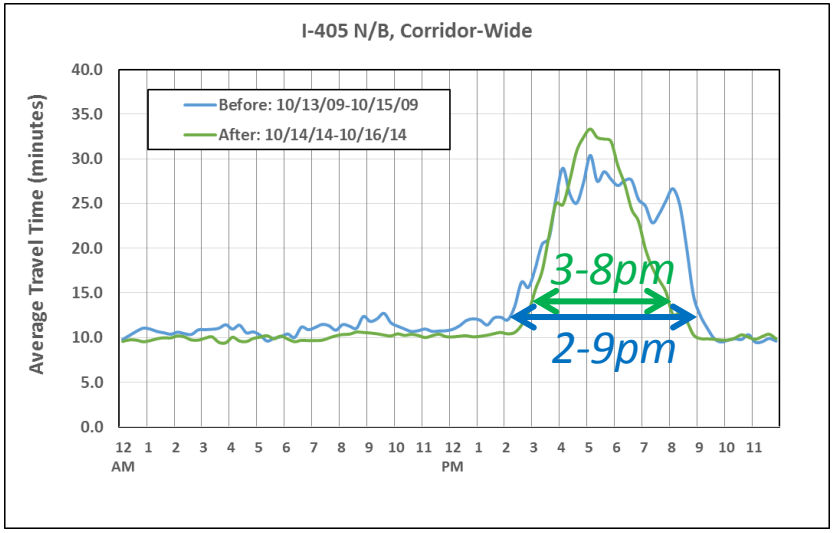
Travel Times

- **Before**, peak period was longer and more congested in Westwood
  - PM peak period was from about 2pm to 9pm
  - Congestion and bottleneck at Westwood held back traffic and had longer travel times

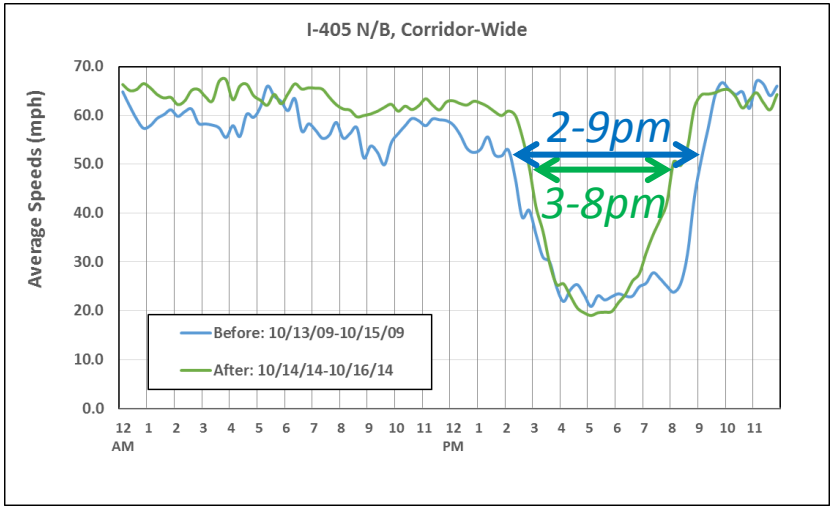
- **After**, peak period got shorter and less congested in Westwood
  - PM peak period is now from about 3pm to 8pm
  - Travel times significantly improved through Westwood, moving traffic faster downstream
  - Congestion beyond US-101 and along US-101 are queuing the traffic on the I-405 mainline

Freeway PM Peak Period

About 2 hours shorter peak



Data source: INRIX



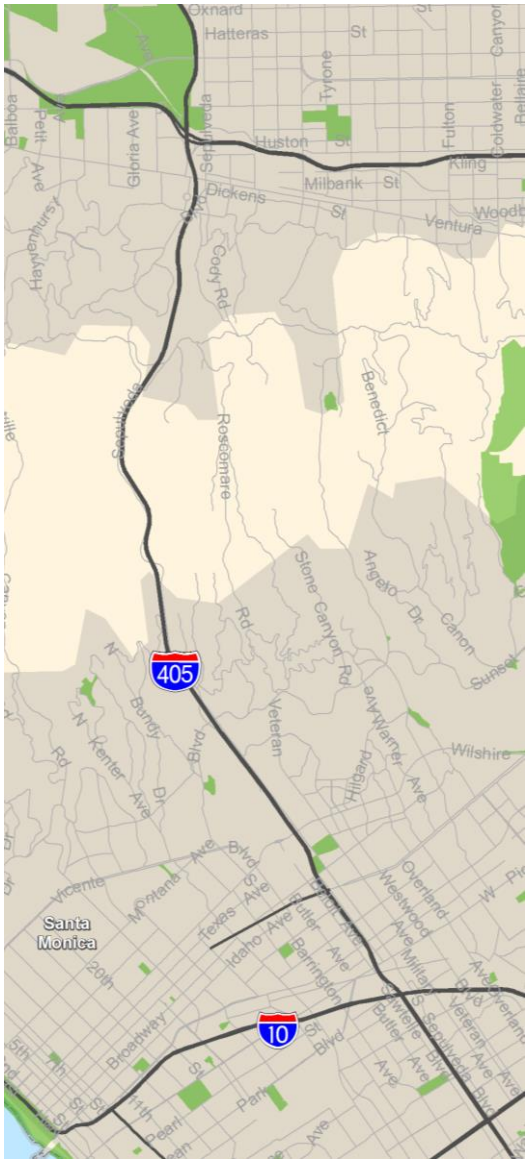
Data source: INRIX

Northbound I-405

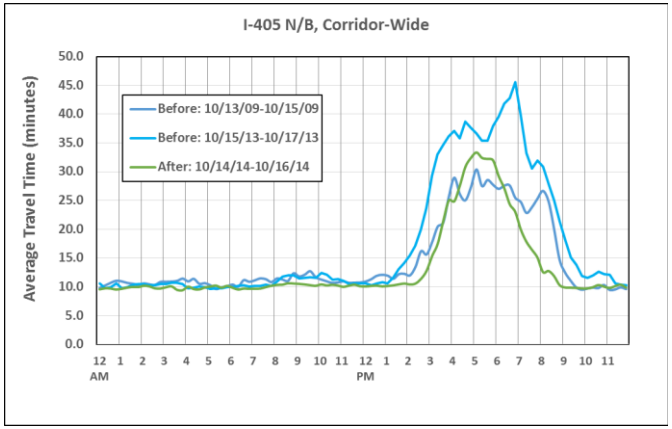
average travel times and speeds of mid-weekdays (Tuesday-Thursday) in October 2009 (before) and October 2014 (after)

Freeway Travel Times

Slightly higher than 2009 at peak but less than 2013

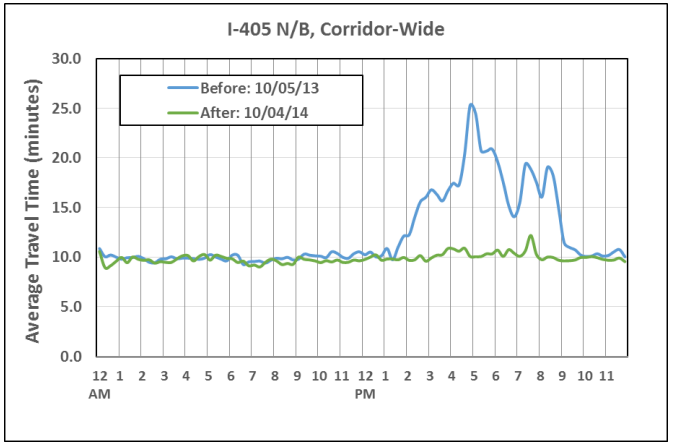


Weekdays from I-10 to US-101



Data source: INRIX

Saturdays from I-10 to US-101



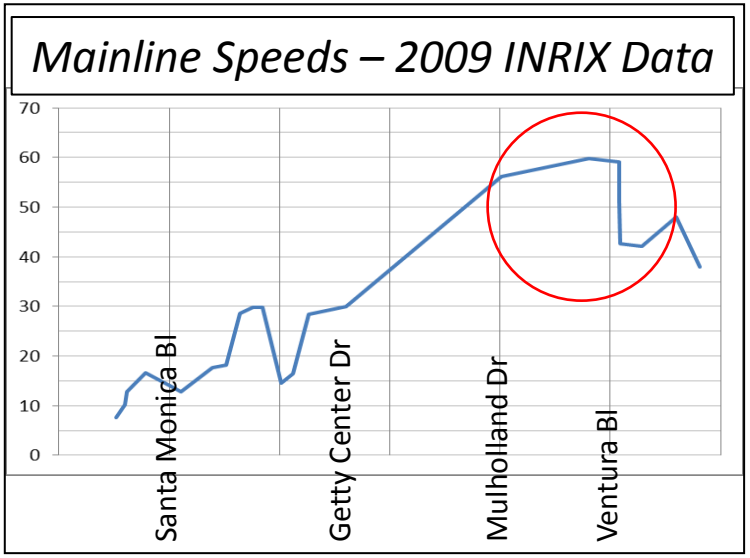
Data source: INRIX

Northbound I-405

average travel times of mid-weekdays (Tuesday-Thursday) in October 2009 (before), October 2013 (before, during construction), and October 2014 (after); and Saturday in October 2013 (before) and October 2014 (after)

Freeway Speeds

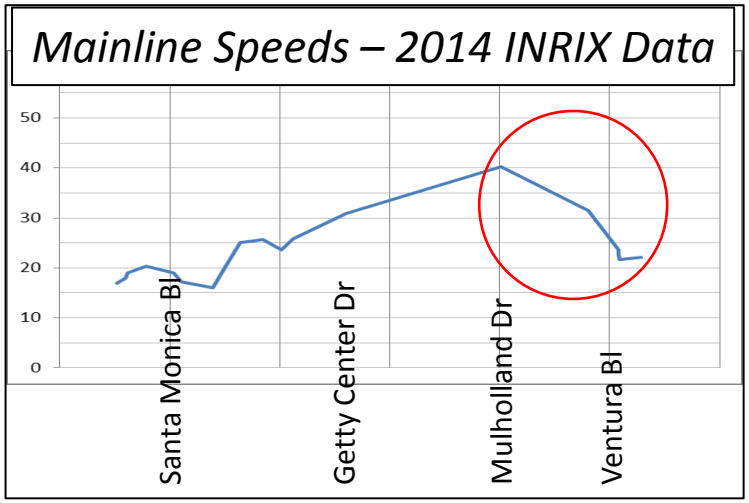
Lower speeds from Getty Center Drive to US-101 after



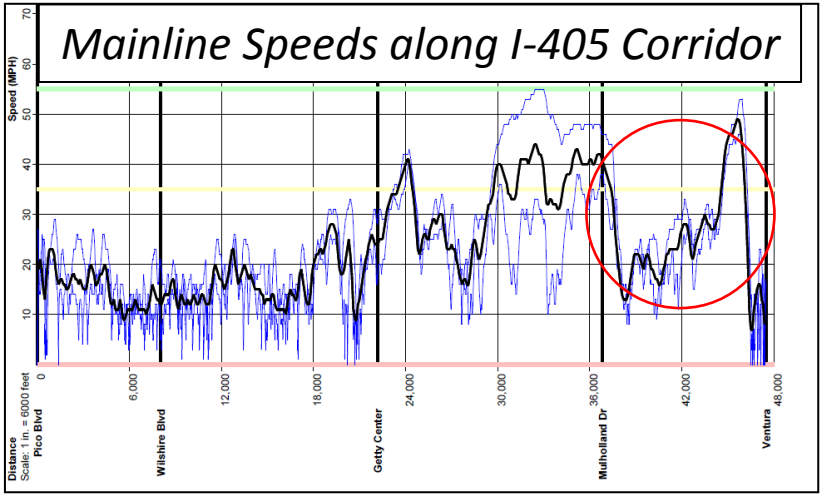
Data source: INRIX

Northbound I-405

higher travel times from Getty Center Drive to US-101 is due to congestion and bottlenecks on I-405 beyond US-101 (further downstream) and along US-101 (from connectors), impeding flow on I-405



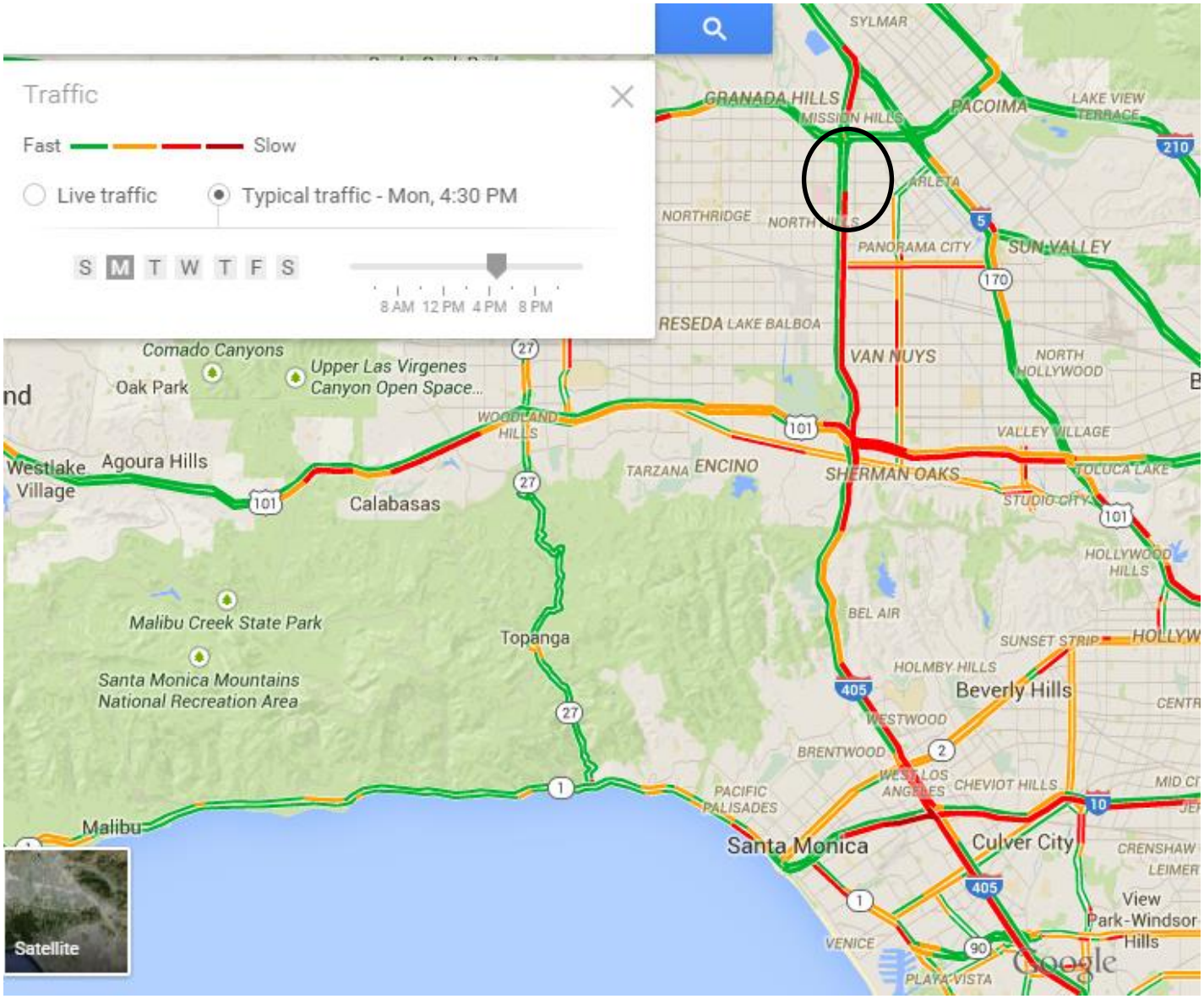
Data source: INRIX



Data source: Manual probe vehicle GPS sample run (April 2015)

Downstream Speeds

Bottleneck downstream queues traffic back



Northbound I-405 *downstream bottleneck between Nordhoff Street on-ramp and SR-118 off-ramp – likely caused by merging and weaving*

Caltrans also stated ramp metering system inoperable since Fall of 2014 due to pavement rehab construction – likely contributing factors compounding conditions

I-405 Evaluation (Post Project)

Reliability & Safety

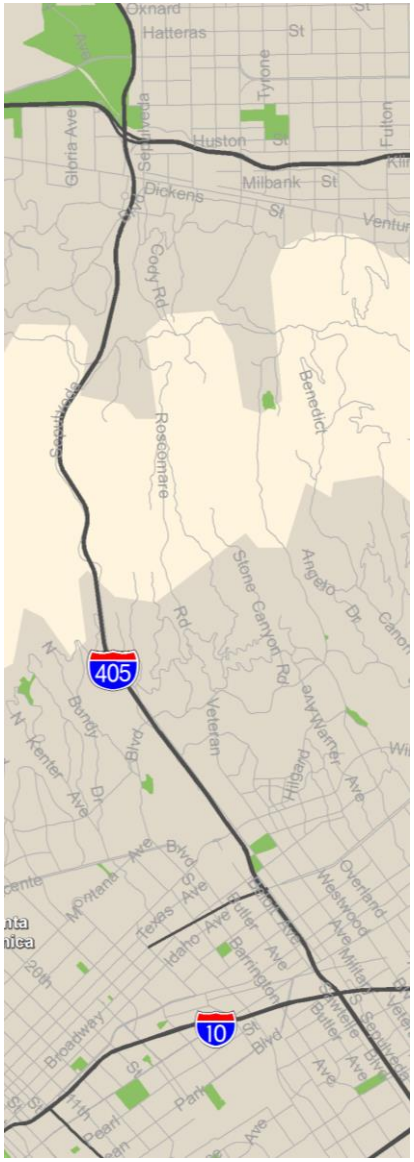
Reliability & Safety

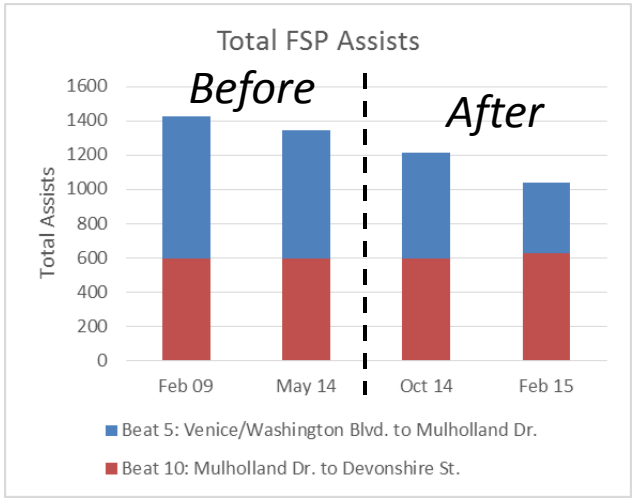
- **Before**, there were more incidents & collisions
  - More incidents for Metro FSP to respond to
  - More collisions that required tows
  - Took longer for Metro FSP vehicles to get to incidents
  - Had unreliable travel times (higher variability)

- **After**, there are less incidents & collisions and Metro FSP can respond quicker
  - Less incidents for Metro FSP to respond to
  - Less collisions that require tows
  - Quicker now for Metro FSP to respond using HOVL and standard shoulers
  - More reliable travel times (less variability)

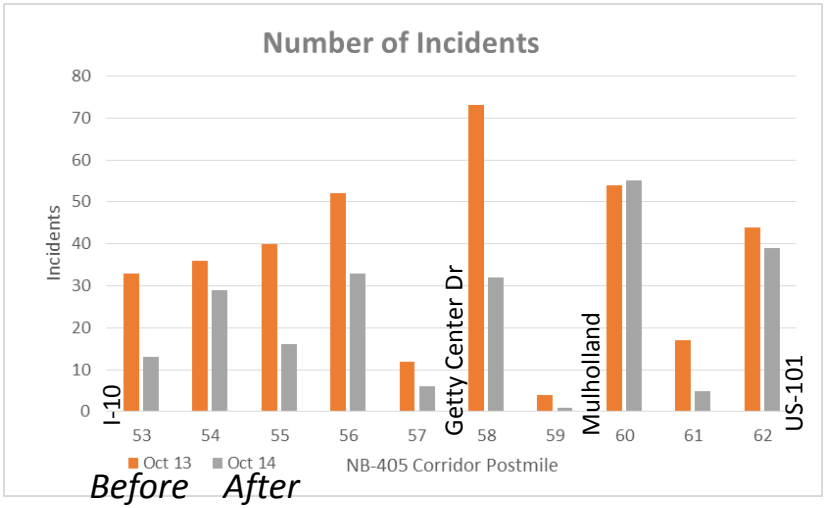
Incidents

About 25% fewer FSP assists and 35% fewer incidents after, means less non-recurrent congestion





Data source: Metro



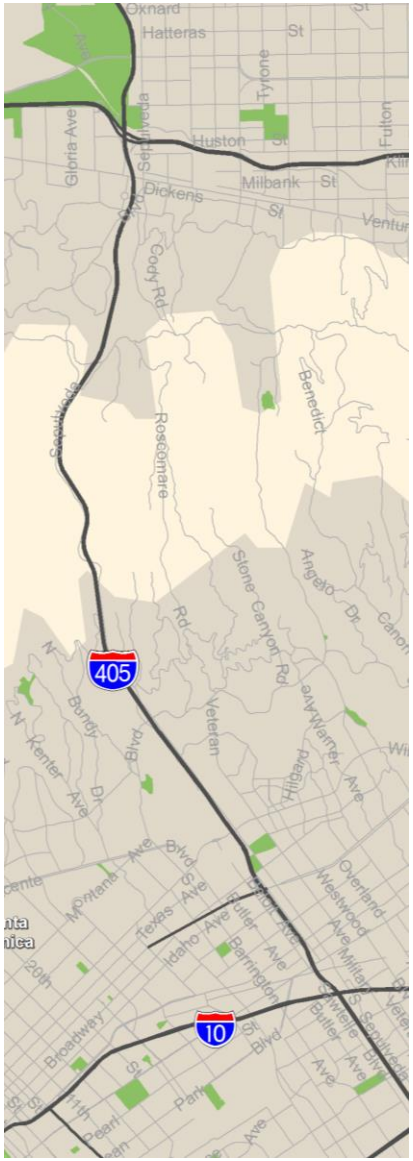
Data source: CHP CAD records

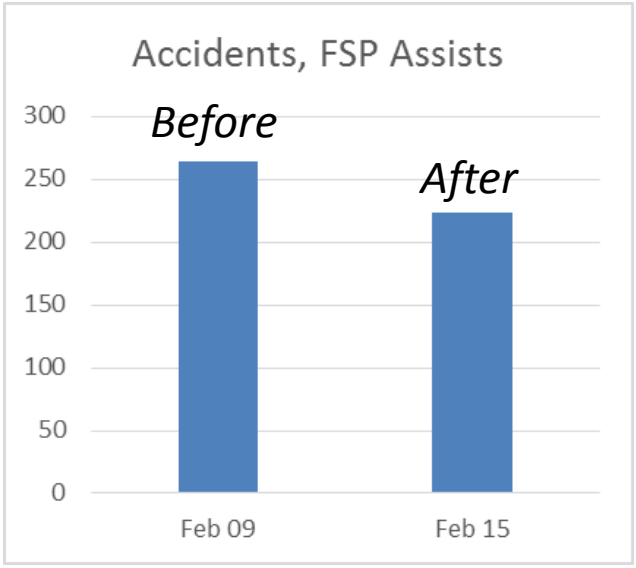
Northbound I-405

- *total number of Metro FSP assists (Beats 5 and 10, which includes portions of I-405) for the month of February 2009 and May 2014 (before) and October 2014 and February 2015 (after)*
- *total number of incidents logged by CHP for the month of October 2013 (before) and October 2014 (after)*

Collisions

About 15% fewer accidents after, means less non-recurrent congestion





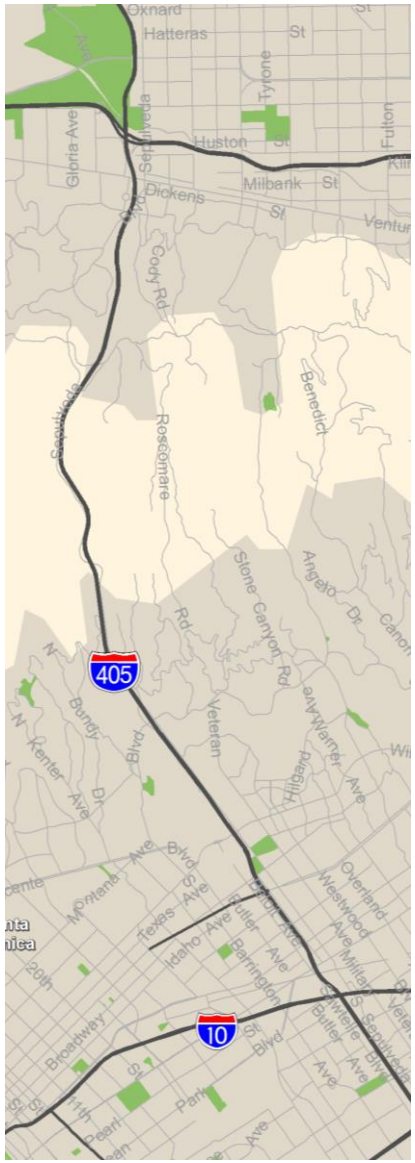
Data source: Metro

Northbound I-405

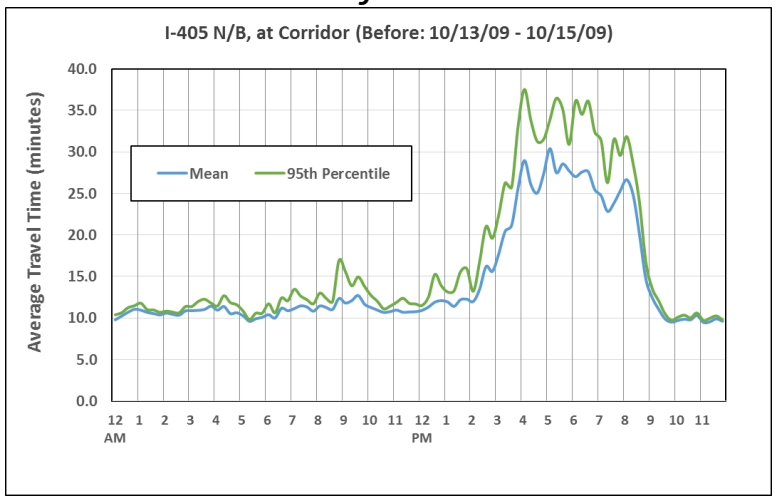
Total number of accidents reported on the Metro FSP assists (Beats 5 and 10, which includes portions of I-405) for the month of February 2009 (before) and February 2015 (after).

Travel Time Reliability

Less variable travel times – better reliability

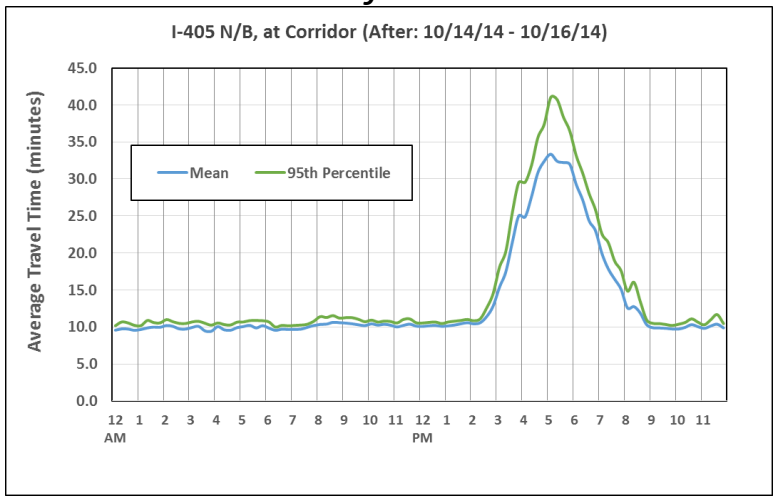


Before



Data source: INRIX

After



Data source: INRIX

Northbound I-405 *average travel time variability (95 percentile compared to the mean) of mid-weekdays (Tuesday-Thursday) in October 2009 (before) and October 2014 (after)*

I-405 Evaluation (Post Project)

Multimodal Improvements &

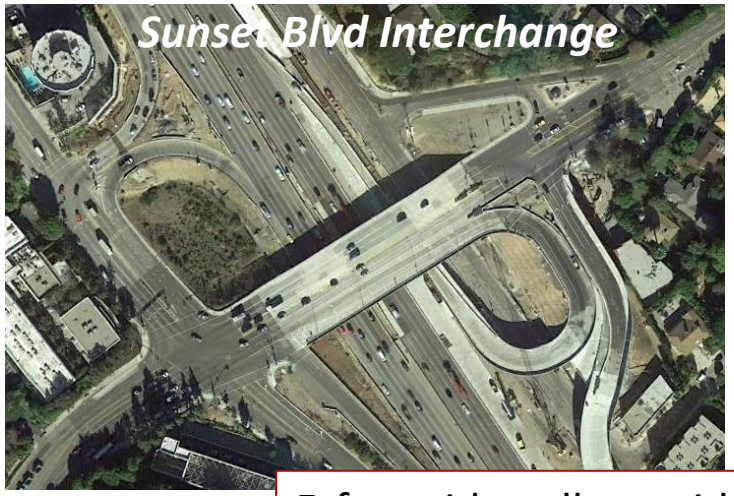
Physical Infrastructure Improvements

Multimodal Improvements

- **Before**, there were limited options
  - No carpool lane on freeway
  - Limited sidewalk on arterial crossings
  - Not much room for bicycles on arterial crossings
  - Bridges and interchanges dated with poor circulation

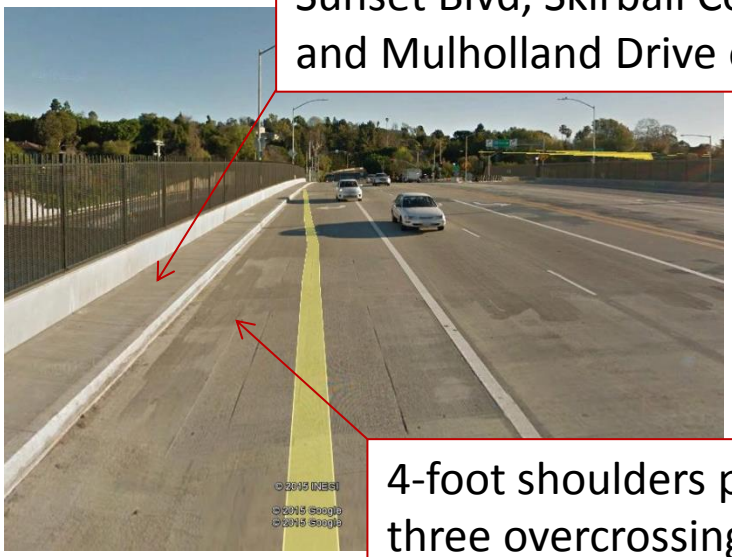
- **After**, there are HOVL option and multimodal improvements
  - Continuous carpool lane option now available
  - New wider sidewalks and pedestrian friendly access
  - Shoulders provided for improved bicycle access
  - Improved transit circulation and travel times on arterials
  - New soundwalls and bridges w/interchange modifications

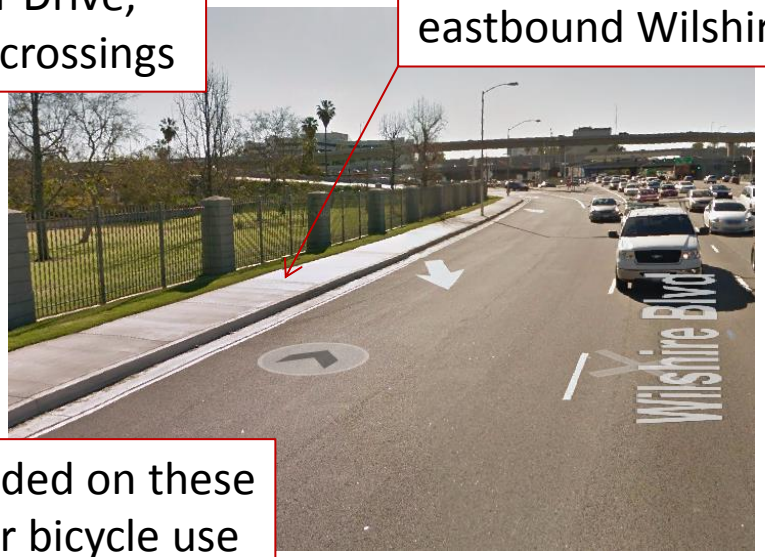
Multimodal Improvements



5-foot sidewalk provided on the Sunset Blvd, Skirball Center Drive, and Mulholland Drive overcrossings

8-foot wide sidewalk provided along eastbound Wilshire Blvd





4-foot shoulders provided on these three overcrossings for bicycle use

I-405 Evaluation (Post Project)

Other Performance Measures
(VMT, Delay, Air Quality)

Other Performance Measures

- **After**, improved performance measures and air quality benefits
  - Delay is reduced as compared to projected No Build (no project conditions at 2015)
  - Fewer incidents and accidents means less non-recurrent congestion
  - Arterials are also now less congested
  - Less total congestion and delay translates to improved quantifiable air quality benefits
  - Intangible benefits like improved circulation, soundwalls, new bridges, and geometric standards for safety

Other Performance Measures

- **Other Measures (VMT, Delay)**
  - Before (Freeway Vehicle Miles Traveled - VMT):
    - Estimated 2009 (October Caltrans VDS data) 1,390,000
  - After:
    - Estimated 2014 (October Caltrans VDS data) 1,525,000
  - Before (Freeway Daily Vehicle-Hours Delay):
    - Estimated 2009 (November INRIX data) 11,000
    - Estimated 2013 (November INRIX data) 11,500
    - **Projected 2015 No Build (2006 EIR/EIS) 16,000**
  - After:
    - **Estimated 2014 (November INRIX data) 10,000**

Other Performance Measures

- **Other Measures (Air Quality, Benefit-Cost)**
  - After (Air Quality Benefits):
    - Estimated 20-year life-cycle benefits over projected 2015 no build
      - Vehicle Operating Cost (Fuel Savings) $52 million
      - Emissions Reduction (CO_2) 266,000 tons
  - Benefit to Cost ratio
    - Estimated 0.6 to 1 (total cost, all cost items)
      - Does not include non-recurrent congestion savings
      - Does not include safety improvements benefits
      - Does not include arterial delay savings
      - Does not include multimodal improvements benefits
      - Does not include intangible benefits

SUMMARY

- Provides HOV System network continuity and modal choice, and opportunity for future transit on freeway
- Improved overall traffic circulation and arterial improvements, including transit services, and improved multimodal elements
- Carries more traffic and more people on the freeway, and results in less traffic demand on arterial corridors
- Shorter freeway PM peak period
- Improved travel reliability, less incidents, less accidents, and reduced non-recurrent congestion
- Reduced delay and air emissions over no build (if project not done) conditions
- Significant unmeasured benefits
- Significant additional project benefits, if downstream congested conditions are improved

ATTACHMENT B

I-405 CORRIDOR EVALUATION (I-405 SEPULVEDA PASS IMPROVEMENT PROJECT BEFORE/AFTER STUDY)

FINAL REPORT

May 2015

I-405 CORRIDOR EVALUATION (I-405 SEPULVEDA PASS IMPROVEMENT PROJECT BEFORE/AFTER STUDY)

FINAL REPORT

May, 2015

System Metrics Group

Table of Contents

List of Exhibits

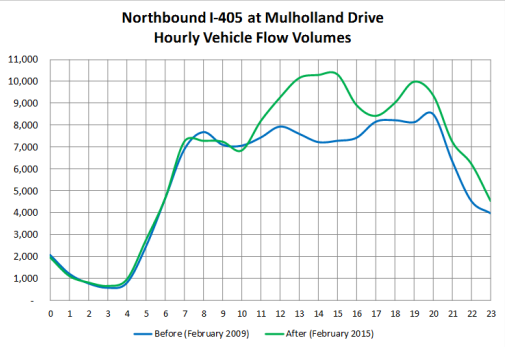
EXECUTIVE SUMMARY

This Final Report summarizes the evaluation of the I-405 freeway and arterial corridor from the I-10 to the US-101, before and after the opening of the I-405 Sepulveda Pass Improvement Project to traffic. The evaluation includes only the I-405 northbound facilities, Sepulveda Boulevard, and the arterial interchanges, from the I-10 freeway to the US-101 freeway. The purpose of this study is to evaluate the benefits and improvements to the traffic and transportation along the affected I-405 corridor with the construction and implementation of the newly added High Occupancy Vehicle (HOV) lane, recently opened to traffic in May 23, 2014. This evaluation study provides a high level but comprehensive analysis of various performance metrics that are conclusive. The project so far has proven to be effective in achieving the intended objectives, even though it has been less than a year since opening. For comparative representation of typical commute conditions, mid-weekdays (Tuesday through Thursday) statistics were compiled and averaged for peak months, including February, early March, October, and early November, when UCLA classes are in session.

Evaluation Results

Evaluation of the before and after conditions was made between different years, 2005/2006, 2009, 2013, 2014, and 2015. The initial before conditions study conducted by the 2005/2006 EIR/EIS is a decade old now. The conditions in 2009 were at the peak of a recessionary period. The conditions from 2010 to May 2014 were during construction, and traffic behaves very differently around construction activities. Traffic during construction does not represent normal conditions. Comparing these "before" conditions to the after, which occurs much later in time, are not comparisons made on equal footing. An equal basis would be comparing the "after" current conditions to what would be if the project had not been completed and open to traffic today. The following is a brief summary of the resulting benefits of the improvements:

- The northbound I-405 freeway now carries more traffic (by as much as 15%) and more people (by as much as 30%), and results in less traffic and congestion on arterials.

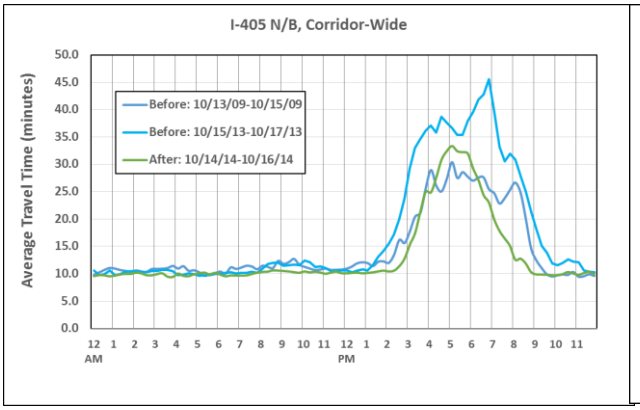


Arterial Roadway PM Peak Hour Traffic Flows

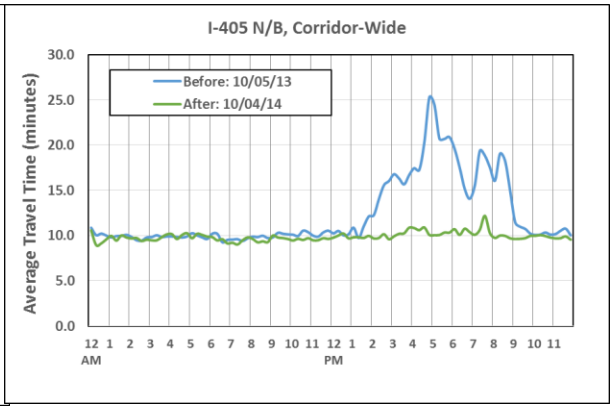
	2005	2015	Difference
Northbound Sepulveda			
at Pico	1,599	864	-46%
at Santa Monica	861	865	0.5%
at Montana	1,687	1,192	-29%
at n/o Sunset	2,254	1,880	-17%
at Skirball	2,008	1,623	-19%
at Valley Vista	2,301	934	-59%
at Ventura	1,541	936	-39%
Northbound Sawtelle			
at Olympic	448	255	-43%

- I-405 freeway mainline has improved overall travel times throughout weekdays and Saturdays. The PM peak period is now shorter by 2 hours, from 2pm to 9pm before, down to 3pm to 8pm after. The arterial roadway, Sepulveda Blvd., also has improved travel times.

Northbound I-405 Weekday Travel Times

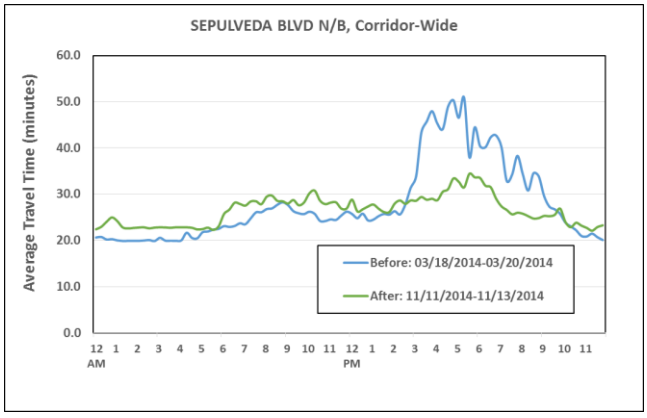


Northbound I-405 Saturday Travel Times



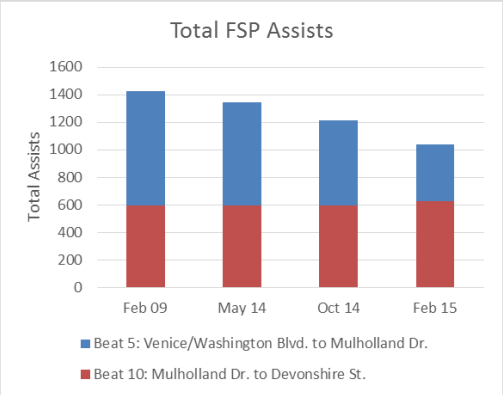
Data source: INRIX

Northbound Sepulveda Blvd Weekday Travel Times

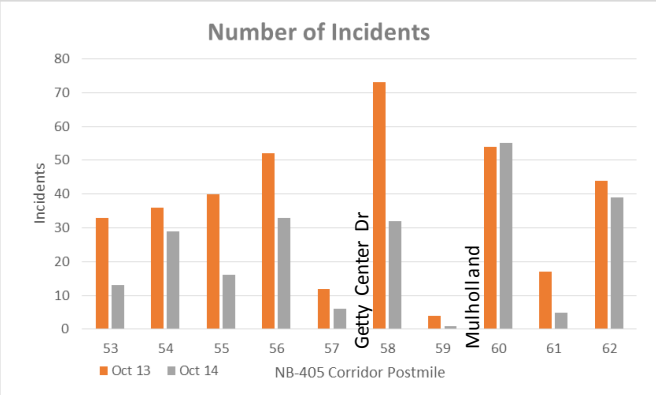


- Vehicle capacity on the Northbound I-405 increased from 10,000 vehicles per hour to 11,700 vehicles per hour. There is 15% more vehicle capacity and more than 30% more person capacity with the addition of the newly constructed HOV lane.
- The project provided for HOV System network continuity and modal choice, and opportunity for future transit on the freeway. The project completed the HOV system gap. There is now continuous HOV lane from I-5 in Orange County to I-5 in San Fernando. Prior to the completion of the I-405 carpool lane, carpools had no advantage in West Los Angeles and Sepulveda Pass. Now, there is a distinct incentive to carpool.
- The project yielded improved overall traffic circulation and arterial improvements, including transit services, and improved multimodal elements. The project added multi-modal improvements such as expanded sidewalks and 4-foot shoulders on rebuilt bridges and interchanges in the project corridor as additional project benefits.

- The project produced improved travel reliability, less incidents, less accidents, and reduced non-recurrent congestion

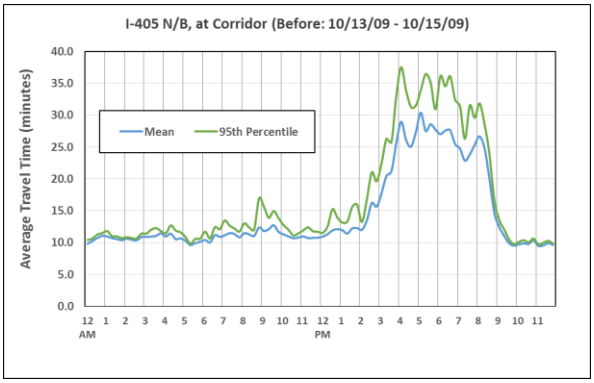


Data source: Metro

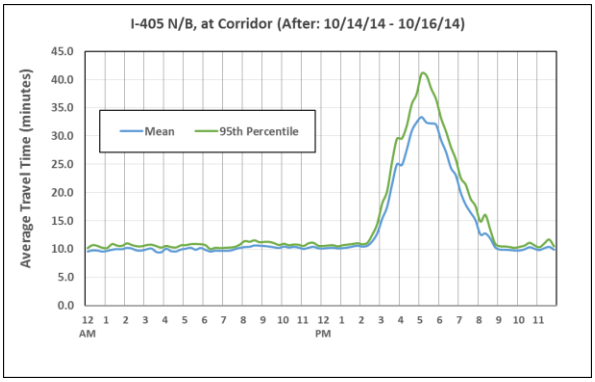


Data source: CHP CAD records

Northbound I-405 Weekday Travel Time Reliability



Data source: INRIX



Data source: INRIX

- If the project had never been built, motorists today would be experiencing 16,000 daily vehicle hours of delay on the northbound I-405. Construction of the project has eliminated 6,000 daily vehicle hours of delay, which today is estimated at 10,000 vehicle-hours of delay. The project is also estimated to reduce 266,000 tons of carbon dioxide emissions compared with no-build projections over a 20-year project life-cycle period.

The benefit analysis did not include: delay saving from non-recurrent congestion associated with the reduction in incidents and collisions; delay savings on arterial roadways and intersections; delay savings on multimodal elements such as transit; and intangible benefits of replacement of Skirball Center Dr., Sunset Blvd., and Mulholland Dr. bridges, standardization of freeway lane and shoulder widths for improved safety and faster emergency vehicle response to accidents, widening of 13 existing underpasses and structures, and construction of 18 miles of retaining walls and sound walls for adjacent communities. In addition, with the ramp improvements, Caltrans has stated that additional operational benefits may be observed once their ramp metering system (RMS) between the US-101 and I-5 are further streamlined.

1. INTRODUCTION

This Final Report summarizes the evaluation of the I-405 freeway and arterial corridor from the I-10 to the US-101, before and after the opening of the I-405 Sepulveda Pass Improvement Project to traffic. The evaluation includes only the I-405 northbound facilities, Sepulveda Boulevard, Sawtelle Boulevard, and the arterial interchanges, from the I-10 freeway to the US-101 freeway.

The purpose of this study is to evaluate the benefits and improvements to the traffic and transportation along the affected I-405 corridor with the construction and implementation of the I-405 Sepulveda Pass Improvement Project, recently opened to traffic in May 23, 2014. The objectives are to determine the amount and/or level of benefits and improvements to the various performance measures (such as: mainline traffic flow, HOV lane traffic flow, speeds, travel times, person throughput, effective capacities, incident management, transit service, peak hour and period congestion, system connectivity, traffic safety, and air quality) as they relate to the goals of enhancing livability, sustainability, and economic performance.

In order to perform the various analyses and make the necessary comparative performance measures, data for before (2005/2006, 2009 before major construction, and 2013/2014 during construction before opening) and after conditions (2014 and 2015 after opening) were needed. Data acquired were limited to selected samples, to provide reasonable statistical representations and draw meaningful inferences or conclusions. This evaluation study provides a high level but comprehensive analysis of various performance metrics that are conclusive. The project so far has proven to be effective in achieving the intended objectives, even though it has been less than a year since opening. Continued monitoring of the performance and additional evaluation after a full year of operations could prove outcome results of additional benefits produced by the project improvements.

For comparative representation of typical commute conditions, mid-weekdays (Tuesday through Thursday) statistics were compiled and averaged. Mondays, Fridays, weekends, and holidays were generally not included in the analysis. Also, seasonal months where schools (e.g., UCLA) were not in session were avoided such as summer months and winter months. For example, Spring Break is typically in late March to early April and Fall sessions do not start until late September. Therefore, representative months included February, early March, October, and early November.

1.1 Study Scope

This study focused on the 11-mile corridor along the I-405, from National Boulevard to Burbank Boulevard, but providing evaluation summary figures from the I-10 freeway to the US-101 freeway. The study included the I-405 northbound HOV lane, I-405 northbound general-purpose (mainline) lanes, and northbound Sepulveda Boulevard. The study also included the assessment of selected intersections along Sepulveda Boulevard and Sawtelle Boulevard at Ventura Boulevard, Sunset Boulevard, Wilshire Boulevard, Santa Monica Boulevard, Olympic Boulevard, and Pico Boulevard interchanges.

The new northbound I-405 HOVL constructed by the project was open to traffic on May 23, 2014. The following assumptions are considered for the evaluation:

Before Conditions

- 2005/2005 traffic data and analysis results from the Project 2006 EIR/EIS
- 2009 before major construction (note: recessionary period)
- October 2013 to early May 2014 during construction before opening
- Projected 2015 No-Build Alternative analysis results from the Project 2006 EIR/EIS
- Projected 2015 No-Build Alternative analysis results from the 2010 Corridor System Management Plan (CSMP)

After Conditions

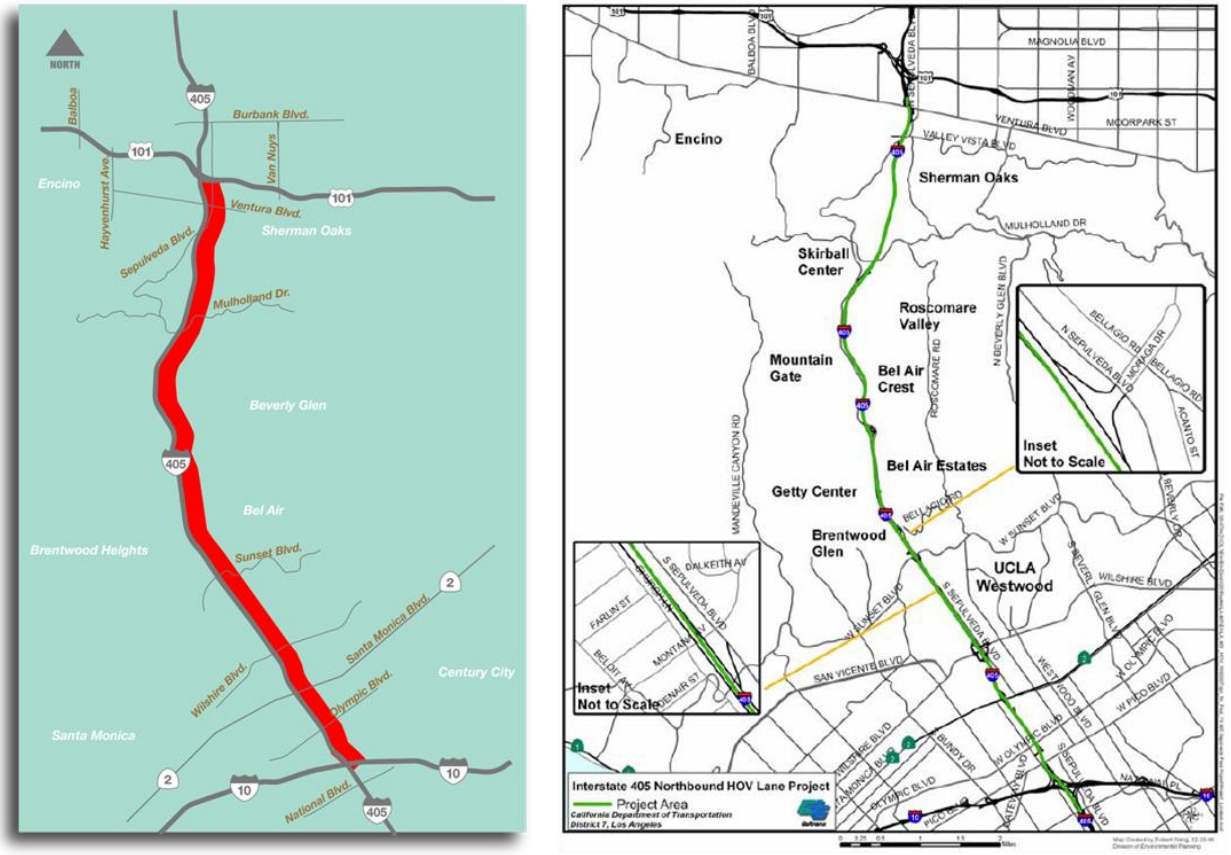
- October/November 2014 (about 6-month normalized traffic conditions after opening)
- February/March 2015 (about 1-year normalized traffic conditions after opening)

It is assumed that the overall traffic demand has not changed significantly over the last year. It is likely that during construction, motorists were using other modes, times, and facilities (latent demand). If the freeway conditions are marginally better in mobility, then it is likely that the other modes, times, and facilities should improve.

In 2009, before start of construction, the demand was likely to be lower due to the height of the economic recession. It should be noted that while vehicle throughput and flow was measured and analyzed, the total demand, including latent demand, was not measured. Typically, during freeway mainline construction, latent demand increases, where normal traffic patterns are disrupted and motorist take other routes, travel during different hours of the day, avoid trips, and use other transportation modes. Once construction ends, much of the traffic typically returns to their previous patterns.

Exhibit 1-1 below illustrates the study location. As shown, the project started from National Boulevard to the US-101 interchange on the northbound I-405 freeway, connecting the HOV lane on the south to the HOV lane on the north.

Exhibit 1-1: Study Location



1.2 Definition

In this report, "before" is referred to as the traffic performance conditions before May 23, 2014, and "after" is referred to as the traffic performance conditions after May 23, 2014. This is before and after the new northbound I-405 HOVL is open to traffic on May 23, 2014.

Corridor is defined as the northbound I-405 freeway and the local arterials (within half-mile of the freeway) from the I-10 freeway to the US-101 freeway. Primary north-south facilities in the corridor include the northbound I-405 freeway and the northbound Sepulveda Boulevard.

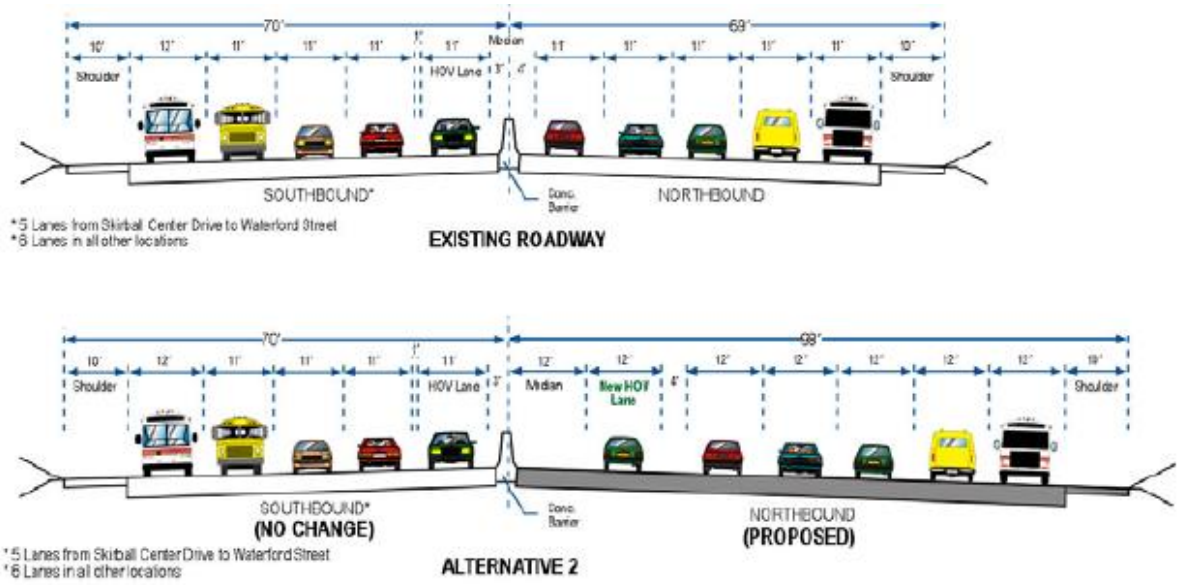
2. PROJECT BACKGROUND

The 10-mile northbound HOV lane was constructed and opened to traffic on the San Diego Freeway (I-405) from south of the Santa Monica Freeway (I-10) to the Ventura Freeway (U.S. 101) on May 23, 2014. Additional improvements include realigning existing on- and off- ramps, removing, replacing and constructing new bridge and ramp structures, building approximately 18 miles of retaining and sound walls, and performing road improvements on adjacent city streets. The project is part of the overall regional HOV lane system network.

The improvements were intended to ease congestion, increase mobility by moving more people, decrease commute times for all motorists, enhance safety, reduce air pollution and promote ridesharing. The project was developed by the California Department of Transportation (Caltrans) in partnership with the Los Angeles Metropolitan Transportation Authority (Metro), and in collaboration with the City of Los Angeles.

As identified in the project Environmental Impact Report/Environmental Impact Study (EIR/EIS), alternatives considered in this evaluation study include the Existing Condition (before project conditions), Alternative 1 (2015 No Build alternative), and Alternative 2 (the constructed project after condition). Exhibit 2-1 below illustrates the Existing Roadway (and Alternative 1) and Alternative 2.

Exhibit 2-1: Study Alternatives



Within the project area, the I-405 is a north-south corridor that connects the I-10 to the US-101 east-west corridors. The only viable alternate roadway route over the Mulholland Pass (part of the Santa Monica Mountain) is the Sepulveda Boulevard. The major arterial interchanges include Olympic Boulevard/Pico Boulevard, Santa Monica Boulevard, Wilshire Boulevard, Sunset Boulevard, Sepulveda Boulevard, Skirball Center Drive, Sepulveda Boulevard at Greenleaf Street and Sherman Oaks Avenue, and Ventura Boulevard Interchanges. All of these interchanges are impacted by the project improvements.

3. EVALUATION APPROACH AND METHODOLOGY

The approach to the evaluation focuses on multimodal improvements to the corridor, as part of a greater transportation network. The corridor was evaluated within reasonable proximity to the project (area of influence of the project improvements) that includes the following facilities:

- I-405 HOV system, freeway mainline, ramps
- I-10 freeway, US-101 freeway
- Parallel arterial (Sepulveda Boulevard)
- Crossing arterials and freeway interchanges

The following transportation elements were evaluated:

- Physical improvements to the corridor (modified interchanges, soundwall, bridges, etc.)
- System-wide continuity (HOV network, transit access)
- Transit access and service improvements (on-time reliability)
- Other multimodal elements (pedestrian and bicycle facilities)

The following performance metrics and measures were evaluated:

- Vehicle mobility benefits
  - Delay reduction
  - Speed and travel time improvements
- Sustainability benefits
  - Air quality benefits and emissions reduction
  - Transit travel times and transit ridership
  - Pedestrian and bicycle access improvements
- Reliability benefits
  - Number of incidents
  - Incident response times
  - Travel time variability
- Safety benefits
  - Collisions and locations of collisions
- Productivity
  - Vehicle and person throughput
  - Arterial intersection level of service (LOS)

A variety of methods to measure performance and the improvements to the various elements were utilized for this study. For the freeway mobility and productivity analysis, we used the Caltrans vehicle detection data to analyze the flow, vehicle throughput, capacity, congestion, and delay. We also used crowd-sourcing GPS (INRIX) data to analyze speeds and travel times.

For the arterial mobility and productivity analysis, the ICU method was used to calculate the level of service (LOS) at selected key intersections. It should be noted, however, that we can only compare the LOS analysis conducted and presented in the 2006 EIR/EIS against the LOS analysis conducted with 2015 data (from manual data collection counts). In other words, LOS analysis could not be conducted for 2009 or 2014 as there are no historical archived data available.

For the reliability analysis, we used the California Highway Patrol (CHP) Computer Aided Dispatch (CAD) data to analyze the incidents; Metro Freeway Service Patrol (FSP) assist record data to analyze the assisted incidents and accidents; and crowd-sourcing GPS (INRIX) data to analyze travel time variability along the I-405 freeway and Sepulveda Boulevard. We compared the 95th percentile to the mean travel times for the variability calculations (sometimes referred to as the Buffer Index) for travel time reliability.

Accident/collision records are available through the CHP Statewide Integrated Traffic Records System (SWITRS) or Caltrans Traffic Accident Surveillance and Analysis System (TASAS), but they have a year to two year lag for the data to become available. As such, for the safety analysis, the Metro FSP assist record data was used to examine the accident statistics that the FSP trucks responded to.

For the person throughput, we applied data on the average vehicle occupancy (AVO) figure from Caltrans HOV annual report and Caltrans provided data to estimate the person throughput.

For the sustainability analysis, we used the Caltrans Cal-B/C economic model to estimate the air quality benefits and emissions reduction. We used the Metro transit ridership data to analyze transit ridership. We reviewed the physical improvements made to make an assessment on the pedestrian and bicycle access improvements.

3.1 Data Needs, Sources, and Collection

In order to perform the various analyses and make the necessary comparative performance measures, data for before (2005/2006, 2009 before major construction, and 2014 during construction before opening) and after conditions (2014 and 2015 after opening) were needed. Due to the tight schedule requirement to complete this study, data acquired were limited to selected samples, to provide reasonable statistical representations and draw meaningful inferences or conclusions. Exhibit 3-1 provides a summary of the data samples, data sample period, and data source(s) for the each data type used in the evaluation analyses.

Exhibit 3-1: Data Samples, Periods, and Sources

Data	Data Sample	Data Period	Source
Freeway HOVL, mainline flows	Hourly over multiple weekdays	October, November 2014; February 2015	Caltrans VDS (ATMS)
Selected key arterial IS turning movement counts	PM Peak hour one weekday	Wednesday, April 1, 2015; Thurday, April 2, 2015	2006 EIR/EIS, manual counts
Freeway mainline, arterial speeds and travel times	Hourly over multiple weekdays	Selected months in 2009, 2013, and 2014	INRIX data
Freeway HOVL speeds and travel times	PM peak hours one weekday	Tuesday, April 14, 2015	manual probe vehicle GPS runs
Freeway incidents and accidents	Selected months totals	February 2009, May 2014, October 2014, February 2015	Metro FSP Beats 5, 10 assist records
Freeway average vehicle occupancy	Estimates from sample counts	Estimates based on 2001, 2002, 2007, and 2011 counts	Caltrans District 7 manual counts
Transit ridership	Selected months daily boardings	October - December 2009, January - March 2014, January - February 2015	Metro transit database
Roadway physical characteristics and improvements	Before and after improvements	2015 Google Earth, 2012/2013/2014 revised design layout drawing	Google Earth, as-built plans

Note – dates for consideration:

- UCLA 2009 Fall Quarter instruction began on September 24, 2009
- UCLA 2013 Fall Quarter instructions began on September 26, 2013
- UCLA 2014 Fall Quarter instructions began on October 2, 2014
- UCLA 2015 Spring break was from March 21 to 27, 2015

4. EVALUATION RESULTS

The evaluation results are summarized by mobility and productivity, reliability and safety, and sustainability benefits.

4.1 Mobility and Productivity

Mobility generally refers to the movement of vehicles, people, and goods, from place to place. Mobility recognizes automobile, truck (freight), and transit modes, but still assumes that movement is an end in itself, rather than a means to an end. Mobility is expressed in terms of speeds and travel times.

Productivity generally refers to the production of outputs and measures the ability to move vehicles, people, and goods efficiently. Productivity is expressed in terms of throughput flow or volumes of vehicles and people, and amount of available capacity.

BEFORE

Before construction, much of the traffic utilized all available roadway facilities including arterials, Sepulveda Boulevard, in particular, to move north-south along the corridor. Before during construction, much of the traffic avoided the corridor during peak hours and may have avoided trips. In summary, before:

- Northbound I-405 freeway peak period throughput flow (volume) was lower
- Alternative routes (Sepulveda Blvd and Sawtelle Blvd) volumes were higher
- Local intersections operations were poor
- Corridor capacity was limited

AFTER

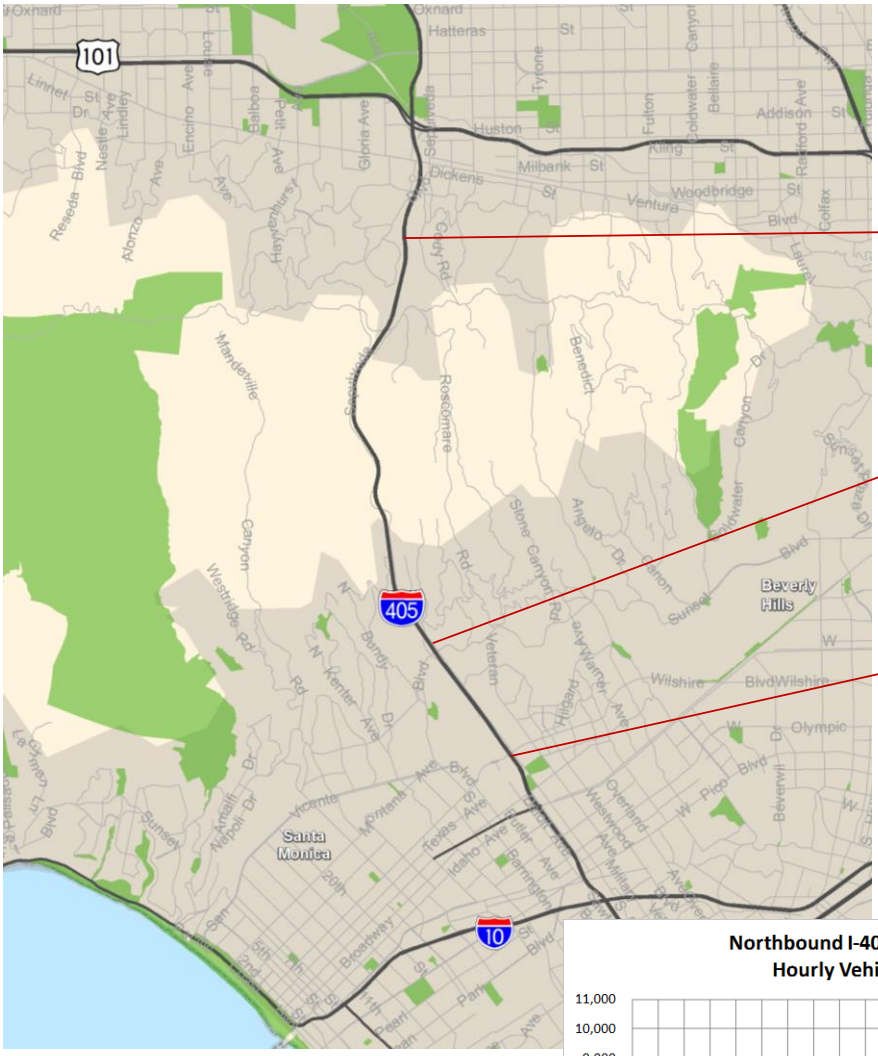
After opening, traffic went back to using the freeway during the peak hours and freeway VMT increased. In summary, after:

- Northbound I-405 freeway peak period throughput flow (volume) is now 5% to 15% higher
- Alternative routes (Sepulveda Blvd and Sawtelle Blvd) volumes are now 20% to 50% lower
- Local intersection operations have improved by one to three level of service (LOS)
- Corridor capacity has increased by at least 17% and can still go higher

4.1.1 Northbound I-405 Freeway PM Peak Period Throughput Flow

Exhibit 4-1 below illustrates the northbound I-405 freeway peak period throughput flow (volume) before (sample typical weekday in February 2009, taken from Caltrans detector data) and after (sample typical weekday in February 2015, taken from Caltrans detector data). As shown, the freeway now carries about 5% to 15% more traffic than before.

Exhibit 4-1: Northbound I-405 Freeway PM Peak Period (3-8 PM) Flows (Volumes)



at Valley Vista

2009	2015
48,590	56,300

Data source: Caltrans VDS

at Sunset

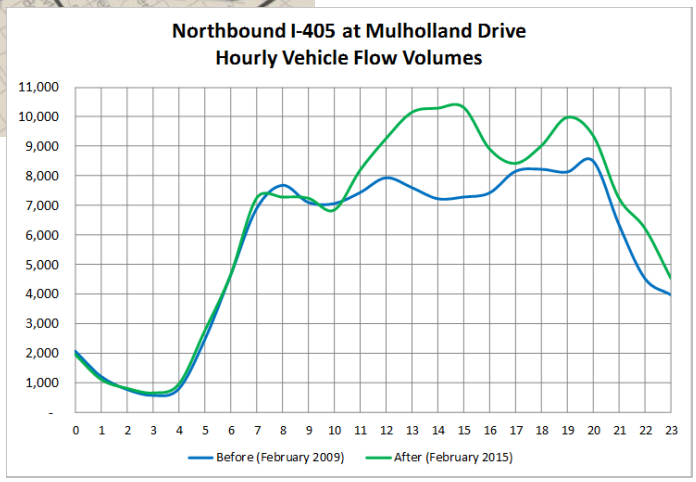
2009	2015
36,880	39,070

Data source: Caltrans VDS

at Wilshire

2009	2015
33,000	35,930

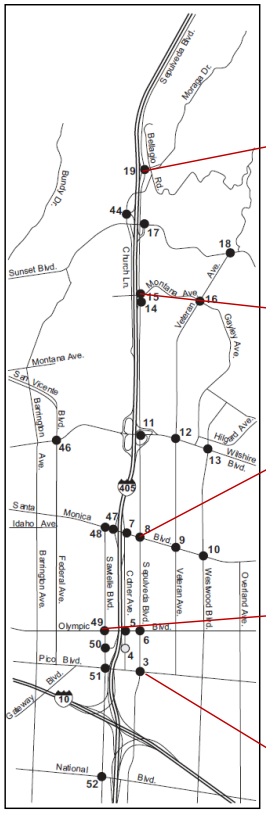
Data source: Caltrans VDS



4.1.2 Northbound Sepulveda Blvd and Sawtelle Blvd PM Peak Hour Throughput Flow

Exhibit 4-2 below illustrates the northbound Sepulveda Boulevard and Sawtelle Boulevard peak hour throughput flow (volume) before (sample typical weekday in 2005, taken from the 2006 EIR/EIS report) and after (sample typical weekday in February 2015, taken from manual data collection). Typically, traffic volumes increase incrementally over time with growth, but in this case, volumes are lower by 20% to 50%. This means that there are now less vehicles using Sepulveda Blvd than before. Likely, they are now using the freeway, indicated by the increase in the freeway volumes.

Exhibit 4-2: Northbound Sepulveda Blvd and Sawtelle Blvd PM Peak Hour (5-6 PM) Flows



at n/o Sunset

2005	2015
2,254	1,880

at Montana

2005	2015
1,687	1,192

at Santa Monica

2005	2015
861	865

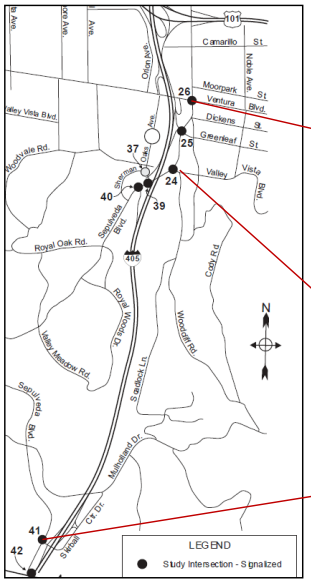
at Olympic (Sawtelle)

2005	2015
448	255

at Pico

2005	2015
1,599	864

Data source: 2006 EIR/EIS, 2015 manual counts



at Ventura

2005	2015
1,541	936

at Valley Vista

2005	2015
2,301	934

at Skirball

2005	2015
2,008	1,623

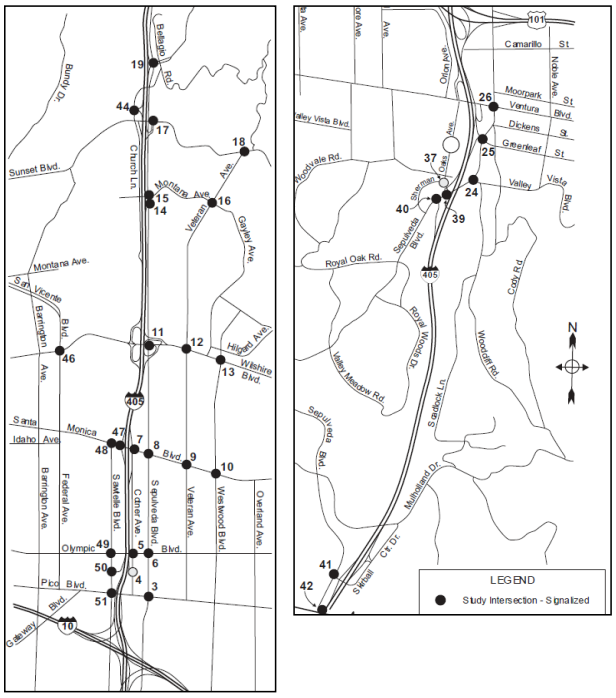
Data source: 2006 EIR/EIS, 2015 manual counts

4.1.3 Selected Corridor Intersections Operations PM Peak Hour Performance

Exhibit 4-3 below illustrates the some of the corridor intersections operations performance (level of service) before (sample typical weekday in 2005, taken from the 2006 EIR/EIS report) and after (Intersection Capacity Utilization analysis conducted with count data of sample typical weekday in February 2015, taken from manual data collection). Only the most poorly operating locations in 2005 were selected for comparative analysis. As shown, the eight of the 11 corridor intersections operations performance has improved significantly, while only two locations either remained the same or has gotten worse.

This is due to the reduction in volumes along the arterial corridors and improvements to the local arterial circulation, as a result of the improvements to the freeway capacity and improvements to the interchanges with the freeway.

Exhibit 4-3: Selected Corridor Intersections Operations (Level of Service) During PM Peak Hour



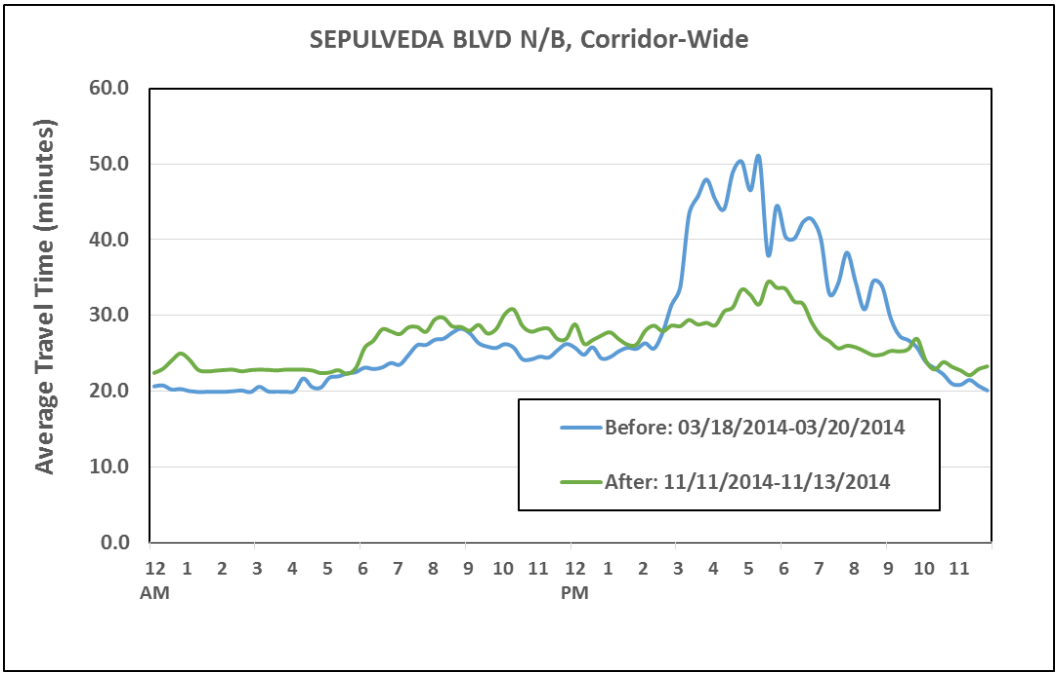
Location Number	Intersection Name		PM Peak (LOS) 2005	PM Peak (LOS) 2015
3	Sepulveda Blvd	Pico Blvd	F	E
6	Sepulveda Blvd	Olympic Blvd	F	C
8	Sepulveda Blvd	Santa Monica Blvd	F	D
11	Sepulveda Blvd	Wilshire Blvd	F	C
12	Veteran Ave	Wilshire Blvd	F	C
26	Sepulveda Blvd	Ventura Ave	E	E
41	Sepulveda Blvd	Skirball Center Dr	F	F
46	Federal Ave	Wilshire Blvd	F	D
48	Sawtelle Blvd	Santa Monica Blvd	F	E
49	Sawtelle Blvd	Olympic Blvd	E	C
51	Sawtelle Blvd	Pico Blvd	E	F

Source: 2006 EIR/EIS, ICU estimates using 2015 manual counts data

4.1.4 Northbound Sepulveda Blvd Corridor-Length Travel Times

Exhibit 4-4 below illustrates the corridor-length (from I-10 freeway to the US-101 freeway) average travel times on the northbound Sepulveda Boulevard before (sample typical weekday in March 2014, taken from INRIX crowd sourcing data) and after (sample typical weekday in November 2014, taken from INRIX crowd sourcing data). As shown, the northbound Sepulveda Blvd travel times are now as much as 35% shorter during the PM peak hours, saving more than 10 minutes on each trip.

Exhibit 4-4: Northbound Sepulveda Blvd Corridor-Length Weekday Average Travel Times

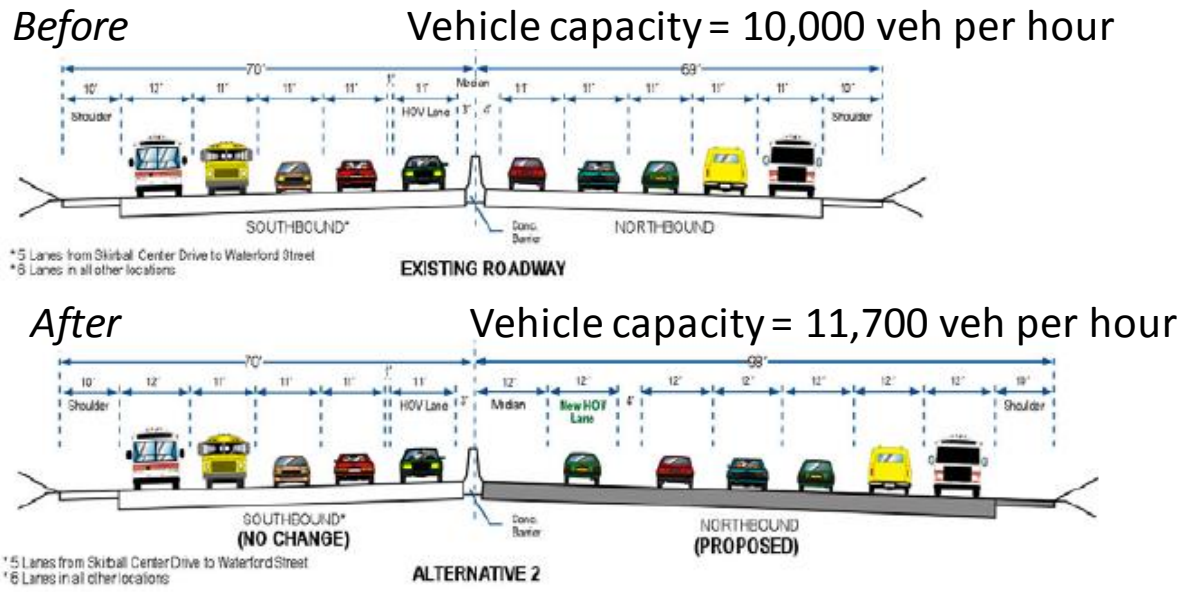


Data source: INRIX

4.1.5 Northbound I-405 Freeway Capacity

Exhibit 4-5 below illustrates the vehicle capacity on the northbound I-405 freeway before and after. Normal capacity (maximum throughput) of a freeway lane is about 2,000 vehicles per hour. As shown, the vehicle capacity has increased by 1,700 vehicles per hour to a total of 11,700 vehicles per hour carrying capacity, with the addition of the HOV lane. This translates to an increase by at least 3,400 persons per hour carrying capacity, or over 30% increase. With future adjustments to the HOVL operational parameters (e.g., occupancy requirements), the person per hour carrying capacity can increase significantly.

Exhibit 4-5: Northbound I-405 Freeway Capacity Increase



BEFORE

Before the HOVL was open to traffic, carpools had no advantage. The freeway section between the I-10 and the US-101 had a gap in the HOV lane system network on the I-405 corridor. Modal choices were limited and sustainability was not incentivized. In summary, before:

- Northbound I-405 freeway carpools were mixed with the single occupant vehicles in the mainline lanes
- Buses and vanpools were also mixed with the single occupant vehicles in the mainline lanes

AFTER

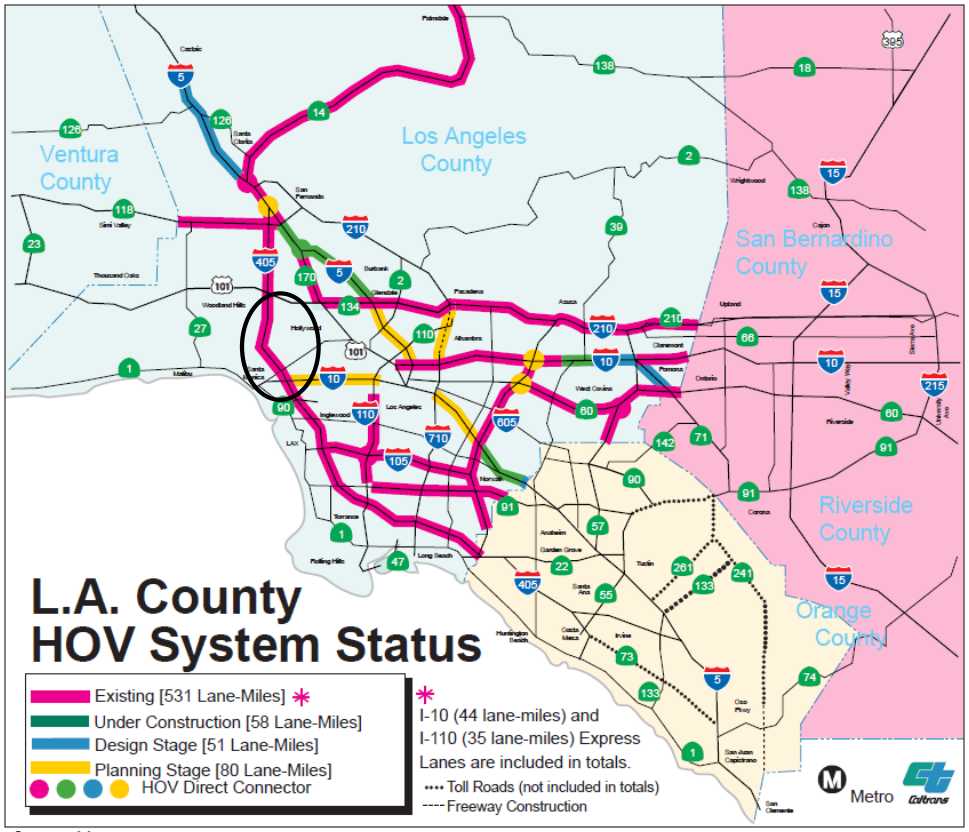
After opening, carpools now have a distinct incentive. The HOV lane system network is now continuous on the I-405 corridor. Modal choices are available for carpoolers, vanpoolers, and transit riders, using the HOV lane system. Sustainability is now incentivized to reduce single occupant vehicles. In summary, after:

- There is distinct incentive to carpool as part of network usage
- Already there is significant use of the HOVL by carpools, buses, and vanpools
- Northbound freeway peak period person-throughput is significantly higher than before

4.1.6 Continuous Northbound I-405 HOV Lane System Network

Exhibit 4-6 below illustrates the northbound I-405 HOV lane system network after opening. As shown, the HOVL system network provides a continuous carpool lane from the Orange County Line to the I-5 Interchange, end to end. Providing continuous and consistent carpool lane provides modal choice to carpool, vanpool, and take transit. Sustainability is now incentivized through the corridor.

Exhibit 4-6: Northbound I-405 HOV Lane System Network and Status

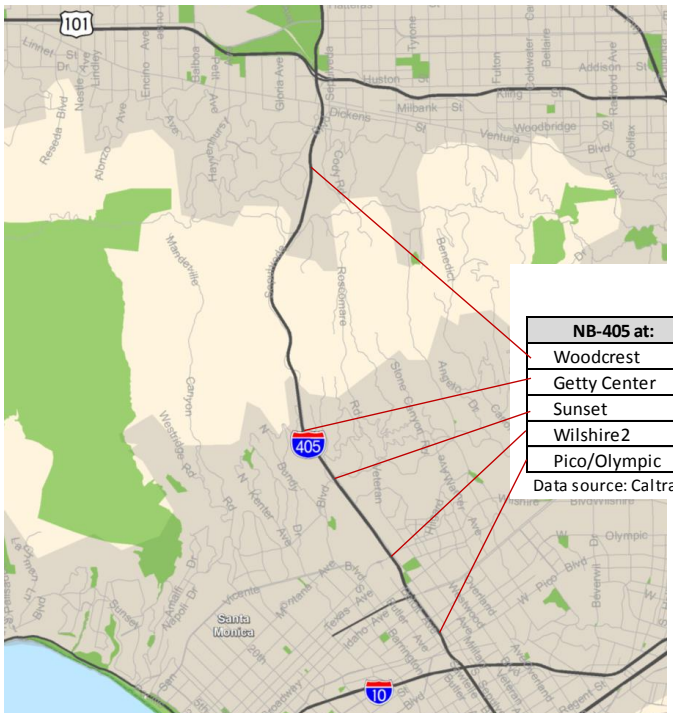


Source: Metro

4.1.7 Northbound I-405 HOV Lane PM Peak Hour and PM Peak Period Throughput Flow

Exhibit 4-7 below illustrates the northbound I-405 HOV lane PM peak hour and PM peak period throughput flow (volume) after (sample typical weekday in February 2015, taken from Caltrans detector data) opening. As shown, the HOVL carries about 1,200 to 1,700 vehicles per hour, already near or at capacity levels. This results in a breakdown of speeds on the HOV lane, as indicated in Exhibit 4-8 where the HOV lanes speeds are only slightly better than mainline.

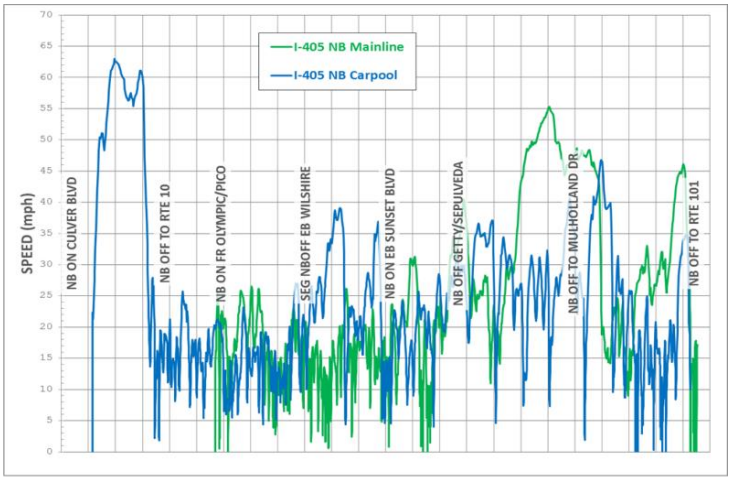
Exhibit 4-7: Northbound I-405 HOV Lane PM Peak Hour and PM Peak Period Throughput Flows



	HOVL Vehicular Volumes	
NB-405 at:	Peak Hour	Peak Period (3-8PM)
Woodcrest	1,480	7,198
Getty Center	1,693	7,676
Sunset	1,392	6,391
Wilshire2	1,345	6,155
Pico/Olympic	1,168	5,070

Data source: Caltrans VDS

Exhibit 4-8: Northbound I-405 HOV Lane and Mainline Speeds along the Corridor (April 2015)

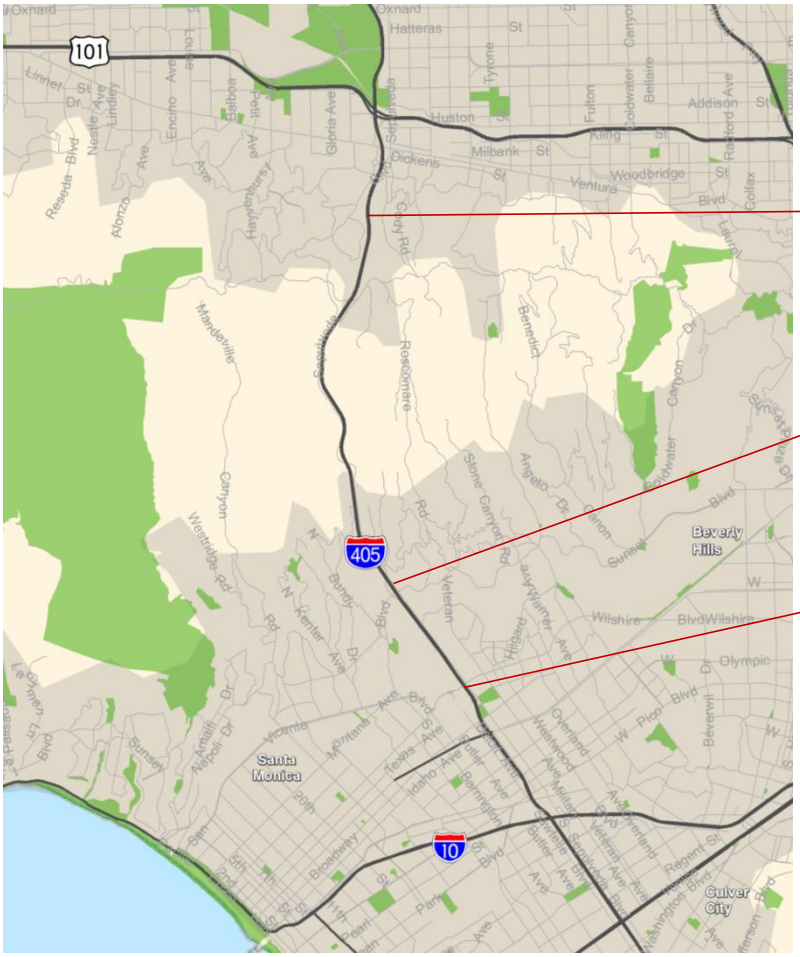


Data source: Manual probe vehicle GPS sample run (April 2015)

4.1.8 Northbound I-405 Freeway PM Peak Period Person-Throughput

Exhibit 4-9 below illustrates the northbound I-405 freeway PM peak period person-throughput flow (volume) before (sample typical weekday in February 2009, taken from Caltrans detector data and applying the average vehicle occupancy data from Caltrans) and after (sample typical weekday in February 2015, taken from Caltrans detector data and applying the average vehicle occupancy data from Caltrans). As shown, the freeway now carries about 10% to 15% more people than before.

Exhibit 4-9: Northbound I-405 Freeway PM Peak Period Person-Throughput



at Valley Vista

2009	2015
58,300	68,380

Data source: Caltrans VDS & AVO estimate

at Sunset

2009	2015
44,260	49,020

Data source: Caltrans VDS & AVO estimate

at Wilshire

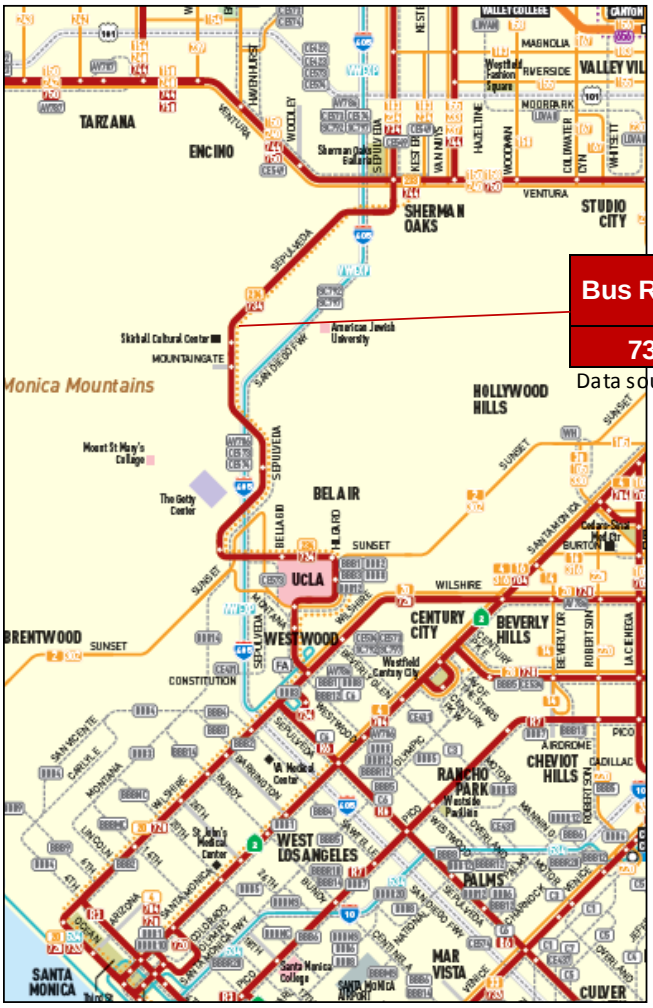
2009	2015
39,600	45,400

Data source: Caltrans VDS & AVO estimate

4.1.9 Continuous Northbound I-405 HOV Lane System Network

Exhibit 4-10 below illustrates the average daily transit ridership on the Metro Rapid Express Bus Route 734 that runs north-south, parallel to the I-405 corridor. The average daily ridership before construction was about 5,183 and during construction, about 3,547, while after was much higher at about 6,238, an increase of 20% to 75%. The increase in ridership may be attributed to the improved speeds and travel times on Sepulveda Blvd as well as improved local traffic circulation along the corridor.

Exhibit 4-10: Metro Rapid Express Bus Line 734 Average Daily Ridership



Bus Route	Oct. - Dec. 2009	Jan.-Mar. 2014	Jan.-Mar. 2015
734	5183	3547	6238

Data source: Metro

BEFORE

Before the peak period was longer and more congested in Westwood. The corridor had longer travel times for most of the day. In summary, before:

- PM peak period was from about 2pm to 9pm
- Congestion and bottleneck at Westwood held back traffic and had longer travel times

AFTER

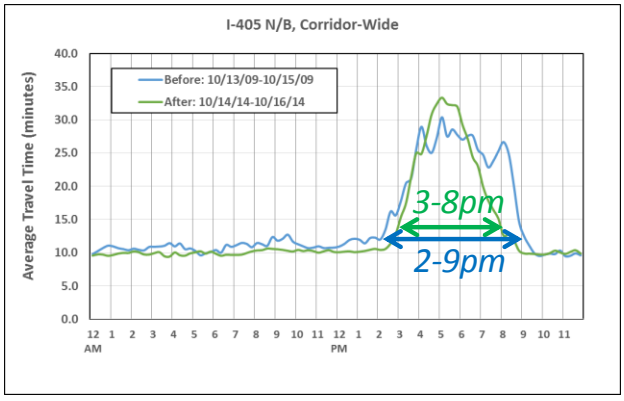
After opening, peak period got shorter and little less congested in Westwood. The corridor had shorter travel times for most of the day. In summary, after:

- PM peak period is now from about 3pm to 8pm
- Travel times significantly improved through Westwood, moving traffic faster downstream
- Bottlenecks beyond US-101 and along US-101 are queuing the traffic on the I-405 mainline

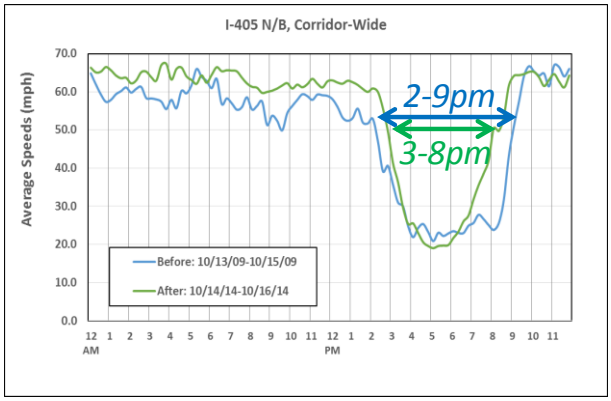
4.1.10 Northbound I-405 Freeway Shorter PM Peak Period

Exhibit 4-11 below illustrates the northbound I-405 freeway travel times and average speeds before (sample typical weekdays in October 2009, taken from INRIX crowd-sourcing data) and after (sample typical weekdays in October 2014, taken from INRIX crowd-sourcing data). As shown, the freeway now has a shorter PM peak period from 3pm to 8pm (5 hours) than before from 2pm to 9pm (7 hours). It also shows that while the travel times are slightly higher during the peak two hours (from 4:30pm to 6:30pm), it has significant shorter travel times outside of those two hours.

Exhibit 4-11: Northbound I-405 Freeway Travel Times and Average Speeds (2009 & 2014)



Data source: INRIX

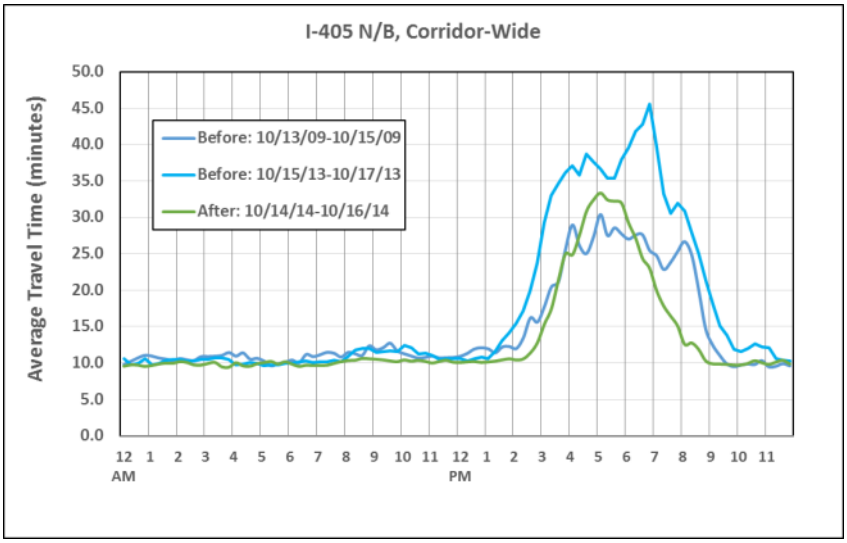


Data source: INRIX

4.1.11 Northbound I-405 Freeway Travel Times

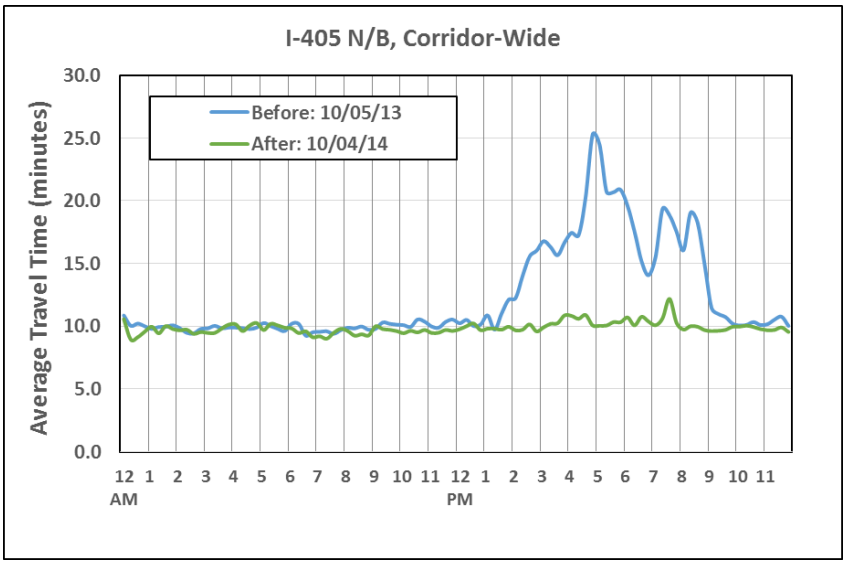
Exhibit 4-12 below illustrates the northbound I-405 freeway travel times before construction (sample typical weekdays in October 2009, taken from INRIX crowd-sourcing data), before, during construction (sample typical weekdays in October 2013, taken from INRIX crowd-sourcing data), and after (sample typical weekdays in October 2014, taken from INRIX crowd-sourcing data). As shown, the corridor has overall shorter travel times now than either of the before conditions. The higher travel times during the peak two hours is due to the congestion and queuing from downstream conditions. Exhibit 4-13 illustrates a sample Saturday comparison before (2013) and after (2014) where it has significantly improved.

Exhibit 4-12: Northbound I-405 Freeway Weekday Travel Times (2009, 2013, & 2014)



Data source: INRIX

Exhibit 4-133: Northbound I-405 Freeway Saturday Travel Times (2013 & 2014)

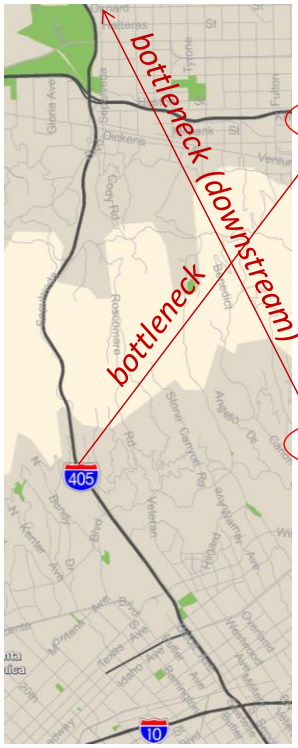


4.1.12 Northbound I-405 Freeway Speeds

Exhibit 4-144 below illustrates the northbound I-405 freeway speeds before (sample typical weekdays in October 2009, taken from INRIX crowd-sourcing data) and after (sample typical weekdays in October 2014, taken from INRIX crowd-sourcing data). The speeds are plotted across the corridor (y-axis) and time during the PM peak hours (x-axis). As shown, the corridor had slower speeds through Westwood and higher speeds past Mulholland Drive, until the US-101 where it slowed down again, whereas now, the speeds are higher through Westwood but now queued up from beyond the corridor, caused by conditions downstream of US-101.

Exhibit 4-15 below illustrates the northbound I-405 freeway speeds before (sample typical weekdays in October 2009, taken from INRIX crowd-sourcing data) and after (sample typical weekdays in October 2014, taken from INRIX crowd-sourcing data, and sample typical weekday in April 2015, taken from manual probe vehicle GPS run). These charts show again that the speeds drop approaching the US-101, after opening, caused by the congested congestion downstream of US-101. Caltrans has stated that they have an ongoing pavement rehabilitation construction work on the mainline freeway and the ramps between the US 101 and I-5 and that that their ramp metering system has been inoperable since Fall of 2014, due to the construction. This may have contributed to the congestion condition downstream of the project location.

Exhibit 4-144: Northbound I-405 Freeway Speed Contour Diagrams (2009 & 2014)



From I-10 to Burbank Blvd (10/13/09-10/15/09 average speeds)

Location along NB-405	2:00 PM	2:30 PM	3:00 PM	3:30 PM	4:00 PM	4:30 PM	5:00 PM	5:30 PM	6:00 PM	6:30 PM	7:00 PM	7:30 PM	8:00 PM	8:30 PM	9:00 PM
BURBANK BLVD	64.5	64.0	58.8	62.3	59.6	59.6	60.0	21.9	52.5	59.4	63.3	65.5	64.7	68.0	68.7
US-101/VENTURA FWY	64.5	64.1	61.3	60.3	52.3	60.3	59.9	52.7	43.9	59.4	56.0	65.5	67.2	65.9	68.8
VENTURA BLVD	65.0	64.6	63.5	63.6	52.5	60.9	60.5	53.2	52.4	60.2	56.1	66.1	67.8	66.5	69.4
VALLEY VISTA BLVD/SEPULVEDA BLVD	59.3	61.4	62.8	60.2	58.1	58.7	60.0	56.6	57.8	44.3	53.5	58.5	61.5	56.8	58.1
MULHOLLAND DR	56.7	38.6	50.3	45.3	48.6	56.1	54.2	49.2	45.4	45.9	51.8	35.0	29.8	43.4	57.0
GETTY CENTER DR	45.5	30.3	28.0	29.4	23.1	28.1	31.3	27.6	28.3	32.9	37.6	38.2	20.9	27.1	47.2
MORAGA DR	41.4	29.0	15.8	16.9	11.0	17.8	14.0	14.3	16.4	14.7	15.8	16.2	17.7	12.9	31.6
SUNSET BLVD	37.2	26.2	16.0	15.3	10.0	12.4	12.3	14.1	13.2	13.8	17.6	14.4	13.3	12.2	30.5
MONTANA AVE	50.5	40.1	39.0	23.3	16.8	33.8	21.5	34.5	30.2	19.7	28.6	32.2	15.0	37.9	50.8
WATERFORD ST	40.3	31.4	22.7	17.0	11.1	16.6	17.7	16.2	16.7	17.3	15.5	19.3	16.1	19.2	36.4
WILSHIRE BLVD	44.2	28.6	20.7	18.2	14.5	15.9	15.3	17.3	14.9	16.4	17.2	17.0	15.5	18.4	36.2
CA-2/SANTA MONICA BLVD	51.3	45.5	25.9	19.1	14.6	12.6	10.2	13.4	14.7	14.4	13.2	15.4	17.4	22.8	44.7
OLYMPIC BLVD/PICO BLVD	50.5	32.8	28.7	18.8	13.6	11.8	9.1	9.6	11.1	11.7	11.9	14.6	18.3	26.6	52.5
I-10/SANTA MONICA FWY	53.9	30.4	30.8	19.9	10.3	10.8	7.0	7.9	9.2	9.7	10.6	14.8	15.8	26.8	57.5

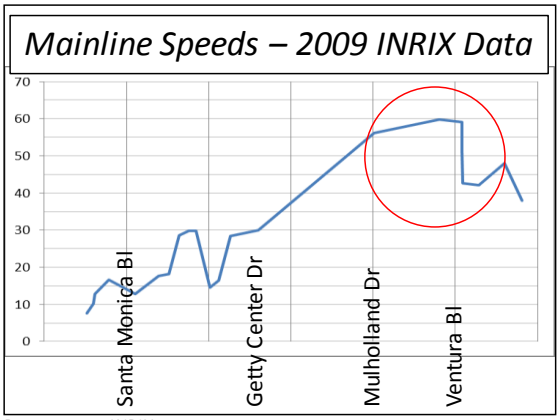
Data source: INRIX

From I-10 to Burbank Blvd (10/14/14-10/16/14 average speeds)

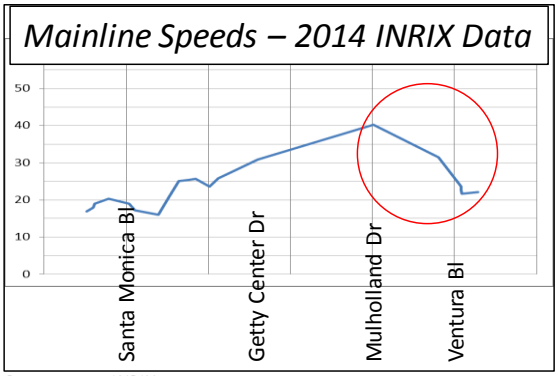
intersection	2:00 PM	2:30 PM	3:00 PM	3:30 PM	4:00 PM	4:30 PM	5:00 PM	5:30 PM	6:00 PM	6:30 PM	7:00 PM	7:30 PM	8:00 PM	8:30 PM	9:00 PM
BURBANK BLVD	64.9	61.8	31.1	23.0	21.3	15.2	18.2	15.2	14.4	18.9	24.5	19.1	48.6	65.6	65.2
US-101/VENTURA FWY	67.1	63.9	38.4	21.5	22.2	14.8	17.8	13.6	15.9	23.0	28.0	29.6	55.6	65.8	63.9
VENTURA BLVD	64.5	62.2	45.9	24.6	22.6	14.4	16.7	13.0	15.1	23.8	34.6	39.0	54.9	64.1	63.5
VALLEY VISTA BLVD/SEPULVEDA BLV	64.7	62.8	56.7	42.2	31.5	18.8	20.7	16.8	17.8	20.6	26.0	30.4	42.1	62.8	63.9
MULHOLLAND DR	61.6	56.3	54.0	49.0	40.3	26.3	28.7	23.6	24.7	25.3	32.6	42.2	49.9	63.5	64.1
GETTY CENTER DR	58.8	55.2	45.9	27.9	30.9	25.7	18.6	21.3	20.8	23.3	29.1	37.0	51.5	62.6	64.5
MORAGA DR	59.7	54.8	44.0	24.4	27.3	23.2	16.3	20.0	18.4	21.3	27.6	33.5	46.5	57.2	63.3
SUNSET BLVD	58.7	51.4	42.3	23.2	25.6	22.2	13.2	20.7	19.5	25.7	25.7	33.5	47.8	32.7	63.0
MONTANA AVE	60.0	49.1	40.8	23.5	25.4	22.1	13.4	20.5	19.8	25.8	26.5	32.5	48.3	29.0	64.2
MONTANA AVE	57.5	46.6	37.8	23.8	25.1	22.0	13.4	20.1	20.0	25.6	27.5	31.4	48.2	29.2	63.7
WATERFORD ST	58.1	39.9	27.8	19.7	20.6	18.1	11.2	16.1	17.1	22.0	23.9	28.5	47.4	24.4	61.9
WILSHIRE BLVD	55.9	50.4	22.3	18.5	17.2	15.8	11.8	14.6	21.1	30.4	41.4	49.0	59.1	55.0	65.1
CA-2/SANTA MONICA BLVD	56.2	54.5	31.3	24.3	20.4	20.2	18.6	20.6	39.8	49.9	53.0	57.5	58.0	61.6	63.2
OLYMPIC BLVD/PICO BLVD	55.9	55.2	36.5	28.0	18.0	21.1	29.1	33.2	51.8	53.7	54.0	58.9	61.1	63.9	63.3
I-10/SANTA MONICA FWY	58.8	58.6	41.9	31.5	16.9	22.1	37.3	41.6	58.1	56.6	55.6	61.0	61.5	64.4	64.3

Data source: INRIX

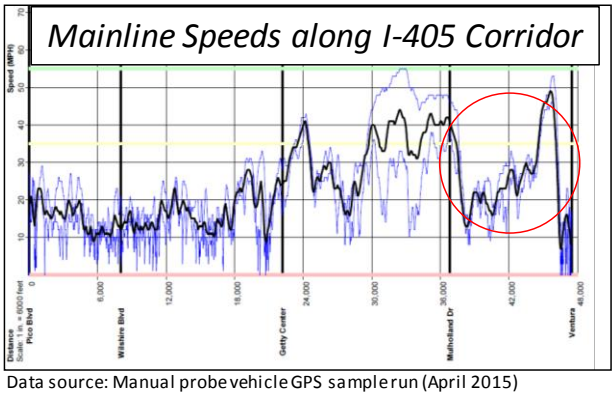
Exhibit 4-155: Northbound I-405 Freeway Speeds along the Corridor (2009, 2014, & 2015)



Data source: INRIX



Data source: INRIX



Data source: Manual probe vehicle GPS sample run (April 2015)

4.2 Reliability and Safety

Reliability is generally in reference to travel time reliability, which is loosely defined as the consistency or dependability in travel times, as measured from day-to-day and/or across different times of the day. Reliability is in most cases a function of incidents and unexpected occurrences on the roadway. Reliability is expressed in terms of travel time variability. In this report, it is the difference between the 95th percentile travel times and the mean or average travel times.

Safety is generally in reference to roadway traffic safety, which is the methods and measures for reducing the risk of a person using the road network being killed or seriously injured. One safety measure is commonly expressed in terms of the number of collisions or accidents on the roadway.

BEFORE

Before, there were more incidents and collisions or accidents. The northbound I-405 freeway was less reliable and experienced more non-recurrent congestion. In summary, before:

- There were more incidents for Metro FSP to respond to
- There were more collisions or accidents that required Metro FSP tows
- It generally took longer for Metro FSP vehicles to get to incidents
- It had unreliable travel times (higher variability)

AFTER

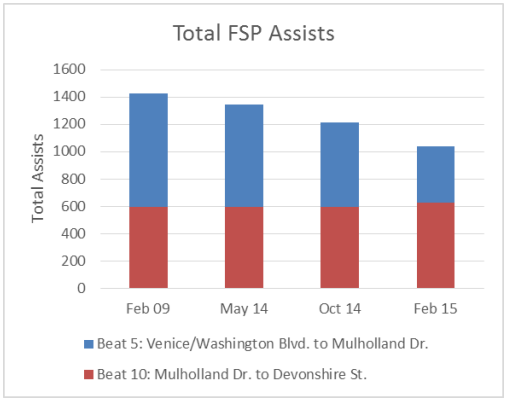
After opening, there are less incidents and collisions or accidents. Metro FSP can respond quicker now using the HOV lane. In summary, after:

- There are less incidents for Metro FSP to respond to
- There are less collisions or accidents that require Metro FSP tows
- It generally takes less time now for Metro FSP to respond to incidents using the HOV lane
- It has more reliable travel times (less variability)

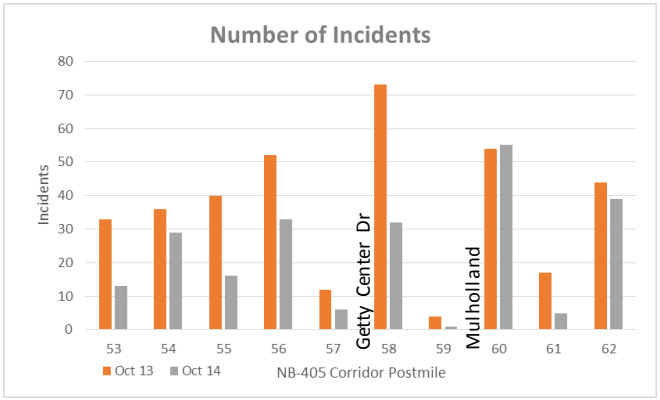
4.2.1 Northbound I-405 Freeway Metro FSP Assists and Number of Incidents

Exhibit 4-166 below illustrates the northbound I-405 freeway total Metro FSP assists (sample months of February 2009 and May 2014, taken from Metro records) and after (sample months of October 2014 and February 2015). As shown, the corridor has overall less total number of Metro FSP assists for Beats 5 and 10 that cover the corridor. The figure also illustrates the total number of incidents as reported by the California Highway Patrol (CHP) Computer Aided Dispatch (CAD) records for before (sample month of October 2013) and after (sample month of October 2014). As shown, there is less total number of incidents on the freeway.

Exhibit 4-166: Northbound I-405 Freeway Metro FSP Assists and Number of Incidents



Data source: Metro

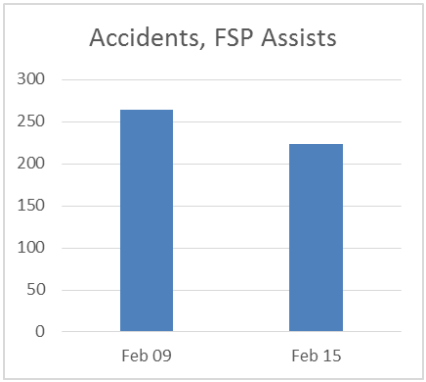


Data source: CHP CAD records

4.2.2 Northbound I-405 Freeway Metro FSP Assists and Number of Incidents

Exhibit 4-177 below illustrates the northbound I-405 freeway total Metro FSP assists of accidents (sample month of February 2009, taken from Metro records) and after (sample month of February 2015, taken from Metro records). As shown, the corridor has overall less total number of accidents, responded by Metro FSP. The figure is an indication of improved overall safety and reduction of non-recurrent congestion.

Exhibit 4-177: Northbound I-405 Freeway Accidents

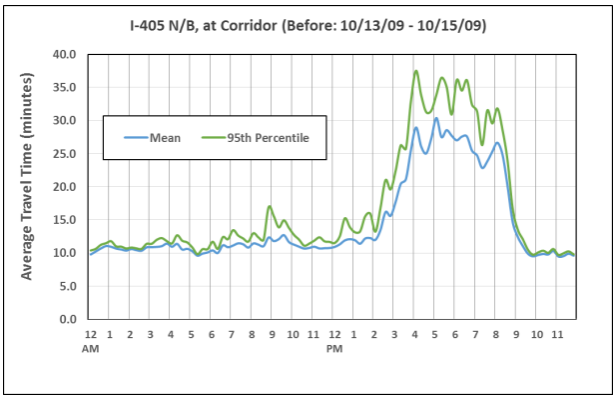


Data source: Metro

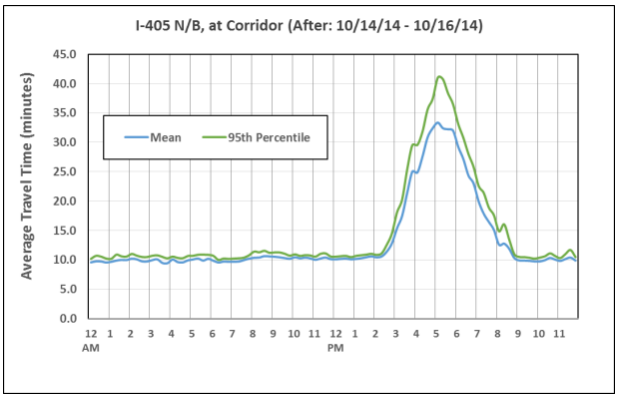
4.2.3 Northbound I-405 Freeway Travel Time Reliability

Exhibit 4-188 below illustrates the northbound I-405 freeway travel time reliability before (sample typical weekdays in October 2009, taken from INRIX crowd-sourcing data) and after (sample typical weekdays in October 2014, taken from INRIX crowd-sourcing data). As shown, the corridor has now better reliability (less travel time variability between the 95th percentile and the mean) than before. This results in reduced non-recurrent congestion.

Exhibit 4-188: Northbound I-405 Freeway Travel Time Reliability



Data source: INRIX



Data source: INRIX

4.3 Other Multimodal and Physical Infrastructure Improvements

Other multimodal improvements are in reference to active transportation elements. Physical improvements are in reference to the construction of physical infrastructure that enhances the corridor operations, safety, and maintenance. The benefits of these improvements are not quantifiably measured to offset the costs of construction. Nonetheless the benefits are just as real as the mobility benefits. They provide enhancements to the local community as well as the travelers on the corridor. Their benefits also typically far exceed the normal life cycle cost of the project. These improvements include sidewalks, ADA wheel chair ramps, provisions for bicycle access, traffic circulation, soundwall construction, new bridge construction and repair, new maintenance facilities such as pump stations.

BEFORE

Before, there were limited options. The infrastructure facilities were dated, deteriorated, and local traffic circulation was inefficient and ineffective. Many of the bridges were damaged and in need of repair. Access for active transportation was limited and inadequate. In summary, before:

- There was no carpool lane on freeway
- There were limited sidewalk on arterial crossings
- There were not much room for bicycles on arterial crossings
- Most of the infrastructure was deteriorated

AFTER

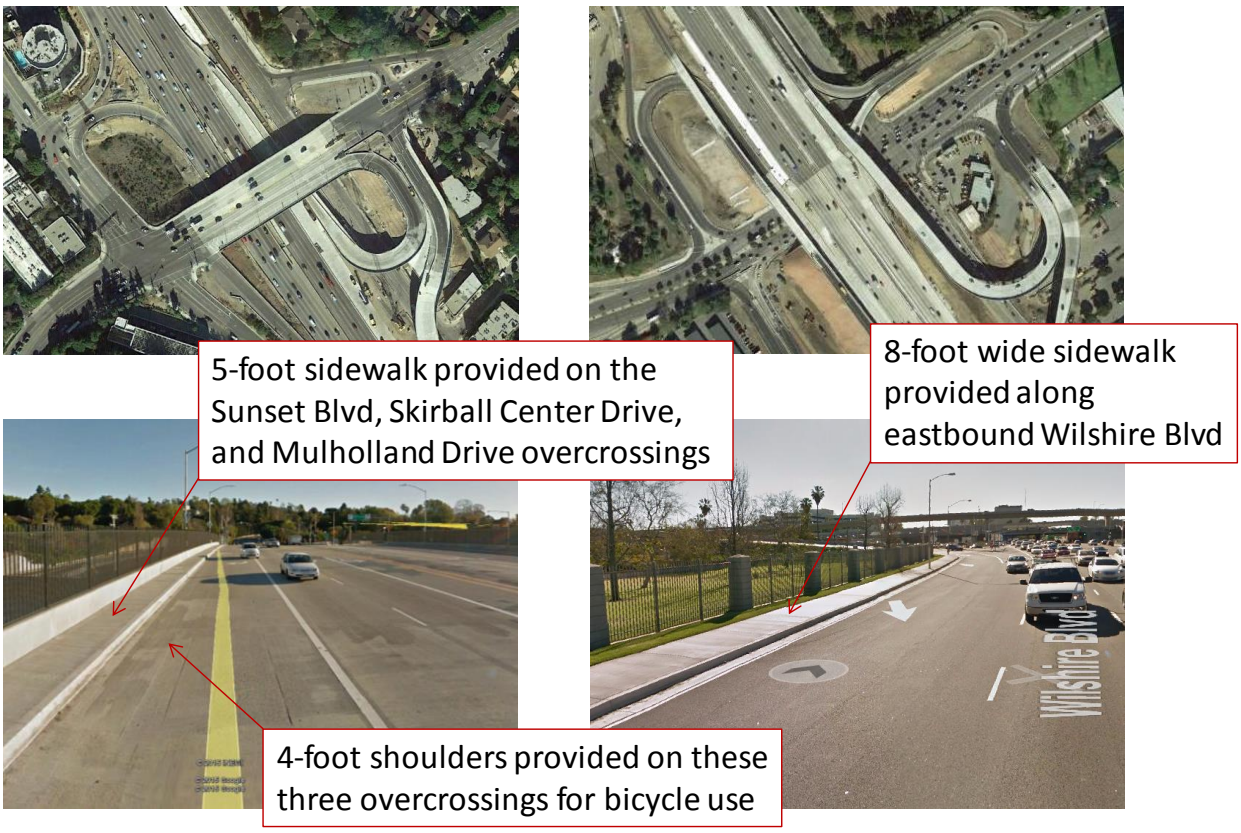
After opening, there is a carpool lane option, multimodal improvements, and physical infrastructure improvements. In summary, after:

- There is now a continuous carpool lane option now available for connection with arterials
- New wider sidewalks and pedestrian friendly access have been implemented
- Shoulders are provided for improved bicycle access
- There is now improved transit circulation and travel times on arterials
- There are new soundwalls, new bridges constructed to replace the old ones, and new maintenance facilities

4.3.1 Interchange Improvements of Multimodal Elements

Exhibit 4-199 below illustrates the improvements to the Sunset Blvd and Wilshire Blvd Interchanges. The improvements include wider sidewalks with ADA compliant wheel chair access ramps, and wide shoulders on the arterials for improved bicycle access.

Exhibit 4-199: Northbound I-405 Freeway Metro FSP Assists and Number of Incidents



Not shown are the addition of soundwalls, bridge replacements, and new maintenance facilities. The interchange modifications also allow for improved traffic circulation that benefits all modes of transportation. These improvements will have lasting benefits to the local community.

4.4 Other Performance Measures and Benefits

Other performance measures and benefits include daily total vehicle hours of delay (Delay), vehicle miles traveled (VMT), and air quality benefits (reduced emissions and vehicle operating costs).

AFTER

After opening, overall Delay is reduced despite the increase in the overall VMT, such that substantial air quality benefits result. In summary, after:

- Delay is reduced as compared to projected No Build (no project conditions at 2015) despite increased throughput volumes (higher VMT)
- Fewer incidents means less non-recurrent congestion (not quantified or included in the benefits measures
- Less total congestion and delay translates to improved quantifiable air quality benefits

4.4.1 VMT and Daily Delay

Error! Reference source not found.20 below presents the analysis findings of the performance measures. As shown, the overall VMT has increased by nearly 10%. Typically this could have air quality consequences, but the reduction in the overall delay results in significant overall benefits. As shown, the projected Delay for 2015 No Build conditions (if the project had not been done) was estimated at 16,000 daily vehicle hours of delay, based on the 2006 EIR/EIS. Daily Delay before the project is estimated at 11,000 vehicle hours in 2009 and 11,500 vehicle hours in 2013. In contrast, the daily Delay after the opening is estimated at less than 10,000 vehicle hours.

Exhibit 4 20: Northbound I-405 Freeway VMT and Daily Delay

Other Measures (VMT, Delay)

- Before Conditions Freeway Vehicle Miles Traveled (VMT):
  - Estimated 2009 (October Caltrans VDS data) 1,390,000
- After Conditions Freeway VMT:
  - Estimated 2014 (October Caltrans VDS data) 1,525,000
- Before Conditions Freeway Daily Vehicle-Hours Delay:
  - Projected 2015 No Build (2006 EIR/EIS) 16,000
  - Estimated 2013 (November INRIX data) 11,500
  - Estimated 2009 (November INRIX data) 11,000
- After Conditions Freeway Daily Vehicle-Hours Delay:
  - Estimated 2014 (November INRIX data) 10,000

4.4.2 Air Quality Benefits

Exhibit 4-21 below presents the analysis findings of the air quality benefit analysis. As shown, the estimated 20-year life-cycle benefits of the project over projected 2015 No Build results in Vehicle Operating Cost of over $52 million and a reduction of emissions by 266,000 tons. These are significant benefits for the recurrent conditions on the freeway. Not included in these figures are the non-recurrent congestion savings from reduced number of incidents and accidents or collisions, which typically represents about half of the total daily delay, and congestion savings on the arterial corridors with improved travel times on Sepulveda Blvd, Sawtelle Blvd, and the connecting arterials with improved local circulation. The impact and benefits are expected to be significant based on the performance measures.

Exhibit 4-21: Northbound I-405 Freeway Air Quality Benefits

Air Quality Benefits

- After Conditions, Air Quality Benefits:
  - Estimated 20-year life-cycle benefits over projected 2015 no build
    - Vehicle Operating Cost (Fuel Savings) $52 million
    - Emissions Reduction (CO_2) 266,000 tons

5. CONCLUSION

Evaluation of the before and after conditions was made between different years, 2005/2006, 2009, 2013, 2014, and 2015. The initial before conditions study conducted by the 2005/2006 EIR/EIS is a decade old now. The conditions in 2009 were at the peak of a recessionary period. The conditions from 2010 to May 2014 are during construction, and traffic behaves very differently around construction activities and does not represent normal conditions. Comparing these "before" conditions to the after, which occurs much later in time, are not comparisons made on equal footing. An equal basis would be comparing the "after" current conditions to what would be if the project had not been completed and open to traffic today. Still, the comparisons of conditions in different times give us some perspective on operating conditions that we can draw some reasonable conclusions.

In short, the project resulted in an increase in the VMT. Despite this increase in higher usage, the measured freeway benefits, although may not appear to be substantial on the freeway, the corridor has absorbed more demand and still performs better than before and Sepulveda Boulevard also performs much better now. Based on the analysis results, the improvements have yielded many quantifiable and measureable benefits since opening in May 2014. These benefits in totality should exceed the overall cost of the implementation. Specifically, the improvements include the following:

- Provide HOV System network continuity and modal choice, and opportunity for future transit on freeway
- Yield improved overall traffic circulation and arterial improvements, including transit services, and improved multimodal elements
- Carry more traffic and more people on the freeway, and results in less traffic demand on arterial corridors
- Results in shorter freeway PM peak period by 2 hours
- Produce improved travel reliability, less incidents, less accidents, and reduced non-recurrent congestion
- Results in reduced delay and air emissions over no build (if project is not done) conditions
- Include performance improvements to the freeway corridor, arterial network, interchange circulation, transit operations and service, active transportation access, multimodal elements, and physical infrastructure (freeway mobility improvement is just one element of many measureable benefits)

In addition, significant additional benefits are expected for this corridor with the project, if downstream bottleneck conditions are improved between Nordhoff Street and Devonshire Street. The backup queuing to the corridor prevents the project from gaining the full potential

benefits that could be produced. Caltrans has stated that additional operational benefits may be observed once the ramp metering system (RMS) between the US-101 and I-5 are further streamlined. Their RMS has been inoperable since Fall of 2014 due to ongoing pavement rehabilitation construction work on the mainline freeway and the ramps throughout that segment.

I-405 Sepulveda Pass Improvements

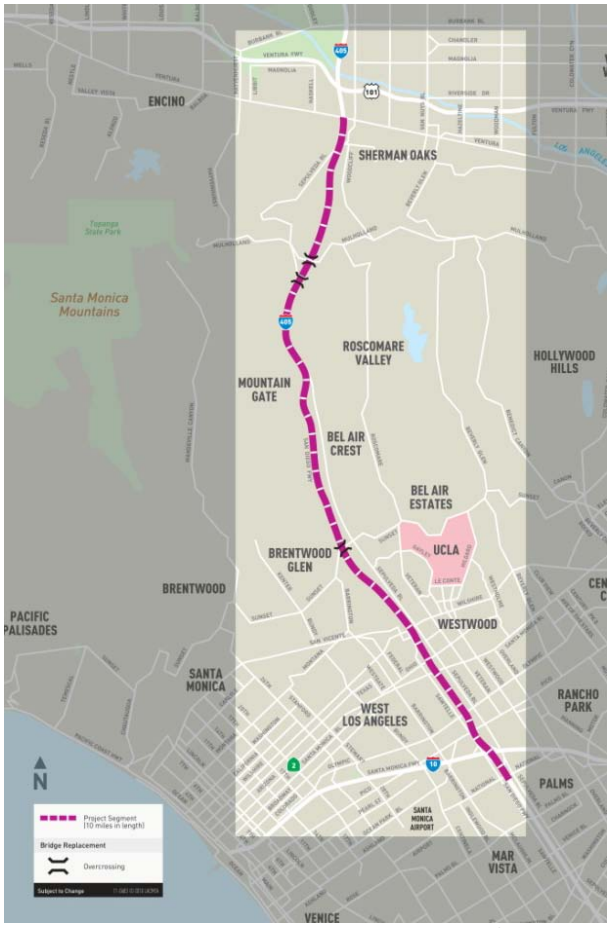
Economic Impact Analysis

The Los Angeles County Metropolitan Transportation Authority (Metro) has completed planned improvements to the stretch of the San Diego Freeway (I-405) travelling through the Sepulveda Pass. This project will reduce existing and forecasted traffic congestion on the I-405 and enhance traffic operations by adding freeway capacity in an area that experiences heavy congestion. In addition to these modifications, the project will improve both existing and future mobility and enhance safety throughout the corridor. Project benefits include a decrease in commuter time, reduction in air pollution, and promotion of ridesharing.

The I-405 Sepulveda Pass Improvements Project has completed the following:

- Added a 10-mile HOV lane on the northbound I-405 between the Santa Monica Freeway (I-10) and the Ventura Freeway (US 101), while also widening lanes in this stretch;
- Removed and replaced the Skirball Center Drive, Sunset Boulevard and Mulholland Drive bridges;
- Realigned 27 on- and off-ramps; widened 13 existing underpasses and structures; and
- Constructed approximately 18 miles of retaining and sound walls on the San Diego Freeway (I-405).

I-405 Sepulveda Pass Improvements Project Site



Source: Metro

Project work began in 2009 and is scheduled for completion in 2015. Expenditures were $1.14 billion, of which $31.2 million was for right-of-way and land acquisition.

As these expenditures occurred over a number of years, the total construction spending of $1.11 billion is adjusted for inflation to $1.204 billion in current dollars. The total economic impact in the five-county Southern California region of this investment is shown on the following page.

Total Economic Impact in Southern California

Initial Spending

$1.2 billion
(inflation-adjusted)

- Initial spending estimates for the project were used as direct activity, and indirect and induced effects were estimated using models developed with the IMPLAN system (V3.1 software and 2013 data) from the IMPLAN Group LLC.
- All dollar figures are quoted in 2015 dollars.

Total Output

$ 2.5 billion

- The total economic output includes direct, indirect and induced business revenues.
- **Direct revenues** are captured by construction, architecture and engineering firms hired by Metro.
- **Indirect and induced revenues** stem from the purchases made by Metro and those generated by the spending of employees whose wages are sustained by both direct and indirect spending.

Total Employment

14,330 jobs

- **Direct employment** includes the Metro workers and other employees hired during the project.
- **Indirect and induced workers** are those whose jobs are sustained by purchases for the project and household purchases funded by workers' wages.
- Job creation estimates are measured on a job-count basis for both wage-earners and proprietors regardless of the number of hours worked.

Total Compensation

$ 901 million

- Total compensation includes income of direct *and* indirect workers.
- Compensation includes wages and salaries *and* benefits, such as health and life insurance, retirement payments, and non-cash compensation.

Total Tax Revenue

State / Local:	$ 106 million
Federal:	$ 187 million

- The proposed projects will generate income taxes, sales taxes, payroll taxes and social insurance taxes, in addition to permits, property taxes, corporate income taxes, gross receipts taxes and other licenses and fees.

Industry Sector Impacts

The economic impact spills across industries in the Southern California five-county region through indirect and induced effects. The complete list of impacts by industry sector due to construction spending for this project appears in the table below. The values in the exhibit should be interpreted as illustrative of the industry effects rather than precise given model and data limitations.

Impact of Sepulveda Pass Improvements in Southern California by Industry Sector			
Industry	Output ($ million)	Jobs	Compensation ($ million)
Agriculture	$ 1.7	18	$ 0.9
Mining	28.0	79	9.9
Utilities	9.1	11	1.9
Construction	1,218.9	6,584	467.9
Manufacturing	277.6	345	26.9
Wholesale trade	76.7	322	25.3
Retail trade	133.2	1,547	56.8
Transportation and warehousing	53.1	292	21.7
Information	62.9	116	13.2
Finance and insurance	91.1	482	34.1
Real estate	154.7	409	14.4
Professional, scientific and technical services	138.0	945	81.4
Management of companies	16.0	69	7.8
Administrative and waste management	43.8	656	24.6
Education services	12.8	170	7.7
Health care and social assistance	78.4	825	46.2
Arts, entertainment and recreation	12.8	163	5.8
Accommodations and food services	44.2	655	18.9
Other services	46.5	554	26.4
Government & non-NAICS	21.6	86	8.6
Total *	$ 2,520	14,330	$ 901

* May not sum due to rounding
Source: Estimates by LAEDC

Detailed Breakdown of Selected Impacts

Economic Impacts in Southern California by Type			
	Employment	Labor Income ($ millions)	Output ($ millions)
Direct effect	6,508	$ 462.5	$ 1,204.4
Indirect effect	3,671	230.3	713.0
Induced effect	4,147	207.7	603.7
Total	14,330	$ 900.5	$ 2,521.1
Annual Average	*2,047*	*$ 128.6*	*$ 360.2*

Employment Impacts by Sector					
	Direct	Indirect	Induced	Total	*Annual Average*
Agriculture, forestry, fishing	-	5	13	18	*3*
Mining	-	74	5	79	*11*
Utilities	-	6	5	11	*2*
Construction	6,508	38	39	6,584	*941*
Manufacturing	-	261	84	345	*49*
Wholesale trade	-	200	122	322	*46*
Retail trade	-	980	564	1,547	*221*
Transportation and warehousing	-	172	120	292	*42*
Information	-	45	70	116	*17*
Finance and insurance	-	151	331	482	*69*
Real estate and rental	-	192	217	409	*58*
Professional, scientific, technical	-	761	183	945	*135*
Management of companies	-	39	31	69	*10*
Administrative and waste management	-	419	237	656	*94*
Education services	-	3	167	170	*24*
Health care and social assistance	-	-	825	825	*118*
Arts, entertainment and recreation	-	25	138	163	*23*
Accommodation and food services	-	105	550	655	*94*
Other services	-	158	395	554	*79*
Government & non-NAICS	-	36	50	86	*12*
Total	6,508	3,671	4,147	14,330	*2,047*
Annual Average	*930*	*524*	*592*	*2,047*	

Methodology

Economic impact analysis is used to estimate the overall economic activity, including spill-over and multiplier impacts, which occurs as a result of a particular business, event or investment. The initial economic activity related to Metro's transportation projects is the purchase of goods and services from local vendors and the wages and benefits paid to local workers.

The total estimated economic impact includes direct, indirect and induced effects. The injection of new funds into the region circulates from Metro to its contractors. This is the *direct effect* of the spending. The contractor in turn purchases goods and services from local establishments that in turn hire workers and buy goods and services to facilitate their business. These are called *indirect effects.* In addition, workers employed on site, as well as employees of all suppliers, spend a portion of their incomes on groceries, rent, vehicle expenses, healthcare, entertainment, and so on. These are called *induced effects.*

The recirculation of the original expenditures multiplies their impact through these indirect and induced effects. The extent to which the initial expenditures multiply is estimated using economic models that depict the relationships between industries (such as road construction and its suppliers) and among different economic agents (such as a cement supplier and its employees). The models used in this analysis were developed using software and data from the IMPLAN Group, LLC. The economic region of interest is five-county Southern California region of Los Angeles, Orange, Riverside, San Bernardino and Ventura counties. This region forms the Los Angeles Combined Statistical Area defined by the Bureau of Labor Statistics.

The metrics used to determine the value of the economic impact include employment, labor income and the value of output. *Employment* includes full-time, part-time, permanent and seasonal employees and the self-employed, and is measured on a job-count basis regardless of the number of hours worked during the year. *Labor income* includes all income received by both payroll employees and the self-employed, including wages and benefits such as health insurance and pension plan contributions. *Output* is the value of the goods and services produced. For most industries, this is simply the revenues generated through sales; for others, in particular retail industries, output is the value of the services supplied.

Expenditures are modeled as nominal expenditures in year of spending, and inflation-adjusted to reflect 2015 dollars. Annual impacts are estimated by dividing the total impacts by the number of years of project duration. All dollar figures are quoted in 2015 dollars.

Spending in the budget category denoted as right-of-way and land acquisition is excluded from economic impact analysis since this is an exchange of assets and does not generate economic activity on its own. Additionally, spending on vehicle purchases and on finance charges, if any, are excluded because they are not expected to occur within the economic region.

Job creation estimates are measured on a job-count basis for both wage-and-salary workers and proprietors regardless of the number of hours worked.