# Highway 9 Adaptive Control System in Norman, Oklahoma



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### The Presenters

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# The Project



 State Highway 9 east from I-35 has long served as one of the main access avenues to special events at OU.

 The concept of adaptive control adjusts the cycle length and/or the splits "on the fly" to improve mainline flow.

 State Highway 9 is access controlled, for the most part, and appears to be an ideal candidate for adaptive control.

# **The Project Location**



Signalized Intersections

## **Initial Steps**

 The City of Norman contacted Econolite in early 2013 to price an adaptive system on Hwy 9.



- The timing, if approved, would create a capital project in the next budget cycle.
- Initial estimates came in at just under \$50,000 for a six intersection system.
- The Norman City Council approved, as part of the City's FYE 2014 budget, a \$50,000 capital project to create a six-signal adaptive system on Hwy 9.

# Initial Steps (Cont.)

- Once Council had approved the FYE 2014 Budget, the City went back to Econolite to create a contract for the work
- In July/August, 2014, it was determined that the initial estimate had failed to include radar units needed to detect the length of potential queues upstream from each signalized intersection



• The cost of the project rose to \$105,000

# Initial Steps (Cont.)

- With the estimate for the necessary queue detecting radar equipment in hand, staff went back to Council requesting the additional \$55,000 in funding needed to implement the project.
- Council unanimously approved the increase in the contract amount, as well as for the contract with Econolite, on October 14, 2014.



# Initial Steps (Cont.)

- From the beginning, the City desired a mechanism to measure the effectiveness of the adaptive system
- BlueTOAD units were being used by Econolite in Stillwater to measure travel times along specific corridors
- Norman would be allowed to borrow the BlueTOAD devices to measure travel times



• Travel time data could be collected before and after adaptive system deployment

## **Construction Timeline**

- Dec. 22-23, 2014: City forces pulled wire and installed cabinet equipment—Avg. high temperature was 50.5°
- Dec. 26 and 29, 2014: City forces pulled wire and installed cabinet equipment—Avg. high temperature was 53°

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+		9	10	17	12	13
14	15	16	37	14	14	20
21	22	27	24	25	28.	27
28	29	30	31	TA.	_	

# **Construction Timeline (Cont.)**



• Jan. 5-6, 2015: City forces pulled wire and installed cabinet equipment—Avg. high temperature was 43° • Jan. 7-9, 2015: City forces and Econolite installed radar units and programmed—Avg. high temperature was 32.7°

# **Construction Timeline (Cont.)**

- Jan. 12, 2015: City forces worked with Econolite installing BlueTOAD
- High temperature was 34°



Enjoy some photos of the installation!





#### • Now, on to the technical elements, Jeff.

- Centracs
   Norman
- Remote a controller Video (via
- Add Centr Adaptive
- What else
- Detection Measurem
  - (BT)



#### <u>Centracs Adaptive</u>

- Original ACS Lite sponsored by FHWA
- Focus on arterial management
- Adjusts Offsets and Splits based on monitored traffic flow (detection)
- Works with existing coordination



# **Centracs Adaptive**

- Splits adjusted based on phase utilization
- Phase utilization determined from stop bar detection
- Unused split time reallocated to busier phases
- Offset adjusted based on green arrival profile
- Flow profile developed from advance detection
- Offset adjusted to optimize vehicles arriving on green
- Changes to split and offset are made in small increments (2-6 seconds)

### **Detection**

- Adaptive requires stop bar detection & at Max queue length detection on mains (lane by lane)
- Existing Autoscope detection (stopbar)
- Need detection beyond max queue lengths



# Detection

#### • Max Queue Lengths at about 1000'

Ruler
Line Path Pro Measure the distance between two points on the ground
Map Length: 999, 16 Feet  Ground Length: 999, 24 Heading: 274,62 degrees
Mouse Navigation Save Clear
9
Bi In Arrow



#### While we were at it...

 Each intersection required detailed information about ALL timing and detection operation (stop bar video and radar)





#### <u>Measurement</u>

Installed 4
 BlueTOAD's
 Bluetooth devices
 for Travel
 Time/Speed
 history & reports



# Measurement—BlueTOAD





— Route WB Jenkins to Imhoff - (2015-02-10 - 2015-02-11)

Route WB Jenkins to Imhoff – Historical Avg of Tue/Wed: From 2015-01-15 to 2015-03-06

Route WB Jenkins to Imhoff – (2015–04–14 – 2015–04–15)

## **Field Implementation**

- All deployments come with anomalies to overcome
- We had a few...
- Radar doesn't need to be in the conventional location – just need range



# Field Implementation (Cont.)

- Radar software uses aerial imagery (Google, Bing, etc...) to help with configuration
- BUT... it can't tell you that things are in the path of the radar
- Had to make adjustments to accommodate obstruction



# Field Implementation (Cont.)



# Waiting for "ON"

- Adaptive ready for ON
- Construction at 24th and McGee
- Construction almost complete at 24<sup>th</sup>
- I-35 construction ongoing
- BlueTOAD data being collected



Now, back to Norman's perspective, David.

# Project Challenge #1



Monroe Elementary School

### Challenge #1 Issues

- Monroe Elementary School is located at 1601
   S. McGee Drive in Norman with a student population of 435
- Formal attendance boundary for Monroe Elementary School extends south of Hwy 9
- All the parents arrive at Hwy 9, southbound on McGee, at essentially the same time after they pick up their children in the afternoon

#### Changes Resulting from Challenge #1

- Set a maximum cap that the Adaptive Control System would only be able to take up to 25 % of the available split from any side street to serve main line movements
- We continued to see improved operations on Hwy 9 but the phone quit ringing about parents with school children not being served on McGee

# Project Challenge #2



#### City of Norman Transfer Station

### Challenge #2 Issues

- The City of Norman Sanitation Transfer Station is located at 3901 Chautauqua Ave
- The Transfer Station operates six days a week and utilizes large trucks
- Upon exit, these large trucks are accessing Hwy 9 via a side street

#### Changes Resulting from Challenge #2

- The arrival patterns of these trucks on the Chautauqua approach to Hwy 9 is very sporadic
- We decided to implement PPLT for the two Chautauqua approaches to Hwy 9 to provide more opportunities for the left-turn traffic on both sides of Hwy 9 (this had been a frequent complaint for a few years)

# Project Challenge #3



#### The University of Oklahoma

### Challenge #3 Issues

- The University of Oklahoma is accessed from Hwy 9 by Jenkins, Chautauqua, and Imhoff
- When traffic leaves OU by any of the three routes, the result is the same, it is attempting to access Hwy 9 at a side street
- Many of the same problems faced in Challenge #1 and Challenge #2

#### Changes Resulting from Challenge #3

- Set a maximum cap that the Adaptive Control System would only be able to take up to 25 % of the available split from any side street to serve main line movements
- We continued to see improved operations on Hwy 9 but the phone quit ringing quite as often about back-ups of traffic onto the OU Campus

# Project Challenge #4



#### ODOT Road Construction at Hwy 9/I-35

### Challenge #4 Issues

- The interchanges on I-35 at both Hwy 9 and Lindsey Street are being rebuilt by ODOT
- The construction has impacted the intersection of Hwy 9 and 24<sup>th</sup> Ave SW
- At times, portions of 24<sup>th</sup> Ave SW were closed and McGee was used as a detour route

#### **Changes Resulting from Challenge #4**

- The Adaptive Control System could not keep up with the constant changes in traffic control and the fact that southbound McGee was beginning to compete as a major movement in the corridor
- We had no alternative but to remove the Adaptive Control System from overall control of corridor movements during those times when 24<sup>th</sup> Ave SW was closed to key movements

#### <u>One Last Lesson</u>

- Sometimes when you're out working in the field, the urge takes control and you have to do something quick
- If this happens to you, make sure the wind is at your back
- Right, Jeff?





# Questions?

