



**Plano**

*City of Excellence*

---

# Innovative Signal Timing Strategies for Saturated Conditions

*Rama Dhanikonda*

*Tiffany Hernandez*

*Liya Lal*

February 8, 2019

---

# Intersections

- Custer Rd. and Parker Rd.

- Overcapacity
- Left turn spill-backs
- Similar peaking profiles

- Legacy Dr. and SH 121

- Overcapacity
- Imbalanced lane utilization
- Reduced lanes on Legacy Dr. north of the interchange



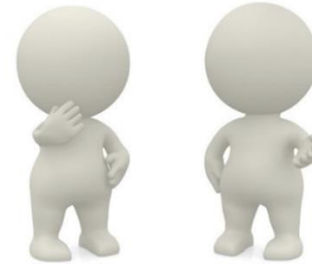
# Custer Rd. & Parker Rd. Requests

DESCRIPTION – “The light to turn left from southbound Custer onto eastbound Parker is not long enough. [...] The northbound traffic from Custer is so heavy that the only way people can turn is on the light. [...] They almost always back up into the left lane. There is no right turn only lane either, so traffic backs up considerably considering all the traffic is forced into two lanes. [...] Please fix the light timing at this intersection!!”

PM

DESCRIPTION – “[...] Most days the line of traffic backs up to Cross Bend Rd or beyond.”

AM



# Data Collection

## Sources

Field Observations

Traffic Camera

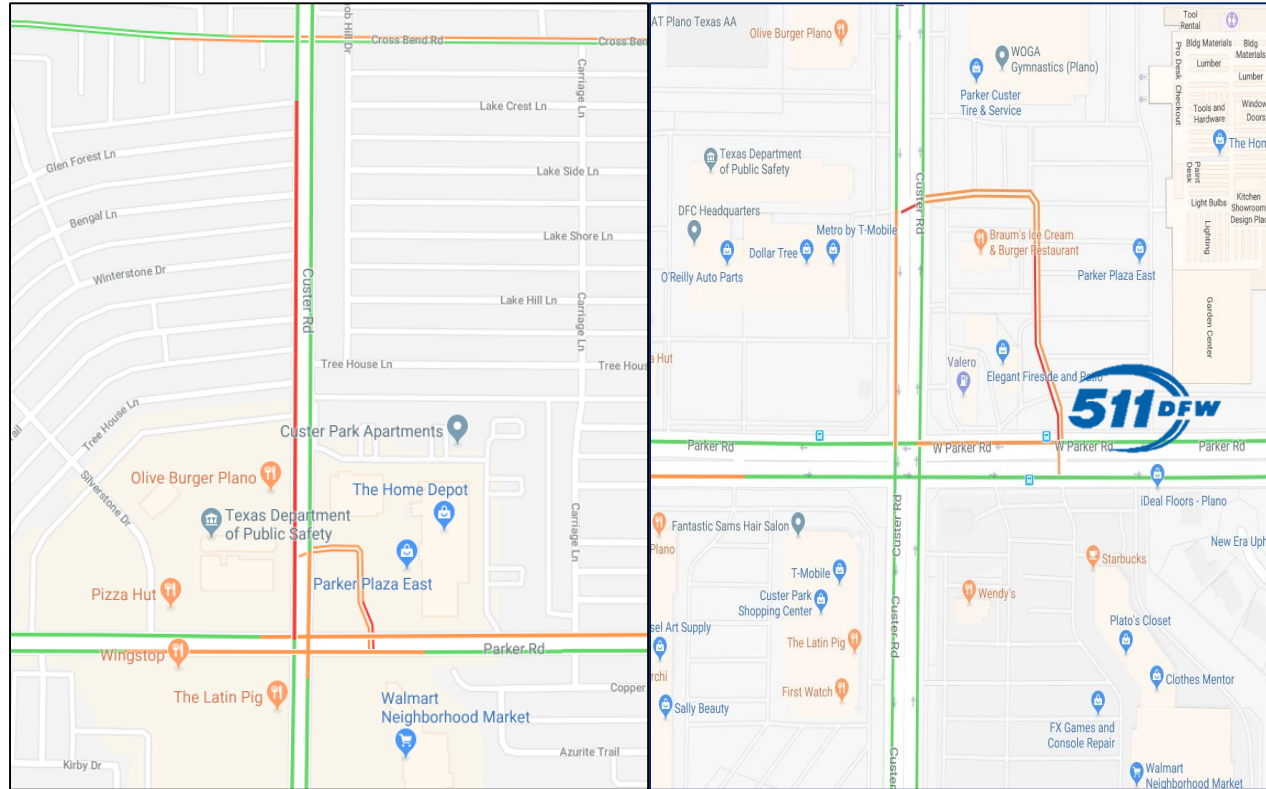
Google Traffic

SPM:

- Traffic Volumes
- Arrivals on Red/Green
- Split Monitoring
- Phase Termination

NCTCOG – 511 DFW

- Travel Time Runs











# Custer and Parker

















## Analysis

- Adjust Splits
- New Solution
- Second TOD Plan

AM PEAK - OLD

1 	2 	3 	4 
27 sec	38 sec	24 sec	71 sec
6 	5 	7 	8 
50 sec	15 sec	26 sec	69 sec

AM PEAK - NEW

1 	2 	3 	4 	9 	10 	11 	12 
21 sec	36 sec	22 sec	81 sec	21 sec	43 sec	15 sec	81 sec
6 	5 	7 	8 	14 	13 	15 	16 
42 sec	15 sec	39 sec	64 sec	49 sec	15 sec	39 sec	57 sec



# Data Collection – Volumes/TMC

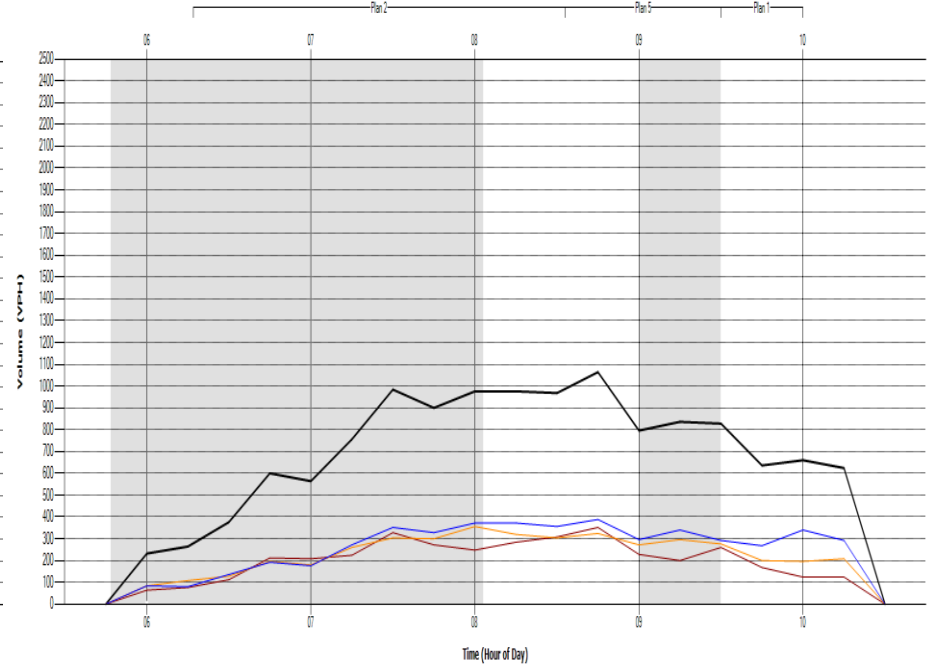
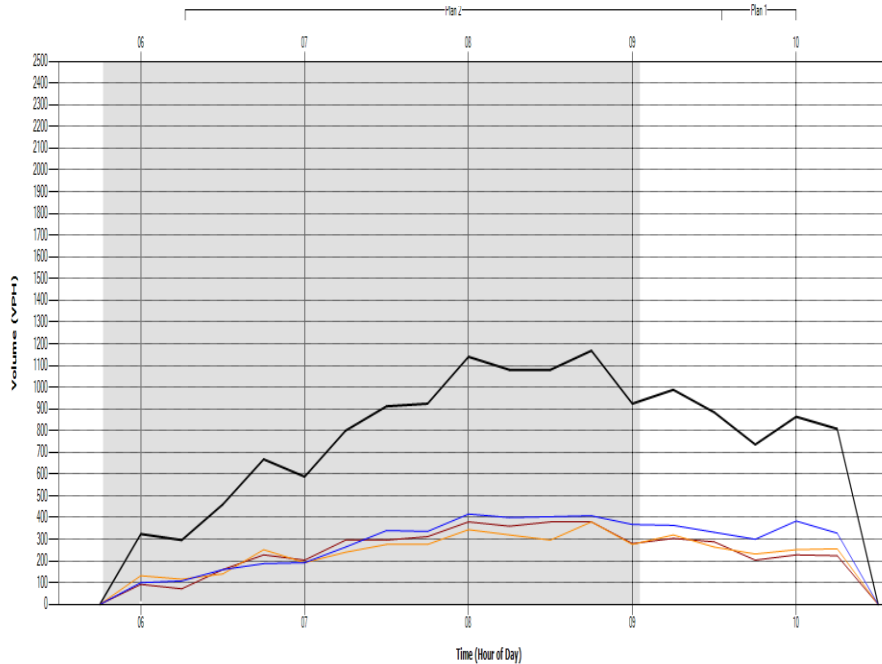
Before

WBT Parker Rd.

After

TV: 3661 PH: 8:00 AM - 9:00 AM PHV: 1117 VPH  
PHF: 0.96 fLU: 0.91

TV: 3260 PH: 8:00 AM - 9:00 AM PHV: 996 VPH  
PHF: 0.94 fLU: 0.88



— Total Volume — Lane 1 — Lane 2 — Thru Right

# Data Collection – Volumes/TMC

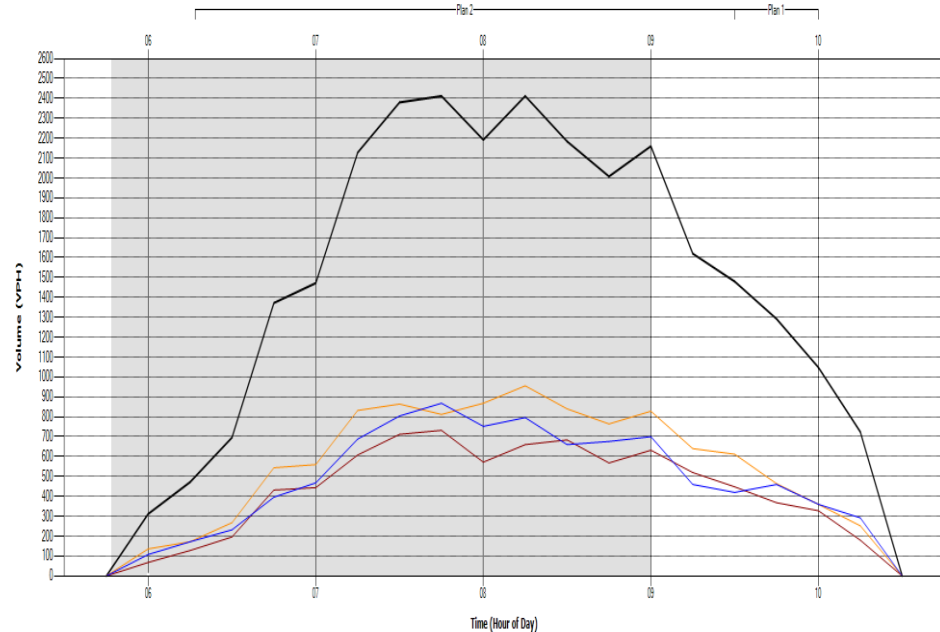
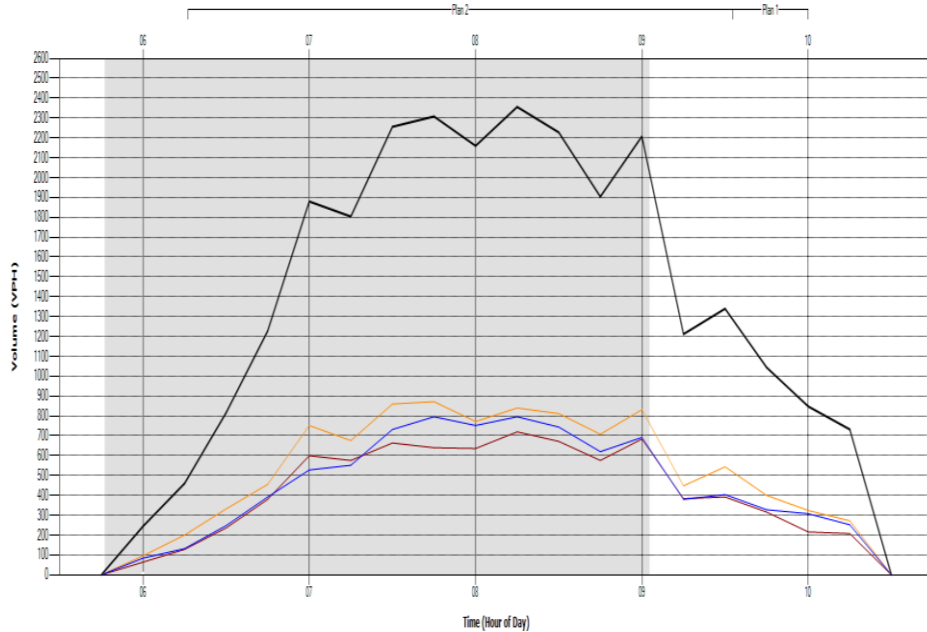
Before

SBT Custer Rd.

After

TV: 6757 PH: 7:30 AM - 8:30 AM PHV: 2270 VPH  
PHF: 0.96 fLU: 0.88

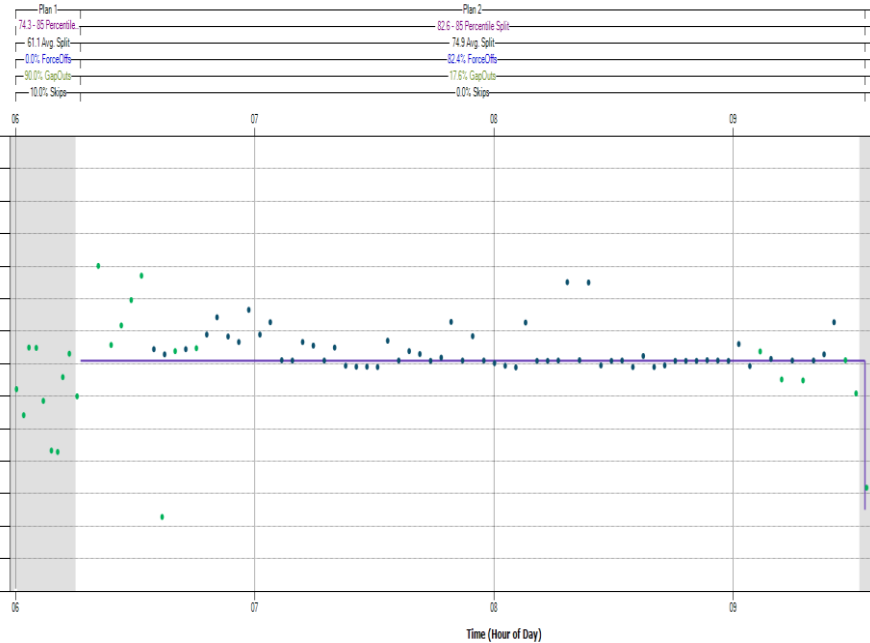
TV: 7102 PH: 7:30 AM - 8:30 AM PHV: 2406 VPH  
PHF: 0.95 fLU: 0.89



— Total Volume — Lane 1 — Lane 2 — Thru Right

# Data Collection – Split Monitor (Φ4: SBT)

Before



After

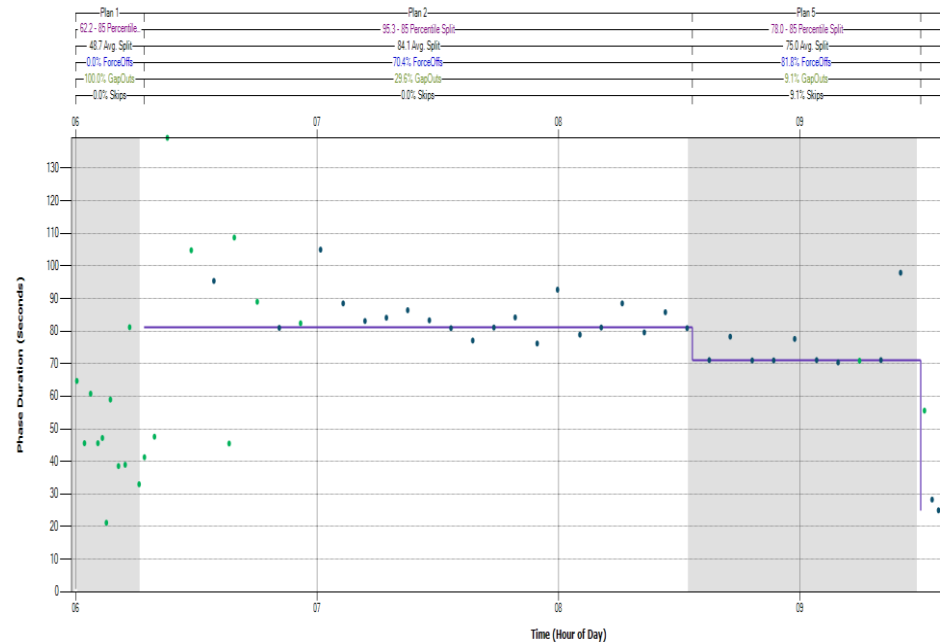


Chart Legend

- Programed Split
- GapOut
- MaxOut
- ForceOff
- PedActivity



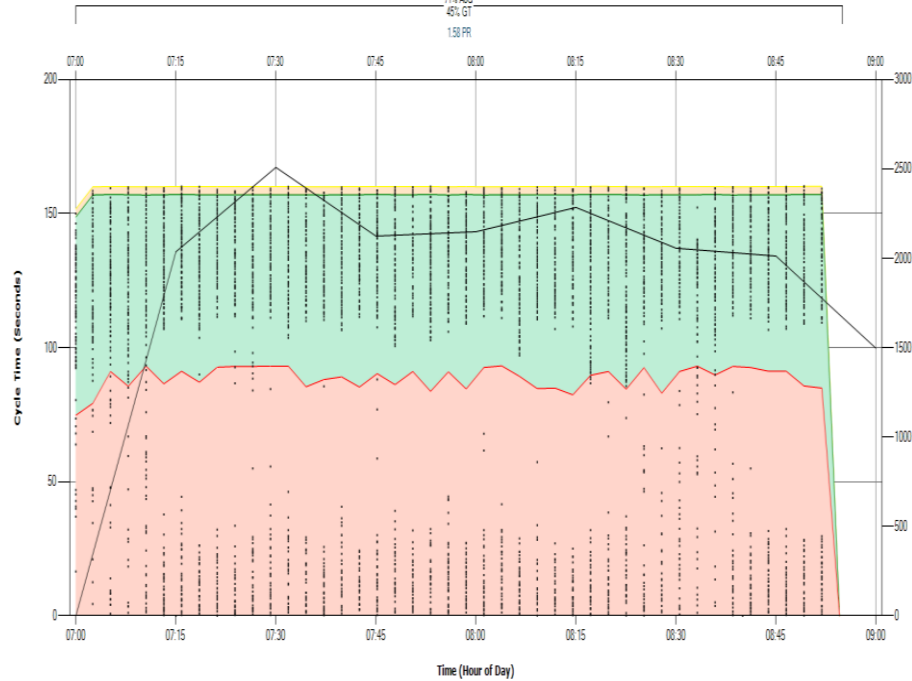


# Data Collection – Purdue Coord. Diagram

Before

Plan 2

71% AGS  
45% GT  
1.59 PR



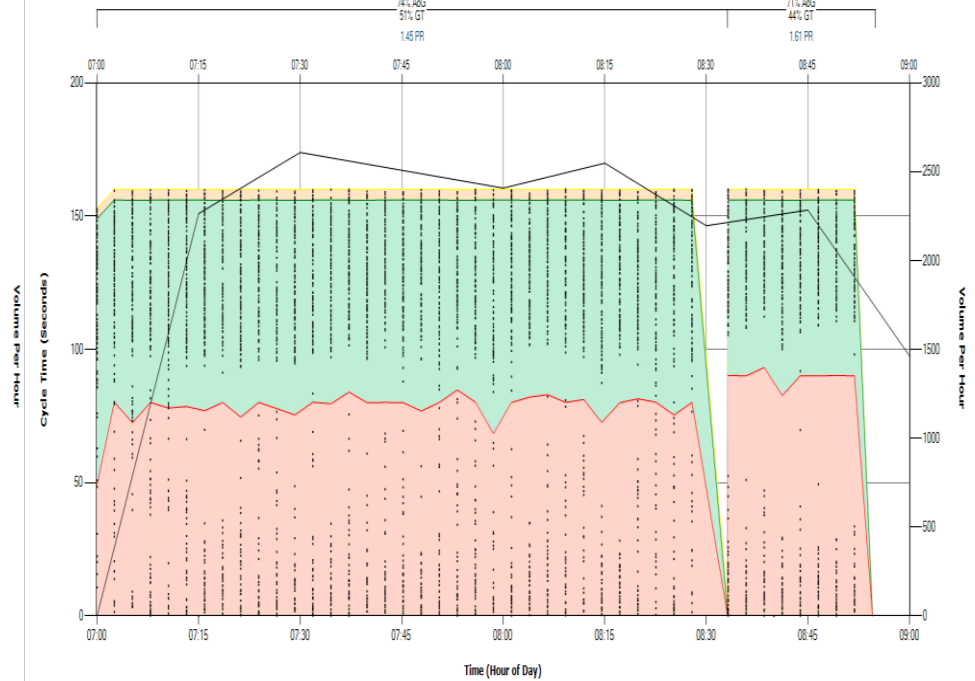
After

Plan 2

74% AGS  
51% GT  
1.45 PR

Plan 3

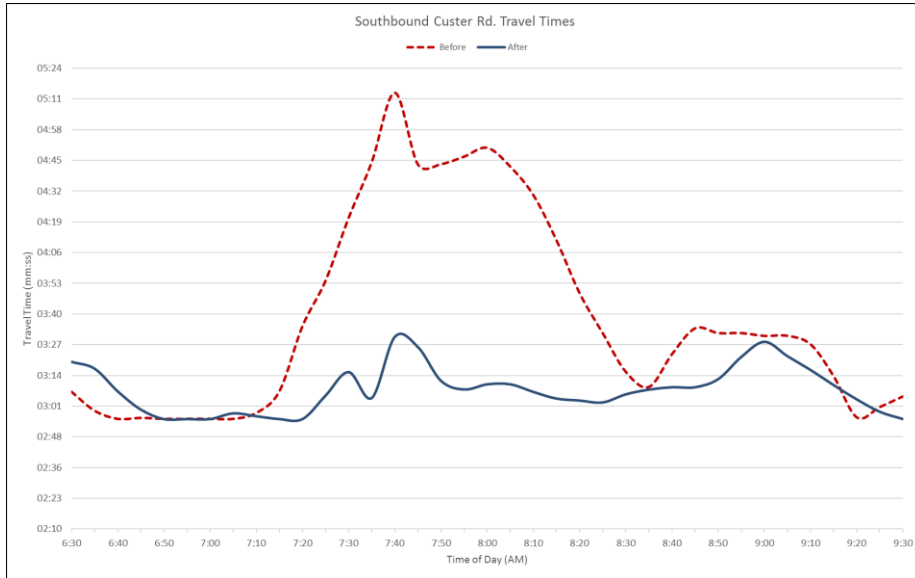
71% AGS  
44% GT  
1.61 PR



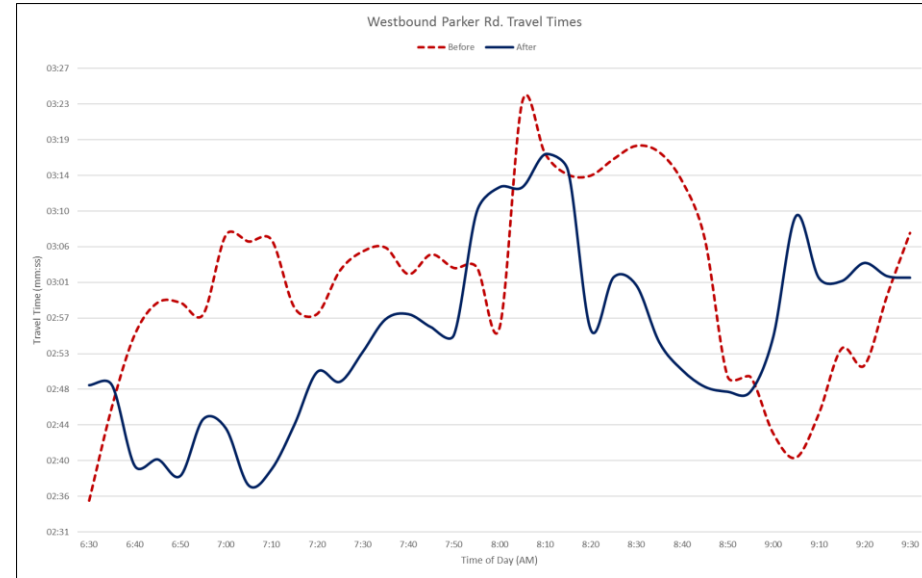
SBT Custer Rd.



# Data Collection – Travel Times



SB



WB



# Challenges Encountered

- Force Offs
- Split Report
- Number of Phases

Split Expanded	Time	Mode	Coord Phase
Split Expanded 01	21	NON	OFF
Split Expanded 02	36	MIN	OFF
Split Expanded 03	22	NON	ON
Split Expanded 04	81	MIN	OFF
Split Expanded 05	15	NON	OFF
Split Expanded 06	42	MIN	OFF
Split Expanded 07	39	MAX	OFF
Split Expanded 08	64	MIN	ON

Split History with Max(M),Gap(G), and Force-off(F)

Controller: 150 CUST-PRKR

Date/Time	Pattern	Cycle	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SP8	SP9	SP10	SP11	SP12	SP13	SP14	SP15	SP16	
02/01/2019 07:34:29 AM	2	64	21/F	36/F	22/G	-	15/F	42/F	-217/F	64/G	21/F	42/F	15/F	82/F	13/F	50/F	37/F	60/G	
02/01/2019 07:39:49 AM	2	64	21/F	36/F	22/F	-	15/F	42/F	-217/F	64/F	21/F	42/G	15/F	82/F	13/F	50/F	37/F	60/F	
02/01/2019 07:45:09 AM	2	64	21/F	36/F	22/F	-	15/F	42/F	-217/F	64/G	21/F	42/F	15/F	82/F	13/F	50/F	37/F	60/G	
02/01/2019 07:50:29 AM	2	64	21/F	36/F	22/F	-	15/F	42/F	-217/F	64/G	21/F	42/F	15/F	82/F	13/F	50/F	37/F	60/F	
02/01/2019 07:55:49 AM	2	64	21/F	36/F	22/F	-	15/F	42/F	-217/F	64/G	21/F	42/F	15/F	82/F	13/F	50/F	37/F	60/G	
02/01/2019 08:01:09 AM	2	64	21/F	36/F	22/F	-	15/F	42/F	-217/F	64/F	21/F	42/F	15/F	82/F	13/F	50/F	37/F	60/G	
02/01/2019 08:06:..																			60/G
02/01/2019 08:11:..																			60/F
02/01/2019 08:17:..																			60/G
02/01/2019 08:22:..																			60/G

1	2	3	4	9	10	11	12
21 sec	36 sec	22 sec	81 sec	21 sec	43 sec	15 sec	81 sec
6	5	7	8	14	13	15	16
42 sec	15 sec	39 sec	64 sec	49 sec	15 sec	39 sec	57 sec



# Legacy Dr. & SH 121



# Intersection Improvements

- Dedicated left turn lane
- Dynamic lane sign – programmed by TOD



## – SH 121 WB

- › AM peak – Left Turn Only
- › Off peak – Left/Thru Shared
- › PM peak – Thru Only

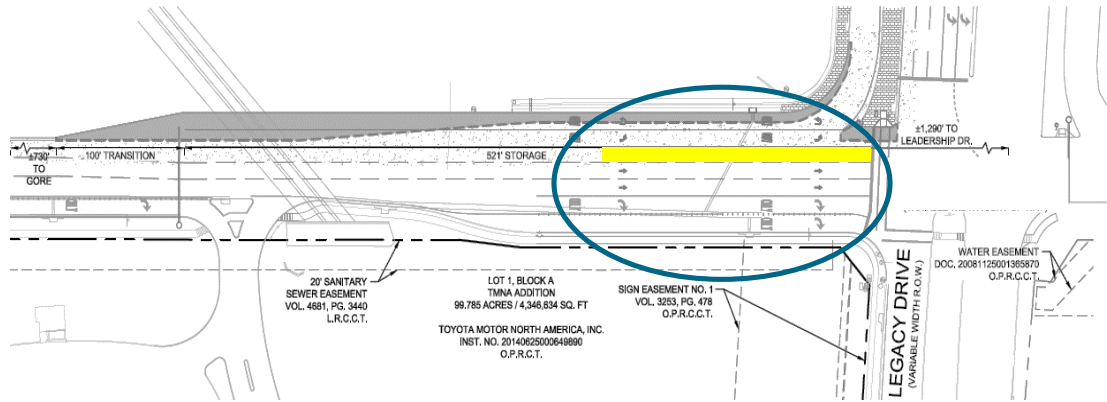
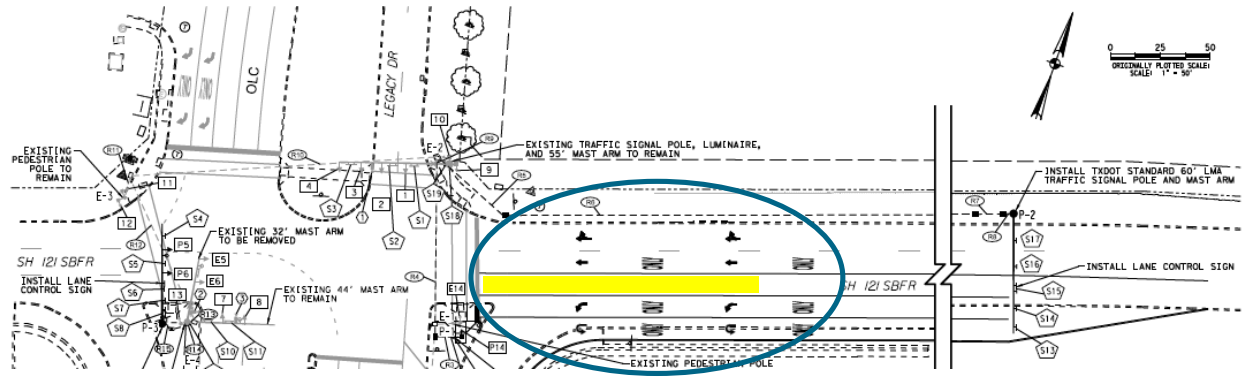
## – SH 121 EB

- › AM peak – Left Turn Only
- › Off peak – Left/Thru Shared
- › PM peak – Thru Only

Action	Pattern	Aux 1	Aux 2	Aux 3	Pre1	Pre2	Special 1	Special 2	Special 3	Special 4	Special 5	Special 6
Action 01	1				0	0		YES				
Action 02	2				0	0	YES					
Action 03	3				0	0			YES			
Action 04	4				0	0						
Action 05	5				0	0						



# Westbound SH 121



# Eastbound SH 121



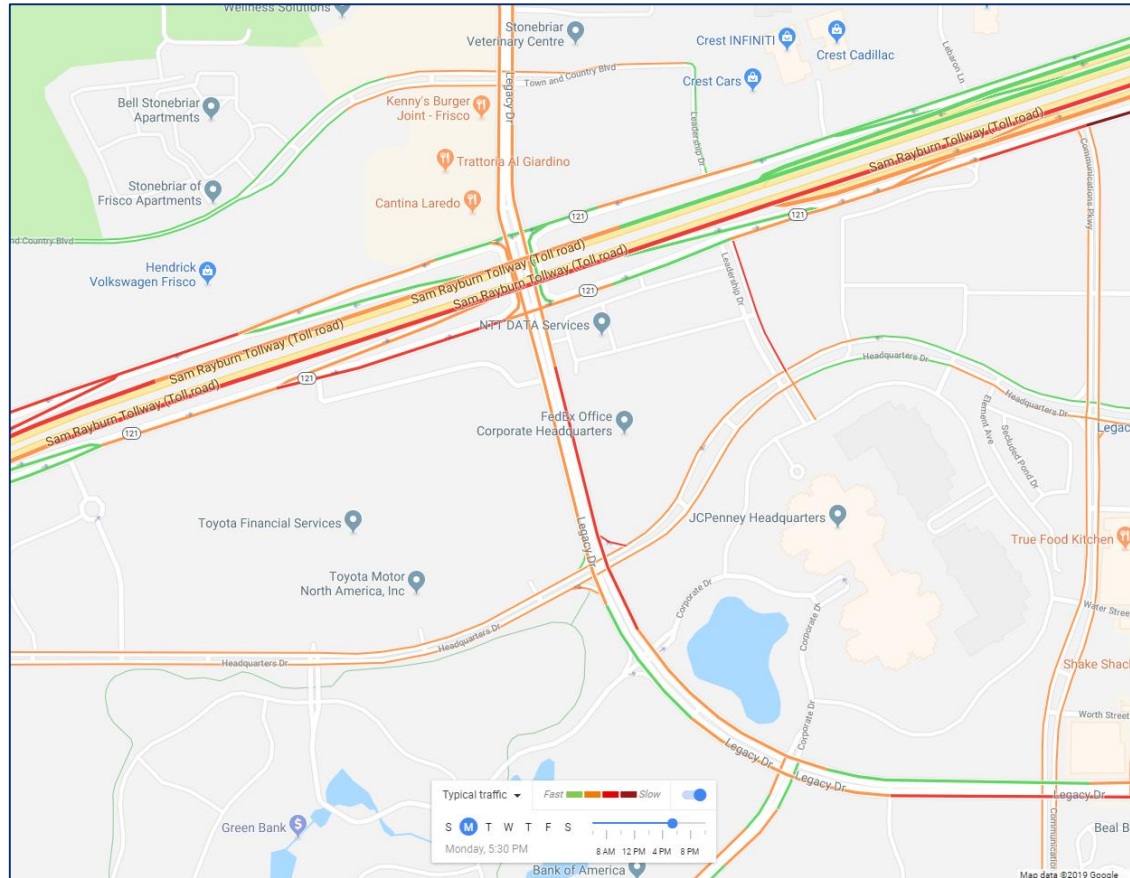
# Issues

- Overcapacity
- Reduced lanes on Legacy Dr. north of the interchange
- Frontage road left turns block intersection
- Imbalanced lane utilization

# Factors to consider



# Google Traffic

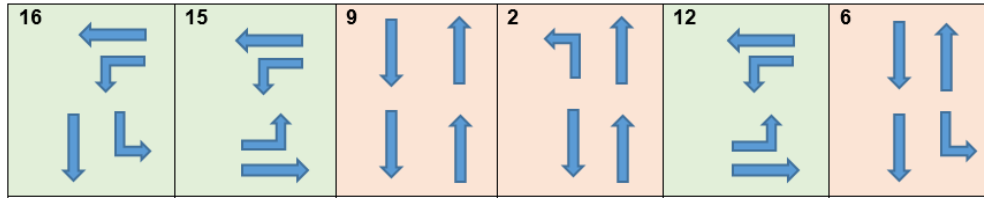




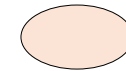
# New Solution under Evaluation

Twice per cycle

AM PEAK

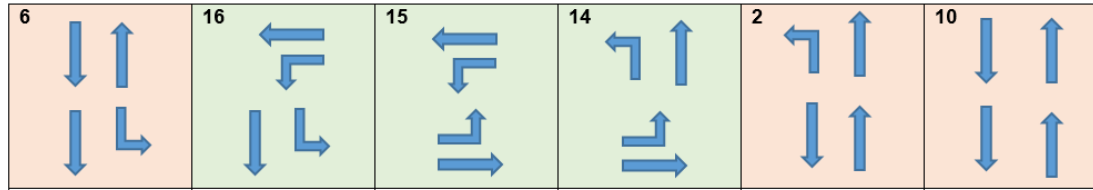


Frontage Rd Phases

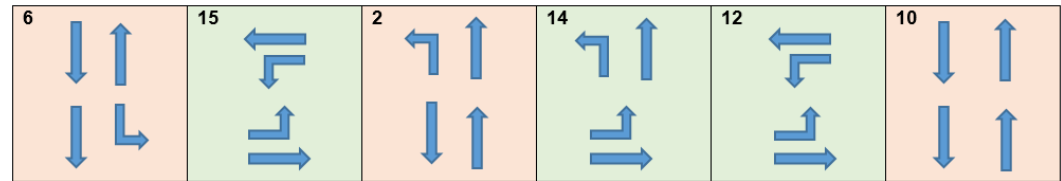


Arterial Rd Phases

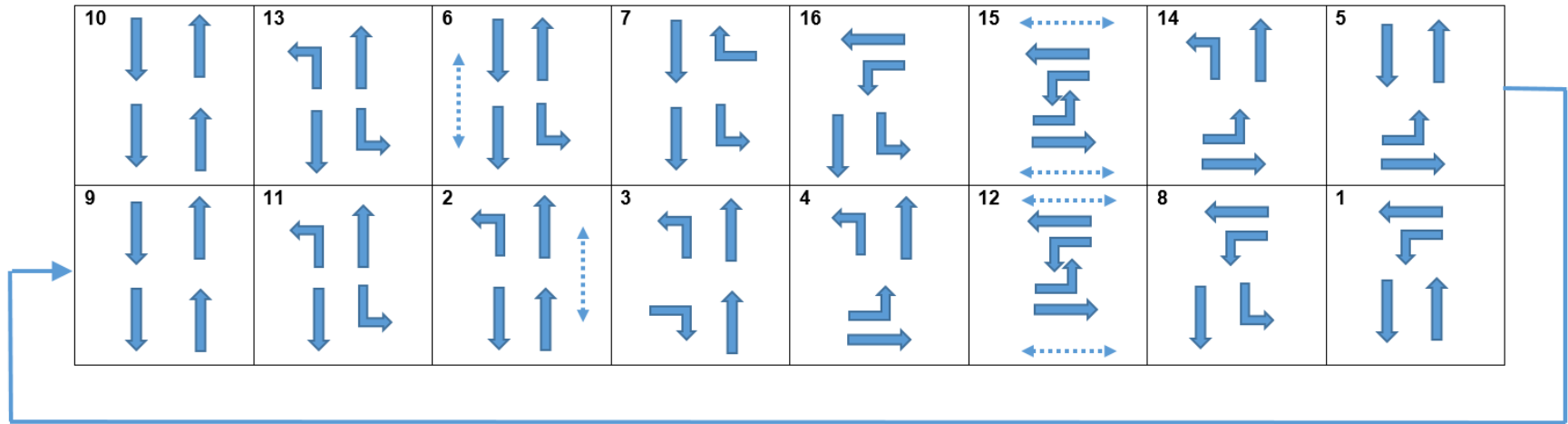
OFF-PEAK



PM PEAK



# Master Sequence



# Overlaps

Overlap	Included P1	Included P2	Included P3	Included P4	Included P5	Included P6	Included P7	Included P8	Modify P1	Modify P2
Overlap 01	6	7	16	11	8	13	0	0	0	0
Overlap 02	10	9	2	3	1	0	0	0	0	0
Overlap 03	6	7	10	16	9	11	2	8	0	0
Overlap 04	14	15	4	5	12	0	0	0	0	0
Overlap 05	14	4	11	2	3	13	0	0	0	0
Overlap 06	6	7	10	5	9	0	0	0	0	0
Overlap 07	6	10	14	4	5	9	11	2	0	0
Overlap 08	15	16	12	8	1	0	0	0	0	0
Overlap 09	2	9	10	0	0	0	0	0	0	0
Overlap 10	4	15	14	12	0	0	0	0	0	0
Overlap 11	6	9	10	0	0	0	0	0	0	0
Overlap 12	8	15	16	12	0	0	0	0	0	0



# Detectors

Det	Volume	Occupancy	Yellow Lock	Red Lock	Extend	Added Initial	Queue	Call	Call Phase	S
Detector 32					YES	YES		YES	10	C
Detector 33						YES			0	C
Detector 34					YES	YES		YES	15	C
Detector 35					YES	YES		YES	3	C
Detector 36					YES	YES		YES	10	C
Detector 37						YES			0	C
Detector 38					YES	YES		YES	15	C
Detector 39						YES			0	C
Detector 40						YES			0	C
Detector 41					YES	YES		YES	11	C
Detector 42					YES	YES		YES	9	C
Detector 43						YES			0	C
Detector 44					YES	YES		YES	12	C
Detector 45					YES	YES		YES	11	C
Detector 46					YES	YES		YES	9	C
Detector 47						YES			0	C
Detector 48					YES	YES		YES	12	C



# Next Steps

- SH 121 Eastbound Construction
- Signal Coordination
- Fine Tuning





**Plano**

*City of Excellence*

---

**Questions?**

---



**Plano**

*City of Excellence*

---

**Thank you**

*Rama Dhanikonda, P.E., PTOE*

*Sr. Traffic Engineer*

*Email: [ramad@plano.gov](mailto:ramad@plano.gov)*

*Phone: 972-941-5341*

---