ORIGINAL TO GENERAL FILES

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

OFFICE OF DESIGN POLICY & SUPPORT
INTERDEPARTMENTAL CORRESPONDENCE

FILE P.I. # 0010782
Clayton, Dekalb, Fulton, & Cobb Counties
GDOT District 7 - Metro Atlanta

OFFICE Design Policy & Support

DATE September 25, 2012

FROM Keith Porey for Brent Story, State Design Policy Engineer

TO SEE DISTRIBUTION

SUBJECT **APPROVED REVISED CONCEPT REPORT**

Attached is the approved Revised Concept Report for the above subject project.

Attachment

DISTRIBUTION:

Bobby Hilliard, Program Control Administrator
Darryl VanMeter, State Innovative Program Delivery Engineer
Glenn Bowman, State Environmental Administrator
Cindy VanDyke, State Transportation Planning Administrator
Kathy Zahul, State Traffic Engineer
Angela Robinson, Financial Management Administrator
Lisa Myers, State Project Review Engineer
Charles "Chuck" Hasty, State Materials Engineer
Jeff Baker, State Utilities Engineer
Michael Henry, Systems & Classification Branch Chief
Ken Thompson, Statewide Location Bureau Chief
Rachel Brown, District Engineer
Scott Lee, District Preconstruction Engineer
Jonathan Walker, District Utilities Engineer
Andrew Hoenig, Project Manager
BOARD MEMBER - 4th Cong. District
BOARD MEMBER - 5th Cong. District
BOARD MEMBER - 6th Cong. District
BOARD MEMBER - 13th Cong. District
FHWA – attn: Rodney Barry, Georgia Division Administrator

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA
REVISED PROJECT CONCEPT REPORT

Project Type:	Operational	P.I. Number:	0010782
GDOT District:	Seven (7)	County:	Clayton, Cobb , DeKalb, Fulton
Federal Route Number:	I-285	State Route Number:	407

P.I.# 0010782 is being split apart from previously-approved Concept for P.I.0010218. Variable Speed Limit Signs will only be installed on the northern section of I-285 from I-20 to I-20. Static signs will be installed on the southern section of I-285 from I-20 to I-20.

Submitted for approval:

Darryl O. Van Metre — 8/21/2012
State Innovative Program Delivery Engineer — DATE

Andrew Hoang — 08/20/2012
GDOT Project Manager — DATE

Recommendation for approval:

GLENN BOWMAN/EKP* — 9/6/2012
State Environmental Administrator — DATE

KATHY ZAHUL/EKP* — 8/23/2012
State Traffic Engineer — DATE

The concept as presented herein and submitted for approval is consistent with that which is included in the Regional Transportation Plan (RTP) and/or the State Transportation Improvement Program (STIP).

Cynthia L Vaughn — 8-24-12
State Transportation Planning Administrator — DATE

* - RECOMMENDATION ON FILE

PLANNING, APPROVED CONCEPT, & BACKGROUND DATA

The purpose of this project is to optimize traffic flow, increase the operational efficiency and reduce congestion, traffic delays, crashes, and vehicle emissions on the freeway corridor by installing Variable Speed Limit Signs (VSLS) on the northern section of I-285 from I-20 to I-20 throughout Cobb, DeKalb and Fulton Counties. Speeds will be adjusted based on traffic conditions to prepare drivers for upcoming traffic conditions thereby reducing congestion and stabilizing the flow of traffic on the freeway. The operation of the VSLS will create a smoother flow of traffic, decrease average travel times, increase throughput, maximize progression along the route, and reduce the potential for traffic crashes created by speed differentials during peak hours. Signs will tie into the existing NaviGAtor system using existing fiber and field switches. Speeds will adjust based on traffic conditions and signs will be monitored from the Transportation Management Center (TMC) using NAV2 active traffic management. Static speed limit signs will be added on the southern section of I-285 from I-20 to I-20 through Clayton, DeKalb and Fulton Counties. VSLS systems have been implemented in other states and countries. Senior Management has determined I-285 shall be a test pilot for VSLS implementation in Georgia.

Description of the approved concept:
In this project Variable Speed Limit Signs will be installed on the inside and outside shoulders of both directions of I-285 throughout Cobb, DeKalb, and Fulton Counties. Signs will tie into the existing NaviGAtor system using existing fiber and field switches, speeds will adjust based on traffic conditions, and the signs will be monitored from the Transportation Management Center using NAV2 active traffic management. Static speed limit signs will be added on the southern portion of I-285 in both directions through Clayton, DeKalb and Fulton Counties. The project length will be 63 miles, with approximately 37 miles of VSLS and approximately 26 miles of static speed limit signs.

PDP Classification: ☐ Major ☒ Minor

Federal Oversight: ☒ Full Oversight ☐ Exempt ☐ State Funded ☐ Other

Projected Traffic as shown in the approved Concept Report: AADT

Open Year (2012): N/A Design Year (20YY): N/A

Updated Traffic: AADT
Open Year (2012): 243,000 Design Year (20YY): N/A

Functional Classification (Mainline): Urban Interstate Prinicipal Arterial

VE Study anticipated: ☒ No ☐ Yes ☐ Completed – Date:

PROPOSED REVISIONS

Approved Features:	Proposed Features:
Project P.I.# 0010218 (Concept Report approved January 2011) included the installation of Variable Speed limit signs (VSLS) on I-285, I-20, I-85 and I-75. I-285 section included installation of Variable Speed limit signs on all 63 miles of I-285.	Project P.I.# 0010782 is required to be split out for installation of Variable Speed limits only on I-285, from I-20 to I-20 (northern section). Static speed limit signs will also be installed on I-285 from I-20 to I-20 (southern section).
Reason(s) for change: The I-285 project is being split from I-20, I-75 and I-85 as a test project for VSLS. Installation of VSLS for other interstates throughout metro Atlanta can be conducting after the I-285 pilot project. Speed analysis was conducted on I-285 to determine that VSLS were most beneficial along the top end, from I-20 to I-20. Speeds on I-285 south of I-20 did not vary throughout the 24-hr study period compared to speeds north of I-20. Thus VSLS are to be installed only north of I-20.	

ENVIRONMENTAL

Air Quality:
Is the project located in a PM 2.5 Non-attainment area? ☐ No ☒ Yes
Is the project located in an Ozone Non-attainment area? ☐ No ☒ Yes
Project is exempt from the conforming plan model as an operational project.

Potential environmental impacts of proposed revision:
No additional impacts are expected with this update to the Concept.

Have proposed revisions been reviewed by environmental staff? ☐ No ☒ Yes

Environmental responsibilities (Studies/Documents/Permits): GDOT has developed a NEPA document; no significant environmental issues are anticipated.

NEPA: No additional impacts are expected with this update to the Concept.
Ecology: It is anticipated that there will be no suitable habitat for foraging or nesting by migratory bird species. It is also anticipated that there will be no significant ecological issues.
Archeology: There are no potential or known archaeological resources present in the survey corridor.
History: There are no potential or known historic resources present in the survey corridor.
Air & Noise: A noise study is not required for this project**.**
Public Involvement: Additional public outreach will not be required due to the revision. However, focus groups and public outreach are being conducted in preparation for the implementation of VSLS.

PROJECT COST & ADDITIONAL INFORMATION

Updated Cost Estimate		Date of Estimate
Base Construction Cost:	$5,386,201	8/20/2012
Engineering and Inspection:	$538,620	8/20/2012
Liquid AC Adjustment:	N/A	N/A
Total Construction Cost:	$5,924,821	
Right-of-Way:	N/A	
Utilities (reimbursable costs):	N/A	
Environmental Mitigation:	N/A	
TOTAL PROJECT COST:	**$5,924,821**	

Recommendation: Recommend that the proposed revision to the concept be approved for implementation.

Comments:

Attachments:

1. Sketch map
2. Concept of Operations
3. Cost Estimate(s)

APPROVALS

Concur: _____
Director of Engineering

Approve: _____ 9/20/12
for Division Administrator, FHWA — Date

Approve: _____ 9/17/2012
Chief Engineer — Date

PROJECT LOCATION

N.T.S.

Georgia Department of Transportation

Concept of Operations for Variable Speed Limit System in Metro Atlanta

Version 1.0

August 2012

Prepared for:

Georgia Department of Transportation
935 East Confederate Avenue, Bldg 24
Atlanta, Georgia 30316

Prepared by:

ATKINS
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1600 RiverEdge Parkway
Suite 600
Atlanta, Georgia 30328

Table of Contents

List of Acronyms and Abbreviations ii
1. Background 1
2. Design 2
3. Enforcement 2
4. Software 3
5. Algorithm 4
6. Testing 5
7. Performance Measurement of System 6

List of Acronyms and Abbreviations

DMS ..... Dynamic Message Sign
GDOT ..... Georgia Department of Transportation
ITS ..... Intelligent Transportation Systems
LED ..... Light-Emitting Diode
TMC ..... Transportation Management Center
VSL ..... Variable Speed Limit

1. Background

Variable speed limit (VSL) systems are a type of intelligent transportation system (ITS) that uses traffic detection data (speed, volume, and occupancy), weather information, and road surface condition technology to determine appropriate speeds at which drivers should be traveling, given current roadway and traffic conditions. Various agencies have used regulatory and advisory VSL systems for congestion mitigation, tunnel truck speeds, and weather conditions in metropolitan areas in the United States and around the world. Michigan implemented the first VSL system in the United States in 1960 to gradually slow traffic approaching backups.

When used to manage heavy traffic volumes, the theory behind these systems is to calculate and display speeds that will achieve the greatest throughput of vehicles. This speed will typically be somewhat below the normally posted (fixed) speed limit during these conditions. Most motorists tend to drive as fast as conditions allow until congestion arises, which can result in abrupt slowdown in speed or even complete stops. This sudden slowdown of vehicles approaching a congested segment causes a breakdown in the flow of traffic, which typically evolves into the routine stop-and-go congestion typical of heavily traveled freeways. VSL systems lower the posted speed limit as traffic density increases in an attempt to decrease the prevailing speed of the vehicles to prevent or delay the breakdown in traffic flow.

In addition to reducing the negative effects of congestion, there are also safety benefits associated with these systems. Abrupt slowdowns in speed, or complete stops caused by congestion or primary incidents, can lead to secondary incidents. The implementation of VSL systems can decrease the frequency and severity of secondary crashes by decreasing the likelihood of fast-moving vehicles suddenly arriving at a slow-moving or stopped queue by reducing the posted speeds in advanced of these slow or stopped traffic conditions.

The Georgia Department of Transportation (GDOT) will be raising the posted speed limit to 65 mph on certain freeways in the metropolitan Atlanta area and will do this as part of the VSL system. GDOT will design this system to reduce speeds during congestion in an effort to increase throughput, decrease travel times, and reduce crash frequency and severity. Other methods already in place are an aggressive incident management program, ramp meters, ITS devices, and “move-over”-type legislation. GDOT will implement the initial VLS system as a pilot project on the northern portion of Interstate 285 (I-285), which loops around Atlanta, between Interstate 20 (I-20) on the east and west side of Atlanta. GDOT may install future systems on all Interstates in the metro Atlanta area.

The system will use VSL signs that leverage the existing ITS fiber optic network for communication to the GDOT transportation management center (TMC) in downtown Atlanta where the NaviGAtor software will be used to control the signs. Algorithms that utilize existing freeway vehicle detection data will automatically calculate the appropriate speed limit for posting on the signs. These calculations will occur at regular intervals and the speed limit signs will be updated as traffic conditions change. Georgia Code 40-6-182 – Establishment of state speed zones – details the use of variable speed limits on Georgia highways; therefore, the posted speed limits on the signs will be regulatory and enforceable.

The remainder of this document explains more fully the VSL system details and its operation.

2. Design

GDOT will use the design-build project delivery method and the Office of Innovative Program Delivery will be responsible for letting the project. A qualified design-build team, with the lowest bid price, will be selected to implement the system.

The VSL system will begin on I-285 north at I-20, both on the west and east sides of Atlanta. The first VSL sign shall be placed 1,500 feet downstream of each entrance ramp from I-20. On the west side, the first sign will be 1,500 feet downstream from the entrance ramp from I-20 west. The system will end on I-285 south at I-20, on the west and east sides of Atlanta. The last sign of the system will be installed following the post-interchange spacing downstream of the D.L. Hollowell Parkway/US 278 and Glenwood Road entrance ramps.

VSL signs will be installed on the right shoulder and median barrier wall of I-285. The signs will be compliant with the Federal Highway Administration's Manual *of Uniform Traffic Control Devices* (MUTCD); they will be regulatory, enforceable signs and appear very similar to standard static speed limit signs to which motorists are accustomed. However, the numeric portion of the sign will be "changeable." The numeric portion of the sign will use light-emitting diode (LED) technology to display white numbers on a black background. The sign and font size will comply with *MUTCD* freeway sign requirements.

VSL signs will generally be placed downstream of every entrance ramp and supplemental signs will be installed in areas with greater congestion and sight distance issues. The signs will be connected to GDOT's TMC via the existing fiber optic network and controlled by the Georgia NaviGAtor II (NAVII) software. All signs should be installed in locations viewable by closed-circuit television cameras to allow TMC personnel to validate speeds. Due to existing infrastructure, each sign should have its own power service.

3. Enforcement

Georgia law case, Wiggins vs. GA, governs how speeding laws are enforced and requires, among other things, a 30-day waiting period before enforcing changes in posted speeds. This was modified by legislation passed in 2010 that allows the use of VSL on Georgia freeways. The agencies permitted to enforce speeds on I-285 are Georgia State Patrol (GSP), DeKalb County, City of Doraville, City of Atlanta, City of Dunwoody, Cobb County, and the City of Sandy Springs. Law enforcement is a key factor in the successful operation of this project. Enforcement will increase compliance, but if over-enforced, the project will fail as drivers may perceive the VSL as deployed for the purpose of generating revenue rather than to improve traffic flow.

Law enforcement agencies are concerned that the implementation of VSL signs could cause potential challenges in speed enforcement with the fluctuation in speeds. GDOT will store posted speed data at

the TMC and will submit monthly reports to law enforcement agencies providing the time, date, and location of posted speeds to aid officers when motorists contest traffic tickets.

GSP may issue tickets for "too fast for conditions" unless drivers are travelling over the maximum speed of 65 mph, which would result in a speeding ticket. Local law enforcement agencies have concerns with ticketing for "too fast for conditions" because it does not result in points on a driver's license and it is the hardest to convict because the officers have to justify the conditions.

The officers other concern is that the VSL signs will not be visible from their unit when parked on I-285; therefore, they may not know the enforceable speed at all times, making it hard to refute public argument. GDOT is willing to work with police officers when determining sign placement to provide better visibility. Displaying updated posted speeds on the NaviGAtor web site is also a possibility; however, this information will not be accessible to motorcycle officers. All posted speed data will be stored at the TMC, and GDOT is willing to provide a report to agencies to aid in enforcement. The report will include the speed posted at any given time of day, duration of posted speed, and will certify the status of the technology.

4. Software

The VSL system software will be embedded into the existing NaviGAtor software (known technically as Delcan's "Intelligent Networks" software). Delcan will add a module to the software specifically for automated sign control and posted speed limit calculations of the VSL system.

The software module will use the existing vehicle detection system data as the source of data used to determine the appropriate speed limit to display. No new detection devices will be required for this project. NaviGAtor currently refreshes its detection device data every 20 seconds. It is not anticipated that this refresh rate will change for the VSL system.

The software module for the VSL system will function as follows:

> Each VSL sign will have a downstream "area of influence," which consists of three vehicle detection stations spaced at one-third of a mile. The current speeds in the area of influence will be the determining factor behind the displayed speed limit on each sign. The current speeds in each area of influence will be averaged over the last three minutes. Since data is received in 20-second intervals, each averaging period will consist of the nine most recent 20-second intervals. Averages will be taken for the traffic in all general purpose lanes (high-occupancy vehicle and high-occupancy toll lanes not included).

The software will have configurable parameters (e.g., speed thresholds to post messages, logic to change posted speeds based on traffic trends [increasing or decreasing speeds], etc.), which will be determined in the development of the VSL module, that will allow system administrators to set up the system initially as well as fine-tune it once it becomes operational. However, on a day-to-day basis, the system will generally run on its own with little operator intervention.

The VSL signs will be controlled by the software and have little to no operator intervention; however, specific GDOT personnel will be able to override the system if needed. Delcan will include a "push to sign" toggle button on the user interface that will be used to override the system and not allow the calculated posted speeds to be pushed to signs while the software will continue to calculate recommended speeds that are displayed within NaviGAtor. If the system is overridden by GDOT personnel, the posted speeds can be user-defined or default to display 65 mph; however, in construction work zones the posted speeds will be determined by the type of work and lane closures during construction activities.

The VSL system will begin on I-285 north at I-20, both on the west and east sides of Atlanta. The first VSL sign shall be placed 1,500 feet downstream of each entrance ramp from I-20. On the west side, the first sign will be 1,500 feet downstream from the entrance ramp from I-20 west. The system will end on I-285 south at I-20, on the west and east sides of Atlanta. The last sign of the system will be installed following the post-interchange spacing downstream of the D.L. Hollowell Parkway/US 278 and Glenwood Road entrance ramps. The VSL sign at the beginning and end of the system shall never display a posted speed of less than 55 mph."

The software will coordinate the use of the existing dynamic message signs (DMS) with the VSL system. During periods of variable speeds, the DMS upstream of VSL signs displaying reduced speeds will display a "REDUCED SPEED AHEAD" message concurrently with travel times or incident messages to provide advance warning for drivers.

The software will have a failsafe measure component that will dictate to the system how to operate in the event of communications or power loss. In the event there is a loss of communication or power between a VSL sign and NaviGAtor, the sign will be blank. If either of these occur in a speed step down (or up) section, the software will push the speeds upstream to the next VSL sign. Also, if the detection data is lost or cannot produce an ample amount of data, the system will revert to displaying a normal free-flow speed limit. The software will have an alert application that will inform TMC personnel of any kind of equipment or software failure.

When posting speeds manually, TMC personal will select from predetermined speeds from a dropdown-type memo (e.g., the software will not allow free text to be posted to the VSL signs).

5. Algorithm

The NaviGAtor VSL software module will run continuously and calculate the appropriate speed limits to display on each sign. The basic premise of the algorithm is that the speed limit will be set near to the prevailing speeds downstream of each sign (the "area of influence," as previously described). The VSL system will have a maximum speed limit of 65 mph and minimum speed of 35 mph. As congestion builds and speeds begin to decrease, the software will detect the change and calculate the appropriate speed to display based on current speed and trends. The speed limit will be stepped down (or up) in 10-mph increments as traffic trends change; however, speeds will remain constant on signs for a minimum of five minutes before being able to be changed.

The possible speed limits to display on the signs are: 65, 55, 45, and 35 mph. The software will round the speeds to the nearest 10 mph increment based on speed trends. For example, if speeds are trending downward and the calculated speed is 50 mph, then the sign will display 45 mph. If speeds are trending upward and the calculated speed is 50 mph, then the sign will display 55 mph. Rounding will occur as follows:

Calculated Average Speed (mph)		Posted Speed Limit (mph)
>	=	
60		65
50	60	55
40	50	45
5	40	35

6. Testing

VSL system testing will be completed in multiple stages. Standalone tests will be completed for the VSL signs and software. A subsystem test will be completed to test the entire VSL system.

The VSL signs will be tested in a factory setting by the contractor with GDOT oversight to ensure the signs conform to GDOT specifications and are fully functional prior to installation. After installation, each sign will be tested locally (i.e. at the base of the sign) to verify functionality in the field. The VSL sign manufacturer's software will be used for both of these stages. Items to be tested include:

- Ability to automatically adjust the sign brightness based on ambient light conditions,
- Working status of all pixels on the sign,
- Accurate display of messages sent to the sign,
- Letter size,
- Colorization of the readouts (white numbers on black background), and
- Conformance to GDOT VSL and ITS specifications.

Software testing will be completed in two stages: simulated and live. Testing with simulated data will ensure the software is pulling and analyzing the existing detector data, calculating the correct speeds to be displayed on the signs, and verifying the overall functionality within NaviGAtor. When the simulation testing is completed and signs have been installed and integrated into NaviGAtor, the live testing of the software will begin. The live testing will ensure the VSL signs in the field change according to the commands/messages being sent by the software.

Before the VSL signs and software can be accepted by GDOT, the system will be required to operate without failure for a minimum of 30 days, also referred to as the 30-day burn. The 30-day burn begins when all of the equipment is installed, functional, and verified by GDOT staff to meet the plans and specifications. The specific 30-day burn details are included in the VSL specification.

7. Performance Measurement of System

GDOT will measure the performance of the VSL system by comparing NaviGAtor data from before implementation and after the acceptance of the project by GDOT. Vehicle throughput (flow rates), speeds, and volumes will be the key variables compared in the before and after study along with accident rates. The data sets for the before and after studies will take into account school being in or out of session and holidays. For example, if the before data set is while school is in session, then the after data set will also be when school is in session. The success of the VSL system will be measured by the increase in vehicle throughput and speeds, and the decreases in travel times and accident rates. The VSL system will be continually fine-tuned to maximize the benefits realized from VSL signs.

P.I.# 0010782 Clayton, Cobb, DeKalb and Fulton Counties 8/20/2012

Variable Speed Limit Cost Estimate

I-285, from I-20 Interchange West of Atlanta to I-20 Interchange East of Atlanta

Item Number	Quantity	Unit	Unit Cost	Item Description	Cost
150-1000	1	LS	$305,800	Traffic Control	$305,800
150-9011	6000	HR	$52	Workzone Law Enforcement	$312,000
610-6515	16	LF	$171.35	Remove Std. Sign	$2,742
615-1200	7225	LF	$9	Directional Bore, 2in, 3in, 4in	$65,025
631-2343	8	EA	$85,000	LED Pixel CMS, Non-Walk-In, 3 x 15, 18 In, Type B	$680,000
636-1029	940	SF	$17.00	Highway sign TP II, TP 3 Sheeting	$15,980
636-2080	1564	LF	$9.00	Galvanied Steel Post, TP 8	$14,076
636-3010	92	EA	$500.00	Ground Mounted Breakaway Sign Support	$46,000
638-1003	8	EA	$60,000	Str Support for Overhead Sign, TP III	$480,000
641-1200	960	LF	$25	Guardrail, Tp W	$23,520
641-5001	8	EA	$650	Guardrail Anchorage, TP 1	$5,200
641-5012	8	EA	$1,800	Guardrail Anchorage, Tp 12	$14,400
647-2141	93	EA	$800	Pull Box, PB-4S	$74,400
647-2170	82	EA	$900	Pull Box, PB-7	$73,800
647-6057	170	EA	$950	Pedestal Pole	$161,500
682-6236	28715	LF	$6	Conduit, Nonmetal, TP 3, 2 IN	$171,429
935-1117	82000	LF	$4	96 Trunk Fiber	$328,000
935-1511	10115	LF	$2	Outside Plant F/O Cable, Drop, SM, 6 Fiber	$20,230
935-3101	93	EA	$450	Fiber Optic Closure, Underground, 6 Fiber	$41,850
935-3602	93	EA	$350	F/O Closure, FDC, Pre-Terminated, TP A, 6 Fiber	$32,550
935-4010	840	EA	$35	Fiber Optic Splice, Fusion	$29,400
939-2305	93	EA	$3,000	Field Switch, Type C	$279,000
939-4040	93	EA	$3,500	Type D Cabinet	$325,500
939-5010	93	EA	$1,600	Electrical Power Service Assembly, Aerial SVC Point	$148,800
939-8000	1	LS	$30,000	Testing	$30,000
939-8500	1	LS	$5,000	Training	$5,000
999-4050	170	EA	$10,000	Variable Speed Limit Sign	$1,700,000
SUB-TOTAL					$5,386,201
Contingency				10%	$538,620
				TOTAL	**$5,924,821**