



Regional Traffic Signal Synchronization Program Overview

Six Corridors from Call 2013 – Lessons Learned

Orange County Traffic Engineering Council

3/23/2017

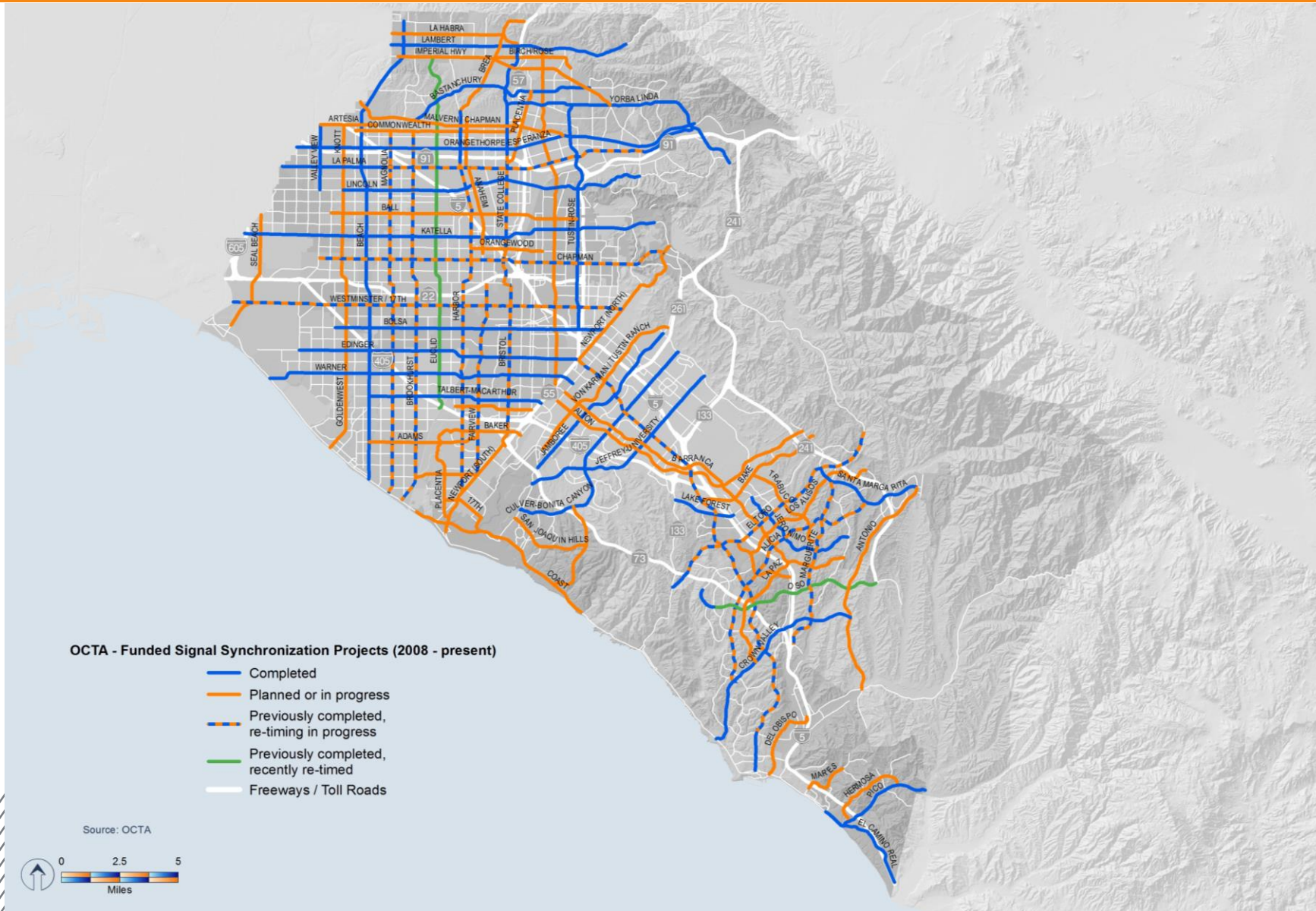
Regional Traffic Signal Synchronization Program

- Regional projects that traverse multiple jurisdictions and freeway interchanges
- #1 Goal = Regularly coordinate signals on a 750-mile network defined and part of the MPAH
- Annual Competitive funding Call for Projects between local agencies
- Three-year grants for signal timing, maintenance & monitoring
- Local agencies should try to implement or lead projects themselves, or
 - OCTA optional implement or lead projects
 - OCTA has led a majority of all signal sync projects – 28 out of 59 projects
- OCTA funded 100% for M1. Local agencies contribute 20% matching funds for M2
 - Match may be cash, in-kind service hours, or combination thereof



MPAH – Master Plan of Arterial Highways
OCTA – Orange County Transportation Authority

Funded Signal Synchronization Projects

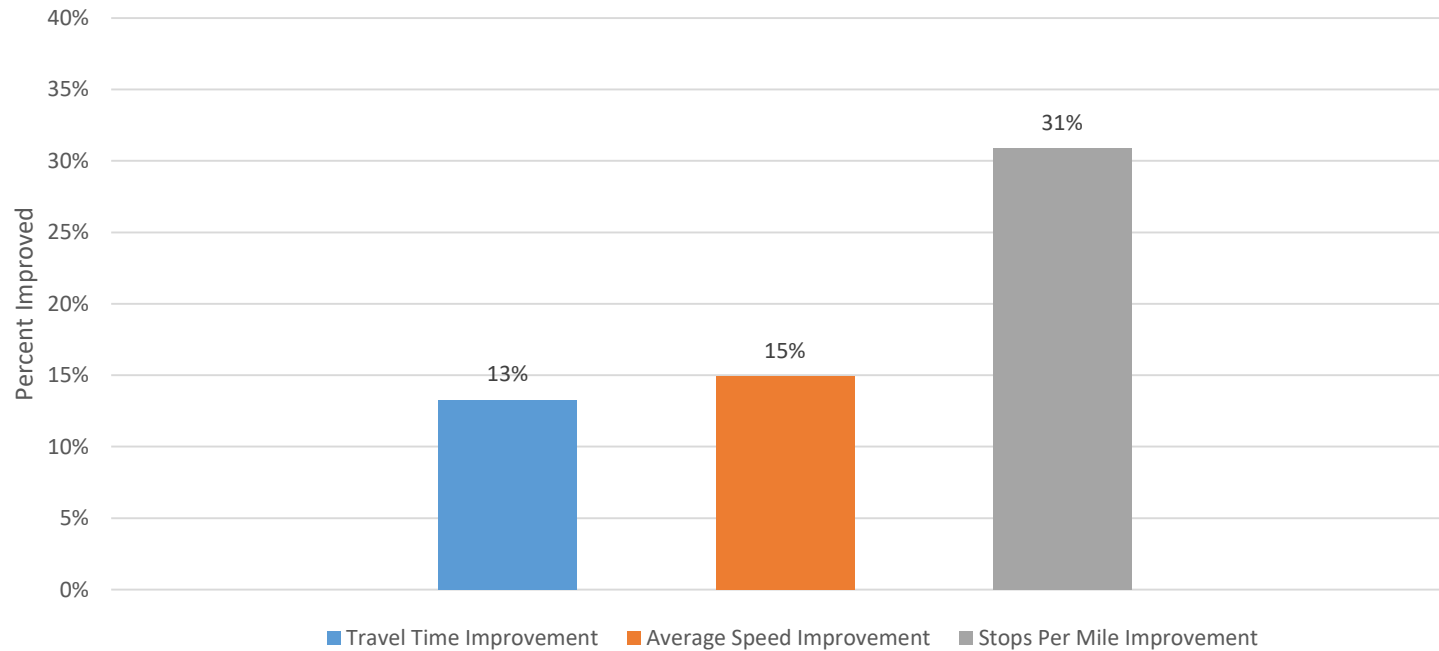


Summary of Results for Completed Projects

- 59 signal synchronization projects completed
 - Since original demonstration project of Euclid Street - 2007
- Approximately \$36 million improvements along 540 miles of roadway
- 2,068 signalized intersections
 - 224 of these intersections are 2nd cycle of projects for retiming.

Summary of Results for Completed Projects

- Travel times improved an average of 13 percent
- Average safe speeds improved an average of 15 percent
- Stops-per-mile improved an average of 31 percent



Summary of Results for Completed Projects to Date



Reduction of over 667.2 million pounds in greenhouse gases



Saved fuel consumption by 33.0 million gallons



At \$3.90 per gallon of gas, projects will save the public \$128.7 million

OCTA 's Standard Price for comparison since inception of Signal Synchronization reports.



At \$2.90 per gallon of gas, projects will save the public \$95.7 million

RTSSP Corridors – Call for Projects FY 2013

- F.Y. 2013 OCTA designated to lead unprecedented 9 large scale RTSSP Projects
 1. Adams Avenue – Costa Mesa, Huntington Beach, Caltrans*
 2. Antonio Parkway – County, RSM, Caltrans*
 3. Bake Parkway – Lake Forest, Irvine
 4. Jeronimo Road – Lake Forest, Mission Viejo*
 5. Kraemer/Glassell/Grand (KGG) – Brea, Placentia, Anaheim, Orange, Santa Ana
 6. Newport Avenue/Boulevard (N) – County, Orange, Tustin, Caltrans*
 7. Newport Boulevard (S) – Costa Mesa, Santa Ana, Caltrans
 8. State College Boulevard – Anaheim, Orange*
 9. Trabuco Road – Lake Forest, Mission Viejo*

* Designates Mobile Source Air Pollution Reduction Review Committee (MSRC) back funded – OCTA Administered and Implemented

MOBILE SOURCE AIR POLLUTION REDUCTION REVIEW COMMITTEE (MSRC)

- South Coast Air Quality Management District (SCAQMD)
 - Mobile Source Air Pollution Reduction Review Committee (MSRC)



- AB 2766 Clean Air Act
 - Collects Fees from DMV Registrations – Reduce Air Pollution
 - 30% directed to MSRC for programs that reduce motor vehicle pollution
 - Signal Synchronization is considered eligible program
- OCTA leveraged \$1.25 Million to back fund the 6 RTSSP Call 3 Projects
 - This is only for the Primary Implementation Phase
 - Replenish expended M2 Construction funds for additional funding for future calls for projects

MSRC PROJECTS

Corridor Name	Partner Agencies are OCTA and	North or West Limits	South or East Limits	Length in Miles	No. of Signals	Project Cost
Adams Avenue	Huntington Beach, Costa Mesa, Caltrans	Lake Street	Fairview Road	5.2	17	\$ 1,258,088
Antonio Parkway	County, Rancho Santa Margarita, Caltrans	Santa Margarita Parkway	Ortega Highway (SR-74)	10.3	26	\$ 1,368,150
Jeronimo Road	Lake Forest, Mission Viejo	Lake Forest Drive	Olympiad Road	6.2	16	\$ 298,200
Newport Avenue/Boulevard	County, Orange, Tustin, Caltrans	Santiago Canyon Road	Sycamore Avenue	6.5	24	\$ 1,107,638
State College Boulevard	Anaheim, Orange, Caltrans	Via Burton	Garden Grove Boulevard	5.5	35	\$ 1,119,973
Trabuco Road	Lake Forest, Mission Viejo	Paseo Sombra	Marguerite Parkway	4.4	14	\$ 300,114
			TOTAL	38.1	132	\$ 5,452,163

MSRC PROJECTS

Cost Breakdown

Project Element	Maximum AB2766 Discretionary Funds payable under this Contract	Additional Project PI Cost (M2 + Match)	Cost Savings to PI Phase
Adams Avenue Project	\$288,436	\$1,258,088	\$969,652
Antonio Boulevard Project	\$313,669	\$1,368,150	\$1,054,481
Jeronimo Road Project	\$68,367	\$298,200	\$229,833
Newport Avenue / Boulevard Project	\$253,951	\$1,107,638	\$853,687
State College Boulevard Project	\$256,771	\$1,119,973	\$863,202
Trabuco Road Project	\$68,806	\$300,114	\$231,307
Totals	\$1,250,000	\$5,452,163	\$4,202,163

MSRC PROJECTS

- Local Agencies may apply for MSRC Grant Monies, too!
- Plan in advance how you are going to pay for your cash match and apply for a grant
- Use MSRC Grant for your Cash Match in Project P
- Perform Due Diligence – MSRC is available but not guaranteed to any agency covered by SCAQMD that is qualified
 - You must contact MSRC for qualification determination

MSRC PROJECTS

- **MSRC Grants for Signal Synchronization is currently exhausted**
- **SCAQMD/MSRC is working on their 2nd Year Work Plan**
- **MSRC encourages agencies to apply for funding**
- **MSRC will notify agencies if they qualify**
 - **Only if you ask first!**

LESSONS LEARNED FROM PROJECT P

COURTESY – CROSSTOWN ELECTRICAL & DATA, INC.

Information from the cities

- Important to gather accurate information from the partner agencies initially so that estimated costs are accurate from the start.
- Example #1: Underestimated lengths of fiber optic cable:
 - This can be due to several reasons - the conduit may not follow the path that they thought it did, conduit is bored deep by directional boring, or there are more pull boxes than anticipated.

Information from the cities

- OCTA/Consultant/Contractors need to understand exactly what each partner wants before developing a budget:
- Example #1:
 - There are many different brands of Battery Backup systems (BBS)
 - Each city has a preference – and the cost can vary widely.
 - OCTA only allows UPS not BBS unless you are modifying an existing situation not replacing it.
- Example #2:
 - Communication equipment, CCTV cameras, video detection systems and pull boxes – cost can vary widely based on each city's requirements.

Project beginning

- Start permit process as early as possible
- When new services are involved – get Edison involved as early as possible
 - Make sure that there is enough budget to perform all this work
- Take photos of existing conditions

Important points

PULL BOXES

- When replacing existing pull boxes with new 6E boxes, any work performed within a wheelchair ramp will require an entire new ADA ramp to be installed joint to joint.

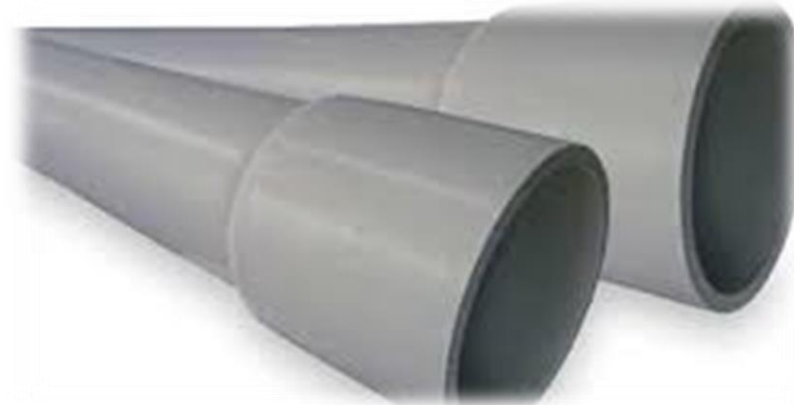


- No pull box may be installed within 1 foot of existing ramps. This can determine where we install our 6E pull boxes when it comes to fiber pulls.

Important points

CONDUIT

- Some recent projects have had multiple locations of broken or clogged existing conduit.



- Contractor needs time to investigate (proof) all conduit runs to verify the plans are correct.
- If we cannot remove the existing interconnect cable as a pull rope, more time, therefore cost, is required to duct rod and install a pull rope prior to the fiber installation.

Important points

POTHOLING AND ASPHALT REPAIR

- Some cities require very expensive pothole patching, so it is important to understand each city's requirements before developing a budget.
- Consider the use of 12" round cored holes
- Use large vacuum to excavate
- Use temporary steel caps to cover hole – can leave covered with cap for a few days
- Backfill with slurry – AC 1" deeper than existing pavement



Important points

DETECTABLE MULE TAPE

- Consider installing detectable mule tape in lieu of #10 green tracer wire. It is much easier to install along with fiber optic cable, especially in occupied conduits and works well. It is stronger than wire and will not stretch.



Important points

EDISON CONDUIT RUNS

- We cannot give an accurate estimate without approved Edison plans.
- There is extra time and work involved due to required depth and inspection policies and fees.
- When the plans call out for us to terminate in an existing Edison manhole, there is not a way to determine what depth we will have to dig down to until Edison opens the vault and finds the nearest available knock out.
- On a recent project Edison required us to dig 8 feet down which required shoring.

Important points

CONTROLLER CABINETS

- Consider using pre-manufactured composite P cabinet foundations where applicable.
- Can go over a pull box or M base



Project acceptance

- Should have an acceptance procedure or checklist for each intersection and line item.
 - I personally think this “should” should be a “shall”! – RGK
- Make sure all intersections are integrated to ATMS/Central, on-line and telematics are stable
 - Intermittent Loss of Signal (LOS) is not acceptable.

COMMUNICATIONS CONUNDRUM

3 DISCUSSION CORRIDORS

INTRODUCING COIN (CONCEPTUAL ONLY)



C  I N

COUNTY OF ORANGE ITS NETWORK



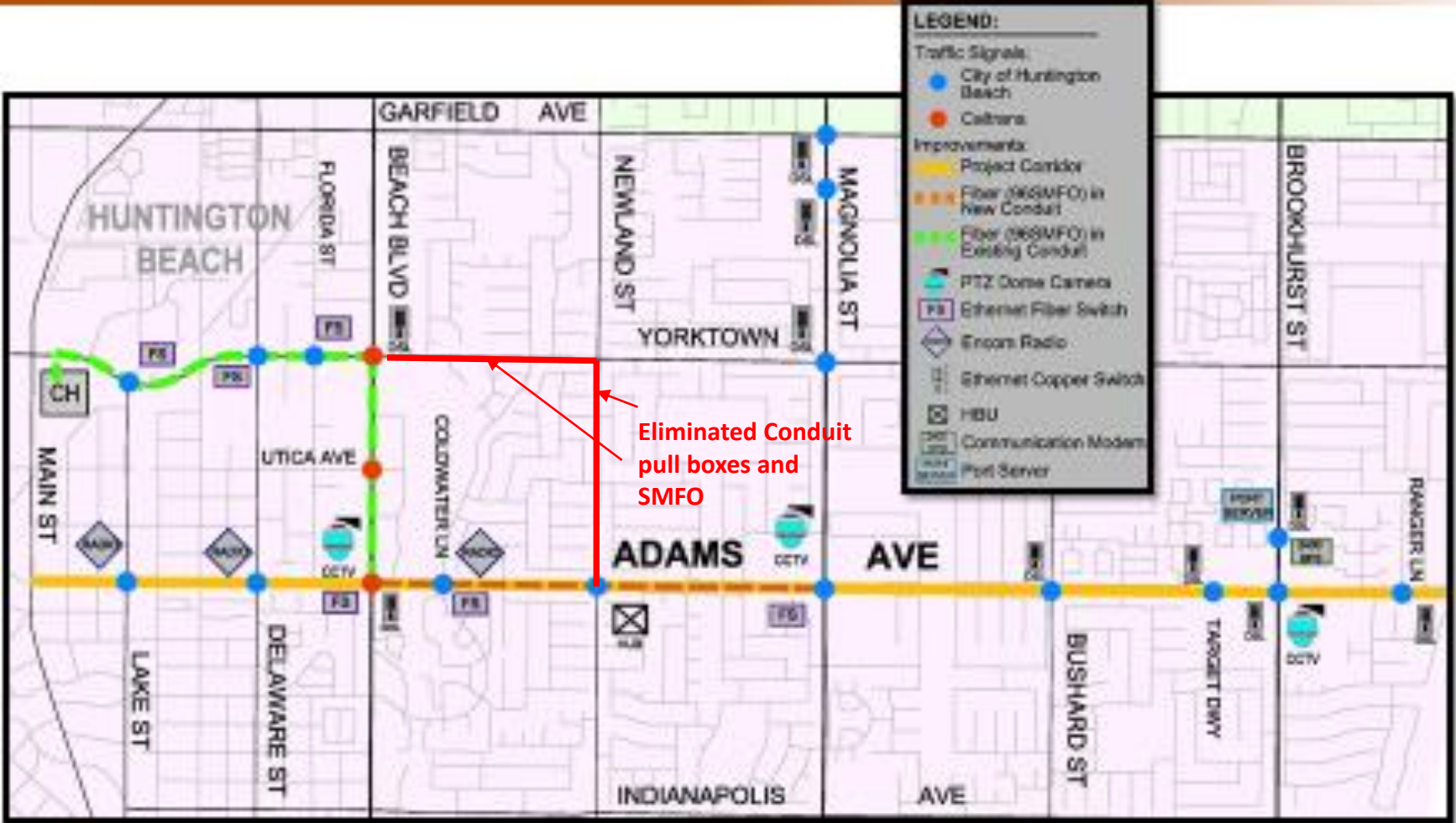
Adams Avenue

- OCTA, Costa Mesa, Huntington Beach
 - Caltrans is partner in infrastructure sharing
- 17 intersections, 5.2 Miles, ADT Range is 19.6K to 37.6K
- New Fiber optic Communications Ethernet Switches, CCTV, and ATMS

Adams Avenue

- Caltrans and HB partnered to utilize existing I/C facilities along Beach Blvd. (SR-39)
 - Saved over 5,300 l.f. of new conduit and pull boxes
 - Cost savings resulted in additional direct interconnect to intersections to the east not on line
 - Magnolia corridor on dysfunctional radio system – now tied into Adams fiber backbone
 - Leveraged to Brookhurst corridor to stabilize that subsystem
 - Additional 3 CCTV locations
 - One shared CCTV Camera at Beach Blvd. (SR-39) and Adams Ave.
 - Caltrans received ½ mile of new terminated fiber optic cable on Beach for future use.

Improvements Implemented City of Huntington Beach



Adams Avenue



Conduit Repair



Unforeseen Obstructions

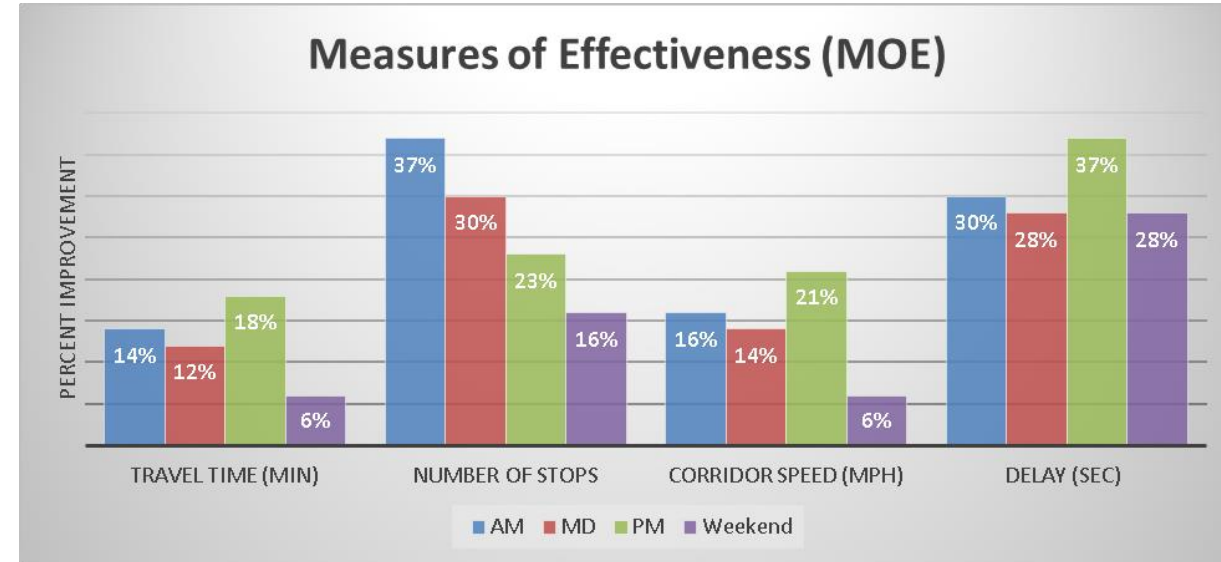


Installation of New Cabinet

Adams Avenue

- B/C = calculated at 7:1 over 3 years

BENEFITS			
Benefit	First Year		Three Years
Travel Time Savings	\$	1,449,635	\$ 4,348,904
Fuel Consumption Savings	\$	688,658	\$ 2,065,973
ROG Emissions Reduction	\$	980	\$ 2,940
NOX Emissions Reduction	\$	14,099	\$ 42,298
PM10 Emissions Reduction	\$	14,325	\$ 42,975
CO Emissions Reduction	\$	637	\$ 1,911
CO2 Emissions Reduction	\$	41,468	\$ 124,404
Vehicle Maintenance Savings	\$	227,217	\$ 681,652
		Total Benefits	\$ 7,311,057



Adams Avenue Before and After Study Results

Adams Avenue Overview

Highlights

- Average travel time reduced nearly 3 minutes in PM peak hour, each direction
- Average stops per vehicle reduced over 2.5 stops for Eastbound travel, weekday AM/PM peak hours

Overall Improvements

- Average travel time: 12 percent
- Average number of stops: 27 percent
- Corridor average speed: 14 percent
- Average vehicle delay: 30 percent

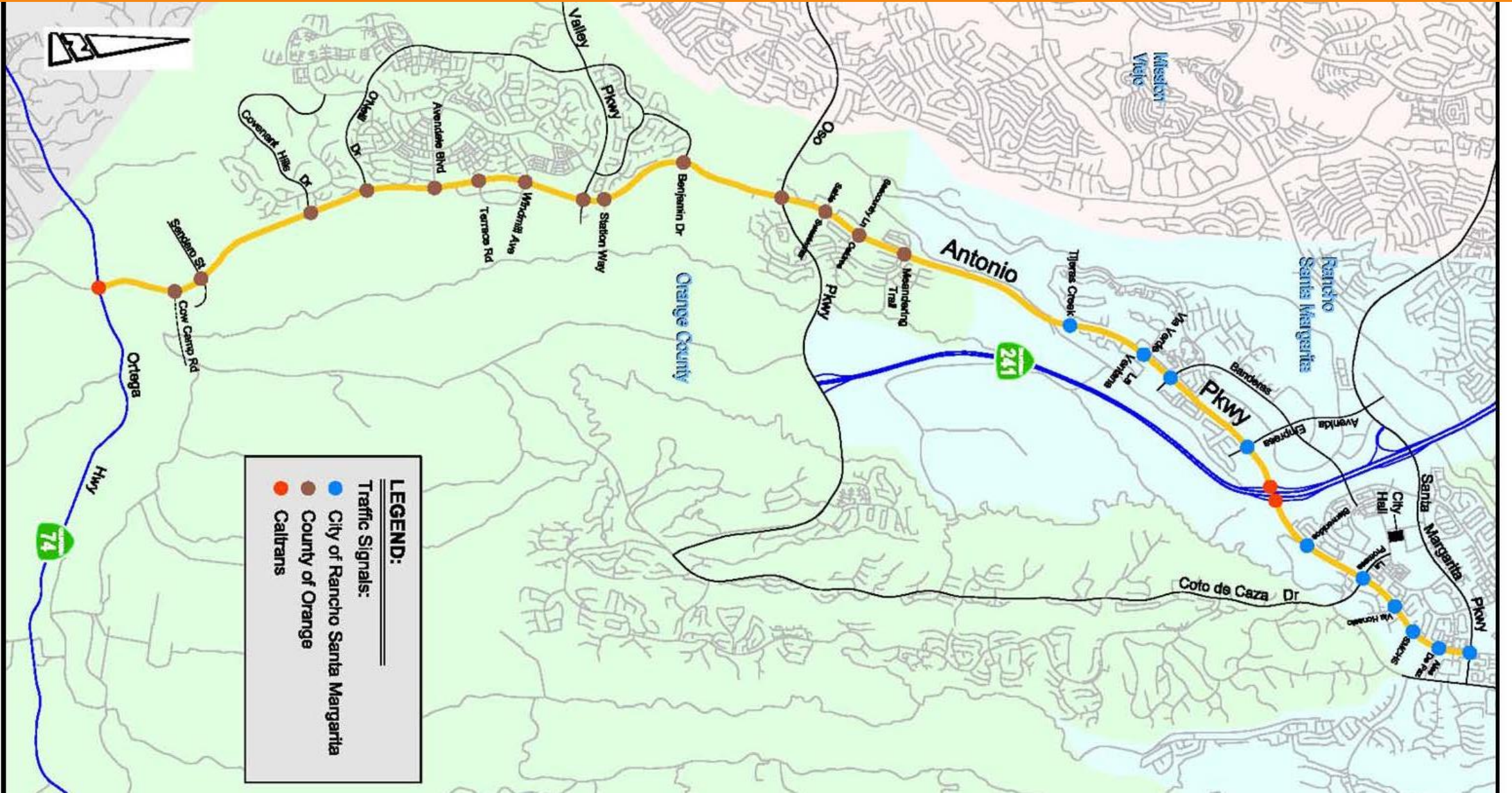
Antonio Parkway

- OCTA, Rancho Santa Margarita, County
 - Caltrans is a partner in infrastructure only – not a partner in Cooperative Agreement
- No Direct Interconnect systems in place for County intersections to OCPW TMC in downtown Santa Ana – over 20 miles as crow flies
- 27 intersections, 10 miles, ADT ranges from 12,000 to 34,000
- Caltrans, RSM, and County partner in infrastructure sharing

Antonio Parkway

- Consultant made several attempts to design systems using radio and tall poles in different locations across the County with no success
- Caltrans offers facilities in hopes of creating a joint network for County – COIN or County of Orange ITS Network
- County Intersections on South end of project. Caltrans intersections are in City of RSM

Antonio Parkway



Antonio Parkway

- Caltrans, RSM, County all enter into separate agreements specifying costs, maintenance, and responsibilities of sharing conduit, fiber pairs, and facilities for current and future usage.
 - SR – 74 Ortega Highway to RSM border – County shares conduit and fiber pairs with Caltrans.
 - ≈ 6 miles
 - RSM border S/O Tijeras Creek (Great Golf Course ) – County, Caltrans and RSM share conduit and fiber pairs north to SR-241 Foothill Toll Road interchange
 - ≈ 3 miles
 - SR-241/SR-133 Caltrans backbone to D12 TMC and building mounted microwave system between OC PW TMC in Santa Ana
 - ≈ 9 miles

SPEAKING

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OCTEC / ITE GOLF TOURNAMENT

FRIDAY – MAY 5, 2017

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Please Notate Check for Annual OCTEC Golf Tournament May 5, 2017

SPEAKING



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GOLF TOURNAMENT

FRIDAY, MAY 5, 2017

**FOUR MAN SCRAMBLE
SHOTGUN START AT 8:00 AM
REPORT IN BY 7:30 AM**

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5215 GREEN RIVER ROAD, CORONA, CA
91 Freeway off at Green River Road
(See Thomas Guide Page 742 B-5, Riverside County)
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Please Dress Appropriately, No Denim or Tank Tops**

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OCTEC Golf Co - Chair

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Jimsommers43@gmail.com

*** MAKE CHECKS PAYABLE TO: O.C.T.E.C. ***

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of GOLF



Antonio Parkway



County TMC



D12 TMC Roof Antennae

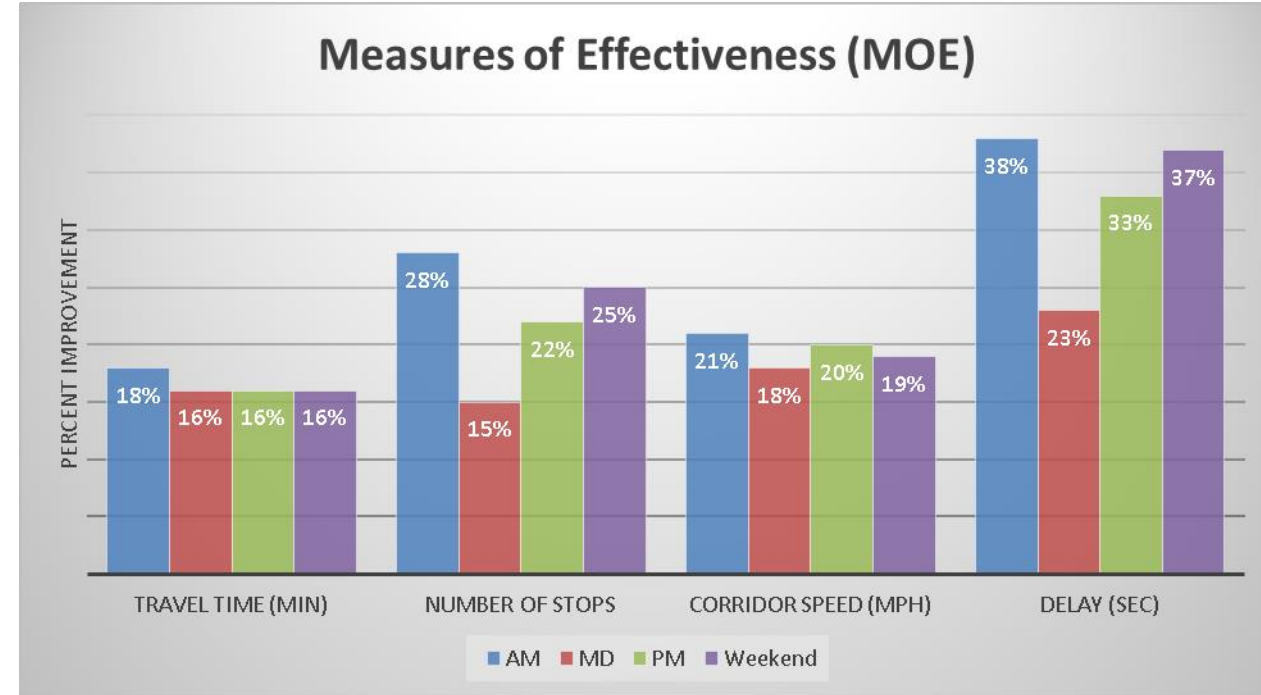


OC/PW TMC Roof Antennae

Antonio Parkway

- B/C = calculated at 9:1 over 3 years

BENEFITS		
Benefit	First Year	Three Years
Travel Time Savings	\$ 2,276,666	\$ 6,829,997
Fuel Consumption Savings	\$ 758,042	\$ 2,274,125
ROG Emissions Reduction	\$ 1,225	\$ 3,676
PM10 Emissions Reduction	\$ 47,125	\$ 141,375
CO Emissions Reduction	\$ 1,026	\$ 3,079
CO2 Emissions Reduction	\$ 45,646	\$ 136,939
Vehicle Maintenance Savings	\$ 206,144	\$ 618,431
Total Benefits	\$	9,994,720



Before and After Study Results

Antonio Parkway Overview

Highlights

- Average travel time reduced nearly 3 minutes in AM, MD , and PM peak hour, each direction
- Average stops per vehicle reduced over 2.5 stops for same

Overall Improvements

- Average travel time: 16 percent
- Average number of stops: 23 percent
- Corridor average speed: 19 percent
- Average vehicle delay: 33 percent

NEWPORT AVENUE/BOULEVARD (Tustin Orange)

- Similar issues to Antonio, County intersections to the far north and no interface to ATMS in Santa Ana.
- Antonio Comm was installed under separate concurrent contract not under auspices of MSRC
- Newport project Comm and Timing all on one project and MSRC deadlines are in play.
- Newport is relying on Antonio systems to be agreed upon with Caltrans to determine if similar system can be added to microwave using I-5 backbone to get to D12 TMC and then sent to OCPW TMC

NEWPORT AVENUE/BOULEVARD (Tustin Orange)

- Decide on Plan B – Wireless from Newport to OCPW TMC
 - How?
 - Crosstown Proofs conduit and cable from Newport down 4th Street
 - Impossible
 - Crosstown, MSI Tec, and CT – West combine forces to see how radio systems could be mounted in different locations using bucket trucks to emulate towers, etc.
 - APM negotiates with OCSD for possible joint use of microwave system from Loma Ridge facility
 - Requires \$68.5K CCO for this extra work

PATHLOSS REPORT AND VIDEO

S2940257 - CT West - Orange County - January 26, 2016

WIRELESS AND CONNECTIVITY PRODUCTS

CONNECTRONICS
Distributors of
Wireless and Connectivity Products

S2940257 - CT West - Orange County - January 26, 2016

Path Summary

Path Name	Availability	Options to Increase Availability
Location 1 to Location 2	*99.9991%	-Increase Antenna Height



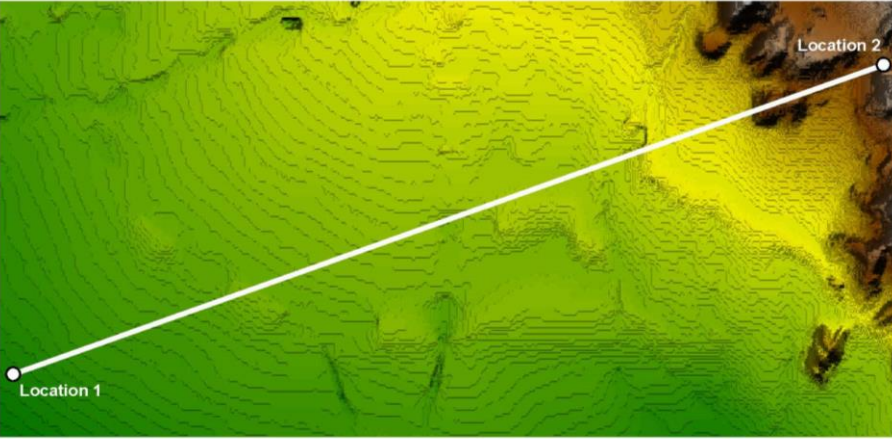
CAUTION - Impaired Fresnel Zone
Fresnel Zone appears to be impacted by clutter. Site survey is required.
(Clutter may consist of trees, buildings, etc.)

*Can be achieved with clear Line of Sight and Fresnel Zone

Ceragon IP-20C 11GHz - 2 x 80MHz Channel - 256QAM 2 x 501Mbps (1,002Mbps-1,236Mbps) - 3ft Dishes

$$F = 11000.00 \text{ MHz } K = 1.33 \text{ SF1} = 100.0, 60.0, 100.0, 60.0$$

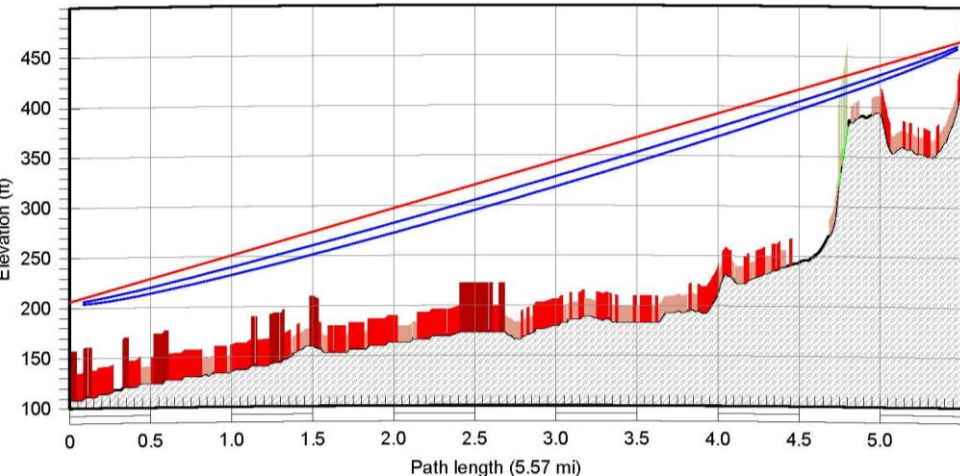
	Location 1	Location 2
Latitude	33 44 51.49 N	33 46 28.54 N
Longitude	117 52 36.23 W	117 47 08.12 W
True azimuth (°)	70.47	250.52
Vertical angle (°)	0.48	-0.54
Elevation (ft)	108.27	420.41
Tower height (ft)	98.00	49.00
Antenna model	HP3-11 (TR)	HP3-11 (TR)
Antenna gain (dBi)	38.50	38.50
Antenna height (ft)	98.00	49.00
TX loss (dB)	0.30	0.30
RX loss (dB)	0.30	0.30
Frequency (MHz)	11000.00	
Polarization	Horizontal	
Path length (mi)	5.57	
Free space loss (dB)	132.34	
Atmospheric absorption loss (dB)	0.14	
Net path loss (dB)	56.08	56.08
Configuration	2+0	2+0
Radio model	IP20C-11-M80X-A	IP20C-11-M80X-A
Radio file name	ip20c-11-ml80x-a	ip20c-11-ml80x-a
Emission designator	80M0D7W	80M0D7W
Maximum receive signal (dBm)	-20.00	-20.00
Polarization	Horizontal	
Rain region	Los Angeles, California	



CONNECTRONICS
Distributors of
Wireless and Connectivity Products

S2940257 - CT West - Orange County - January 26, 2016

Transmission summary (Location 1-Location 2.pls)



CONNECTRONICS
Distributors of
Wireless and Connectivity Products

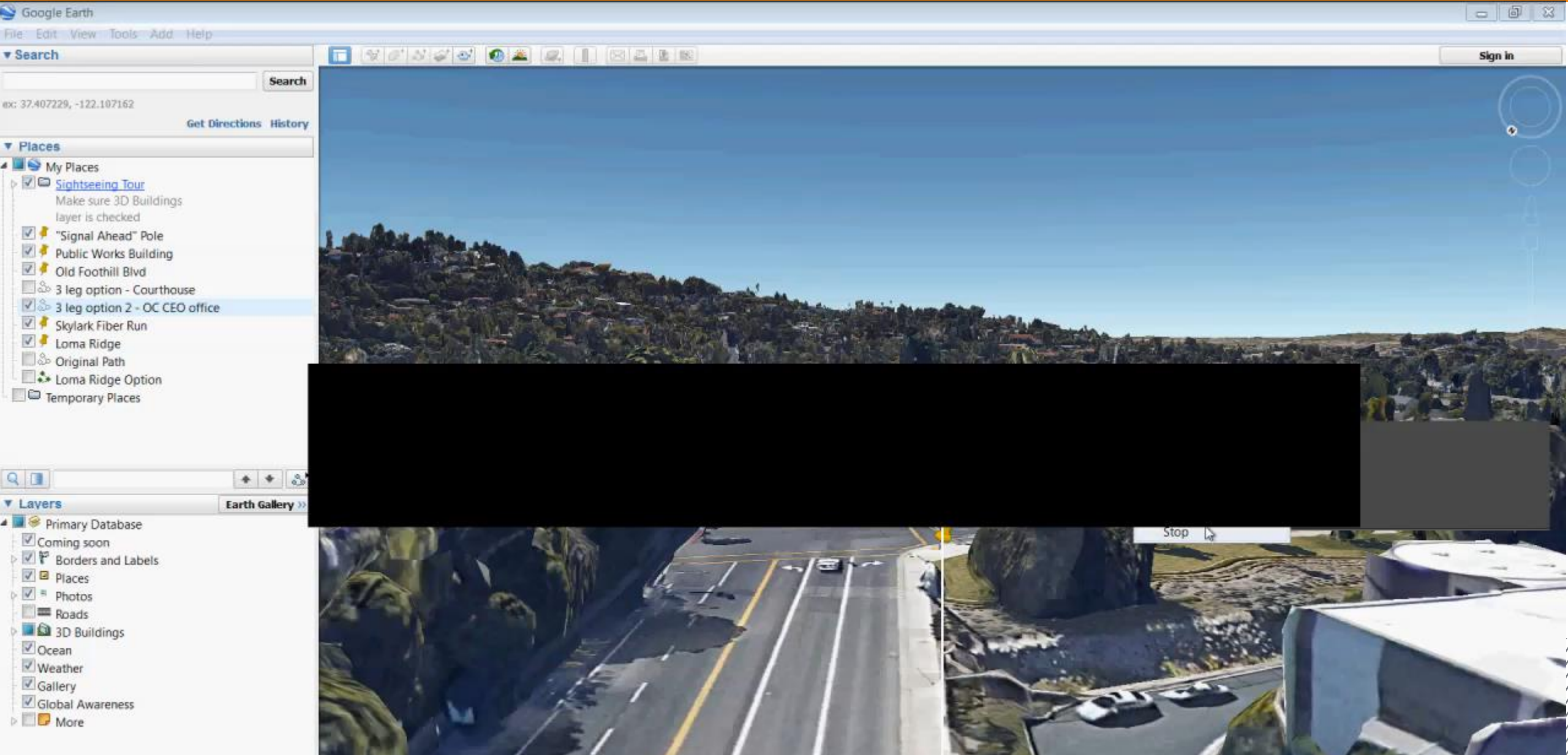
S2940257 - CT West - Orange County - January 26, 2016

	TX power (dBm)	RX threshold level (dBm)	EIRP (dBm)	Receive signal (dBm)	Thermal fade margin (dB)	Flat fade margin - multipath (dB)
1024QAM 607.998185Mbps	23.00	-52.75	61.20	61.20	-33.08	19.67
512QAM 559.54866Mbps	24.00	-55.75	62.20	62.20	-32.08	23.67
256QAM 510.203124Mbps	25.00	-58.75	63.20	63.20	-31.08	27.67
128QAM 443.211964Mbps	25.00	-61.25	63.20	63.20	-31.08	30.17
64QAM 375.380586Mbps	25.00	-64.25	63.20	63.20	-31.08	33.17
32QAM 306.890424Mbps	25.00	-66.75	63.20	63.20	-31.08	35.67
16QAM 234.101937Mbps	26.00	-71.75	64.20	64.20	-30.08	41.67
QPSK 116.400016Mbps	26.00	-81.50	64.20	64.20	-30.08	51.42

	Worst month multipath	Annual multipath	Annual rain	Total annual (2 way)	Time in mode (2 way)
1024QAM 607.998185Mbps	99.9921	99.9921	99.9976	99.9996	99.9948
512QAM 559.54866Mbps	99.9968	99.9968	99.9990	99.9997	0.0030
256QAM 510.203124Mbps	99.9987	99.9987	99.9996	99.9998	0.0012
128QAM 443.211964Mbps	99.9992	99.9992	99.9998	99.9999	0.0004
64QAM 375.380586Mbps	99.9996	99.9996	99.9999	99.9999	0.0003
32QAM 306.890424Mbps	99.9998	99.9998	99.9999	99.9999	0.0001
16QAM 234.101937Mbps	99.9999	99.9999	99.9999	99.9999	0.0001
QPSK 116.400016Mbps	99.9999	99.9999	99.9999	99.9999	0.0001

Multi-path fading method - Vigants - Barnett
Rain fading method - Crane

PATHLOSS REPORT AND VIDEO



NEWPORT AVENUE/BOULEVARD

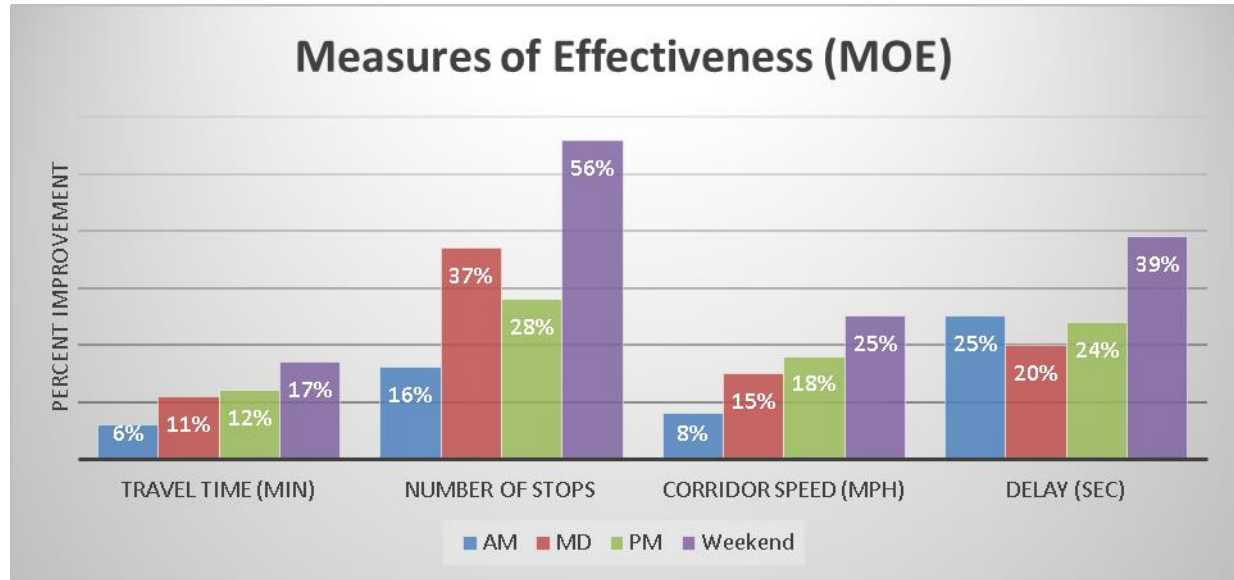


City of Orange TMC – Funded 3 Corridors: Kraemer/Glassell/Grand, Newport Avenue North, & State College Boulevard Projects

NEWPORT AVENUE/BOULEVARD

- B/C = calculated at 9:1 over 3 years

BENEFITS		
Benefit	First Year	Three Years
Travel Time Savings	\$ 429,732	\$ 1,289,196
Fuel Consumption Savings	\$ 193,910	\$ 581,731
ROG Emissions Reduction	\$ 293	\$ 879
NOX Emissions Reduction	\$ 4,190	\$ 12,569
PM10 Emissions Reduction	\$ 3,085	\$ 9,256
CO Emissions Reduction	\$ 179	\$ 536
CO2 Emissions Reduction	\$ 11,676	\$ 35,029
Vehicle Maintenance Savings	\$ 103,429	\$ 310,286
Total Benefits	\$	2,239,483



Before and After Study Results

Newport Boulevard/Avenue Overview

Highlights

- Average travel time reduced 1 minute in MD peak hour, Northbound direction
- Average stops per vehicle reduced 2.0 stops for Northbound travel, weekday MD peak hours

Overall Improvements

- Average travel time: 12 percent
- Average number of stops: 36 percent
- Corridor average speed: 15 percent
- Average vehicle delay: 27 percent

Next Steps

- 29 signal synchronization projects in-progress involving 93 agencies
- \$54 million of improvements
- 267 miles and 998 signals



Thank You

Q & A