DOWNTOWN
TRAFFIC SIGNAL TIMING

GREEN LIGHT LINCOLN – PHASE III

CITY OF LINCOLN NEBRASKA

FELSBURG HOLT & ULLEVIG

iteris

Project Team

Felsburg Holt & Ullevig

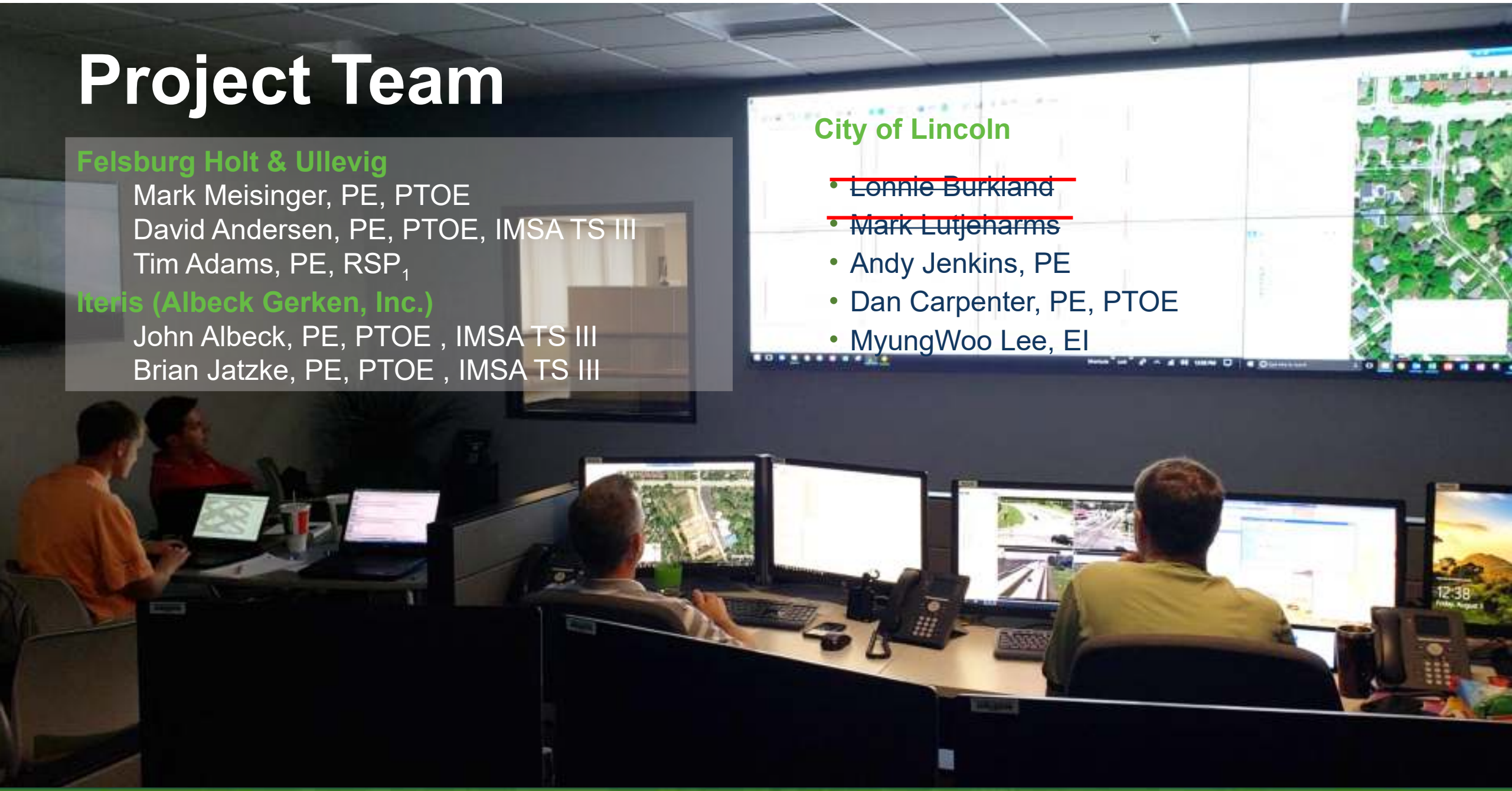
Mark Meisinger, PE, PTOE
David Andersen, PE, PTOE, IMSA TS III
Tim Adams, PE, RSP_1

Iteris (Albeck Gerken, Inc.)

John Albeck, PE, PTOE , IMSA TS III
Brian Jatzke, PE, PTOE , IMSA TS III

City of Lincoln

- ~~Lonnie Burkland~~
- ~~Mark Lutjeharms~~
- Andy Jenkins, PE
- Dan Carpenter, PE, PTOE
- MyungWoo Lee, EI



Background

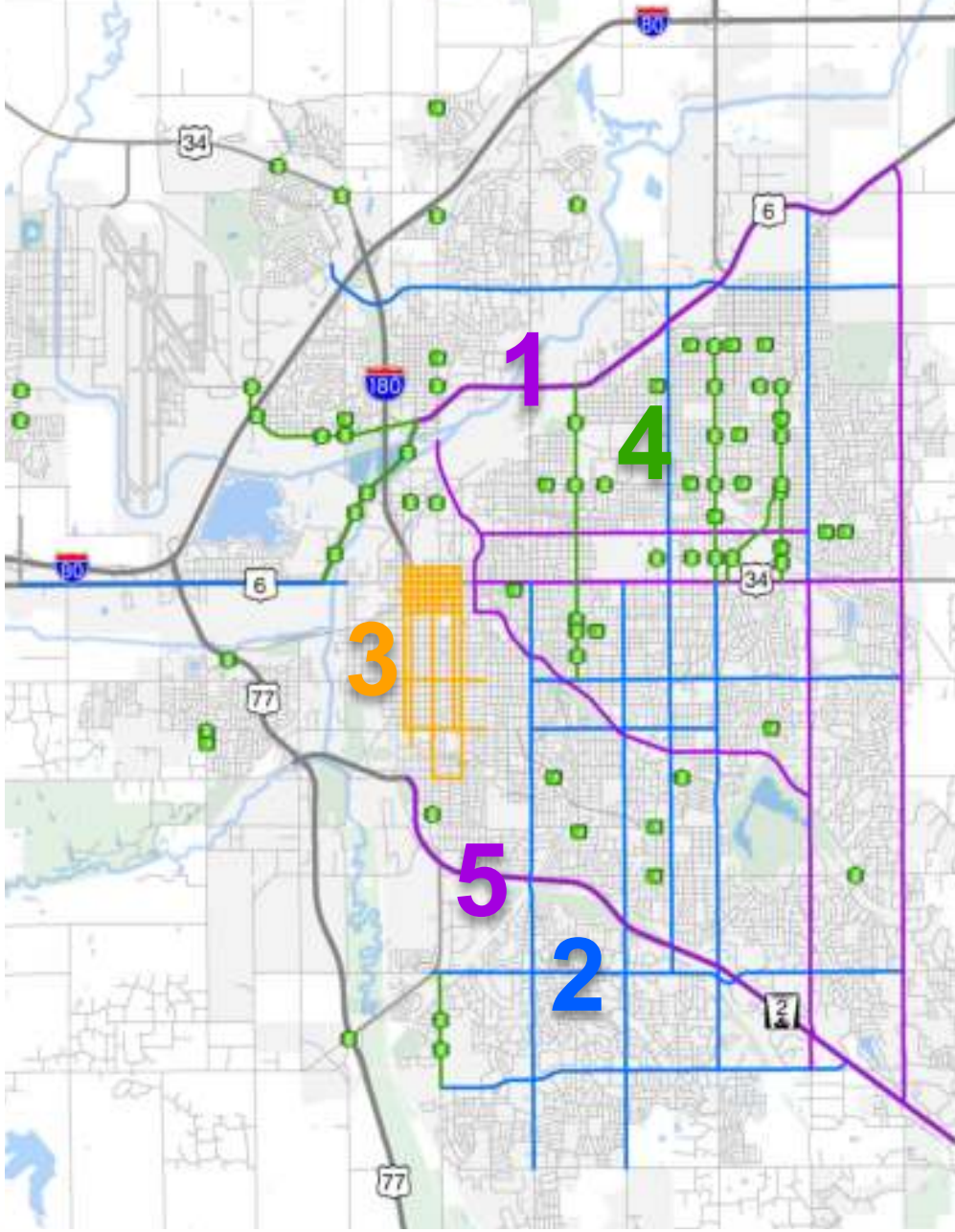
Green Light Lincoln Initiative

- Traffic Management Master Plan
- Improve traffic safety and traffic flow citywide
- Upgrade signal equipment and signal timings at 410+ signals across the city

Phases 1, 2, 3, 4 = COMPLETE

Phase 5 will restart the cycle this fall.

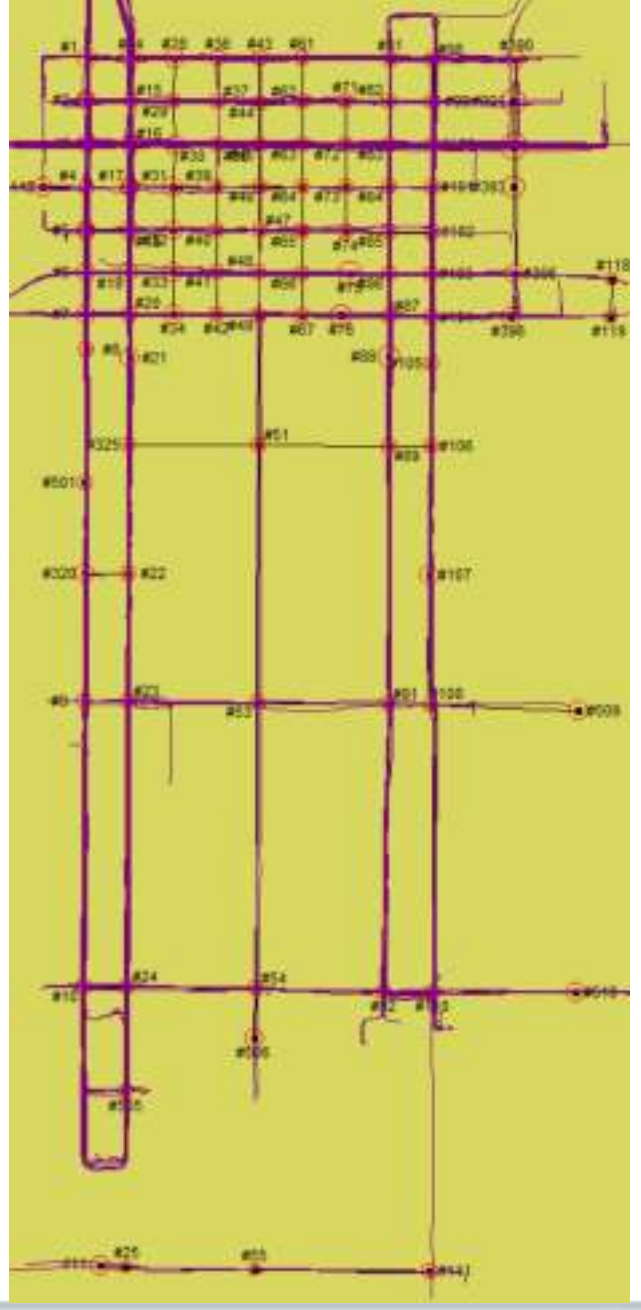
https://lincoln.ne.gov/city/ltu/engine/traffic/green-light-lincoln/



Overview

Green Light Lincoln – Phase III (2019)

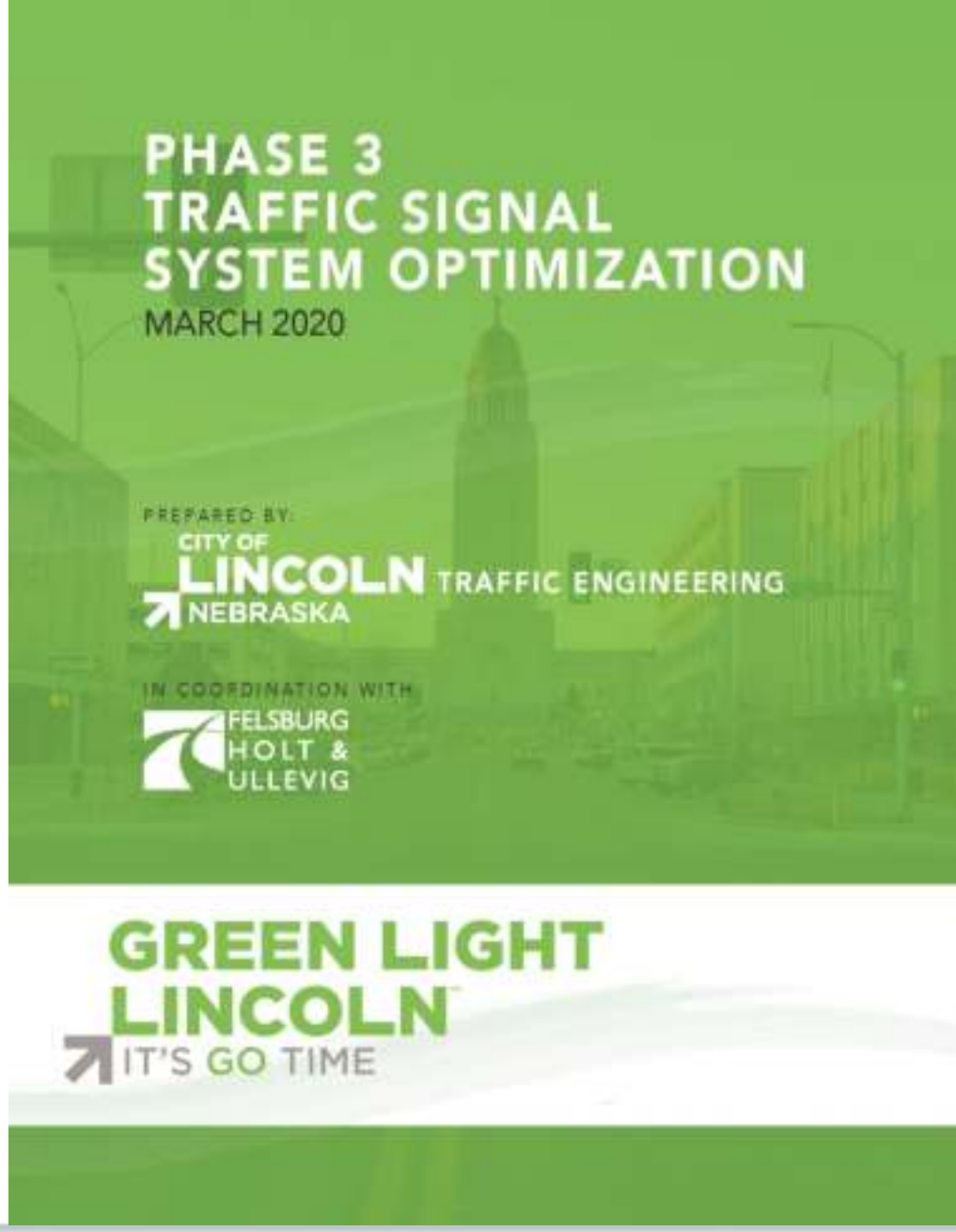
- **92** signals
  - **67** signals in ½ mile X ½ mile grid
- One-way pairs with one major two-way street
- Two-way cycle track
- Event Plans
  - Husker game day



Overview

Green Light Lincoln – Phase III (2019)

1. Cycle Track Literature Review Memo
2. ITE Clearance Interval Review Memo
3. Traffic Signal Warrants Review Memo
4. StreetLight Data Comparison Memo
5. Final Report



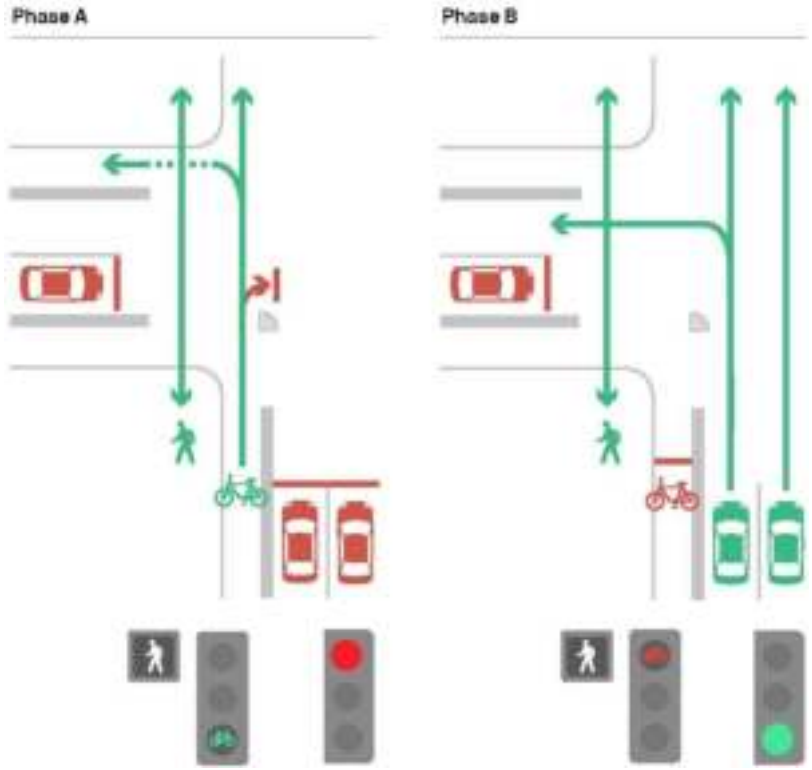
N Street Cycle Track

State of the Practice Review

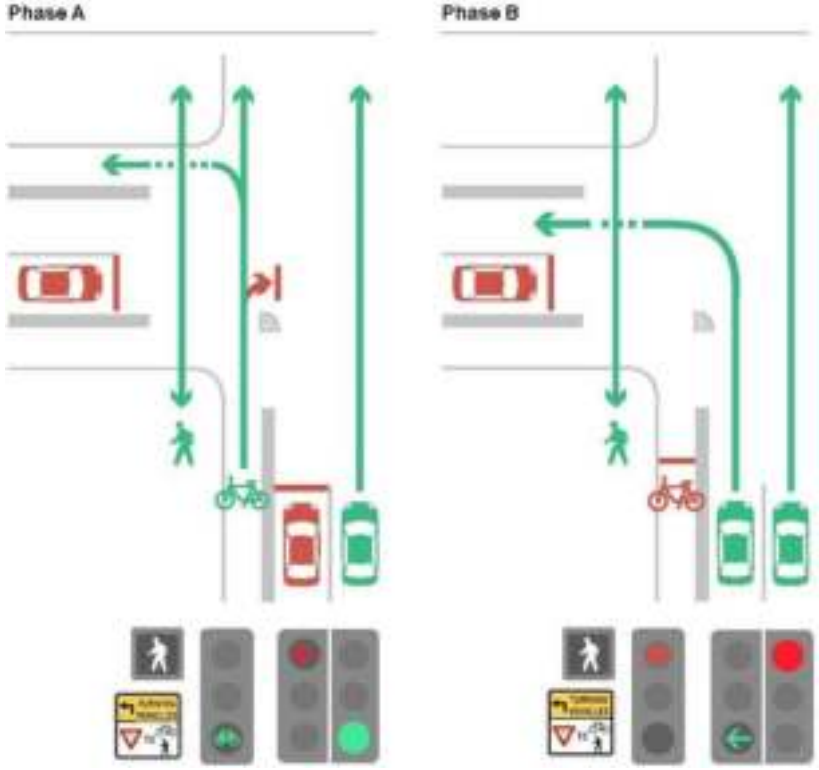
- Literature / State of the Practice Review
- 6 Scenarios Considered

N Street Cycle Track

State of the Practice Review



Scenario 1
Separated Bicycle & Vehicle Phasing (Existing)

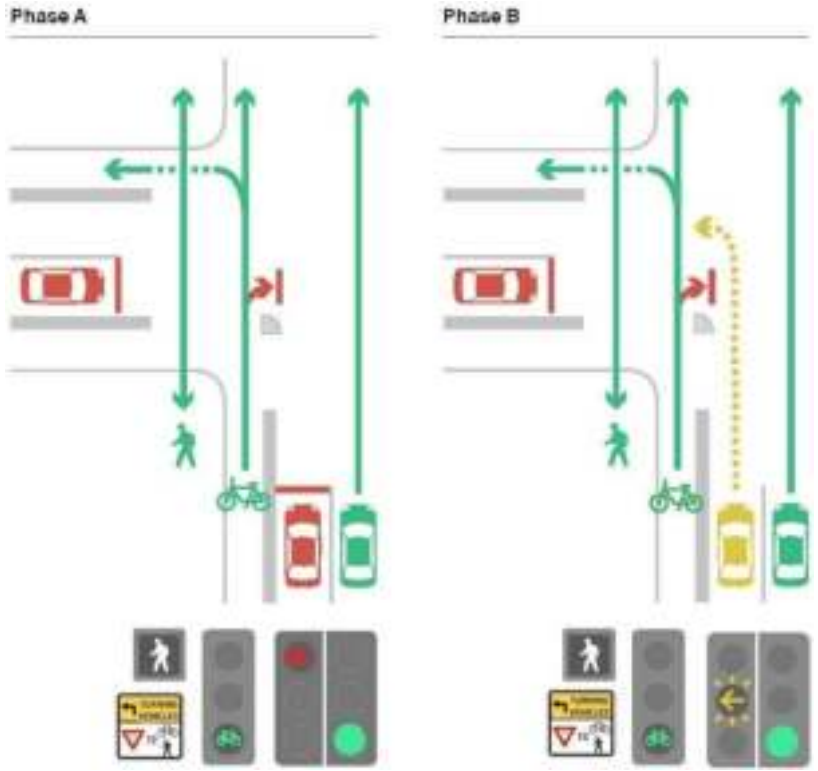


Scenario 2
Protected Bicycle Phase with Restricted Lefts

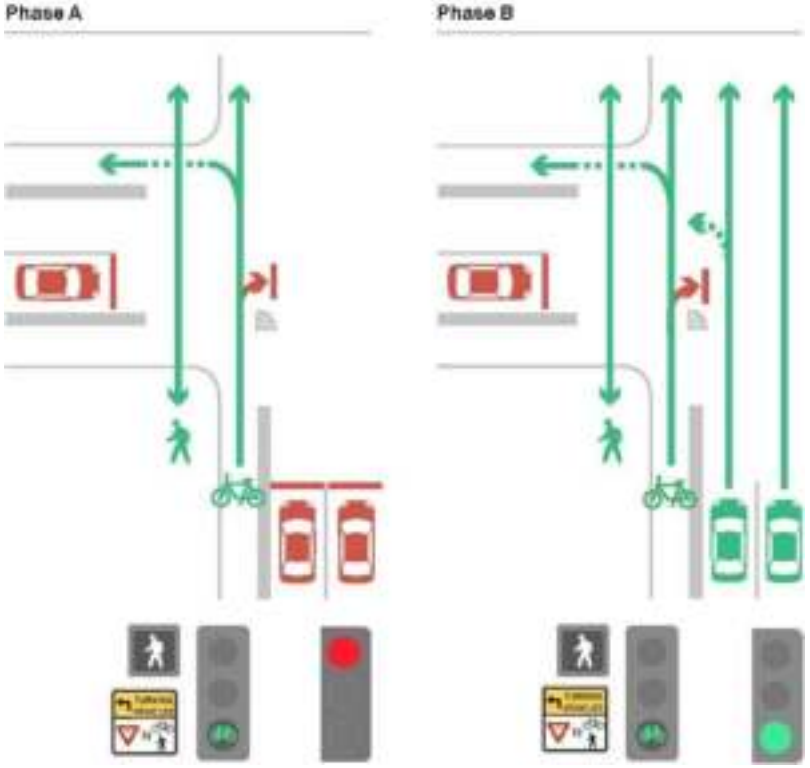
Graphics modified from NACTO – Don't Give Up at the Intersection (2019)

N Street Cycle Track

State of the Practice Review



Scenario 3
Leading Bicycle Interval with Flashing Yellow Arrow

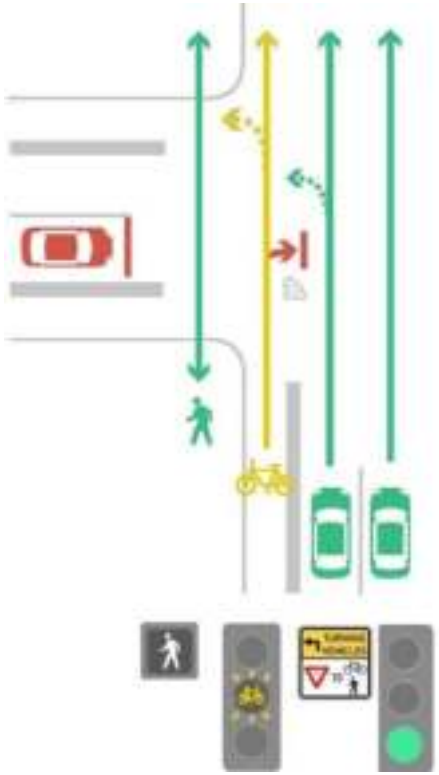


Scenario 4
Leading Bicycle Interval

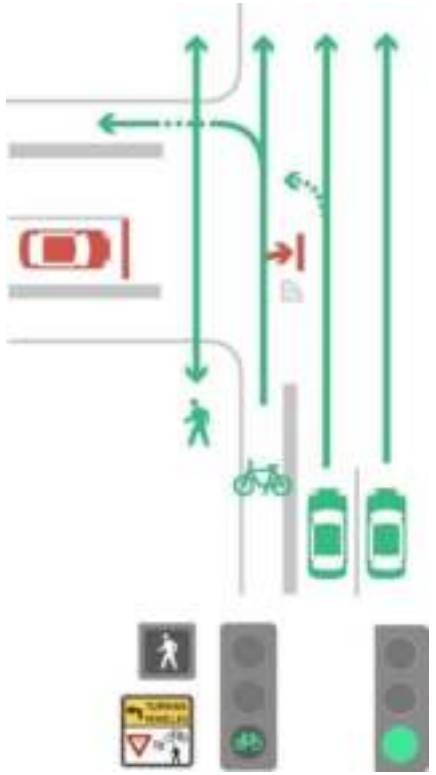
Graphics modified from NACTO – Don't Give Up at the Intersection (2019)

N Street Cycle Track

State of the Practice Review



Scenario 5
Single Phase with Flashing Yellow Bicycle Signal Head

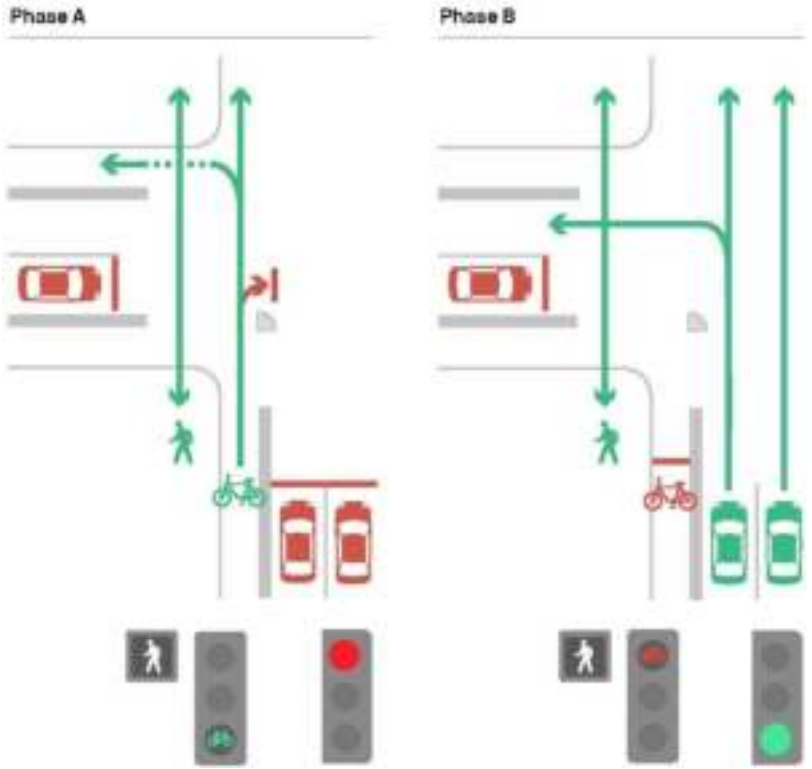


Scenario 6
Single Phase with All Green

Graphics modified from NACTO – Don't Give Up at the Intersection (2019)

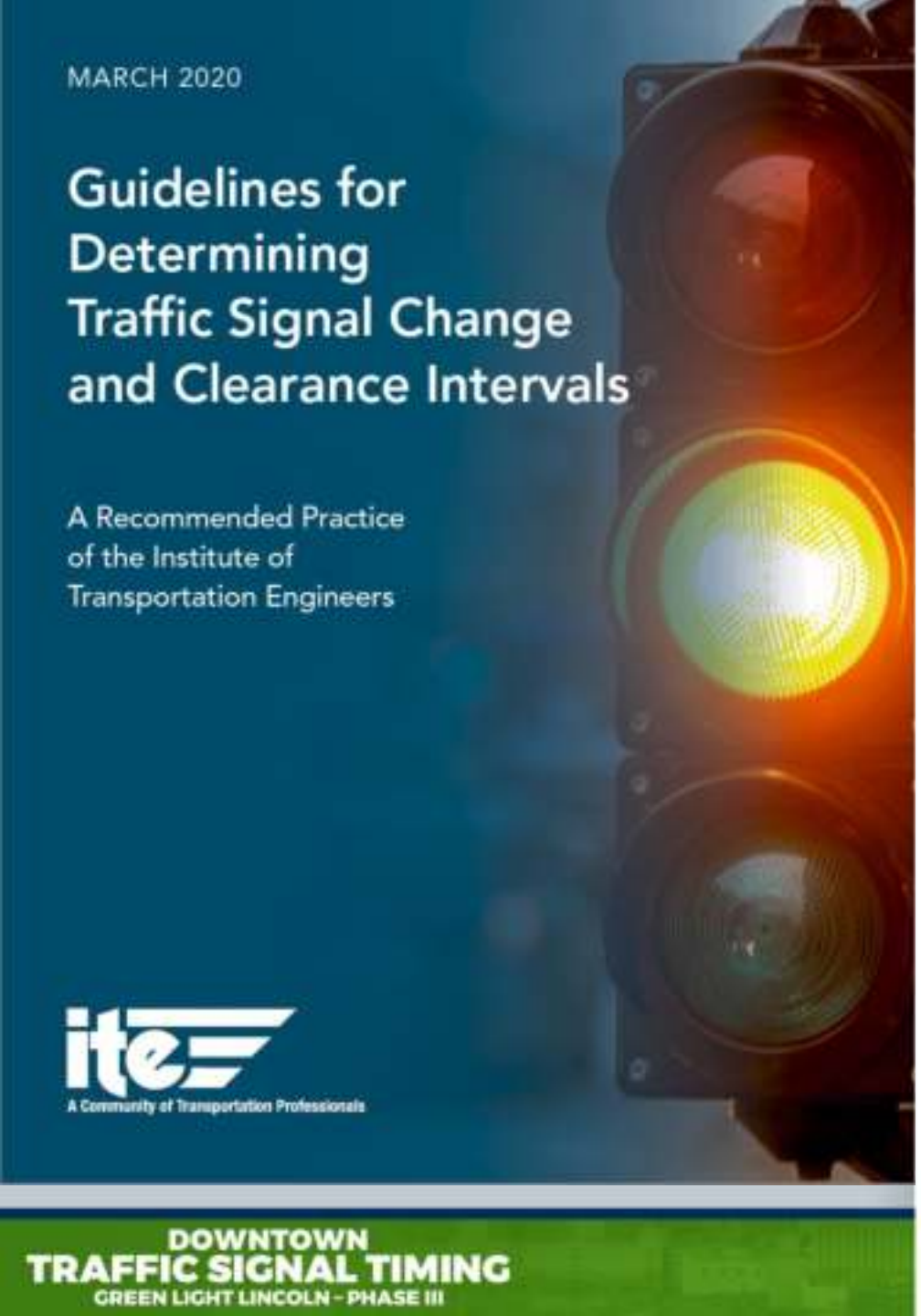
N Street Cycle Track

Do Nothing Alternative! Except C=75 to C=80



Scenario 1

Separated Bicycle & Vehicle Phasing (Existing)



ITE Clearance Interval Review

Guidelines for Determining Traffic Signal Change and Clearance Intervals – An ITE Recommended Practice

- Second Notice of Intent to Adopt
  - Appeals period May 8, 2019 – June 10, 2019

Consultant review provided to City

Decided to wait for official publication

- Good decision…

TRAFFIC SIGNAL WARRANT REVIEWS

DOWNTOWN
TRAFFIC SIGNAL TIMING
GREEN LIGHT LINCOLN – PHASE III

Location: S 20th St & A St Ped
Date: 11/1/2017

FELSBURG HOLT & ULLEVIG

Gap (sec)	Tally								Total
	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	
15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
18	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0
19	0	2	1	1	0	3	1	0	8
15-19	0	2	1	1	0	3	1	0	8
20	0	0	0	0	0	0	0	0	0
21	0	0	1	0	0	0	0	0	1
22	2	0	0	0	1	0	0	0	3
23	0	1	0	1	0	0	0	0	2
24	0	0	0	0	0	0	0	0	0
20-24	2	1	1	1	1	0	0	0	6
25	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	1	0	0	1
27	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0
29	1	0	0	0	0	0	0	0	1
25-29	1	0	0	0	0	1	0	0	2
30	0	0	0	0	0	0	0	0	0
31	1	1	0	0	1	0	0	0	3
32	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0
30-34	1	1	0	0	1	0	0	0	3
35	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0
35-39	0	0	0	0	0	0	0	0	0
40+	1	0	0	0	0	0	0	0	1
Total	**5**	**4**	**2**	**2**	**2**	**4**	**1**	**0**	**20**

Pedestrians	Tally								Total
	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	
Adults	0	4	1	4	1	0	2	0	12
Children	1	9	0	9	2	2	0	0	23
Total	**1**	**13**	**1**	**13**	**3**	**2**	**2**	**0**	**35**

Highest Crossing Hour	3:15 PM - 4:15 PM
Adequate Gaps	10
Schoolchildren	20

MUTCD Volume-based Warrant Evaluation
P020E014S - S 20th St & A St Ped
Green Light Lincoln - Phase 3

FELSBURG HOLT & ULLEVIG

Major Street: A St
Approach Speed: 35 MPH
Lanes Moving Traffic: 1
Option: Low speed, urban community

Minor Street: S 20th St
Right Turn Volume Included: 100% NB, 100% SB
Lanes Moving Traffic: 1
Date of Count: 11/1/2017
Projected to Year: 2017

WARRANT 1, Condition A - Minimum Vehicular Volume — 100% Satisfied — No

	Vehicles per hour 100% (80%)	5:00 PM to 6:00 PM	4:00 PM to 5:00 PM	3:00 PM to 4:00 PM	7:00 AM to 8:00 AM	2:00 PM to 3:00 PM	8:00 AM to 9:00 AM	12:00 PM to 1:00 PM	11:00 AM to 12:00 PM
Both Approchs. Major Street	500 (400)	1078	992	893	740	680	651	598	528
Higher Vol. Approch. Minor Street	150 (120)	45	60	63	54	54	54	50	40

WARRANT 1, Condition B - Interruption of Continuous Traffic — 100% Satisfied — No

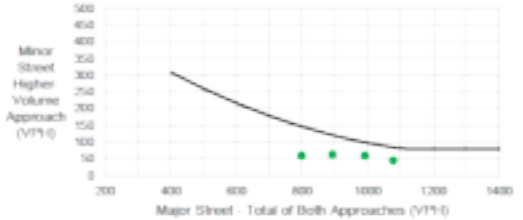
	Vehicles per hour 100% (80%)	5:00 PM to 6:00 PM	4:00 PM to 5:00 PM	3:00 PM to 4:00 PM	7:00 AM to 8:00 AM	2:00 PM to 3:00 PM	8:00 AM to 9:00 AM	12:00 PM to 1:00 PM	11:00 AM to 12:00 PM
Both Approchs. Major Street	750 (600)	1078	992	893	740	680	651	598	528
Higher Vol. Approch. Minor Street	75 (60)	45	60	63	54	54	54	50	40

WARRANT 1, Combination of Conditions A and B — 80% Satisfied — No

WARRANT 2, Four Hour Vehicular Volume

	Both Approchs. Major Street	Higher Vol. Approch. Minor Street
5:00 PM - 6:00 PM	1078	45
4:00 PM - 5:00 PM	992	60
3:00 PM - 4:00 PM	893	63
7:30 AM - 8:30 AM	799	60

100% Satisfied — No

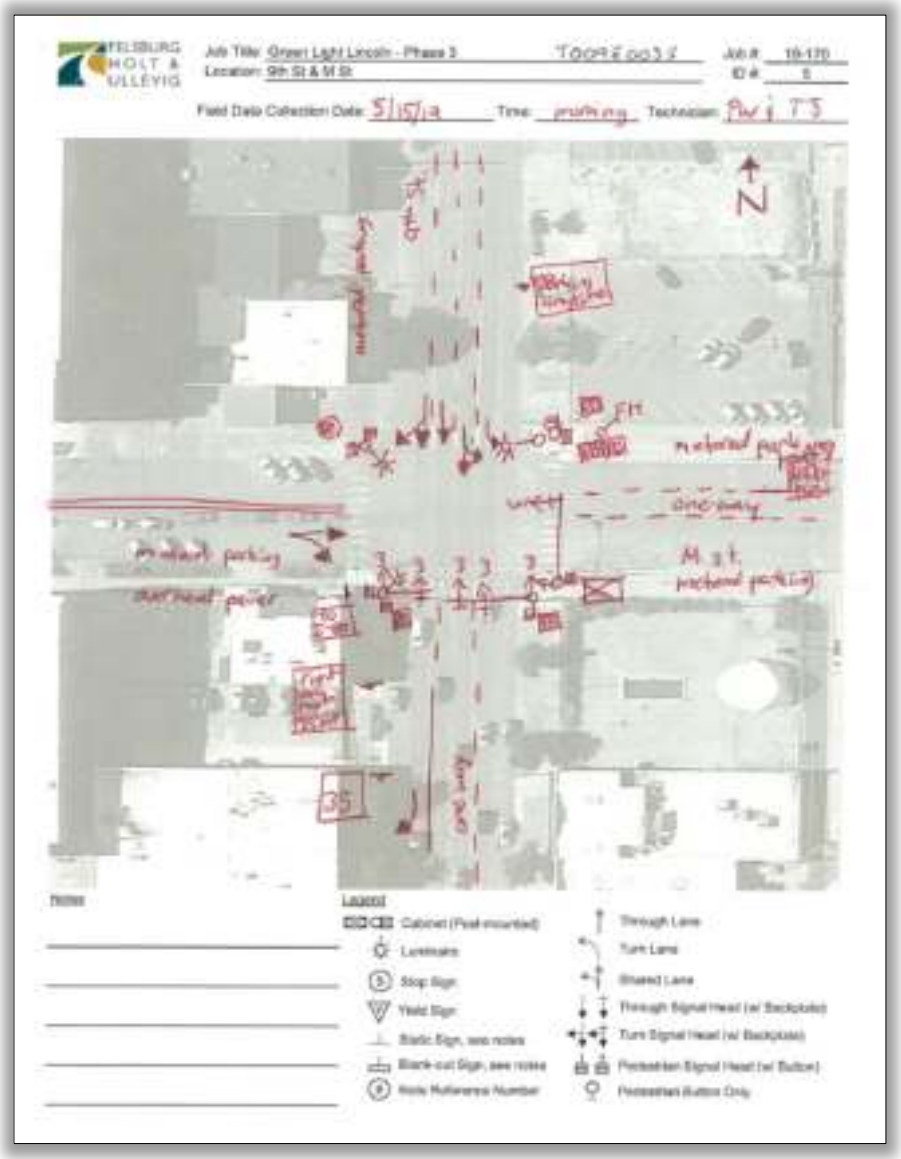


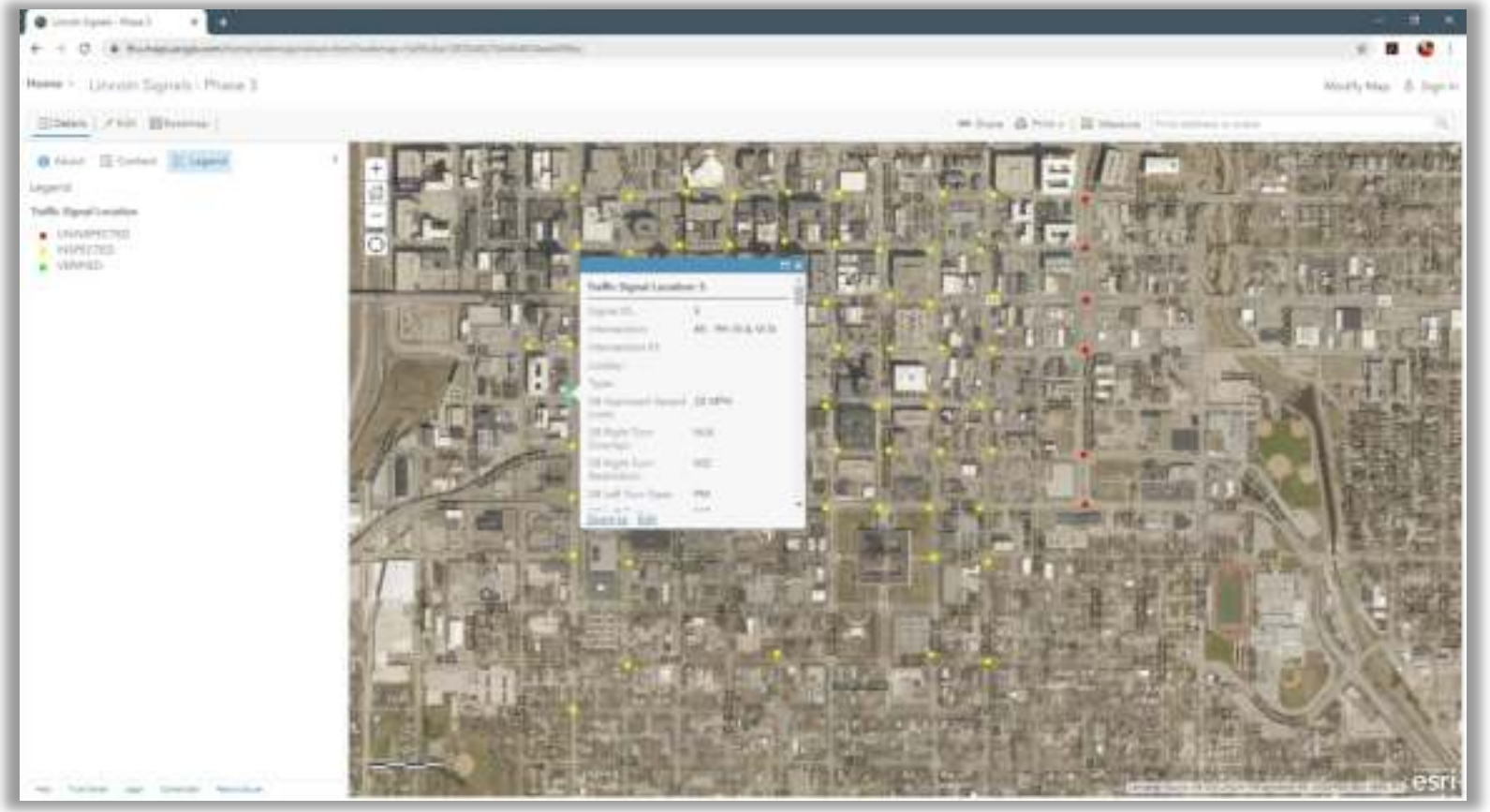
WARRANT 3, Peak Hour

	Both Approchs. Major Street	Higher Vol. Approch. Minor Street
4:30 PM - 5:30 PM	1133	64

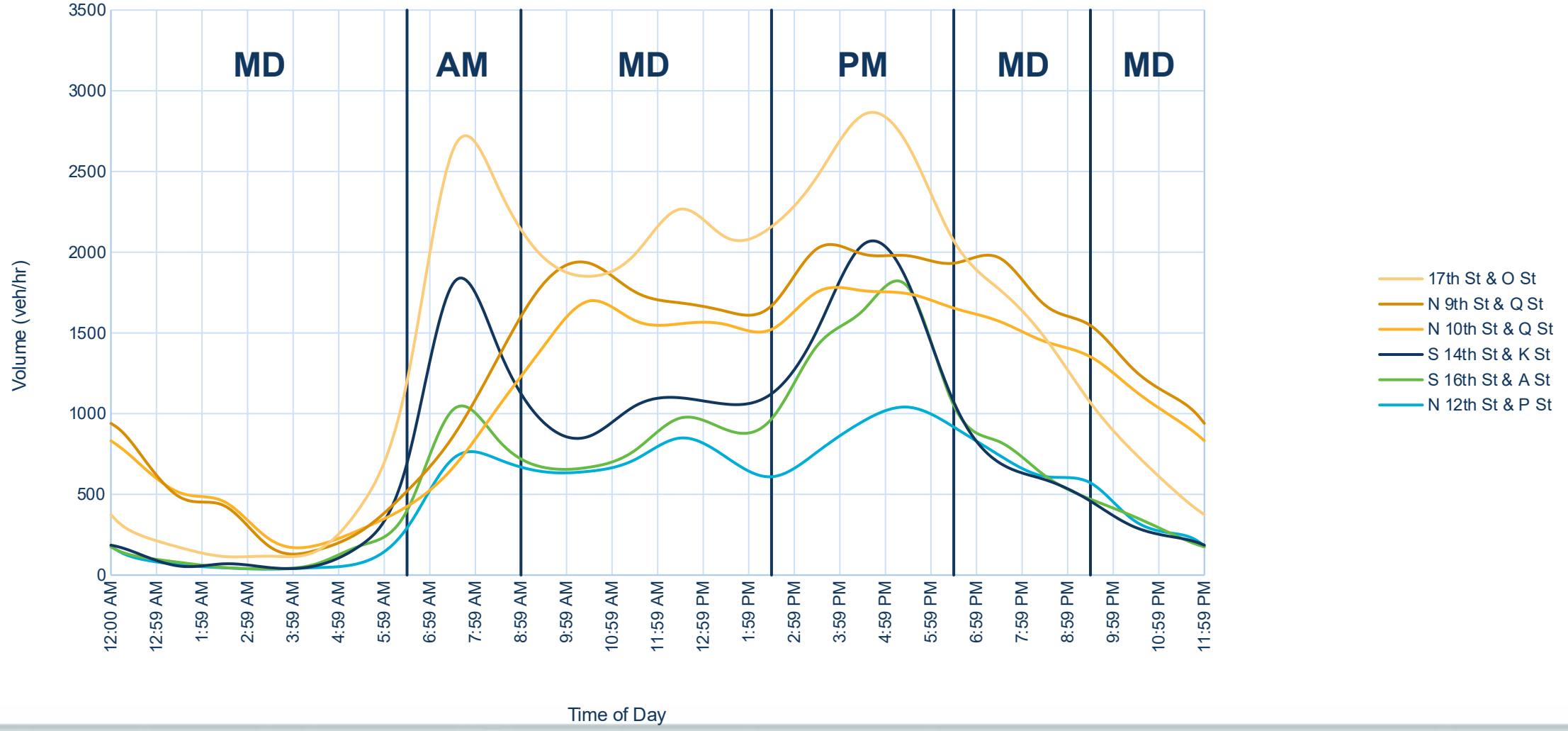
100% Satisfied — No

Data Collection





Data Collection



STRATEGY

Cycle Lengths

Time of Day Plans

- Transition Minimization

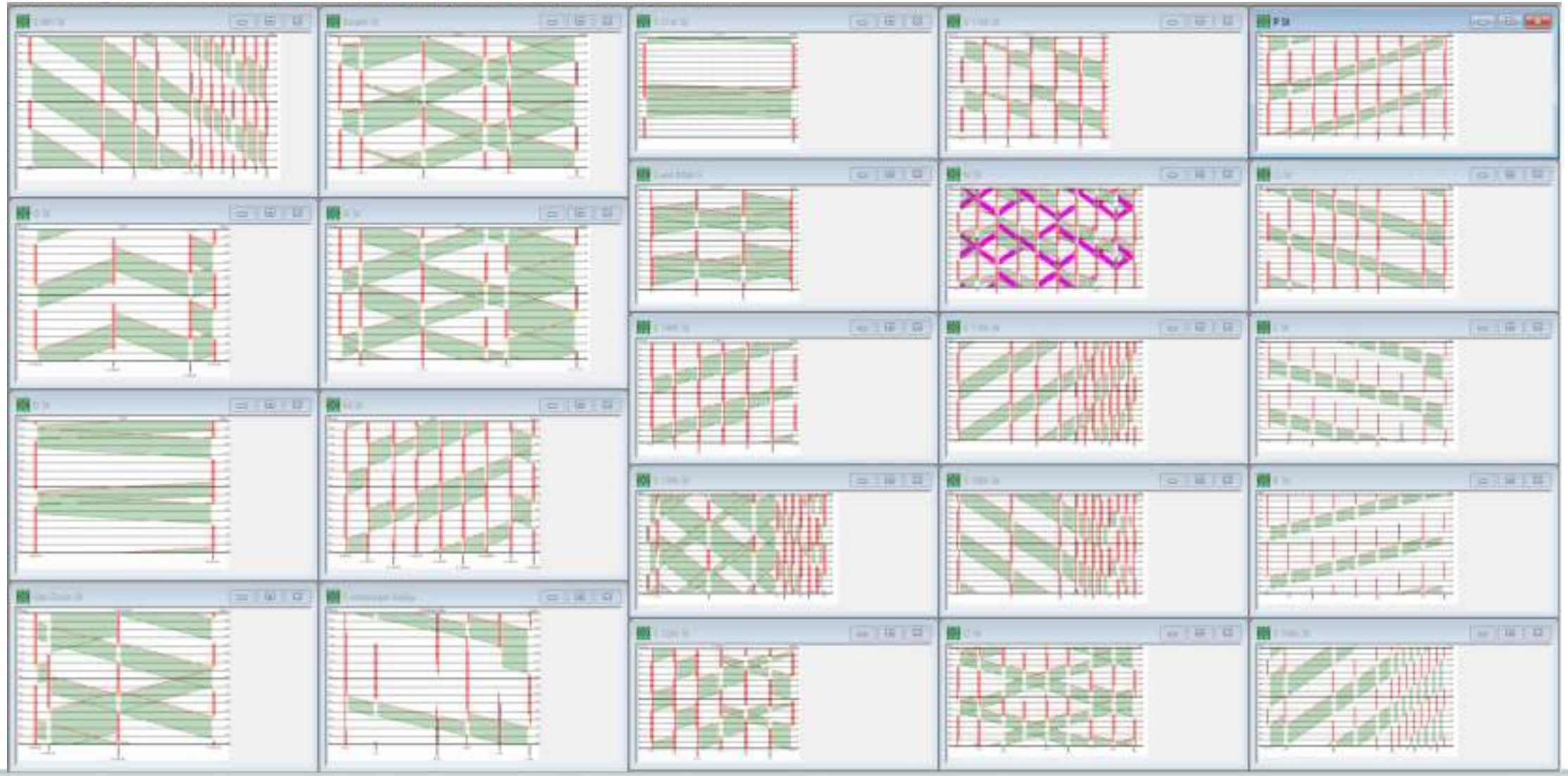
Corridor Prioritization

1) 9th Street / 10th Street

2) K Street / L Street
2) O Street

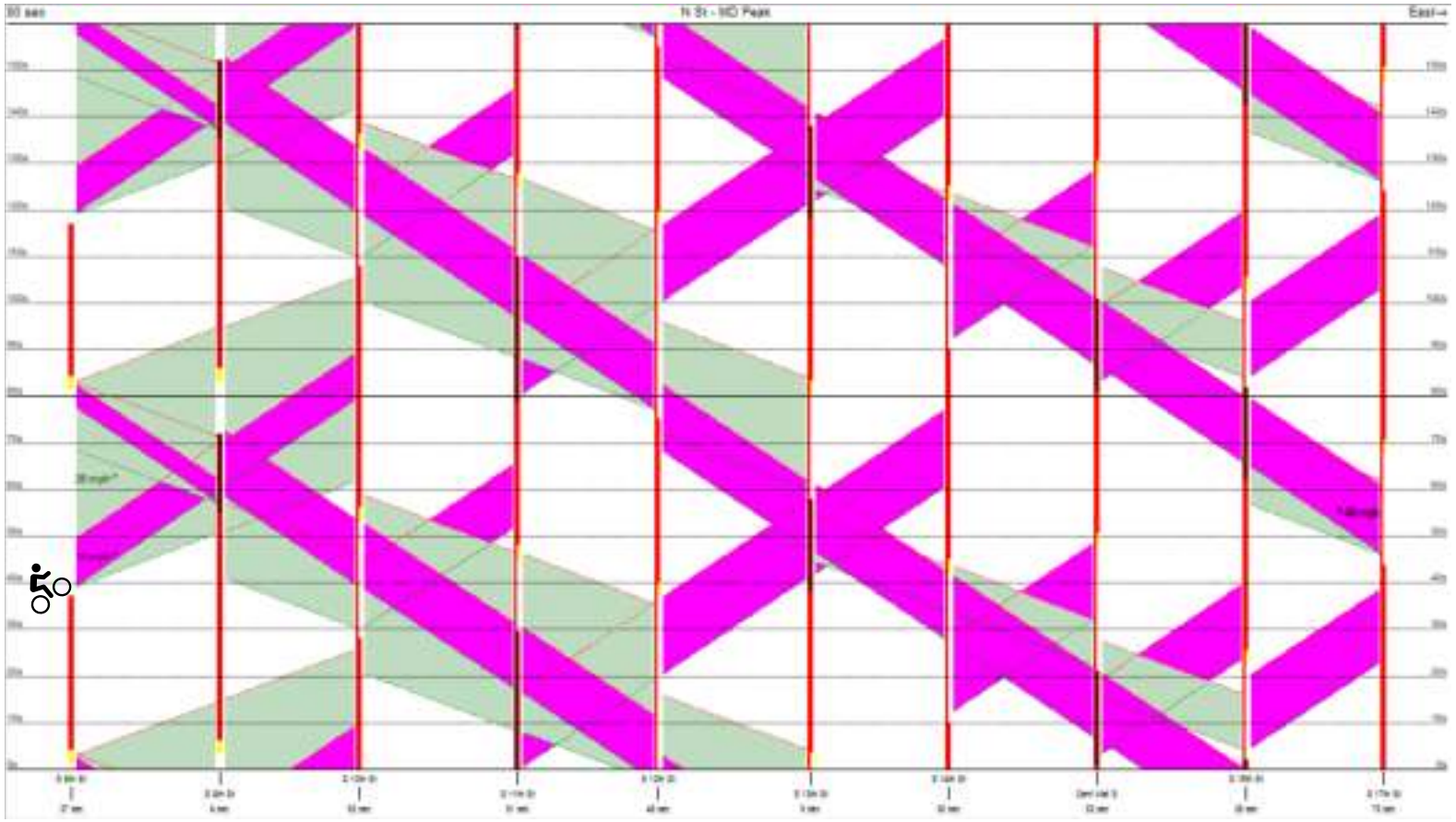
3) P Street / Q Street
3) 16th Street / 17th Street
3) N Street Cycle Track

Strategy



N Street Cycle Track

Time-Space Diagram



N Street Cycle Track

Strategy

- Minimize stops Eastbound

AM = Westbound **MD** = Balanced **PM** =

AM – 74s

MD – 88s

PM – 55s

		AM Period		MD Period		PM Period	
		Travel Time (sec)	Stops (#)	Travel Time (sec)	Stops (#)	Travel Time (sec)	Stops (#)
Eastbound	Before	412	7.6	412	7.6	412	7.6
	After	416	6.8	417	6.6	357	5.4
	Difference	4	-0.8	5	-1	-55	-2.2
	% Difference	1.0%	-10.5%	1.2%	-13.2%	-13.3%	-28.9%
Westbound	Before	283	2.6	283	2.6	283	2.6
	After	209	2.2	195	1.2	281	3.3
	Difference	-74	-0.4	-88	-1.4	-2	0.7
	% Difference	-26.1%	-15.4%	-31.1%	-53.8%	-0.7%	26.9%

Challenges

Equipment upgrades

- Phasing Standardization

Complex Implementation

- Careful Planning
- Experienced Implementation Team
- Roll with the Punches

Performance Measures

- Travel Time Runs
- Big Data

Challenges

Implementation and Fine-tuning

- Reenactment, actual rolling with the punches may have looked different

Measures of Effectiveness

Travel Time Results (Tru-Traffic Version 10)

Corridor	Start	End
9th St	Q St	South St
10th St	Q St	Park Ave Ped
O St	9th St	Antelope Valley Pkwy
K St	9th St	Antelope Valley Pkwy
L St	9th St	Antelope Valley Pkwy

Period	Start	End
AM	7:00	8:30
MD	11:00	13:00
PM	16:00	18:00
Before Runs	9/3/2019	9/10/2019
Fine-tuning	9/16/2019	9/25/2019
After Runs	10/10/2019	10/24/2019

Measures of Effectiveness

Delay (seconds)

9th Street / 10th Street

9th St / 10th St		AM	MD	PM
NB	Before	72	60	134
	After	65	44	83
	Difference	-7	-16	-51
	%Change	-10%	-27%	-38%
SB	Before	32	13	69
	After	16	6	24
	Difference	-16	-7	-45
	%Change	-50%	-54%	-65%

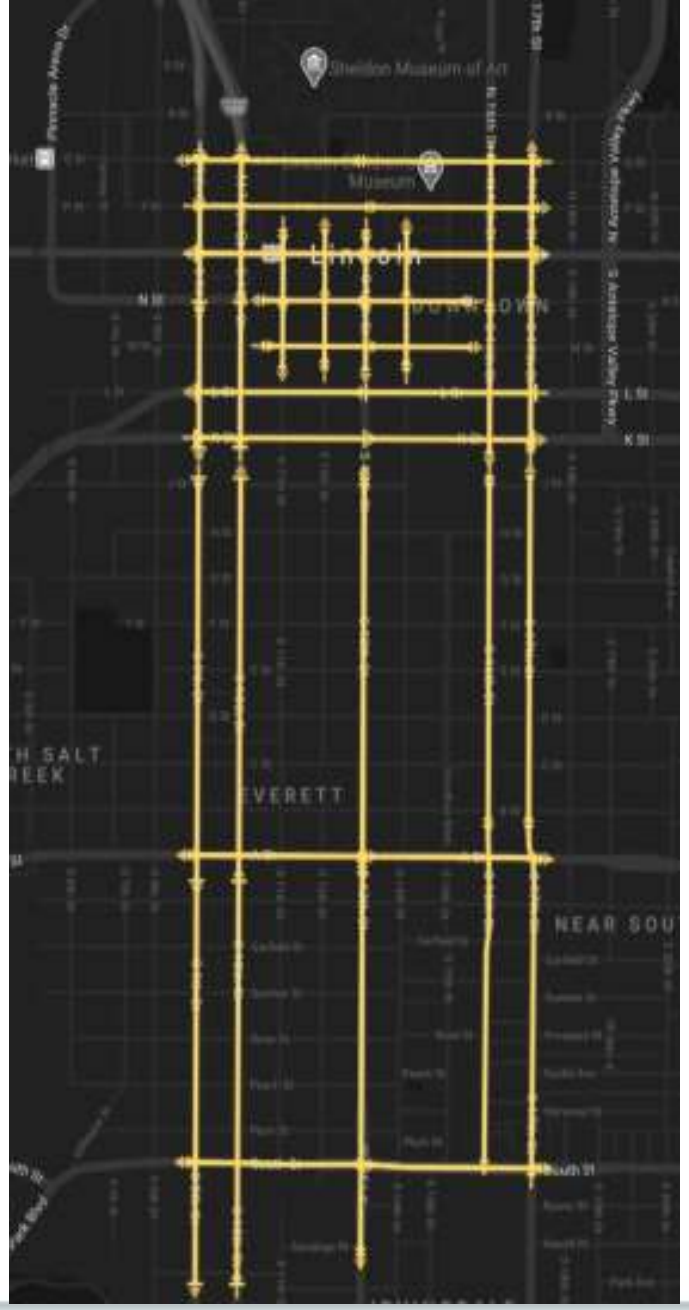
Measures of Effectiveness

Big Data

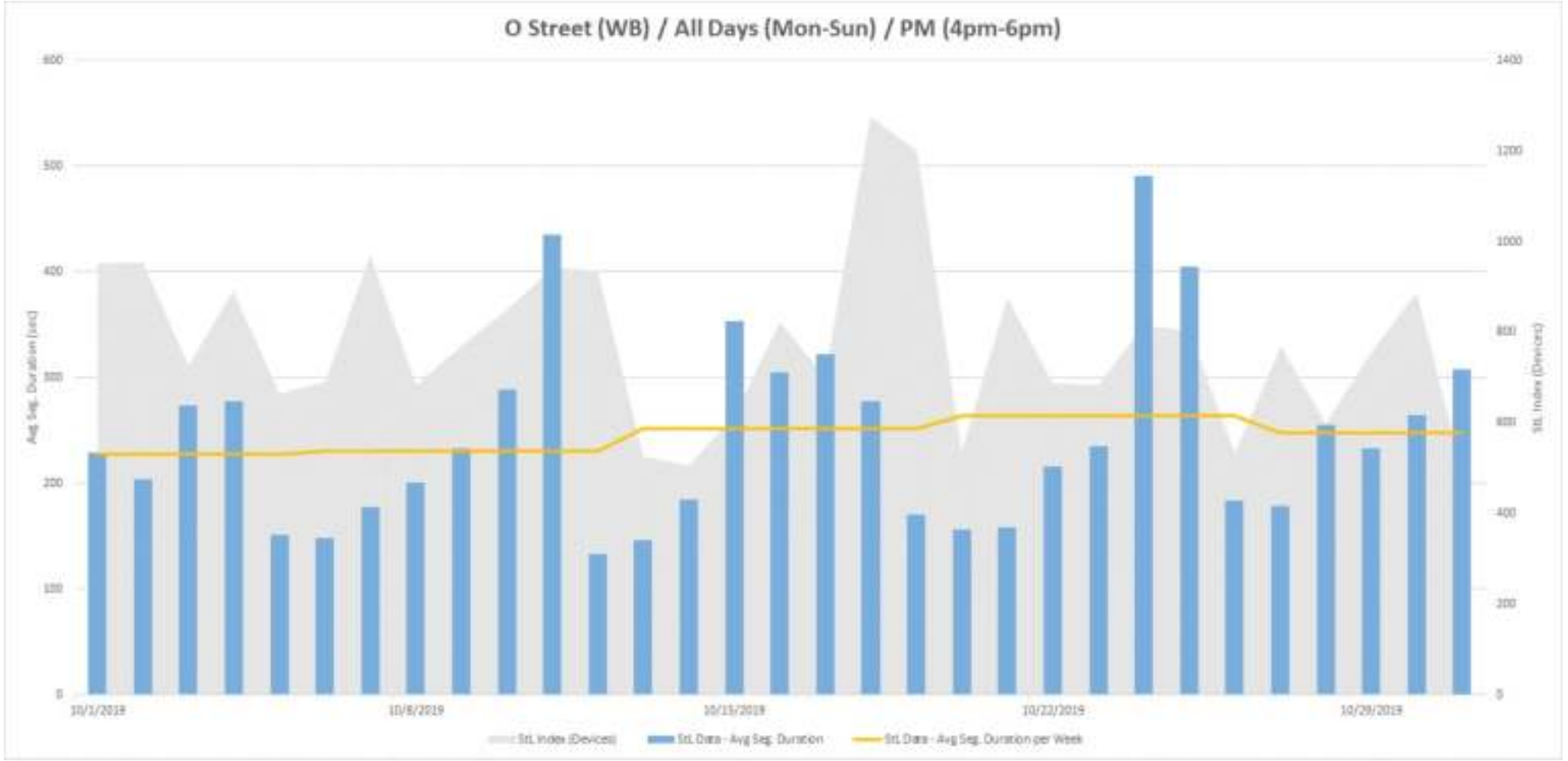
- Corridor results
- Network results

StreetLight Data

- Strategies for best results
  - Segment/Zone Placement
  - Analysis Parameters
  - Data Scrubbing & Assessment of Results
- Limitations
  - “Black box” algorithm
  - Does not report stops



Innovative Big Data Analysis



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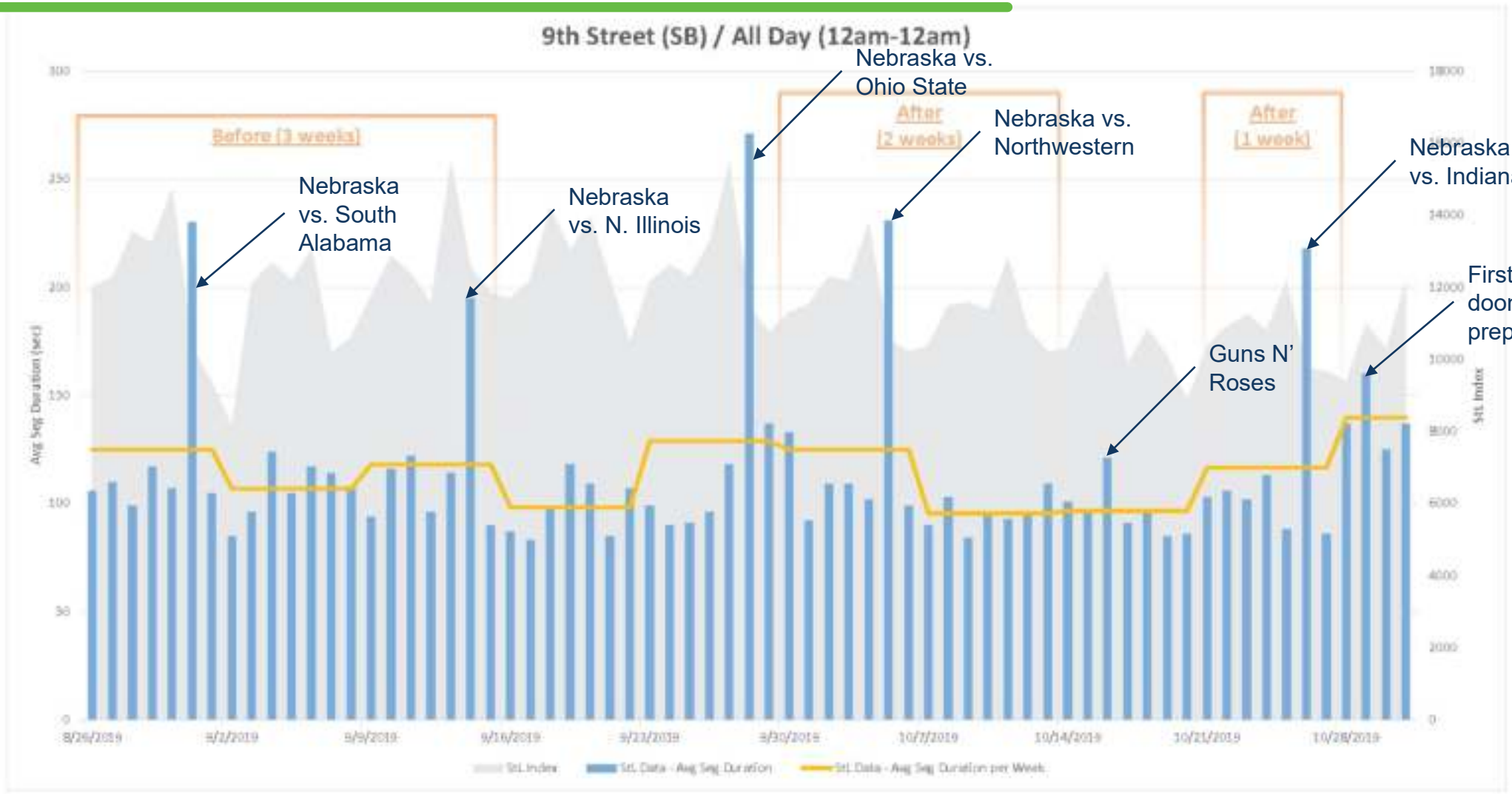

StreetLight Data Comparison

Green Light Lincoln: **Phase I**								
I: Mon-Thur (M-Th)	Before TT_{avg} (min/veh)			After TT_{avg} (min/veh)			Change TT_{avg} (sec/veh)	
I: AM Peak (7am-9am)	StL Data	TruTraffic	Diff.	StL Data	TruTraffic	Diff.	StL Data	TruTraffic
70th Street (NB): Pine Lake - O St	17.1	10.9	57%	10.8	10.3	5%	-375	-36
70th Street (SB): Pine Lake - O St	11.9	11.3	5%	12.9	10.0	29%	64	-78
84th Street (NB): Hwy 2 - O St	11.2	10.9	2%	10.9	9.5	15%	-17	-85
84th Street (SB): Hwy 2 - O St	15.3	11.5	33%	13.0	9.8	32%	-138	-100
84th Street (NB): O St - Hwy 6	9.0	7.1	27%	7.2	6.4	14%	-107	-43
84th Street (SB): O St - Hwy 6	9.0	7.0	29%	9.0	7.3	23%	-2	18
Antelope Valley Pkwy (NB): K St - Military Rd	4.6	7.2	-35%	5.2	5.3	-2%	34	-112
Antelope Valley Pkwy (SB): K St - Military Rd	5.0	4.8	6%	6.2	4.4	43%	72	-23
Cornhusker Hwy (EB): 11th St - 56th St	8.6	7.6	14%	8.8	7.7	14%	7	5
Cornhusker Hwy (WB): 11th St - 56th St	10.8	8.0	35%	10.1	6.4	57%	-44	-94
Hwy 2 (EB): Van Dorn - 91st St	15.9	12.7	26%	15.1	11.5	31%	-47	-68
Hwy 2 (WB): Van Dorn - 91st St	14.1	14.7	-4%	12.8	11.8	8%	-77	-172

QUESTIONS?

David.Andersen@fhueng.com
Mark.Meisinger@fhueng.com

*Trained Professional, do not drive distracted