ITS MASTER PLAN I-10 MOBILE RIVER BRIDGE & BAYWAY BRIDGE

ISSUE DATE:
SEPT.15.2023

VERSION: 0

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a joint venture

VERSION HISTORY

VERSION NUMBER	PURPOSE DESCRIPTIONS	DATE
Version 0	Preliminary Draft	15/SEPT/2023

APPROVALS:

_____ _____

Name Date

Title

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INTRODUCTION

The Kiewit Infrastructure Engineering (KIE) ITS team developed an ITS Master Plan along and in the immediate vicinity of the I-10 Mobile River Bridge (MRB) and Bayway Bridge (BWB) projects. The ITS Master Plan covers I-10 from I-65 to SR-59, US-98/90 from the Bankhead Tunnel to Old Spanish Trail, and I-65 from Airport Blvd to I-10. The intent of this expanded coverage area outside of the MRB/BWB project limits is to identify permanent ITS system upgrades that will support traffic diversion and current traffic conditions, both during construction and after project completion. This ITS Master Plan will provide guidance on the deployment of ITS devices in conjunction with these projects as prescribed in the ITS Technical Provisions. The ITS system design and construction will be performed separately for the MRB and BWB projects. An ITS Master Plan is necessary to ensure that the ITS design efforts for each project are coordinated and function as a system once both projects are constructed.

APPROACH

The ITS Master Plan development approach can be summarized as follows:

- Existing ITS System Inventory
- Existing ITS System Assessment
- Proposed ITS System Objectives & Technologies
- Proposed ITS System Conceptual Layout
- Proposed ITS Infrastructure Special Provisions

In conjunction with these tasks, two workshops were held with KIE ITS team members and ALDOT:

- Workshop 1 – Thursday, June 22, 2023
    - Presented existing ITS inventory and assessment
    - Facilitated high-level discussion of the proposed ITS system requirements
        - Objectives, technologies, and conceptual layout
- Workshop 2 – Wednesday, July 19, 2023
    - Discussed proposed ITS system objectives, infrastructure requirements and technologies
    - Presented draft of proposed ITS system conceptual layout (KMZ format)

EXISTING ITS SYSTEM INVENTORY

The KIE ITS team worked with ALDOT to prepare the inventory of the existing ITS system. The inventory included I-10 from I-65 to SR-181 and US-90/US-98 from Bankhead Tunnel to Old Spanish Trail. Information contained in the inventory included:

- Pan-Tilt-Zoom (PTZ) cameras

- Vehicle detection (Radar Vehicle Detector & Infrared-based Vehicle Detector)
- Dynamic message signs (DMS)
- Congestion/curve ahead warning system
- Fog warning system
- Variable speed limit signs
- Tunnel lane control signals & public addressing (PA) system
- Fiber optic cable
- 5KV power distribution

Inventory information was made available by ALDOT to use as a baseline for incorporating the ITS existing system inventory into the ITS Master Plan effort. InLine imported the ALDOT information into a KMZ file format to assist with confirmation of the existing ITS deployments. The KMZ file was also used as a visual resource during the assessment of the existing system. The ITS inventory data is attached in Appendix A and the locations of existing field devices are provided in Appendix B.

EXISTING ITS SYSTEM ASSESSMENT

Upon completion of the existing ITS system inventory, the KIE ITS team assessed the existing ITS system. The assessment included a high-level determination of the system's functionality and operations. A collection of photos displaying the devices currently in use is presented below and the assessment of the existing ITS system is summarized in Table 1.

Figure 1: ITS Devices Currently in Use (source: Google Streetview)

Table 1: Existing ITS System Assessment

DEVICE	FUNCTION	STATUS	OTHER NOTES
Cameras (PTZ)	Congestion & incident visual monitoring & verification	Functional	ALDOT likes current model of newer devices
Radar-based vehicle detection (RVD)	Congestion/travel time data collection	Not functional	ALDOT is currently using third party probe data and seeking a new RVD system. Single span model is preferred (one RVD to side-fire and get both directions of traffic).
Infrared-based vehicle detection	Volume/class data collection	Functional	Operated by ALDOT Traffic Monitoring Section, they like current “TIRTL” devices
Dynamic message signs (DMS)	Travel time, incident, emergency alert driver notifications	Functional	Older amber DMS, update to full color in project area
Congestion/curve ahead warning system	Advanced warning of congestion/curve ahead	Functional	Congestion ahead signs are manually activated, curve ahead signs are speed detection activated, overhead congestion ahead sign at Duval will not be needed after project (sight distance issue to be corrected in project)
Fog warning system	Visibility sensors, warning signs w/flashers, variable speed limit signs, and dimmable roadway lighting that would warn drivers during heavy fog conditions	Functional	Needs updating - The visibility sensors require frequent cleaning/maintenance to remain functional
Variable speed limit signs	Speed control during heavy fog or adverse driving conditions	Functional	Needs updating
Tunnel lane control signals	Lane usage/control in tunnel	Functional	Dark unless in use for lane control
Tunnel PA system	Communicates audible message inside tunnel	Functional	
Fiber optic cable	Communication between ITS devices & TMC	Functional	Existing fiber covers I-10 from I-65 to SR-59; partially covers US-98/90 at Bankhead tunnel, 1 mile from I-65 to east, and from Spanish Fort Blvd. to Old Spanish Trail; and I-65 from Airport Blvd. to I-10

DEVICE	FUNCTION	STATUS	OTHER NOTES
Traffic signals	Regulate and control the flow of vehicles at intersections	Functional	Existing interchange traffic signals at the I-10/Canal St./Water St. interchange, US-98 west of the Bankhead Tunnel are connected to the City of Mobile traffic signal management system. The signals on US-98 east of the Bankhead Tunnel are connected to the ALDOT traffic signal management system
5KV power distribution	Powering existing ITS devices	Functional	Existing 5KV power distribution on north side of I-10 from Dunlap Dr. to US-98 at Spanish Fork

CONGESTION MONITORING VIA PROBE DATA

ALDOT currently uses probe data provided by third-party sources to monitor traffic congestion and disseminate travel time information to motorists. Probe data refers to information collected from various sources, such as GPS-enabled vehicles, smartphones, and other location-aware devices, that track and transmit traffic conditions and movement patterns. The basic process includes data collection and aggregation, traffic flow analysis, congestion detection, and travel time estimation. ALDOT provides travel information via dynamic message signs, traffic information apps, and communication channels to road users.

PROPOSED ITS SYSTEM OBJECTIVES & TECHNOLOGIES

The KIE ITS team worked with ALDOT to confirm the desired functionality and objectives of the proposed ITS system, and to consider the technologies available to provide the desired functionality and objectives. These objectives included:

- Redundant and expandable communication system
- Congestion monitoring
- Incident management and diversion
- Dissemination of information and alerts
- Display of tolling information and lane control
- Weather monitoring and motorist advisory for low visibility conditions
- Vehicle to infrastructure (V2I) capability and future technology support
- Automated incident detection (AID)
- Wrong way driving prevention (WWDP) system

REDUNDANT AND EXPANDABLE COMMUNICATION SYSTEM

Redundancy and future expansion of the ITS and communication systems will be provided via a new 144 fiber single mode fiber optic loop along US-98/90 from the TMC to the Eastern Shore and along I-10 from the western limit of the project to the Eastern Shore.

Future expansion of the ITS and communication systems is recommended via ITS “nodes” consisting of platforms spaced roughly every 0.5 mile beginning at the western project limit and along the HLAs, main span, and BWB. An example of the node layout is shown in Figure 2. The ITS equipment on each node will vary, but may include devices such as ITS cabinets, battery backup system (BBS) cabinets, lighting control cabinets, and step-down transformers. All the ITS devices will be powered by existing 5KV power from the TMC. Several conduits will be routed from each node to conduits in the median barrier to facilitate future expansion of the ITS system. The conduit to the median will connect to every light pole in the median barrier.

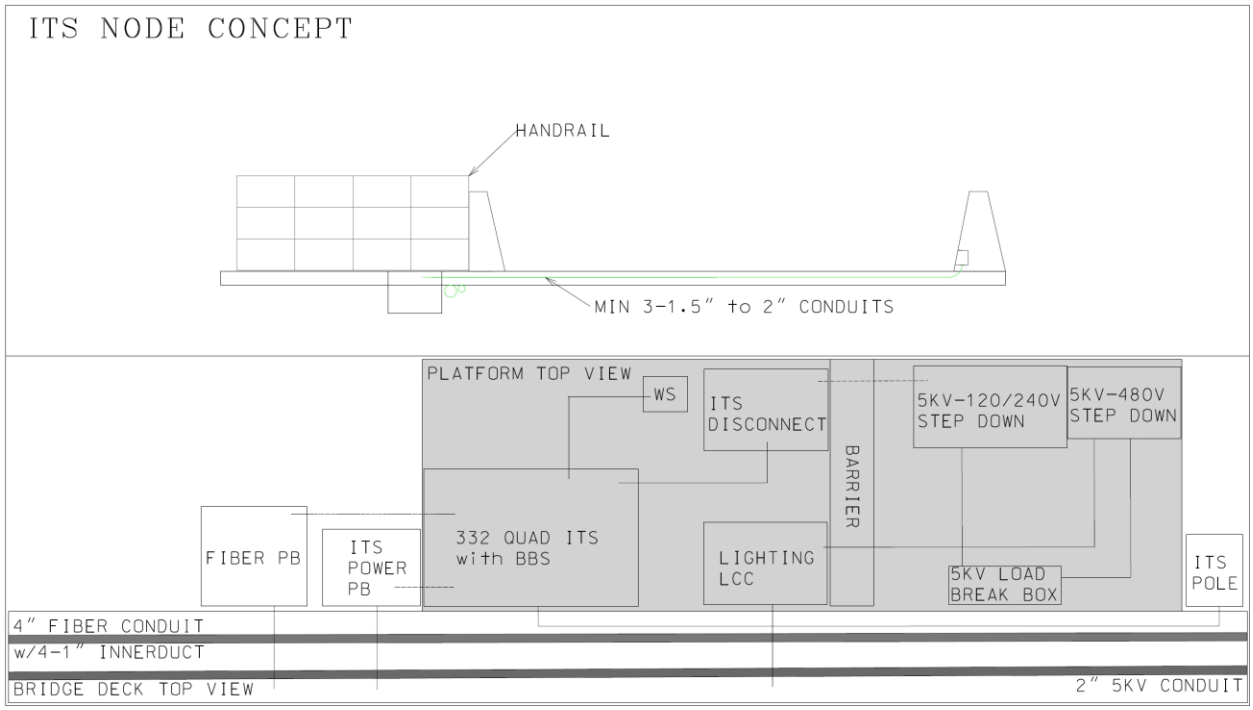

Figure 2: Example of Node Layout

CONGESTION MONITORING

Congestion monitoring will be accomplished using a combination of PTZ cameras and vehicle detection technologies such as radar or LIDAR. These cameras may be mounted on structures in the median barrier or outside of the travel lanes, as providing adequate visual coverage dictates. A combination of vehicle detection devices and probe data is recommended. ALDOT indicates they would prefer to use vehicle detection devices as a primary source of data collection and keep third-party probe data as a supplement.

INCIDENT MANAGEMENT AND DIVERSION

Incident management and diversion will be accomplished using a combination of PTZ cameras, radar, LIDAR, congestion monitoring reporting, dynamic message signs and coordination with the City of Mobile and ALDOT traffic management systems for surface street diversion routes.

DISSEMINATION OF INFORMATION AND ALERTS

Information and alerts (congestion, travel time, incidents, alternate routes) will be disseminated using a combination of DMS, AlgoTraffic alerts, roadside V2I systems, and other emergency alert systems as required and deemed appropriate.

DISPLAY OF TOLLING INFORMATION AND LANE CONTROL

The tolling gantries are planned to be located at the mid-bay interchange of I-10 and US-90/US-98. Tolling information will be displayed via a separate system of DMS signs. Tolling information can be supplemented through use of other DMS signs if needed. Toll rates are not anticipated to dynamically change for congestion or lane management, but the displays should be capable of displaying variable rates if the tolling objectives and/or rate structures are modified in the future. Tolling information shall be closely coordinated with the tolling system designer.

WEATHER MONITORING AND MOTORIST ADVISORY FOR LOW VISIBILITY CONDITIONS

The current fog warning system functionality will be captured via weather stations deployed at various locations throughout the project including HLAs, the main span, and the Bayway span. The weather stations will provide additional weather monitoring capabilities beyond fog monitoring, depending on the technology selected. The fog warning system will include warning signs w/ flashers, variable speed limit signs and light dimming capability.

VEHICLE TO INFRASTRUCTURE (V2I) CAPABILITY AND FUTURE TECHNOLOGY SUPPORT

We recommend initiating provisioning for forthcoming V2I support primarily within the existing design's infrastructure. V2I devices are expected to be installed on median street light poles or on other roadside structures. A determination regarding the chosen technology will be made at a later stage.

AUTOMATED INCIDENT DETECTION (AID) AND WRONG WAY DRIVING PREVENTION (WWDP)

We recommend conducting a Concept of Operations assessment for both AID and WWDP, aimed at establishing the desired functionalities and essential system prerequisites required to achieve those functionalities primarily within the existing design's infrastructure. This assessment should encompass the performance metrics specified in the project's ITS Technical Provisions. The WWDP system coverage should include all exit ramps within the MRB/BWB project limits. For the AID system, its coverage should encompass the high-level approaches (HLAs), main span, and BWB. This AID system should be capable of detecting stopped vehicles, pedestrians, and road debris.

PROPOSED ITS SYSTEM CONCEPTUAL LAYOUT

A master plan conceptual layout of the proposed ITS system has been prepared in KMZ/GIS and CAD electronic formats. The roll plot of the proposed ITS layout is attached in Appendix C. Note that the icon of the existing devices set for replacement are displayed in green, while the devices

that are not being replaced will remain unchanged. The guidelines provided in Table 2 were used to determine approximate ITS device locations.

Table 2: Proposed ITS System

DEVICE	REQUIREMENT	LOCATION GUIDE
Cameras (PTZ)	Full coverage along both directions of travel on I-10, US-90/US-98, and all interchanges within ITS master plan area	Every 0.5 mile along I-10 and US-90/US-98, and more frequent as needed for curve/cross over area, as well as monitoring DMS for verification
Radar/LIDAR vehicle detection (RVD or LVD)	Full coverage along both directions of travel on I-10, US-90/98, and selected interchanges within ITS master plan area with ability to count and classify vehicles, queue detection, and wrong-way driving detection	Generally located every 0.25 miles on I-10; install queue detection on each exit ramp with a signalized cross street
Dynamic message signs (DMS)	Provide DMS in both directions of travel along I-10. Consider placing DMS at key locations outside of the MRB&BWB project limits to be used for providing detour information during heavy congestion and incidents	Place DMS along I-10 approaching to MRB&BWB, half mile prior to interstate exits. Placing DMS along US-90/98 approaching to MRB&BWB, 0.2 mile prior to each intersection. Place roadside DMS at Dauphin Island Pkwy, S Water St, Old Spanish Train, US-31 and SR-181 (See drawing for details)
Congestion/curve ahead warning system	Determined by roadway geometric features	Replace in-kind where original contributing roadway geometric features are not addressed
Fog warning system (consists of signs, weather stations, dimmable roadway lighting)	Covering bridge area on I-10	Fog advisory signs w/ flashers placed on the HLA and BWB; variable message signs placed at 0.5 mile spacing on HLA, main span, and BWB; weather stations placed on each HLA, the main span, and the BWB
Variable speed limit signs	Based on fog zones	Replace, in-kind; consider other areas if fog zones are modified
Tunnel lane control signals	Retain in place	Replace in-kind those signals impacted by MRB improvements; all others remain
Tunnel PA system	Retain in place	Retain in-place
Fiber optic cable	Full coverage along I-10, US-98/90 within ITS master plan area	Place fiber on north side of I-10 from Exit 25 all the way down MRB and BRB to the last DMS (0.5 mile east of AL-59). Place fiber on north side of US-98/90 from TMC to I-10 Exit 35 and connect with I-10 fiber. (See drawing for details)

DEVICE	REQUIREMENT	LOCATION GUIDE
5KV power distribution and backup power (batteries and generator)	Full coverage along I-10, US-98/90 within ITS master plan area. All ITS devices will be powered by 5KV power; batteries turn on when backup power needed until generators kick in	5KV power distribution on north side of I-10 from Exit 25 all the way down MRB and BRB to I-10 Exit 35
WWDP	WWDP system to include multiple detection technologies (fixed camera, thermal camera, radar) and warning signs	Locate on exit ramps based on wrong way driving risk analysis
AID	Automated detection of stopped vehicles, pedestrians, and debris	Location to be determined, but likely on HLA, main span, and BWB

APPENDIX A

Refer to KMZ file "Existing_ITS_I-10 MRB" and Excel file "ITS Field Inventory"

APPENDIX B

Refer to PDF file "ITSMASTERPLAN - Existing"

APPENDIX C

Refer to PDF file "ITSMASTERPLAN - Proposed"