Tulsa-Jenks
Multi-Modal Safety Project

Appendix F:
Riverside Parkway Congestion Update

INCOG

THE MUSCOGEE NATION

Submitted by The Indian Nations Council of Governments and the Muscogee Nation

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TECHNICAL MEMORANDUM

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Date: September 5th, 2018

Subject: S Riverside Parkway at E 101st Street/Creek Turnpike Eastbound – Congestion Update

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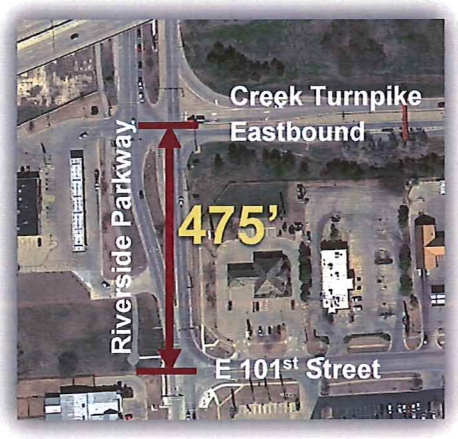
This Technical Memorandum documents the congestion at the south end of Riverside Parkway at Creek Turnpike Eastbound (southern terminal) and E 101st Street, the timing improvements that have been implemented to date at the intersections, and the long-term infrastructure improvements required to further mitigate current congestion.

EXISTING CAUSES OF CONGESTION

The existing intersection of Riverside Parkway at Creek Turnpike Eastbound (southern terminal) and E 101st Street experiences significant congestion during the evening peak hour (3:00-6:00pm) due to both the traffic patterns and geometric constraints. Some of the key causes of traffic congestion at these two (2) intersections are the following:

1. Close Intersection Spacing

The intersection of Riverside Parkway and E 101st Street is approximately 475' south of the intersection of Riverside Parkway at Creek Turnpike Eastbound. Preferred traffic signal spacing is approximately 1,200 feet. In constrained situations, traffic signal spacing less than 800' is not recommended. Closely spaced traffic signals can increase congestion due to lack of storage space and coordination challenges. These two (2) intersections are spaced as far apart as possible given the constraints of the Creek Turnpike alignment and the section line road of E 101st Street.



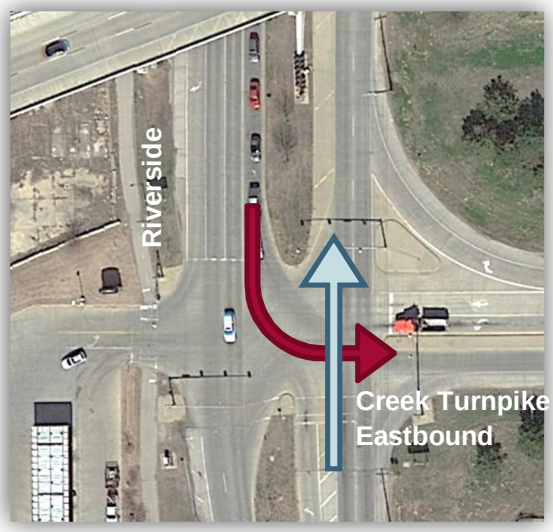
2. School Traffic

The existing Jenks Middle School is located on E 101st Street east of Riverside Parkway. School traffic (vehicles and school buses) generated during the evening peak hour is concentrated and highly directional, creating significant challenges at the nearby intersections. Before school is released a high volume of traffic enters the school via a southbound left-turn at the intersection of Riverside Parkway and E 101st Street. Upon dismissal, that same volume of traffic leaves the school via a

westbound right-turn at E 101st Street and Riverside Parkway. During dismissal, it is not uncommon that the westbound queue extends from Riverside Parkway east to the middle school (1,500 feet+).

3. Predominant Movements are Conflicting

Two (2) of the heaviest movements at the intersection of Riverside Parkway and at Creek Turnpike Eastbound is the southbound left-turn movement and the northbound through movement. Both movements conflict and compete for green time at the intersection. The southbound left-turn movement is only a single left-turn lane, which compounds the congestion. Because the movements cannot run concurrently, the traffic signal timings must balance the congestion and delay for both movements equally. Because of these conflicting movements, the intersection is operating over capacity during peak time periods.



4. Unreliable Wireless Communication and Power

Traffic signals rely on an internal clock to operate important functions like when to adjust the time of day timing plan, when a cycle should begin and end, and most importantly how the timings interact with neighboring intersections (coordination). Along coordinated corridors like Riverside Parkway, a vehicle traveling northbound is timed to progress through multiple consecutive intersections without stopping. Each traffic signal has a separate clock that tells time to maintain the traffic signal timing and associated progression between intersections. These clocks can drift to either be faster or slower than the actual time. When a traffic signal clock drifts, this creates an issue for progressing traffic along a corridor because the intersection may bring up the red phase too early or start the green phase too late, stinting progression. The clock drift on this corridor is caused by two main factors, unreliable communication and unreliable power source. To decrease clock drift at signalized intersections, the City utilizes wireless communication along the Riverside Parkway corridor to re-sync the clocks at each intersection up to four times a day. Due to line of sight issues from grade changes and obstructions, the communication can be unreliable. If communication is down when the clocks sync, the intersection controller will not know the correct time and instead use the controller's internal time clock. From a power supply standpoint, variations in the electrical service can cause a controller time clock to drift as well. In the Tulsa area, controller time clocks drift as much as 10-15 seconds in a 1-2-day period. This significant amount of drift can effectively defeat traffic signal coordination. For closely spaced intersections, clock drift is compounded due to the lack of queue space between intersections.

5. E 101st Road Closure

To add to the traffic patterns and geometric challenges, E 101st Street east of the middle school was closed for traffic for a majority of the school year this year for roadway construction/street

maintenance. Due to this closure, all traffic entering and exiting the school and local businesses must use the intersection of Riverside Parkway at E 101st Street. The congestion at the study intersections is anticipated to improve when E 101st Street is open to traffic east of the middle school.

COMPLETED TIMING ADJUSTMENTS

The City has implemented and fine-tuned traffic signal timings along the Riverside Parkway corridor in recent years to mitigate the congestion at the two (2) intersections. Once E 101st Street was closed east of the middle school, the City recognized that traffic patterns had changed and reevaluated new traffic signal timings to address the change in traffic. The following traffic signal timing modifications have been implemented at the two (2) intersections since E 101st Street was closed:

1. Created Two New Timing Plans for the Evening Peak – October 2017

Prior to the E 101st Street road closure, both intersections operated one (1) timing plan throughout the evening peak hour. After the road closure, two (2) new timing plans were created to better manage school and evening commuter traffic separately. The school plan ran until approximately 4:30pm at which time the school traffic decreased (westbound traffic on E 101st Street) and the commuter traffic increased (southbound left-turn movement at Riverside Parkway and Creek Turnpike Eastbound). The two (2) plans prioritized different movements to better align with the change in traffic patterns.

2. Revised the Second Evening Plan (4:30-6:00pm) – May 2018

Following the statewide teacher strike earlier this year, the Jenks school district delayed dismissal the remainder of the school year to make up necessary class hours. The late dismissal caused the school traffic to further coincide with the commuter traffic during the evening peak hour. The 4:30-6:00pm timing plan for the intersection of Riverside Parkway and E 101st Street/Creek Turnpike Eastbound (southern terminal) was adjusted to account for the change in traffic patterns. The revised timings also modified phasing at the intersection of Riverside Parkway and Creek Turnpike Eastbound with the following timing improvements:

- *Omitted Eastbound and Westbound Protected Left-turn Phases*: The protected left-turn phase for the eastbound traffic (Kum & Go Gas Station Driveway) and westbound traffic (Creek Turnpike Eastbound) were omitted. Both eastbound and westbound approaches were revised to run concurrently with permitted left-turns (green ball). This allowed 10 seconds per cycle to be reallocated to the other higher priority movements.

- *Double Serve the Southbound Left-turn*: The current southbound left-turn phase was 60 seconds prior to the retiming. Based on field observations, it was determined that by the end of the 60 second split the green time was not efficiently processing cars due to large gaps between vehicles. The left-turn phase was therefore modified to come up twice per cycle for 30 seconds each time. This allows the platoon to recompact and utilize the green time more efficiently. Field observations showed 2-5 more southbound left-turns processed each cycle using the same amount of green time, just served twice.

- *Offset Adjustments*: Because the southbound left-turn lane was served twice per cycle, the northbound traffic from the E 101st Street intersection was affected. The timings (offsets) of

each intersection were adjusted to provide better progression for the northbound through traffic.

LONGTERM INFRASTRUCTURE IMPROVEMENTS

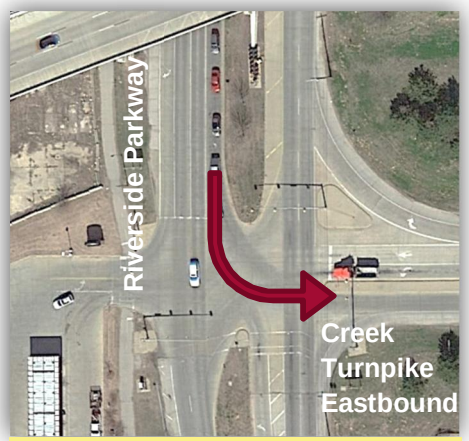
In addition to traffic signal timing improvements, roadway and infrastructure improvements could be implemented to help mitigate congestion. Below is a list of the most impactful improvements.

1. Upgrade Corridor Communication and Components to Improve Reliability

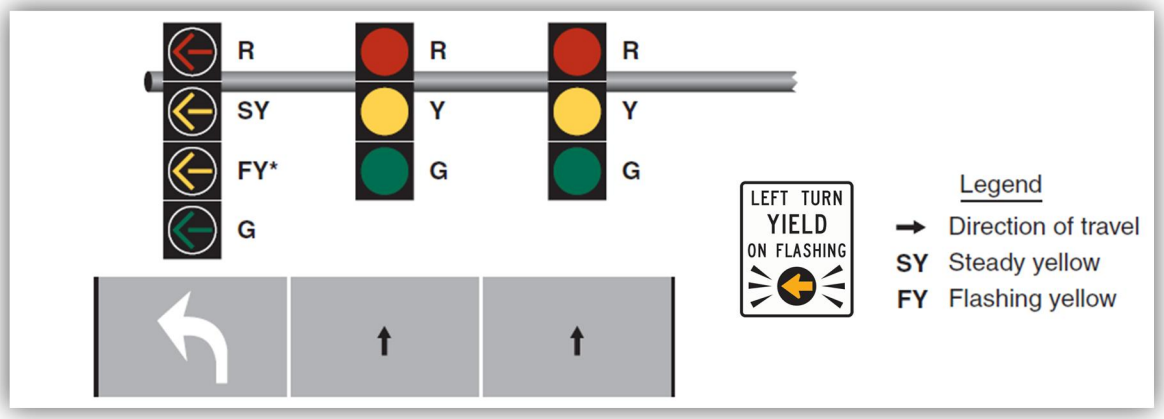
As previously mentioned, the communication along the corridor is currently unreliable, but critical to keep the controller clocks at each intersection aligned. The City is currently in the process of upgrading the communication along the corridor to improve reliability and reduce/eliminate controller clock drift related to failed communication. GPS clocks and power conditioning may also be utilized at the intersections along the corridor to further eliminate clock drift and ensure proper coordination.

2. Flashing Yellow Arrow (FYA) Implementation for the Southbound Left-turn

The existing southbound left-turn from Riverside Parkway to Creek Turnpike Eastbound is protected only, which only allows vehicles to turn left when a green left-turn arrow is displayed. If the traffic signal head was replaced with a four-section Flashing Yellow Arrow (FYA) display, motorists could utilize both a protected and permitted phase to progress through the intersection when gaps are present. The flashing yellow arrow head would also allow the movement to continue to be served twice per cycle.



FYA Implementation Movement

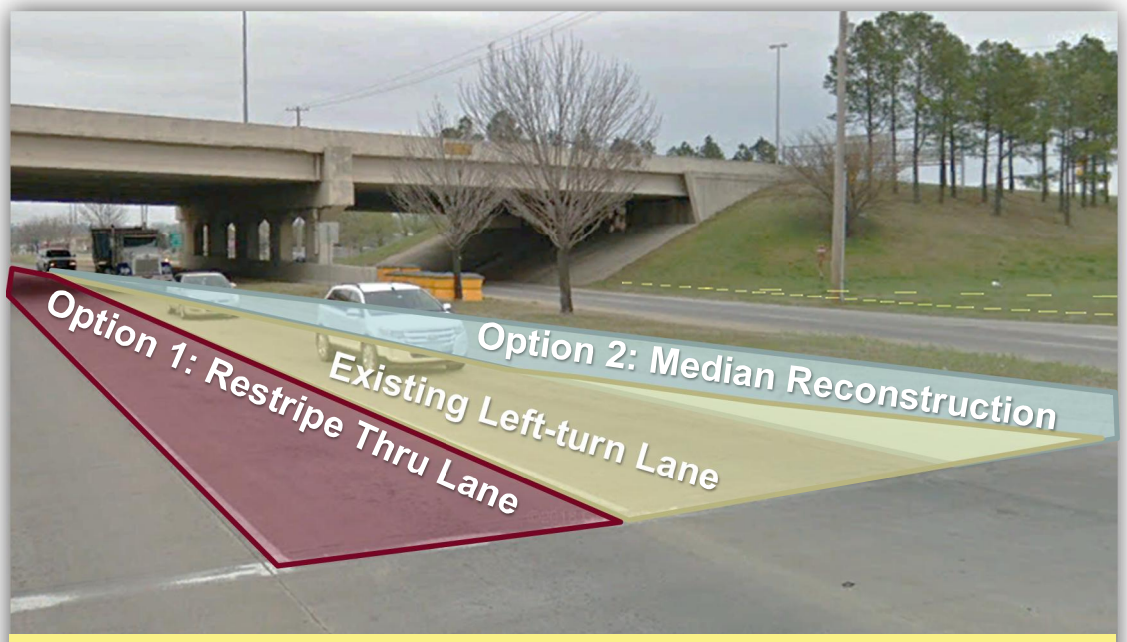


3. Southbound Dual Left-turn Lanes at Riverside Parkway and Creek Turnpike Eastbound (southern terminal)

The existing single southbound left-turn lane at the intersection of Riverside Parkway and Creek Turnpike Eastbound is over capacity. Installation of a dual left-turn lane will significantly reduce congestion at the intersection. Operations will improve because more green time can be added to the northbound through movement. The additional left-turn lane will require widening the east leg to provide two (2) eastbound departure lanes between the traffic signal and the two (2) approach lanes serving the existing toll plaza. This improvement should be considered a high priority.

Dual Left-turn Lane Options: Two (2) options were identified to implement a second southbound left-turn lane on Riverside Parkway:

> ***Option 1: Restripe Existing Through Lane****:* There are currently two (2) existing southbound through lanes at the intersection of Riverside Parkway at Creek Turnpike Eastbound. The inside through lane could be converted (using pavement markings, signage, and traffic signal head modifications) from a through lane to a dedicated left-turn lane. This option is lower cost and could be implemented in relatively short period of time.
>
> ***Option 2: Widen Roadway into Median****:* The existing median area between the stop bar and the concrete barrier for the bridge supports is wide enough to construct a second left-turn lane. This improvement would require paving improvements, pavement markings, signage, and traffic signal modifications. This option is more expensive, but would not reduce the capacity of the southbound through movement.



Widening Options for the Southbound Left-turn Lane at Riverside Parkway and Creek Turnpike Eastbound (Southern Terminal)

Creek Turnpike Approach Improvements: If the southbound dual left-turn lanes are constructed, improvements are needed at the Creek Turnpike Eastbound toll plaza entrance. Just east of Riverside Parkway, the eastbound Creek Turnpike is a single lane and then widens to two (2) lanes at the toll plaza to accommodate a Pikepass lane (left lane) and a pay lane (right lane). The southbound dual left-turn lanes will require dual receiving lanes which will require widening of the existing eastbound departure lane at the intersection (see exhibit below). To reduce the need for motorists to change lanes between the intersection and toll plaza, a second Pikepass sensor should be installed in the right lane to supplement the cash collection. The improvement to the Creek Turnpike toll plaza and roadway leading up the toll plaza is within the Oklahoma Turnpike Authority (OTA) Right-Of-Way. Implementation of these improvements will require coordination and a funding agreement with between the City and OTA.

Oklahoma Turnpike Authority Improvements to Accommodate SB Dual Left-turn Lanes

4. Northbound Riverside Parkway – 3rd Through Lane Widening Starting at E 101st Street

Riverside Parkway from E 101st Street to the north is designed to accommodate an additional through lane to approximately E 96th Street. The bridge north of the Creek Turnpike Westbound (northern terminal) is wide enough to accommodate the additional through lane as well as a majority of the roadway cross sections (the additional lane is currently unusable due to pavement markings). The additional northbound lane would provide additional through capacity and queue storage at the intersection of Riverside Parkway at Creek Turnpike Eastbound (southern terminal). This improvement is a long-term improvement and should be considered a lower priority than improvement #3 (dual southbound left-turn lanes).

CONCLUSIONS AND RECOMMENDATIONS

The existing intersections of Riverside Parkway at Creek Turnpike Eastbound (southern terminal) and E 101st Street are congested during the evening peak hour for the following reasons:

1. *Close Intersection Spacing:* causing lack of storage space and coordination challenges.
2. *School Traffic:* causing highly directional and compact traffic patterns.
3. *Predominant Movements are Conflicting*: the southbound left-turn and northbound through at Riverside Parkway and Creek Turnpike Eastbound (southern terminal) must run independent of each other and are competing for green time.
4. *Unreliable Wireless Communication and Power*: causes the intersection clocks to drift because they are unable to sync or keep time, which leads to corridor coordination issues.
5. *E 101st Street Road Closure*: forces all school traffic to use the intersection of Riverside Parkway at E 101st Street for ingress and egress.

From a traffic signal timing standpoint, the City of Tulsa has updated, refined, and field adjusted the traffic signal timings two (2) times during this school year:

1. October 2017: Created two (2) timing plans to better accommodate new traffic patterns when the E 101st Street road closure began; and
2. May 2018: Revised the timing plans to better accommodate new traffic patterns when the Jenks Middle School dismissal was pushed later in the day due to the recent teacher strike.

In addition to traffic signal timing improvements, the following roadway and infrastructure improvements could be implemented to help mitigate congestion:

1. Upgrade Corridor Communication and Components to Improve Reliability: improves the reliability of the clocks and ultimately coordination along the Riverside Parkway corridor by implementing upgraded communication equipment, power conditioning, and GPS clocks at each intersection.
2. Flashing Yellow Arrow (FYA) Implementation for the Southbound Left-turn: increases capacity by allowing vehicles to turn left on both the protected and permitted phases.
3. Southbound Dual Left-turn Lanes at Riverside Parkway and Creek Turnpike Eastbound (southern terminal): significantly reduces the congestion by increasing the capacity for the southbound left-turn and adds more green time for the northbound through movement. **High Priority Improvement.**
4. Northbound Riverside Parkway – 3rd Through Lane Widening Starting at E 101st Street: provides additional through capacity and queuing storage along northbound Riverside Parkway.

Operations along the corridor should be reevaluated when road construction is completed along E 101st Street in the fall. Congestion at the two (2) subject intersections should improve under normal traffic patterns. Revised traffic signal timings may be necessary once school is in session.

In the meantime, the City should evaluate the feasibility (i.e., identify funding options, prepare preliminary designs, and develop construction cost projections) of implementing Long Term Infrastructure Improvements #2 and #3.