STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

JAMES H. TROGDON, III
SECRETARY

April 6, 2017

TO: Louis Mitchell, PE, Division Engineer

FROM: J. Kevin Lacy, PE, State Traffic Engineer

SUBJECT: I-77 Express Lane Construction Work Zone Review

Attached is the final report of the Work Zone Review conducted by Steve Kite and me on March 27th and 28th. This review was conducted as a result of various concerns received by the Department and as directed by Secretary Trogdon. There are several recommendations within the report. I am asking the Division to implement each recommendation or a response from the Division indicating the reason the recommendation was not implemented. If the Division revised the recommendation, please provide how it was revised and implemented.

We recognize the challenge of managing a long work zone that has a high traffic volume that is critical to the region and state as a whole. My general impression of the appearance and operation of the work zone is that it was in very good condition and it operated well.

If there are any questions concerning the specifics of the review, please contact me or Steve Kite at (919) 814-5000. I look forward to receiving your comments on our recommendations.

JKL

cc: James Trogdon, PE
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WORK ZONE REVIEW

Interstate 77 Express Lane Construction Project Work Zone Review

Documents Prepared By:

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4/6/2017

Date

SEAL

Introduction

The Department of Transportation has received complaints about the condition and operation of the Interstate 77 work zone. These complaints have been received from citizens and elected officials. There have also been various media reports concerning the work zone. In the past, the local Division Office has reviewed the work zone and have not identified any major concerns or corrections that are needed. Secretary Trogdon directed an additional review by individuals who are familiar with work zone design, operation and safety, in addition, are not connected with the day to day project oversight or review of traffic management plans.

On March 27th and 28th, Kevin Lacy and Steve Kite reviewed the work zone during the afternoon peak, post afternoon peak, night traffic operations, morning peak and mid-morning operations. They also reviewed the Interstate 85 work zone for comparison purposes. Kevin Lacy is the State Traffic Engineer and directs the Transportation Mobility and Safety Division of NCDOT. Steve Kite is the Eastern Work Zone Traffic Control Engineer and Department's technical lead in the work zone traffic control field. Mr. Kite has recently been recognized by American Traffic Safety Services Association with the National Safety Award. Both are professional engineers with more than 20 years of professional experience in traffic engineering and traffic safety.

Background

The work zone is part of the design-build project to widen I-77 to add managed lanes along the corridor. This project has a history of controversy concerning the managed lanes aspect of the project that will have tolls. However, the number of non-toll general purpose lanes will not change.

The traffic volumes on I-77 through the work zone range from over 180,000 vehicles per day (vpd) in the southern end of the project near downtown Charlotte to over 60,000 vpd in the northern end of the project in Iredell County. The number of lanes vary from five lanes plus axillary and long ramps in the downtown Charlotte area to two lanes in each direction. There are various lane drops, several major system to system interchanges (I-277, I-85, and I-485) and a dozen or more service interchanges that serve Charlotte and the various communities north of Charlotte. Many of the interchanges have obsolete designs with direct tapers or short acceleration lanes. This is one of the complaints that have been received by the Department that this project will correct.

Contracting any project with these traffic volumes combined with a large number of interchanges, some closely spaced with older design standards, will be a challenge.

Since the beginning of the work zone, the number of crashes has increased significantly. The crash patterns that have seen the majority of these increases are rear end and side swipe same direction crashes. These crash patterns are indicative of

highly dense traffic streams. However, the average severity of the crashes in the work zone has decreased. This indicates that the increases in crashes typically are occurring at low speed conditions where the crashes tend to be property damage only or minor injury crashes. While we prefer no one is involved in a crash, it is common that the number of crashes on a roadway increase during work zones. This is often related to the changing conditions, distractions, and frequently less space on the roadway itself.

General Findings

The work zone was over 26 miles in length and overall, the work zone traffic control devices were very good. Nearly all of the drums were new or like new. The majority of the stationary signs were either new or like new and were installed plumb. These devices were visible during day and dark conditions. There were a few drums missing along the work zone with the tire rings on the shoulder, but considering the length of this work zone it's a very minor issue.

There was little to no debris in the work zone. In fact there was very little litter in the work zone. Litter was noticeable absent. I suspect that the area has recently been picked up and this may also explain the minimal amount of debris. We point this issue out because this is one of areas of major complaints about the work zone.

There are several interchanges where the right shoulder is closed through the interchange. In these cases, the contractor has used rolled up type signs in lieu of stationary mounted signs.

There are several "END ROAD WORK" stationary signs installed along the project. Apparently, these signs were in place as the full work zone was being phased in and have not been removed.

The contractor has installed the "ROAD WORK AHEAD" warning signs as required by the Manual on Uniform Traffic Control Devices (MUTCD). However, the North Carolina standard drawings also require "BEGIN ROAD WORK" signs at the entrances of the work zone on I-77. In addition, the MUTCD recommends installing "ROAD WORK NEXT XX MILES" for all work zones greater than two miles.

The line removal in mostly adequate throughout the project. There are small sections where the removal has created scarring and deeper intrusions. There are several places where some additional actions are recommended.

The pavement markings are generally adequate. There are section where the marking and material are better than others. The night time retroreflectivity of the markings are generally adequate and similar to the day time visibility. There are some sections that have better materials; therefore they are more visible. The most noticeable areas where the markings lost the retro was the wider lines in gore areas.

All lane shifts are signed with advanced signing. In some cases, the lane shifts are so small that it is difficult to recognize a shift had occurred. We did observe one shift that was more abrupt and the ghost lines from the removed markings and pavement joints may create confusion. This section is on I-77 southbound between the I-85 interchange and the La Salle street interchange.

There was general lack of raised pavement markings through the work zone. It may be due to the contractor waiting until the spring to reduce the risk of plowing them up.

Speed Limit Discussion

The speed limit is 55 mph from the Cindy Lane overpass southward through the work zone. The remaining work zone is 65 mph. The median shoulder throughout the work zone is closed with barrier placed two feet from the travel lane. The right shoulder is generally open and available for use if necessary. There are sections where the shoulder was narrowed to maintain lane width, or the shoulder is closed for short sections through an interchange.

During our observations, the general flow of traffic was around the speed limit when traffic volumes permitted. During higher traffic periods, the speeds where generally constrained by the traffic density. There were clear opportunities to travel at higher speeds, especially further north of exit 28.

Lowering the speed limit is possible, but not necessary from an operational or safety perspective. An example, the I-85 work zone speed limit was lowered due to placing concrete barrier on both shoulders. The speed limit was lowered 5 mph; however, the compliance is minimal, but it appears anecdotally the higher end speeders have slowed. This may be due to the fact barrier is on both sides of traffic and we have digital speed limit signs that indicate when drivers are speeding.

If we lower the speed limit in the I-77 work zone and it is enforced, there will likely be many people complaining about lowering the speed unnecessarily.

There are ordinances in place to allow the Resident Engineer to lower the speed limit during lane closures. These require adequate signage, and removal when the lane closure is no longer in place.

Adding the $250 penalty throughout the work zone is another consideration. There have not been many changes to the normal operations of I-77 with the work zone. While it is a large and long work zone, the majority of the lane shifts are very slight, and the only other changes to traffic patterns are the barriers narrowing the left shoulder. Placing this penalty for the full work zone does not appear to meet the criteria where there is added need and risks. However, during the lane closures, there is justification and there are ordinances in place for these situations.

Recommendations

The following recommendations should be considered by the Division and the contractor. The Division will be required to respond either by indicating that they will implement each recommendation, or not. If the recommendations are not implemented, then the Division will provide comments on why, or how the recommendation was revised and implemented.

- Remove the "END ROAD WORK" signs that are not required for the current traffic pattern.

- Install "BEGIN WORK ZONE" signs at the project limits to meet the NCDOT standard drawing requirements; and install "NEXT 26 MILES" plaques with these "BEGIN WORK ZONE" signs at the project limits to meet the MUTCD recommendations.

- Consider installing "BEGIN WORK ZONE" with the appropriate length plaques at the on ramps of the three systems interchanges (I-277, I-85, and I-485).

- Remove the portable roll up signs and replace with stationary signs.

- Install additional shoulder mounted signs where lanes drop. The shifting of traffic has many of the overhead signs and their arrows misaligned. The additional signs will provide warning and notice to drivers.

- Remove the "skinny" drums and replace as necessary with standard drums. This will improve the target value of the drums and are less likely to be knocked over.

- Replace the covers on signs that have been torn. There are a number of signs installed for a future phase that has been uncovered. Either replace the covers, or remove the signs until needed. These include DETOUR and ROAD CLOSED signs.

- Install "WORK ZONE" plaques (MUTCD G20-5aP) on all speed limit signs. This will re-enforce to drivers in the long work zone that it is still a work zone. This is one of the primary complaints received through the media.

- Consider installing work zone "performance" markings in all sections of the project where the traffic pattern will be in place longer than 6 months. This will improve durability and retroreflectivity.

- Install raised pavement markings.

- Rework the I-77 southbound traffic shift between between I-85 and La Salle Street. This will need to cover all lanes with a masking and remark to prevent the ghost markings and pavement joints from confusing drivers. Use solid lane lines through this lane shift to help minimizing lane changing in the area.

- Conduct a follow-up review in 3 to 6 months.