

**PROJECT SPECIAL PROVISION
'SMART' Work Zone System**

Description:

This item shall consist of furnishing, installing, relocating, operating and maintaining an automated, portable, real-time work zone system meeting the requirements noted herein, and providing the maintenance of the system during the duration of the project. Included in the operational responsibilities is the assuming of all communication costs such as cellular telephone, satellite and Internet subscription charges. In addition to these requirements, the Contractor shall assume all responsibility for any damaged equipment due to crashes, vandalism, adverse weather, etc. that may occur during the systems deployment.

The goal of this system is to monitor two work zones along I-40 in Forsyth and Davie Counties. The first work zone is located between NC 801/I-40 interchange in Davie County and SR 1101/I-40 interchange in Forsyth County. This work zone will have lane closure in each direction for the duration of the project. The second work zone is located at SR 1109 (Kinnamon Rd) bridge over I-40 in Forsyth County. The second work zone will have lane closures in each direction during weekends only for the duration of the work at that site. Traffic conditions will deteriorate due to backups caused by high traffic volumes, work zone vehicle interference, weather, etc. This project will require the SMARTZONE vendor to supply the necessary equipment to monitor traffic queuing due to over capacity, work zone vehicle interference, and weather. In addition, **this project will also require the SMARTZONE system to notify the Traffic Management Centers in Winston-Salem and Charlotte and the Resident Engineer's office once the delay through the workzone exceeds 25 minutes. The contact person in Winston-Salem is Patti Newsome, phone number (336) 703-6500. The contact person in Charlotte is Ann Lorscheider at (704) 342-6814. The contact person at the Resident Engineer's office in Winston Salem is Wright R. Archer III, at (336) 761-2220**

The SMARTZONE Contractor shall furnish this system for measuring and delivering condition-responsive messages for the both work zones on I-40. the first work zone located between NC 801/I-40 interchange in Davie County and SR 1101/I-40 interchange in Forsyth County and the second work zone located at SR 1109 (Kinnamon Rd) bridge over I-40 in Forsyth County. (See attached Drawings). The decision to deploy or remove the SMARTZONE will be made by the Department. Once the decision is made to deploy the SMARTZONE, the Department will coordinate with the Contractor on the remaining duration of the system.

The Department will guarantee the Contractor a minimum of 4 months total usage for this contract if the system performs satisfactorily with no major malfunctions. Malfunctions may include but are not limited to the inability of the equipment to provide accurate-real time delay or travel time information, inability to withstand

an interstate roadside environment, inability to withstand normal weather conditions, etc. The Department reserves the right to terminate this contract at any time if it determines this SMARTZONE system is not performing in accordance with this specification. The maximum duration for this contract will be 6 months.

The Department will compensate the Contractor for mobilizing the SMARTZONE system to the project at the contract unit price for “mobilization”.

This “mobilization” includes providing the equipment for both work zones in both East and Westbound I-40. Full payment will be made for mobilization once all equipment has arrived and is fully operational within 45 days of award of the contract. If the system is not fully operational within 45 days of award of the contract, a pay reduction will occur for each day the system is not fully operational. The pay reduction will be equal to 10% of the amount bid for mobilization per day.

Once this equipment has arrived, any relocation or repositioning along the project or removal of equipment from the project will be incidental to the contract unit price for monthly rental.

If the Department requests the Contractor to remove all equipment and to remobilize at a later date, that remobilization will be paid for at the contract unit price for “re-mobilization”.

The Division 9 Construction personnel in Winston Salem, will be the coordinating group in charge of monitoring this SMARTZONE system.

SMARTZONE System Requirements

The SMARTZONE system shall consist of the following (as a minimum):

- *10 portable changeable message signs remotely controlled via central computer base station.*
- *16 portable traffic sensors linked to central computer base station*
- *1 central base station equipped with appropriate software and either wireless or dedicated phone line communications to “link” with the SMARTZONE*
- *8 pagers to provide notification to designated personnel in Winston-Salem and Charlotte Traffic Management Centers and the Resident Engineer’s office.*
- *The SMARTZONE shall be capable of providing current operational status (i.e. current traffic data and messages, communications system, signs and sensors) via the central base station computer and via the Internet to a dedicated project web-site established for the purpose of monitoring the corridor and the SMARTZONE equipment*

- *The website address shall be the following (www.i-40Davie_forsyth.com)*
- *The web-site shall have the capability of providing a password protected “link” for approved personnel to have limited access to the operational characteristics of the system to manually override errant messages on the CMS’s due to communication interruptions or other system failures.*
- *The web-site shall have the capability of providing a password protected “link” for approved personnel to have access to retrieve the volume and speed data the system is collecting.*
- *The website for the monitoring of the SMARTZONE shall be capable of verifying and validating the real-time messages on the Changeable Message Boards for password approved personnel.*
- *The SMARTZONE software shall be configured so that appropriate personnel are notified by pager and email once a malfunction has occurred in the system.*
- *The SMARTZONE system shall notify system shall notify the Winston-Salem and Charlotte Traffic Management Centers and the Resident Engineer’s office once the delay through the workzone exceeds 25 minutes. This notification shall be made by pagers. The contact persons are Ann Lorscheider in Charlotte (704) 342-6814, Patti Newsome in Winston-Salem at (336) 703-6500, and Wright R. Archer III, in Winston Salem at (336)761-2220*
- *The software shall be configured to assess any type of malfunction that has occurred. This assessment includes communication disruption between any device in the system configuration, changeable message board malfunctioning, speed sensor malfunction, etc. The SMARTZONE system shall be capable to notify the Resident Engineer’s office and the contractor about any system malfunction.*

The exact locations of all devices shall be determined as part of an on-site communications analysis with project personnel.

Materials

All materials used shall meet the manufacturer’s specifications and recommendations.

Construction Methods

The provisions of Article 1105-3 in the North Carolina Standard Specifications for Roads and Structures (2002) will be applicable to the work covered by this section.

In addition, the below requirements are to be met.

- The SMARTZONE shall utilize North Carolina approved portable Changeable Message Signs (CMS) to convey real-time traffic condition information to motorists.
- **The SMARTZONE shall operate continuously (24 hours, 7 days a week) when deployed on the project. It shall be in the “data collection” mode when the queue sensors aren’t activated.**
- To support incident management, the SMARTZONE shall allow the Division 9 staff to manually override motorists information messages for a user-specified duration, after which automatic operation will resume with display of messages appropriate to the prevailing traffic conditions.
- Critical system operator control functions shall be password protected.
- The SMARTZONE shall be capable of providing current operational status (i.e. current traffic data and messages, communications system, signs and sensors) via the dedicated project website.
- The SMARTZONE shall be capable of acquiring traffic volume and speed data and selecting motorist information messages automatically without operator intervention after system initialization.
- The dedicated project website shall provide a full color map depicting the project area with locations of traffic sensors, CMS's and cameras.
- Using color-coding, the Map shall reflect the current traffic conditions at each traffic sensor and display the entire information message being shown by each CMS.

SMARTZONE Traffic Data Acquisition

- **Each traffic queue sensor shall communicate with the computer base station to activate the appropriate CMS whenever the prevailing traffic speed slows to 55 miles per hour. Once activated, the preprogrammed messages shall be automatically displayed on the CMS as shown on the attached drawing.**
- **The SMARTZONE shall be capable of calculating and having “real time” delay information displayed on the portable CMS’s. This “real time” delay shall be calculated and displayed on the portable CMS’s to the nearest minute for delays up to 15 minutes after the initial 5 minute delay. For delays exceeding 15**

minutes, the delay information displayed on the CMS's shall be rounded to the nearest 5 minute increment.

- **The “real time” delay information displayed on the CMS's is to be updated every 1 minute.**
- **The website delay information is to be updated simultaneously with the delay information displayed on the Changeable Message Signs**
- **To allow for motorist information messages of high specificity, the SMARTZONE shall acquire quantitative traffic data using an accurate speed measurement technique that includes the capability of detecting stopped traffic and counting traffic volume.**
- **The SMARTZONE'S traffic sensors shall be of a type whose accuracy is not degraded by inclement weather or degraded visibility conditions including precipitation, fog, darkness, excessive dust, and road debris.**
- **The SMARTZONE shall be capable of acquiring traffic data from up to four lanes of traffic in multiple directions.**
- **All traffic data acquired by the SMARTZONE shall be archived in log file with time and date stamps. At the completion of the project, the SMARTZONE vendor shall provide the Department this logged information on disk.**

SMARTZONE Motorist Information Messages

- **The SMARTZONE shall be capable of providing speed, delay, length of traffic queue, and lane closure advisories to motorists. The primary system messaging will be providing the number of minutes of delay to the end of the workzone from each portable changeable message sign.**
- **Records of all motorist information messages displayed by the SMARTZONE system shall be recorded in log files with time and date stamps. This information shall be provided to the Department on disk at the completion of the project.**
- **System must have capacity to preset up to 10 different default or automatic advisory messages for each CMS, for a total capacity of at least 80 different default and automatic messages (10 for each of the 8 CMS's).**
- **Default and advisory message content shall be programmable from the central base station.**
- **For later use, the SMARTZONE system shall be capable of storing messages created by an authorized user in overriding any default or automatic advisory message.**

System communications

- **Communications between central computer base station and any individual CMS and sensor shall be independent through the full range of deployed locations and SHALL NOT rely upon communications with any other CMS, sensor or camera.**
- **The SMARTZONE communication system shall incorporate an error detection/correction mechanism to insure the integrity of all traffic conditions data and motorist information messages.**
- Any required configuration of the SMARTZONE communications system shall be performed automatically during system initialization.

Changeable Message Signs

- **The approximate location of portable changeable message signs and traffic sensors for the various construction phases will be as shown on the attached drawings.**
- The portable changeable message signs shall be on the North Carolina approved products list and have the following features
 - Remote sign operation via central computer base station and/or website
 - ALL MESSAGES ARE TO BE CENTER JUSTIFIED
 - Messages to be displayed shall have the capability to be timed to changes at various times of the day and days of the week.

Any request to change the messages on the Changeable Message Signs has to be approved by the DOT.

System Performance

To ensure a prompt response to incidents involving the integrity of the SMARTZONE devices and changeable message signs, the SMARTZONE Contractor will be required to make all necessary corrections to the essential components of the system within 24 hours of notification by the Department. If all corrections are made within this 24 period and the system is brought back on-line, no pay reduction will occur. Essential components are the Portable Changeable Message Signs, Communications Equipment, and Speed and Volume Sensors, Computer hardware and software required to place the real time information on the signs. Non-essential components of this system are the dedicated project website and if used, video cameras.

For either direction of I-40, if the 24 hour timeframe expires and the essential components of the system are not fully restored to proper working order, no payment will be made from the time of initial notification until the system is brought back online. The pro-rated monthly payment will be determined as follows:

1 day = 5% pay reduction	6 days = 30% pay reduction
2 days = 7% pay reduction	7 days = 35% pay reduction
3 days = 10% pay reduction	8 days = 40% pay reduction
4 days = 20% pay reduction	9 days = 50% pay reduction
5 days = 25% pay reduction	10 days = 75% pay reduction

If the essential components of the SMARTZONE system are down for more than 10 total days in a month whether they are consecutive or cumulative, then NO payment will be made for that month.

For the non-essential elements the pro-rated monthly payment will be determined as follows:

1 day = 5% pay reduction	6 days = 25% pay reduction
2 days = 7% pay reduction	7 days = 30% pay reduction
3 days = 10% pay reduction	8 days = 35% pay reduction
4 days = 15% pay reduction	9 days = 40% pay reduction
5 days = 20% pay reduction	10 days = 50% pay reduction

If the non essential elements of the SMARTZONE system are down for more than 10 total days in a month whether they are consecutive or cumulative, then NO payment will be made for that month.

The Department reserves the right to terminate this contract at any time if it determines the SMARTZONE system is not performing in accordance with this specification.

*** System Option**

As a system option, the SMARTZONE Contractor may provide four (4) cameras (2 for each direction of I-40 or 2 in the same direction if work is only occurring in 1 direction of I-40) to provide live video feed of the workzone. If used, these cameras shall become activated when the speed sensors detect delay in the workzone. Otherwise, they are to remain "off" unless authorized personnel request activation.

The requested activation "On Demand" feature is one the Department can use to verify traffic conditions and/or verify messages on the Changeable Message Boards as well as other incident management purposes.

This "On Demand" feature shall be accessible from the project website with by providing a password protected "link" for approved personnel. If used, the cameras shall be mounted on a portable trailers located near the lane closure (See attached drawings) and shall have PTZ (Pan/Tilt/Zoom) capabilities.

As a minimum, the cameras shall have a 1 frame/second update rate.

As this is an optional item, there will be an optional pay item for this feature that the SMARTZONE Contractor will be allowed to price on a monthly basis. This monthly price is for ALL of the cameras, not for each. However, the camera option WILL NOT play a role in determining the low bidder. The low bidder will be determined by the required pay items for this contract. Once awarded, if funding allows, the Department will use the provided monthly price quoted at the time of bidding to negotiate the duration of these devices with the SMARTZONE Contractor.

Method of Measurement

The quantity for the **MOBILIZATION** of the 'SMART' Work Zone System to be paid for will be the 'SMART' Work Zone System required and satisfactorily installed as described in the "Description" Section and shown on the attached drawing for both directions on I-40 as required by this Special Provision. **"Mobilization" includes providing SMARTZONE equipment for both East and Westbound I-40. Once this equipment has initially arrived, any relocation along the project or removal of this equipment from the project will be incidental to the contract unit price for monthly rental.**

If the Department requests the Contractor to remobilize at a later date, that remobilization will be paid for at the contract unit price for "re-mobilization.

The quantity for the **'SMART' Work Zone System** to be paid for will be the 'SMART' Work Zone system required and satisfactorily installed as described in the "System Requirements and Description" Sections and shown on the attached drawing for both directions on I-40 during the life of the project as required by this Special Provision.

The quantity for the **REMOBILIZATION** of the 'SMART' Work Zone system to be paid for will be the 'SMART' Work Zone system required and satisfactorily reinstalled as described in the "System Requirements and Description" Sections and shown on the attached drawing for both directions on I-40 as required by this Special Provision. **"Remobilization" includes providing 'SMART' Work Zone equipment for both East and Westbound I-40. Once this equipment arrives, any relocation along the project (as described previously) or removal of this equipment from the project will be incidental to the contract unit price for monthly rental.**

The quantity for the **'SMART' Work Zone Website** to be paid for will be measured by providing a project dedicated, full-time website as described in the special provision of this contract.

The quantity for the **4 Portable 'SMART' Work ZONE Video Cameras** to be paid for will be the 'SMART' Work Zone video cameras system required and satisfactorily installed on I-40 as described in the "System Options" Section during the life of the project as required by this Special Provision.

Basis of Payment

The quantity for **MOBILIZATION** of the 'SMART' Work Zone System, measured as stated above, will be paid for at the contract unit price lump sum for "MOBILIZATION OF SMART Work Zone System"(Lump Sum)

The quantity for the **'SMART' Work Zone System**, measured as stated above, will be paid for at the contract unit price per month for "SMART Work Zone System" (Month)

The quantity for **REMOBILIZATION** of the "SMART" Work Zone System, measured as stated above, will be paid for at the contract unit price for "REMOBILIZATION OF 'SMART' Work Zone System (Each)

The quantity for the **'SMART' Work Zone Website**, measured as stated above, will be paid for at the contract unit price per day for 'SMART' Work Zone Website (Month)

The quantity for the **4 Portable 'SMART' Work ZONE Video Cameras**, measured as stated above, will be paid for at the contract unit price per month for "4 Portable 'SMART' Work Zone Video Cameras (Month)

Such price and payment will be full compensation for all work covered by this provision including but not limited to furnishing, installing, relocating, operating, maintaining, and removing the system at the discretion of the Department.

Payment will be made under:

Mobilization of 'SMART' Work Zone System Lump Sum

'SMART' Work Zone System Per Month

Remobilization of 'SMART' Work Zone System..... Per Each

'SMART' Work Zone Website.....Per Month

I-4741

OPTIONAL BID ITEM

4 Portable 'SMART' Work Zone Video Cameras Per Month