

## MEMORANDUM

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To: Port of Kingston

From: Mike Hendrix, PE, PTOE  
Patty Buchanan, PE

Date: June 17, 2021

Re: ATMS Design for Shoulder Holding Lanes

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## INTRODUCTION

Vehicle traffic heading to the Kingston WSF ferry terminal backs up on State Route 104 (SR 104) through Kingston and often extends further to the west during peak hours. A previous effort identified a parcel which can be converted into a vehicle holding lot to remove these vehicles from the roadway network. The lot can also have an active traffic management system (ATMS) that indicates when drivers are to proceed to the dock along with other information such as holding wait times, in-and-out order, etc. Due to the lack of available funding for the full holding lot, the Partner agencies are pursuing a phased project which would include the widening/improvement of the shoulder of eastbound SR 104 to accommodate holding traffic. This approach is expected to be eligible for PSRC and other funding agency grant opportunities. It is expected that this shoulder will accommodate a single holding lane approximately 750-ft long. The holding lane will be controlled by an ATMS system. This ATMS system development, operation, and recommendation are described in the following sections.

## SYSTEM OVERVIEW

The geometric design provides a single holding lane on the shoulder. The holding lane will be positioned on the south side of SR 104 extending from Lindvog Road NE along the frontage of the property planned to be used for a holding lot in the future. Between the holding lane and the through travel lanes on SR 104, a 5-foot wide bike lane/buffer will be installed to allow people riding bikes to bypass the queue. This bike lane/buffer also provides a location where drivers can exit their vehicles while waiting. No physical barriers are intended to separate moving traffic on SR 104 from the shoulder holding lanes other than the 5-foot buffer. This prevents signal equipment from being placed between the shoulder and through travel lanes. The plan view and cross-sections are shown on the conceptual plans separate from this document.

### Shoulder Holding Lanes Concept of Operations

The proposed operation is described from entering the holding lane from the west.

- Driver is directed to use the shoulder holding lane by new static guide signing at key points in both Kingston and along SR 104.
- The ATMS is continuously monitoring the occupancy within the downtown Kingston holding lanes. A user defined threshold will need to be determined based on operations determined during the design process. This threshold is meant to indicate when vehicles are allowed to leave the holding lane near Lindvog Road NE.

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- A vehicle is detected at the SR 104 and Lindvog Road NE signal via detection at the stop line. If the ATMS has determined that there is room available in downtown Kingston, a call is placed for the holding lane signal phase. If the ATMS system has determined that there is no room, the call is not placed. However, this process will be continuous if there is a vehicle being detected at the stop line at Lindvog Road NE.
- When the holding lane is being discharged, the eastbound approach at the SR 104 and Lindvog Road NE signal will change to green for ferry traffic only; eastbound general purpose traffic on SR 104 will be stopped by a red signal indication. Note that this signal arm will be modified with an additional red-yellow-green signal head and a blank-out symbolic no right turn sign (MUTCD sign code R3-1). The signal indication for the ferry holding lanes will have a supplementary sign reading FERRY SIGNAL and be louvered to prevent traffic on SR 104 from seeing the indication. This is similar to operations at the intersection of SR 525 and S Ferry Dock Road near the Clinton ferry dock.

A graphic of the operation is attached.

### Detection

Detection is critical for proper system operation. There are key points where detection is to be installed. The locations and purpose of the detection are described below:

- Stop line detection and departure detection in the holding lane at Lindvog Road NE. The stop line detection is intended to be used to see if there is a vehicle that is waiting to proceed to the dock. The departure detection (located after the stop line) is meant to count exiting vehicles and respond when the number of vehicles departing meets the available space in downtown Kingston.
- Detection in both ferry holding lanes in downtown Kingston. Detection in the ferry holding lanes in downtown Kingston are meant to indicate if space is available for vehicles traveling from Lindvog Road NE. In addition, this detection system also provides information on how long vehicles are taking to being served. As vehicles fill the holding lanes on the ferry dock, the service rate is expected to slow. Detection will be placed where the dual ferry lanes begin, roughly half way between Iowa Avenue and Ohio Avenue. Follow-up detection are intended to be placed in the holding lanes on both the approach and departure legs of SR 104 at Ohio Avenue and on the approach leg of SR 104 at Washington Boulevard.

Other detection elements include license plate reader (LPR) cameras. The intent of the LPR cameras are to maintain the first-in, first-out order that is currently maintained by tokens issued by the Washington State Patrol (WSP) during peak travel times. For the LPR system to work, two sets of cameras are needed: one to detect when the vehicle has entered the system and one when the vehicle is nearing the toll booth. These locations are described below.

- On the traffic signal pole at Lindvog Road NE. This will detect when the vehicle has left the holding lane and is traveling to the ferry dock.
- On a new pole on the median located between Iowa Avenue and Ohio Avenue in downtown Kingston. There will be two LPR cameras, one for each lane, on the pole. These cameras will check if the license plate detected was read at Lindvog Road NE. If so, there is no additional action. If the license plate was not read at Lindvog Road NE, not read at Iowa Avenue, or not read at either location, then the image of the vehicle is sent to a monitor in the toll booth. The toll booth operator can then view the image of the vehicle and determine if the driver skipped the queue or was just missed by the LPR camera.

Note that the existing ferry holding lanes in downtown Kingston have substantial tree cover. It is expected that this tree cover will remain and will not be disturbed during construction. Therefore, detection will be limited to non-

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video types of detection. Detection types proposed include in-ground loop detection which would be configured similar to loops at metered on-ramps, microradar pucks, or radar-detection units mounted on roadside poles.

In addition to active detection that will feed information to the ATMS, a fixed CCTV camera located at the intersection of Lindvog Road NE and SR 104 is proposed to be installed facing the holding lanes. This will assist WSF staff in evaluating operations at the holding lanes.

### Additional Equipment Requirements

In addition to the vehicle detection and LPR cameras, there will be additional equipment required to ensure that the system is operational. These are described below:

- **System Controller and Cabinet.** A controller and cabinet with detector cards, controller, and communication equipment will need to be located close to the ferry dock. This controller is expected to also have a battery backup system to ensure continuous operation, even during power outages. Further, equipment in this cabinet is expected to process images and license plates for distribution to the ferry toll booths. Communication equipment including antennas or fiber optic cables are to be installed to connect to the ferry toll booths. For estimating purposes, wireless antennas are assumed. During design, this may be changed to fiber optic cables depending on budget.
- **Wireless communication antennas.** The current communication system between traffic signals is a copper wire interconnect. To provide a more enhanced and robust communication network, two-way radio antennas are proposed to connect the system controller at the dock to the controller cabinet at Lindvog Road NE. This will consist of wireless antennas at Lindvog Rd NE, the controller cabinet near the dock, and intermediate hops, as necessary to maintain line-of-sight between antennas. Where possible, existing poles or structures will be used to mount antennas. Note that this is in addition to the wireless antennas described for the system controller.
- **New traffic signal controllers at Lindvog Road NE, Bannister Road, and Washington Street.** New controllers are required at Bannister Road and Washington Street to ensure that the signals can continue to be in coordination. The existing cabinets are expected to remain in place. The new signal controller at Lindvog Road NE is required to handle the additional signal phase for the ferry. Further, this controller cabinet will also have a battery backup system to ensure continuous operation similar to the system controller.

### ASSUMPTIONS

The following assumptions were made for the operation of the system.

1. The ATMS equipment will be on the land-side of the ferry dock. No equipment will be on the dock, other than items such as monitors located in toll booths for license plate/vehicle confirmation as necessary for operation of the system.. Maintenance of the system will need to be determined with a memorandum of understanding (MOU) between the Partner agencies to define maintenance responsibilities.
2. The system will operate continuously. Directional guide signing installed at key decision points will be installed to direct motorists to the holding lane.

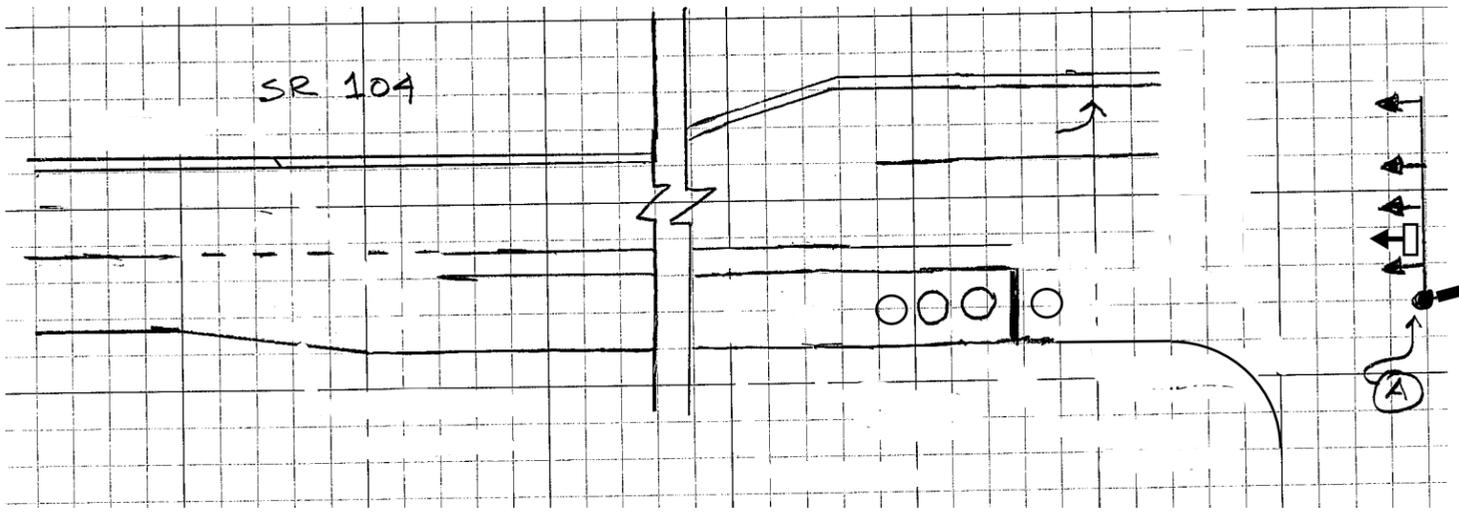
## FUTURE ENHANCEMENTS

The ATMS will operate effectively as described above. However, there are opportunities to enhance the operations and experience for ferry users. These are described below for consideration.

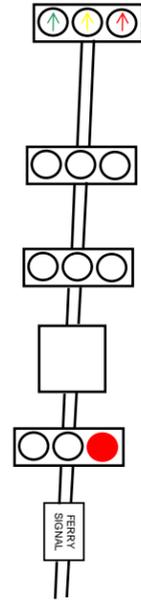
Other items that may be considered for future operations of the holding lots include the following:

- Installation of CCTV cameras for monitoring both the holding lane and to confirm the signal and lane control signs are operating properly.
- Integration of the system to the Olympic Region's Traffic Management Center to allow direct monitoring and communication to the traveling public via variable message signs, social media, or other platforms.
- Integration of the system with existing or future variable message signs when traffic backups are severe. There are limited alternative routes for traffic utilizing the Kingston to Edmonds ferry. One alternative is using SR 307 to connect to SR 305 to connect to the Bainbridge Island to Seattle ferry. However, drivers will need to make this decision before encountering any ferry queue. Automated messages triggered by additional sensors would provide additional enhancements to the system.
- Implementation of travel time information. The system will have some limited capacity to determine the Queue Wait Time between the holding lane and the dock due to the license plate readers. However, this time will be heavily dependent on the ferry schedule and actual real-time status. Potential integration of the LPR cameras with other devices such as Bluetooth readers could provide an accurate time estimate. These times could be conveyed via platforms such as WSDOT websites, social media, and available variable message signs.

# SINGLE HOLDING LANE OPERATION

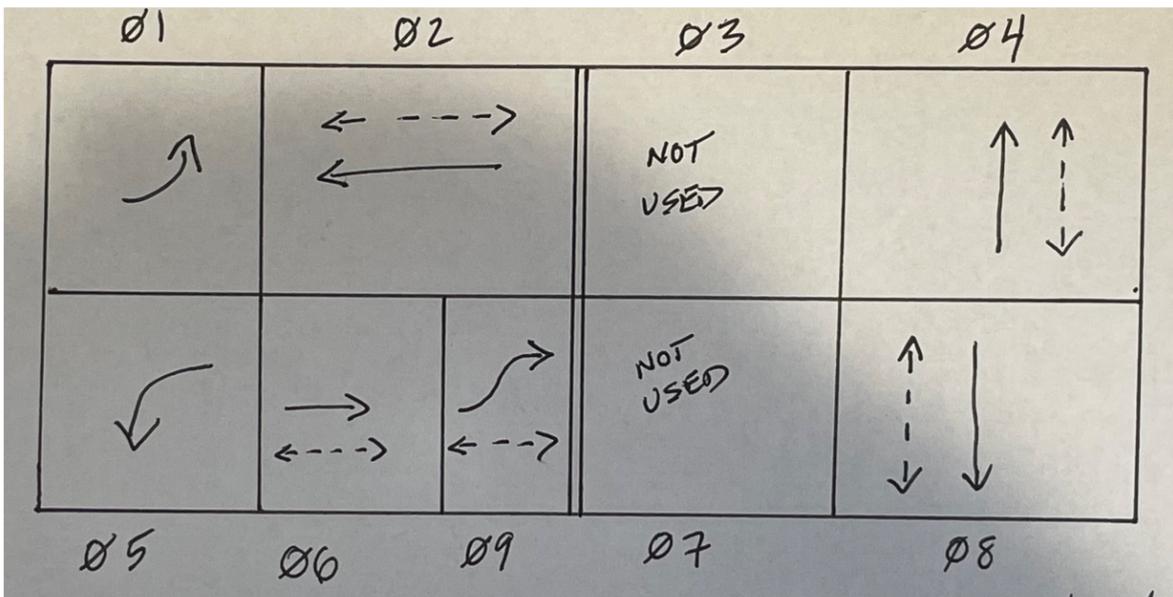


CONDITION 1:  
HOLDING TRAFFIC ON  
SHOULDER



Intersection operations depending on traffic conditions. See phasing diagram.

CONDITION 2:  
TRAFFIC RELEASED TO  
DOWNTOWN KINGSTON



## LEGEND

- License Plate Reader Camera and Pole
- Vehicle Detector (Type TBD)
- Vehicle Signal or Lane Use Signal
- Blank-Out Sign

PROPOSED PHASING DIAGRAM