Signal System Performance Measures based on Conventional Travel Run Data

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Outline

- ❑ Beyond the automated Signal Performance Measures (SPMs)
- ❑ UNR Research on travel-run-based SPMs
- ❑ Case Examples
- ❑ Q&A

Automated SPMs

Better link performance

Better arterial performance

Automated SPMs

- ❑ **The good – You have mostly heard!**
- ❑ **Limitations and beyond**
 - ❖ **Thresholds – what is considered good or bad?**
 - ❖ **Link-based performance $\neq$ arterial performance**
 - ❖ **Still need solution/alternative to improve operations**
 - ❖ **Cost?**

Case Example

Sahara Ave, Las Vegas

*Offsets at all other intersections use EndGreen of Phase 4, except for Durango which uses phase 8.

Initial MD Plan in Naztec NEMA

% Arrival on Red (11/10/15)

EB-66; **WB-52**

EB-16; WB-17

EB-47; **WB-73**

EB-32; **WB-NA**

EB-68; WB-33

FAST Adjusted MD Plan

% Arrival on Red (12/8/15)

EB-61; WB-52

EB-15; WB-16

EB-49; WB-59

EB-26; WB-NA

EB-60; WB-40

MOE Comparison

EB-66; **WB-52**

EB-16; WB-17

EB-47; **WB-73**

EB-32; WB-NA

EB-68; WB-33

EB-61; **WB-52**

EB-15; WB-16

EB-49; **WB-59**

EB-26; WB-NA

EB-60; WB-40

Orange County's Performance Index

- Measures of Effectiveness (MOEs)
 - Average Speed (S)
 - Green per Red (GpR)
 - Stops per Mile (SpM)
- Performance index (PI)

$$\begin{aligned} \text{PI} &= 1.5*(S - 10) + \text{GpR}*8 + 40 - \text{SpM}*10 \\ &= 1.5*(30-10)+4*8+40-1*10 \\ &= \underline{92} \end{aligned}$$

What are Missing?

- **Speed limit or free-flow speed - Higher speed limit likely results in higher actual speed**
- **Cycle length - Longer cycle length likely results in better arterial travel runs**
- **Spacing – shorter spacing makes progression more difficult**
- **Volume level – higher volume makes progression more difficult**

UNR Methodology

- One score based on %Speed
- One score based %Stop – **a standard stop is 25% of cycle length**
- Weighted score based on both (30% and 70%)
 - Adjustment based on cycle
 - Adjustment based on spacing
 - Adjustment based on V/C
 - Final score (100 scale) to determine QOS

Case Study - Before

Highway 74 – Caltrans District 8

Corridor Synchronization Performance Index

Summary

Arterial: City of Hemet-Hwy 74

Timing	No. of Runs	Average Speed Score	Average Stop Score	Average Score	Quality of Signal Timing
MD	7	72.1	85.9	84.7	B

Details

Arterial: City of Hemet-Hwy 74

Timing Plan: MD

Timing	GPS File Name	Average Speed (mph)	% Speed	Speed Score	No. of Stops	Standard No. of Stops	% Stop	Stop Score	Original Score	Cycle Length Adjustment	Spacing Adjustment	Adjusted Score	Quality of Signal Timing
MD	0-EB-City of Hemet-2015-10-23 -13_01_47	22.9	0.65	75.4	3	2.3	0.23	87	83.5	86.5(+3)	86.5(+0)	86.5	B
MD	1-WB-City of Hemet-2015-10-23 -13_19_15	16.7	0.48	57.7	4	4.1	0.41	69.3	65.8	68.8(+3)	68.8(+0)	68.8	D
MD	2-EB-City of Hemet-2015-10-23 -13_26_49	21.2	0.61	70.6	3	2.5	0.25	85	80.7	83.7(+3)	83.7(+0)	83.7	B
MD	3-WB-City of Hemet-2015-10-23 -13_35_07	21.8	0.62	72.4	4	1.8	0.18	92.3	86.3	89.3(+3)	89.3(+0)	89.3	B
MD	4-EB-City of Hemet-2015-10-23 -13_42_14	22.8	0.65	75.2	3	2.2	0.22	88	84.2	87.2(+3)	87.2(+0)	87.2	B
MD	5-WB-City of Hemet-2015-10-23 -13_51_28	20.4	0.58	68.2	5	3.1	0.31	79.3	76	79(+3)	79(+0)	79	C
MD	6-EB-City of Hemet-2015-10-23 -13_57_33	26.4	0.75	85.4	1	0.6	0.06	100	95.6	98.6(+3)	98.6(+0)	98.6	A

Case Study – After 1

Highway 74 – Caltrans District 8

Corridor Synchronization Performance Index

Summary

Arterial: City of Hemet-Hwy 74

Timing	No. of Runs	Average Speed Score	Average Stop Score	Average Score	Quality of Signal Timing
MD-UNR	4	68	84.2	82.4	B

Details

Arterial: City of Hemet-Hwy 74

Timing Plan: MD-UNR

Timing	GPS File Name	Average Speed (mph)	% Speed	Speed Score	No. of Stops	Standard No. of Stops	% Stop	Stop Score	Original Score	Cycle Length Adjustment	Spacing Adjustment	Adjusted Score	Quality of Signal Timing
MD-UNR	1-EB-2015-12-16 14-55-02MDUNR	19.4	0.55	65.4	3	2.9	0.29	81.3	76.6	79.6(+3)	79.6(+0)	79.6	C
MD-UNR	2-WB-2015-12-16 13-55-42MDUNR	18.1	0.52	61.6	5	3.8	0.38	72	68.9	71.9(+3)	71.9(+0)	71.9	C
MD-UNR	3-EB-2015-12-16 13-46-48MDUNR	19.4	0.55	65.3	3	2.6	0.26	83.7	78.2	81.2(+3)	81.2(+0)	81.2	B
MD-UNR	4-WB-2015-12-16 14-46-1MDUNR	24.4	0.7	79.6	2	1	0.1	100	93.9	96.9(+3)	96.9(+0)	96.9	A

Case Study – After 1

Highway 74 – Caltrans District 8

TranSync Demo

Caltrans D8 – LT Gap out

Caltrans D8 – Transition

How Travel Runs Should Be Collected?

Summary

- ❑ **Automated SPMs is a future trend and will change the way we do signal timing.**
- ❑ **Much needs to be done beyond SPMs and improving signal operations is the goal.**
- ❑ **The SPMs can be enhanced with traditional travel-run-based SPMs and with adequate signal timing tools.**
- ❑ **Signal timing plans must be adequately implemented and operated.**

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