ITS INNOVATIVE PROJECT
ARTERIAL TRAVEL TIME MONITORING SYSTEM
USING BLUETOOTH TECHNOLOGY

Final Implementation Plan

Submitted to:
Minnesota Department of Transportation
(Mn/DOT)

March 2010
### DOCUMENT VERSION CONTROL

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<th>Submittal Date</th>
<th>Version No.</th>
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ATTACHMENT – SAMPLE VARIANCE FORM FOR ACCEPTANCE TESTING
ARTERIAL BLUETOOTH SYSTEM INTEGRATION

1.1 COMPONENT PROCUREMENT
The following components will be procured prior to installation in the field and system deployment:

- Eight (8) Savari StreetWAVE Bluetooth receivers
- Eight (8) Omni-directional receiver antennas
- Eight (8) 120 v AC to 24 v DC power converters
- Eight (8) NEMA-3 cabinet enclosures to house power converter equipment
- Eight (8) mounting brackets for Bluetooth receivers
- Eight (8) 3G wireless modems (third-party service provider)
- Power cable – for field installation
- Ethernet cable – for field installation

1.2 COMPONENT SYSTEM INSTALLATION
Savari StreetWAVE receivers will be installed with mounting brackets and placed on existing traffic signal pole mast arms at each of the designated six intersections on CSAH 81. In addition, a 24v DC power converter housed in a field-hardened cabinet enclosure will be mounted on the pole to convert existing 120v AC power for use with the StreetWAVE receiver at each location. The Arterial Bluetooth system will be installed over a three-day period at the following locations:

**TABLE 1: CSAH 81 ARTERIAL BLUETOOTH DEPLOYMENT LOCATIONS**

<table>
<thead>
<tr>
<th>Intersection</th>
<th>Number of Devices</th>
<th>Mounting Location</th>
<th>Captured Traffic</th>
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</thead>
<tbody>
<tr>
<td>81/Green Haven Dr.</td>
<td>2</td>
<td>NE and SW corner</td>
<td>NB and SB</td>
</tr>
<tr>
<td>81 / Broadway</td>
<td>1</td>
<td>SW Corner</td>
<td>SB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Perhaps median as an alternative)</td>
<td>NB and SB if located on median</td>
</tr>
<tr>
<td>81 / 63rd St</td>
<td>1</td>
<td>NE corner</td>
<td>NB</td>
</tr>
<tr>
<td>81 / Bass Lake Rd</td>
<td>1</td>
<td>SW corner</td>
<td>SB</td>
</tr>
<tr>
<td>81 / 42nd St</td>
<td>1</td>
<td>NE corner</td>
<td>NB</td>
</tr>
<tr>
<td>81 / 36th St</td>
<td>2</td>
<td>NW and SE corner</td>
<td>NB and SB</td>
</tr>
</tbody>
</table>
1.3 **Bluetooth System Software/Interface Integration and Configuration**

The central software algorithm developed for the Arterial Bluetooth project will match MAC signatures from Bluetooth-enabled devices traveling along CSAH 81 and time stamp each device at the various StreetWAVE locations to calculate travel time for each captured vehicle and each link. This information will be aggregated according to user-defined time periods and will be stored in a central server location with access through the internet using secured user identification and passwords. The information will be graphically displayed in both tabular and Google map-based formats.

This system will be stored on a central server that is hosted and maintained by the consultant team and accessed via the internet by Hennepin County and Mn/DOT staff throughout the deployment period.

For system integration and configuration purposes, consultant staff will spend one or two days in the field during the field installation period logging in to the central server from each location during device configuration and testing activities. Each device and location connection will be configured with appropriate IP addresses in the system and verified by capturing screen shots of each device. This action will indicate communications and system connections as well as the ability to receive data from each of the installed StreetWAVE devices along CSAH 81.
2.0 ARTERIAL BLUETOOTH SYSTEM TESTING PROCEDURES

2.1 VERIFICATION PLAN

The Arterial Bluetooth Verification Plan for system installation will consist of the following steps:

- Visual inspection of each device upon installation on the identified signal mast arm.
- Logging in to the central server to verify the server can receive messages from each StreetWAVE device.
- Confirmation of device power on-visual and via laptop connection to internet to confirm device functionality.
- Confirmation of device 3G modem connection via laptop connection to WiFi network to confirm communications connection (if laptop can browse the internet, connection has been made to 3G network).
- Confirmation of 3G data transfer rates at each location with captured screen shots.
- Verification of GPS coordinates for each installed device will be performed by comparing information obtained by separate map interface application and capturing screen shot information.
- Verification of web interface functionality with installed devices will be performed by going online to the web interface and capturing each device icon from the StreetWAVE Google map application. This should be done from three locations: a) From Hennepin County Public Works Building in Medina, b) From Mn/DOT Water’s Edge Building, and c) From consultant locations (Iteris and Savari offices). This will result in the capture of collected raw data from each installed device location and will be presented in the form of screen shots as demonstrated in Figure 1.
FIGURE 1: ARTERIAL BLUETOOTH PROJECT SAMPLE VERIFICATION SCREEN SHOTS
2.2 REQUIRED RESOURCES FOR IMPLEMENTATION ACTIVITIES

The following resources will be required for the implementation activities associated with the Arterial Bluetooth project along CSAH 81:

- Field equipment to include bucket truck, miscellaneous hardware (to be provided by Hennepin County Public Works staff and consultants)
- Electric/power terminations to installed equipment (to be provided by Hennepin County Public Works staff)
- Laptop for system configuration/confirmation in field (provided by consultant)
- Staff to install, activate, configure and test installed devices and connections (Hennepin County Public Works staff and consultant)

Final field installation dates and coordination will be provided by the consultant team’s project manager and is expected to occur sometime within the last two weeks of April 2010 or the first two weeks of May 2010 depending upon the weather and coordination among project team members.

2.3 ACCEPTANCE TESTING PROCEDURE AND DOCUMENTATION

Acceptance testing will occur once all systems have been installed, configured and deployed. For the purposes of this demonstration project, a one day acceptance test will be performed by the consultants and verified by Mn/DOT and Hennepin County Public Works staff. A check-off sheet will be used to identify all acceptance test procedures performed and provided by the consultant to the field verifier. The acceptance test will conform to identified system requirements for the Arterial Bluetooth project. Any variance from the field requirements and acceptance test will be documented on an approved variance form.

3.0 ARTERIAL BLUETOOTH SYSTEM TESTING PROCEDURES

3.1 IMPLEMENTATION PLAN SCHEDULE

Please see the following page for a project Implementation Plan schedule.
## ITS Innovative Ideas Project -- Arterial Bluetooth Travel Time CSAH 81

### Variance Report Form

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#### Variance Date:

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#### Variance Time:

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#### Equipment Involved:

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#### Variance Class:

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#### Variance System (Circle one and provide more detail below): [ ] DEVICE [ ] POWER [ ] OPERATIONS [ ] COMMUNICATIONS

#### Variance Description:

#### Variance Resolution:

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#### Confirmation:

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