Attachment D

Oregon Department of Transportation

RAMP METERING FIRMWARE

AND

PROGRAMMING SERVICES

FOR THE

ADVANCED TRANSPORTATION CONTROLLER

INTELLIGENT TRANSPORTATION SYSTEMS

OFFICE OF MAINTENANCE AND OPERATION

HIGHWAY DIVISION

2012

1.0 Introduction

The Oregon Department of Transportation is seeking to procure NTCIP compliant ramp metering Firmware designed to run on the Advanced Transportation Controller (ATC) as specified in Section 3.1. ODOT has approximately 150 ramp meters in the Portland area and 4 new ramp meters planned for in Eugene. ODOT intends on upgrading the existing ramp meters in Portland with ATC controllers running ramp metering Firmware from this Contract. Additionally, ODOT intends on using the ATC with this Firmware for the Eugene ramp meter project.

As a part of the Price Agreement resulting from this RFP, ODOT may issue Work Order Contracts with the successful Proposer to provide programming services for the development of additional Firmware for the ATC.

ODOT may be interested in other transportation related firmware that Proposers can offer that can be installed on a Linux platform.

2.0 Ramp Metering Definitions

"Actuated" means the detector zone state, which indicates the presence of a vehicle in the detection zone per NTCIP 1207 v02.06.

"Advanced Warning Sign" means a sign which alerts motorists of ramp meter signal operation per NTCIP 1207 v02.06.

"ATC" means the Advanced Transportation Controller as defined by this Request for Proposal.

"Calculation Interval" means the period of time over which data analysis, data averaging and data processing is performed per NTCIP 1207 v02.06. The length of this period is usually a fraction of 60 seconds – many agencies use 10s, 15s, 20s, or 30s.

"Central Ramp Metering Software" means the ramp metering software that runs on a central server that provides metering rates based on speed, volume, and occupancy conditions for the corridor when the meters are in central system wide corridor mode.

"Central System Wide Corridor Mode" means an operation mode where a central server examines the traffic conditions along the mainline and the amount of queuing on the ramps and automatically adjusts the timing rates of the RMCs to optimize the flow rates of the mainline or ramps, based on user's pre-programmed parameters.

"Demand Detector" means the detector on the upstream side of the metered lane stop bar per NTCIP 1207 v02.06. Detects vehicles demanding a green interval. Used for signal sequencing.

"Detector" means a device used to sense vehicles per NTCIP 1207 v02.06. For example, inductive loop, video image processor, microwave radar. See also sensor.

"Downstream Detection Station" means the Mainline Detector Station typically used to monitor the impacts of metering operations per NTCIP 1207 v02.06.

"Event Table" means a set of events that are scheduled to occur at a given time of day, days of week, months, and/or days of month per NTCIP 1207 v02.06. Each event consists of parameter IDs and values.

"Excessive Queue Detector" means the detector at the entrance to the metered lane per NTCIP 1207 v02.06. Detects the intolerable queue from the ramp meter signal. Used for queue management.

"Firmware" means the ramp metering program developed by the Contractor, resides permanently on the ATC, and operates the metering of vehicles at on-ramps. "Firmware" is also used interchangeably with "Ramp Metering Controller" and "Ramp Meter" in terms of functionality.

"Flow Rate" means the rate at which vehicles pass a detection zone, expressed in vehicles per hour per lane as defined in NTCIP 1207 v02.06.

"Intermediate Queue Detector" means the detector midway between the metered lane stop bar and the entrance to the metered lane per NTCIP 1207 v02.06. Detects the queue forming from the ramp metered signal. Used for queue management.

"Interval" means each part of the signal cycle during which the signal indications do not change per NTCIP 1207 v02.06.

"Lane Average" means an average based on the number of lanes contributing data. Defined in NTCIP 1207 v02.06.

"Local Manual Mode" means the mode of operation where the ramp meter firmware uses pre-determined fixed timing parameters for the rates. The ramp meter does not use vehicle presence detection on the ramp or the freeway corridor.

"Local Software" means the software that resides on a technician or engineer's laptop for monitoring the ramp meter, detectors, and configuring parameters of the ramp meter on-site.

"Local Time of Day Mode" means a metering strategy that uses pre-determined rates for a specific time of day. It does not use detection data of the mainline.

"Local Traffic Responsive Metering" means a strategy that uses metering rates based on freeway conditions near the metered ramp and the queue on the ramp.

"Local Traffic Responsive Mode" means the mode of operation where the ramp meter examines the traffic conditions on the mainline adjacent to the ramp and the queuing on the ramp itself. The Firmware's pre-determined parameters are used to better manage the flow.

"Mainline" means the principle roadway per NTCIP 1207 v02.06. Ramp meters are designed to manage congestion on the mainline.

"Maximum Metering Rate" is defined by NTCIP 1207 v02.06 as the highest metering rate used by the RMC. Three maximums are defined:

1. absolute maximum, which identifies geometric and driver limitations;
2. operational maximum, which identifies mainline capacity and metered lane demand traffic constraints; and
3. system maximum, which identifies inter-agency agreements and policies.

The lowest of these three metering rates will be the upper limit for the metered lane.

"Merge Detector" means the detector placed where the metered lane is absorbed into the mainline lanes per NTCIP 1207 v02.06. Used to detect a queue at the merge point.

“Metered Lane” means a lane on the on-ramp that is equipped with a signal per NTCIP 1207 v02.06.

“Metered Lane Dependency” means the relationship between metered lanes under control of a single ramp meter controller. In multi-lane configurations, metered lanes may operate independently of each other, or the interval of one may depend on the interval of others. Defined per NTCIP 1207 v02.06.

“Metering Plan” means a table of metering rates, and occupancy, speed, and volume thresholds to be used for traffic responsive metering decisions. Defined per NTCIP 1207 v02.06.

“Minimum Metering Rate” means the lowest metering rate used by the RMC as defined by NTCIP 1207 v02.06. Three minimums are defined:

1. absolute minimum, which identifies geometric and driver limitations;
2. operational minimum, which identifies mainline capacity and metered lane demand traffic constraints; and
3. system minimum, which identifies inter-agency agreements and policies.

The highest of these three metering rates will be the lower limit for the meter lane.

“NTCIP” means the National Transportation Communications for ITS Protocol. It is a joint standardization effort of the American Association of State Highway and Transportation Officials (AAHSTO), Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA) with funding from the Federal Highway Administration (FHWA). It is library of standards that define the communication protocols for field devices used in the transportation industry.

“Occupancy” and “Percent Occupancy” means the percentage of time that vehicles are present in a detection zone per NTCIP 1207 v02.06, expressed in 0.1%.

“Passage Detector” means the detector on the downstream side of the metered lane stop bar per NTCIP 1207 v02.06. Detects vehicles passing the ramp meter. Used for signal sequencing and metered lane volume counts.

“Priority Lane” means the designation for special purpose meter lanes usually reserved for vehicles with a minimum number of occupants such as transit vehicles and carpools. The green interval of the priority lane will be interleaved with the green intervals of the other metered lanes in a dependency group per NTCIP 1207 v02.06.

“Queue Override” means the process that adjusts the metering rate based on traffic conditions at the queue detectors to shorten the length of queue, per NTCIP 1207 v02.06.

“Ramp Meter Control” means a system in which the entry of vehicles onto a freeway from an on-ramp is controlled by a traffic signal allowing a fixed number of vehicles to enter from each metered lane of the on-ramp during each cycle per NTCIP 1207 v02.06.

“Ramp Metering” means the use of a traffic signal(s) deployed on a ramp to control the rate at which vehicles enter a freeway facility to smooth the flow of traffic onto the freeway system for efficiency, safety, and environmental purposes.

“Red Violation” means the process that extends the red interval timing for each metered lane in a dependency group upon actuation of the passage detector of the metered lane during its red interval, per NTCIP 1207 v02.06.

"RMC" means Ramp Meter Controller. For this contract, RMC means the ATC with the ramp metering Firmware installed.

"Sample Period" means the duration in time in seconds for the sensor zone where data is being collected, per NTCIP 1209 v2.10.

"Sensor" means a physical device used for sensing traffic, per NTCIP 1209 v02.10. See also detector.

"Short Stop" means the condition which occurs when a vehicle approaching the metered lane signal stops and fails to actuate the demand detector, per NTCIP 1207 v02.06.

"Shutdown Gap" means the gap between vehicles at one queue detector required before the Startup Yellow Interval, per NTCIP 1207 v02.06.

"Station" means a group of mainline lanes in the same direction of travel, used to collect composite traffic data, per NTCIP 1207 v02.06.

"Station Average Flow Rate" means a lane average flow rate based on the flow rate averaged for all working mainline lanes in the station whose lane usage status contains flow rate, per NTCIP 1207 v02.06.

"Station Average Occupancy" means a lane average occupancy based on the occupancy averaged for all working mainline lanes in the station whose lane usage status contains occupancy, per NTCIP 1207 v02.06.

"Station Average Speed" means a vehicle average speed based on the speed averaged for all working mainline lanes in the station whose lane usage status contains flow rate, per NTCIP 1207 v02.06.

"Traffic Responsive Metering" means a strategy using freeway detectors to calculate or select ramp metering rates based on current freeway conditions and the amount of queue on the ramp.

"Trailing Detection Zone" means the detection zone of the downstream detector within a mainline detector station, per NTCIP 1207 v02.06.

"Upstream" means the direction from which vehicles arrive, per NTCIP 1207 v02.06.

"Upstream Detection Station" means the Mainline Detection Station typically used to serve as input into the metering algorithm, per NTCIP 1207 v02.06.

"User" means ODOT.

"Vehicle Average" means an average based on the number of vehicles contributing data, per NTCIP 1207 v02.06.

"Vehicle Count" means the number of vehicles that pass a detection zone, per NTCIP 1207 v02.06. Expressed in vehicles per calculation interval.

"Work Request" means a request by ODOT for Contractor Services, which Contractor accepts. A Work Request will include a payment schedule and a description of the Services. A Work Request

may include a deliverable schedule, a milestone schedule and any other items as agreed by the parties and permitted under this Contract.

3.0 General Requirements

3.0.1 Contractor shall supply ODOT with ramp metering Firmware designed to run on the Agency's ATC.

3.0.2 As part of a Price Agreement issued as a result of this RFP, Contractor shall provide troubleshooting services for issues resulting from the integration of the ATC Firmware, the ATC and ODOT's ramp metering central software. These services shall include working with the ATC manufacturer and ODOT's central software contractor(s). These troubleshooting services must be provided as a part of the cost of the firmware and as a component of the annual maintenance for years 2 through 5 of the Price Agreement. ODOT, in its sole discretion, shall determine Contractor's level of participation in these services.

3.0.3 Contractor shall provide programming services and additional transportation related firmware as required.

3.0.4 Proposers shall state in a section labeled **3.0.4 – Installation of Firmware** how to install their Firmware onto the ATC. Proposers shall state the installation utility necessary, if any.

3.0.5 Proposer shall provide a cost for licensing of the Ramp Metering Firmware on Attachment B – Cost Proposal Worksheet. Licensing may be either Enterprise wide or per Installation. Licensing must be quoted as a one time only price. If Proposer quotes a per license price, that price will be multiplied by 160 for evaluation purposes.

3.1 Agency's ATC Specifications

The Agency's ATC is constructed to the following standards, specifications, and versions:

ITE ATC 5.2b
ITE ATC V6 draft
Caltran's TEES 2009
ATC API V2.06b
ATC API V2.017 draft
Linux kernel version 3.0
BusyBox version 1.18.5
uClibc version 0.9.32
52 MB of Flash Memory
64 MB of DRAM
300 MIPS CPU

Additional specifications are available upon request.

4.0 Standards

The following standards are applicable to defining the protocols and operation of the local ramp metering firmware:

NTCIP 1201 Global Object (GO) Definitions – version 02, v02.32

NTCIP 1207 Object Definitions for Ramp Meter Control (RMC) Units – Version 02, v02.06b

NTCIP 1209 Data Element Definitions for Transportation Sensor Systems, v01.13

NTCIP 2104 Ethernet Subnetwork Profile, v01.11

NTCIP 2202 Internet (TCP/IP and UDP/IP) Transport Profile, v01.15

NTCIP 2301 Simple Transportation Management Framework Application Profile, v01.08

5.0 Ramp Metering Firmware Requirements

5.1 General

5.1.1 ODOT intends to operate its ramp meters primarily in central system wide corridor mode. Each ramp meter controller shall be capable of receiving its instruction to turn On/Off ramp metering and to adjust the metering rates from the central software. There will be times when ODOT elects to operate specific ramp meters in other modes, such as local traffic responsive or Time of Day (Event Table) based on construction projects or special events. ODOT requires the ability to change the mode of operation of each ramp meter controller using its central software.

5.1.2 It is ODOT's intention for the ramp metering Firmware to be compliant to NTCIP 1207. However, ODOT understands that some functionality specified within this RFP may be in conflict with the standard or use different nomenclature. The Intent to Awardee shall provide a project requirements list detailing the RMC NTCIP Conformance Groups supported within their firmware. The RMC NTCIP Conformance Group shall identify the groups, the NTCIP clause, objects, object types, object status, and object ranges that are supported.

5.1.3 **Proposer's Ramp Metering Experience and Longevity (Up to 75 Total Points Possible)**

Proposers shall describe/provide in a section labeled **5.1.3 - Proposer's Ramp Metering Experience and Longevity:**

5.1.3.1 Proposer's entity background and history

5.1.3.2 Proposer's experience with developing and implementing other ramp metering systems. This can include central software as well as local firmware that resides on the controller.

5.1.3.3 Proposer's experience and expertise for developing applications on Linux operating systems.

5.1.3.4 Key staff resumes and any additional documentation showing Proposer's experience with application development.

5.1.4 **Proposer's Understanding of Ramp Metering and ODOT's Needs (Up to 50 Total Points Possible)**

Proposer shall provide, in a section labeled **5.1.4** - **Proposer's Understanding of Ramp Metering and ODOT's Needs,** a detailed description of the ramp metering system, system

architecture diagrams, and any other content necessary in explaining their overall understanding of ODOT's ramp metering Firmware needs. Points will be assigned for the completeness of the response, how well they demonstrate their knowledge of ramp metering, and how well they understand the Agency's needs.

5.1.5 **Proposer's References (Up to 25 Total Points Possible)**

Proposer shall provide, in a section labeled **5.1.5 - Proposer's References,** 3 evaluating reference forms as provided in Attachment E (Contractor Past Performance RFP Reference Check Questionnaire), completed by 3 different public transportation agencies (i.e. state, county, or city **excluding ODOT**) which use Proposer's ramp metering software firmware.

Contractor Past Performance RFP Reference Check Questionnaire:

Double-click icon to open attached file →	 G:\ Bid-ContractFolders\E

The ratings from the three (3) references will be added together to provide a point score from 0 to 25 for each Proposer. If a reference question results in a response of "not applicable", a score of 0 points will be awarded for that response.

It is the Proposer's responsibility to provide each proposed reference the **Contractor Past Performance RFP Reference Check Questionnaire** form and to confirm each proposed reference submits the form to the single point of contact named on page 1 of this RFP. Proposer shall complete the required information on the form and forward it to their reference for completion and submittal to ODOT within the time frame detailed on the form. References received after the deadline will be deemed non- responsive and not included in the scoring. Submittals must be received via e-mail from the reference's e-mail address. No reference forms will be accepted from Proposer's e-mail address.

5.1.6 **Proposer's Involvement with Ramp Metering and ATC API National Standards (Up to 25 Total Points Possible)**

Proposers shall provide, in a section labeled **5.1.6 – Proposer's Involvement with Ramp Metering and ATC API National Standards,** a description of the individuals within the Proposer's business and their involvement with the development of NTCIP 1207 and ATC API Standard.

5.1.7 **Ramp Metering Firmware Delivery Schedule (Up to 50 Total Points Possible)**

Proposers shall provide, in a section labeled **5.1.7 - Ramp Metering Firmware Delivery Schedule,** a timeline schedule in which they can deliver the ramp metering Firmware proposed to ODOT for test purposes and deployment. Proposers shall identify within their schedule when and if they need an ATC from ODOT to complete their testing.

5.1.8 **Ramp Metering Testing Outline (Up to 25 Total Points Possible)**

Proposers shall provide, in a section labeled **5.1.8 – Ramp Metering Testing Outline,** an outline of testing Proposer's firmware on Agency's ATC and Agency's central ramp metering

software. Proposers should include any test equipment required. Points will be assigned based on the completeness of the test outline.

5.1.9 **Proposer's Experience with Other Transportation Systems (Up to 50 Total Points Possible)**

This section is to demonstrate the Proposer's background, experience, and capabilities of developing Firmware in support of other transportation systems. This section will help ODOT determine, as projects and needs arise, if additional firmware will be procured or developed through a Work Order Contract with the selected Contractor. (Section 12.1)

Proposers shall describe in a section labeled **5.1.9 - Proposer's Experience with Other Transportation Systems:**

5.1.9.1 Proposer's experience with development and integration of traffic signal software, if any. This can include both local firmware running on a traffic controller and the central software systems. Proposers shall state if they have traffic signal firmware, the operating system it resides on currently, and what modifications, if any, would be required to run on the Agency's ATC/Linux platform. Proposers shall provide product literature of their traffic signal firmware if available.

5.1.9.2 Proposer's experience with NTCIP traffic signal standards (Actuated Signal Control "ASC", Signal System Masters "SSM", Signal Control and Prioritization "SCP").

5.1.9.3 Proposer's experience with Caltran's AB 3418 traffic signal protocol.

5.1.9.4 Proposer's experience with developing firmware in support of other transportation specific projects. Proposers should state the project scope and the hardware and software involved.

5.1.9.5 Proposer's experience with parking management software. Proposers shall state if they have parking management firmware, the operating system it resides on currently, and what modifications, if any, would be required to run on the Agency's ATC/Linux platform. Proposers shall provide product literature of their parking management firmware if available.

5.1.9.6 Proposer's experience with development and integration of Road and Weather Information Stations (RWIS) and the NTCIP (Environmental Sensor Station) standard.

5.2 Ramp Metering Operational Requirements

Note: Proposers must provide all desired functionality requirements at proposed time of delivery as detailed in this Attachment D, Section 5.1.7 - Ramp Metering Firmware Delivery Schedule at the cost proposed in Attachment B - Cost Proposal Worksheet.

5.2.1 Users shall be able to configure the traffic condition thresholds in plans.

5.2.2 Users shall be able to configure the ramp metering rate based on the time of day.

5.2.3 Ramp meter Firmware shall support metering with the following lane configurations:

- Each lane served consecutively

- One lane served after any other lane is served
- One lane can operate independently with a different rate than other lanes, effectively operating as two independent ramp meters
- For multiple lanes, green indications shall alternate between lanes
- For multiple lanes, green indications shall be simultaneous on all lanes
- For multiple lanes (split ramp), Firmware shall have configuration option to automatically adjust the ratio of green indicators for each lane proportional to the percentage of demand from each lane
- Have the ability to allow concurrent green indication for priority lane (priority gets 1 green for every 1 green from all other lanes)

5.2.4 Firmware shall support flow rates of 200 to 1,800 vehicles per hour per lane.

5.2.5 **(Desirable 15 Points)** – 15 desirable points shall be awarded for Firmware that supports red time extension using passage detectors. When cars are detected going thru the ramp meter during "red" signal, the RMC automatically extends the red time to extend the gap. Proposers shall, in a section labeled **5.2.5 - Red Time Extension Using Passage Detectors,** identify in their Proposal if their Firmware meets this requirement or not and describe how specifically.

5.2.6 **(Desirable 15 Points)** – 15 desirable points will be awarded for Firmware that supports green time extension using passage loops. This feature extends the green time of the signal when the passage detector is active during a "green" signal. The Firmware shall support a user settable value of 0 to 10 seconds. Proposers shall, in a section labeled **5.2.6 - Green Time Extension Using Passage Loops,** identify in their Proposal if their Firmware meets this requirement or not and describe how specifically.

5.2.7 The Firmware shall support a user selectable minimum red time.

5.2.8 Upon communications failure, the ramp meter shall be capable of automatically switching to another pre-programmed mode such as local traffic responsive. This functionality shall be user configurable.

5.2.9 Traffic responsive metering rates shall be automatically adjusted based on local mainline conditions (speed, volume, occupancy), threshold settings by the user, time of day, and day of the week.

5.2.10 Metering rates shall be implemented by varying red time between constant green indications.

5.2.11 The ramp meter shall be able to provide ramp metering data and status to the central software upon poll in at least 20 second intervals.

5.2.12 The calculation interval for local traffic responsive mode shall be 20 seconds by default. The user shall be able to select the calculation interval in 20 second intervals through the front panel interface and through the central/local software. The maximum calculation time of 255 seconds per NTCIP 1207 shall be supported.

5.2.13 Ramp metering Firmware shall support IP addressing. The Firmware shall use TCP/IP for network connectivity.

5.2.14 The Firmware shall support a minimum of 9 plans.

5.2.15 **(Desirable 30 Points)** – Up to 30 desirable points shall be awarded for Firmware that supports 20 plans or more. Proposers shall, in a section labeled **5.2.15 - 20 Plans or More,** identify within their Proposal how many individual plans (events) their Firmware supports.

5.2.16 **(Desirable 30 Points)** – 30 desirable points shall be awarded for ramp meter controllers that are capable of being interconnected, using local area networking, such that they operate in coordination with upstream and downstream ramp meters in times when the central server or wide area network circuit is down. This is a form of communication mode where the ramp meter controllers are coordinating their metering rates without the use of the central software. Ideally, this mode would be between Central System Wide Corridor Mode and local traffic responsive mode in terms of priority. Proposers shall provide, in a section labeled **5.2.16 – LAN Connection of RMC,** a detailed narrative how their system operates in order to receive points. ODOT will award points based on the completeness of the Proposer to demonstrate how they will meet this requirement.

5.2.17 **(Desirable 30 Points)** – Up to 30 desirable points shall be awarded for Firmware that supports traffic sensor station data over a local area network for times when the wide area network is down. If ODOT has a detector station a few miles upstream or downstream of the ramp meter, it would be beneficial to ODOT that the ramp meter controller would query the traffic conditions and use this data for improving the metering rates while it is in local traffic responsive mode. ODOT's traffic sensor stations are Wavetronix HD-125 sensors connected to a UDP/IP network. The protocol is Wavetronix's native protocol.

Proposers shall provide, in a section labeled **5.1.17 - Traffic Sensor Station Data Over a Local Area Network,** a detailed description of how their Firmware meets this requirement in order to receive points.

5.2.18 **(Desirable 10 Points)** – Up to 10 desirable points shall be awarded for Firmware that, during communication outages, stores traffic data (speed, volume, occupancy per lane) and detector status logs until communications are restored and the central software polls the data. In order to receive points, the Proposal needs to support a minimum of 24 hours of data. The log shall be rolling, meaning that when 24 hours of data has been recorded, the RMC will continue to overwrite the stored data with the latest values. Proposers shall provide, in a section labeled **5.2.18 - Firmware to Store Traffic Data (speed, volume, occupancy per lane) and Detector Status Logs,** a detailed description of how their system performs this function in order to receive points.

5.2.19 The Firmware shall operate signals, ramp advanced warning signs, entrance ramp detection, and mainline detection.

5.2.20 **(Desirable 15 Points)** – Up to 15 desirable points shall be awarded to Firmware where the user is able to reassign Inputs and Outputs within the Firmware using the local interface. This is convenient to ODOT as it allows configuration of the Inputs and Outputs within the controller as opposed to having to re-wire the cabinet in certain situations. Proposers shall provide, in a section labeled **5.2.20 - Reassign Inputs and Outputs within the Firmware Using the local interface,** a detailed description of how their Firmware meets this requirement in order to receive points.

5.2.21 The Firmware shall support Manual, Communications, Time Base Control, and Default metering command sources as defined by NTCIP 1207. ODOT requires the operation of the followings modes within these defined command sources.

a. Local manual (Manual)

b. Central manual (Communications)
c. Local holiday/event (fixed timing – Time Based Control)
d. Central system wide corridor (Communications)
e. Local traffic responsive (Default)
f. Local time of day (fixed timing – Time Based Control)

5.2.22 Traffic responsive plans shall include:

- Minimum and maximum metering rates
- Ramp meter On and Off thresholds
- Time of Day
- Day of Week
- Mainline traffic condition thresholds

5.2.23 Traffic responsive metering rates shall be automatically adjusted based on local mainline traffic conditions, local threshold values, time of day, and day of week.

5.2.24 The metering rates shall vary the red time between constant green time.

5.2.25 **(Desirable 15 Points)** – Up to 15 desirable points shall be awarded for Firmware that can monitor for suspect detection data and not act upon it. Suspect data includes:

- Over count demand (> 3,000 vphpl)
- Unrealistic occupancy (> 95%)
- Unreasonable average speed (> 100 mph or < 5 mph)
- Conflicting data (speed without volume)

Proposers shall provide, in a section labeled **5.2.25 - Firmware to monitor for suspect detection data**, a detailed description of how their Firmware meets this requirement in order to receive points.

5.3 Front Panel Requirements

5.3.1 **(Desirable 25 Points Possible) - Front Panel User Interface**
Up to 25 desirable points shall be awarded to Proposers providing, in a section labeled **5.3.1 - Front Panel User Interface,** a detailed description of their Firmware's front panel interface and menu structure. Points will be provided to Proposers based on the completeness of their response and the ease of use by the user.

5.3.2 Users shall be able to configure and manage the ramp meter from the controller's front panel.

5.3.3 The Firmware shall implement passwords for security purposes. Passwords shall support a minimum of 8 characters. After 5 minutes of no activity by the User, the controller shall lock out access and require the password for logging back in. ODOT shall be able to manage and administrate passwords. Contractor backdoors or default passwords are not allowed.

5.3.4 The following version information shall be user accessible from the controller's front panel:

- Hardware version number
- Operating system version number
- Ramp meter application version number

5.3.5 Users shall be able to use the controller's front panel for configuring the communication settings. This includes network and serial communications settings.

5.3.6 Detector diagnostics and traffic data logs shall be accessible at the controller's front panel. The user shall be able to view a rolling log of local mainline lane speeds, volumes, percent occupancies, and detector status for each detector within the last 24 hours.

5.3.7 Users shall be able to trigger metering start-up cycle from the controller's front panel for inspection and diagnostic purposes.

5.4 Start Up Requirements

Start-up sequence of a ramp meter shall be:

1. Flashing yellow (default 10 seconds)
2. Solid yellow (default 4 seconds)
3. All red
4. Green/red metering (no yellow during metering)

5.5 Detection Requirements

5.5.1 The Firmware shall support the use of induction loops and microwave radar detectors for both the mainline and ramp monitoring. The Firmware shall support detection contact closures from the cabinet's input file, regardless if it is from inductive loop amplifiers or the Wavetronix SmartSensor HD. In addition, the ramp meter Firmware shall support the Wavetronix SmartSensor HD data coming in from the RS-485 port of the ATC. The RMC Firmware shall convert the Wavetronix native data coming into the ATC to NTCIP 1207 objects or NTCIP 1209 objects.

5.5.2 The Firmware shall be capable for detecting 6 (minimum) freeway lanes. The Firmware shall be capable of reading the speed, volume, and occupancy for each individual lane.

5.5.3 The Firmware shall be capable of monitoring 4 lanes (minimum) of excessive queue detectors, 4 lanes (minimum) of intermediate queue detectors, 4 lanes (minimum) of demand detectors, and 4 lanes (minimum) of passage detectors.

5.5.4 The Firmware shall identify lanes in a right to left fashion. For example, ramp lanes 1 thru 4 and freeway lanes 1 thru 6, where 1 being the right-most lane.

5.5.5 The Firmware shall automatically set the demand detector into recall mode if detection doesn't occur within a user configurable time threshold of 1 to 10 minutes.

5.5.6 The Firmware shall automatically turn Off the demand detector recall once vehicles are detected.

5.5.7 Users shall be able to manually set demand detectors On/Off into recall mode.

5.5.8 When inductive loops are used for mainline detection, the Firmware shall allow the user to select or set the loop spacing interval and length. Leading detection zone lengths of 3 to 10 feet shall be supported. Trailing detection zone lengths of 3 to 10 feet shall also be supported. Speed trap spacing lengths of 15 to 30 feet shall be supported.

5.5.9 The Firmware shall support user configurable sampling rates of 10 to 255 seconds.

5.6 Advanced Warning Signs Requirements

5.6.1 The Firmware shall be capable of turning On/Off "Ramp Signal ON", "Stopped Vehicle Ahead", and "Form Two Lines" ramp signage automatically for ramp metering operation. The Firmware shall use the same controller outputs as ODOT's existing ramp metering Firmware. See Appendix C for ODOT's existing ramp metering wiring diagram.

5.6.2 The Firmware shall allow the user to turn On/Off the signage outputs manually through the front panel of the ATC for test purposes.

5.7 Time of Day (Event Tables) Requirements

5.7.1 The time of day plan shall include the following:

- Metering rates configurable by every 30 minutes
- Ramp meter On and Off thresholds
- Time of Day
- Day of Week
- Mainline traffic condition thresholds

5.7.2 The firmware shall have the ability to use calendar scheduling when not running in Central/Communications mode. An example is when communication fails.

5.8 Ramp Metering NTCIP Object Requirements List

Contractor's Firmware shall support the NTCIP objects listed in Appendix B for communicating with ODOT's central ramp metering software at the end of this document. The objects listed are the minimal objects used by ODOT's central software for communicating with the RMC.

6.0 Testing

After the Notice of Intent to Award is issued, ODOT and the Intent to Awardee shall meet to formulate a test plan and schedule for testing the ramp metering Firmware. ODOT and the Intent to Awardee will conduct NTCIP (6.2) and Operational Testing (6.1). ODOT retains the right to request rework or modification of the Ramp Metering Firmware if any issues are discovered during the NTCIP or Operational testing. ODOT retains the right to request rework or modification based on issues discovered with installing or operating the Ramp Metering Firmware on the ATC. All rework or modifications shall be reworked to the satisfaction of ODOT. It is ODOT's sole discretion to decide whether to request rework or modification, or revoke the Notice of Intent to Award based on the outcome of testing.

Testing shall take place in Salem, OR.

6.1 Operational Testing

The Intent to Awardee shall demonstrate to ODOT how their Firmware loaded on an ATC complies with the operational requirements of this specification.

6.2 NTCIP Testing

The Intent to Awardee and ODOT are to use NTCIP testing software, along with the ODOT's central ramp metering software, to test the Ramp Metering Firmware.

7.0 Training

Contractor shall provide an instructor for up to 4 hours of classroom time, in Salem, Oregon, to train up to 30 ODOT staff in the installation, configuration, and operation of the ramp metering firmware. ODOT will provide a classroom. (ODOT facility) The cost for the initial training shall be included in the price of the Firmware. Additional trainings may be requested by ODOT.

Proposer shall provide a price for additional trainings on the Cost Proposal Worksheet. (Attachment B) Additional trainings shall be as described in the initial training.

8.0 Acceptance Period

Upon completion of the Operational (6.1) and NTCIP Testing (6.2), ODOT will use the Ramp Metering Firmware in the operation of actual ramp meters. Within 30 days of such operation, ODOT shall notify Intent to Awardee in writing that either a) the Firmware has passed the Acceptance Period and confirmed the Ramp Metering Firmware meets the specifications set forth in this specification, or b) notify the Intent to Awardee in writing that the Firmware fails to meet the specifications set forth in this specification, detailing how the Firmware fails to meet these specifications. Upon receipt of a written notice specifying a failure, Intent to Awardee shall correct any such failure within five (5) business days from the date of receipt of ODOT's notice or such date as ODOT shall specify in its notice, and shall resubmit the Firmware to ODOT for reevaluation, all at no additional charge to ODOT. Thereafter, if the Firmware fails to conform or perform as required, ODOT may allow Intent to Awardee to continue to correct the Firmware or ODOT may declare a material breach.

Final Acceptance of the Ramp Metering Firmware will occur when, in the Agency's sole determination, the Firmware successfully passes the Acceptance Period.

9.0 Warranty

Contractor shall provide a one year warranty on all Firmware purchased by ODOT that includes, at a minimum, updated releases of Ramp Metering Firmware that addresses fixes, bugs, patches, newer versions of the NTCIP standards, and any additional functionality. Contractor shall provide ODOT with a complete revision history of changes, upgrades, and fixes upon release.

Contractor shall provide technical support by telephone or email for the installation, maintenance, and operation of the Ramp Metering Firmware. Contractor shall provide telephone and email response time that does not exceed 3 business days.

10.0 Annual Firmware Maintenance

Contractor shall provide ODOT the option of purchasing annual maintenance, after the expiration of the warranty period, including, but not limited to, updated releases of Ramp Metering Firmware that addresses fixes, bugs, patches, newer versions of the NTCIP standards, and additional functionality. Contractor shall provide ODOT with a complete revision history of changes, upgrades, and fixes upon release.

Contractor shall provide technical support by telephone or email for the installation, maintenance, and operation of the Ramp Metering Firmware. Contractor shall provide telephone and email response time that does not exceed 3 business days.

Contractor shall include the price for annual maintenance and technical support in the Cost Proposal Worksheet (Attachment B)

11.0 Optional Items

11.1 Data Collection and Monitoring (up to 15 Total Points Possible)

ODOT seeks to obtain additional traffic data from the mainline detectors (inductive loops and Wavetronix radar) that are being used in support of ramp metering. However, this additional data is not part of ramp metering operations. ODOT would use different central software to retrieve this data from the RMC. It is envisioned that this data would still be monitored and stored on the RMC/ATC but be in separate Firmware than used for ramp metering. Proposers shall provide, in a section labeled **11.1 - Data Collection and Monitoring,** a written response detailing what they can provide, and the NTCIP Conformance Group for supporting this data.

Proposer shall detail any additional costs for goods/services described in this section (11.1) on the Cost Proposal Worksheet (Attachment B)

Per lane data:

- Classification counts
- Average headway
- Speed bin counts
- Average gaps
- 85th percentile speed
- Direction counts

Per vehicle data:

- Speed
- Length
- Class
- Lane assignment
- Range

11.2 Local Software

Proposers shall propose local ramp metering software if they offer it. ODOT is interested in local ramp metering software that can be installed on a Windows XP, Windows 7 laptop that allows its engineers and technicians to locally configure and monitor the RMC. Proposers shall provide, in a section labeled **11.2 - Local Software,** detailed information (product screenshots, brochures, specifications, etc.) such that ODOT can determine how interested it is in purchasing this software.

Proposers shall provide costs for goods/services described in this section 11.2 on the Cost Proposal Worksheet (Attachment B)

12.0 Programming Services

As part of a Price Agreement issued as a result of this RFP, ODOT may require Contractor to provide or develop additional Firmware for the ATC in support of other devices or for other Intelligent Transportation Systems projects. Other devices and systems include, but are not limited to:

1. NTCIP Devices
   Environmental Sensor Station (ESS)
   Dynamic Message Sign (DMS)
   Traffic Signal (ASC, SSM, SCP)

2. Other Devices or Systems

a. On/Off control for items like blankout signs or flashing beacons remotely controlled
b. Traffic gates (open and close) remotely and locally controlled
c. Parking management system (in and out counter)
c. Queue warning systems (contact state changes to drive permanent message activations on a VMS sign based on pre-determined traffic congestion conditions)
d. Overlength warning systems (state change from inductive loops or Wavetronix radar unit to drive permanent message activations on a VMS sign based on pre-determined vehicle length data)
e. AB 3418 Caltran's Traffic Signal Protocol

12.1 Written Work Requests

If additional Programming Services are required, ODOT may request Contractor to provide such Programming Services under a Price Agreement issued as a result of this RFP. If so, ODOT will issue a written Work Request describing the Programming Services required. Upon successful negotiations, ODOT will issue Work Order Contracts detailing the tasks and associated deliverables and delivery schedule to authorize these services.

12.2 Ordering

Contractor shall provide Deliverables for additional Programming Support at ODOT's request during the Price Agreement term.

Only ODOT's Contract Administrator is authorized to make Work Requests.

Appendix A - Central Software Functional Requirements (For Information Purposes Only)

Overview

ODOT has contracted elsewhere for the development and procurement of the ramp metering central software. However, ODOT feels the functional requirements of the central software for ramp metering is beneficial to Proposers in developing their Proposals for the ramp metering firmware.

Central Software Requirements

1. Central software shall monitor queuing on the ramps and speed, volume, and occupancy conditions as a minimum on the mainline in real time. The central software shall use the mainline and ramp meter conditions for automatically adjusting ramp metering timing rates.

2. Users shall be able to configure the traffic condition thresholds in plans.

3. User shall be able to configure the ramp metering rate based on time of day.

4. The central shall allow a user to create and download a time of day plan. Time of day plans shall include:

    - Metering rates configurable by every 30 minutes
    - Ramp meter On or Off thresholds
    - Time of day
    - Day of week
    - Mainline traffic condition thresholds

5. Central ramp metering software shall support metering rates of 200 to 1,800 vphpl using:

    - Actuated demand with demand detectors
    - Violation extension using passage detectors
    - Truck extension using passage detectors
    - Minimum red in red rest

6. The central software shall be capable of retrieving the following version information:

    - Hardware version number
    - Operating system version number
    - Ramp meter application version number

7. Central ramp metering software shall support IP addressing and TCP/IP networking.

8. Central software shall perform data validation of traffic data used for determining ramp metering decisions. Example: user defined table of normal data ranges.

9. Central software shall exclude invalid data from ramp metering decisions. Central software shall adapt to missing or poor data.

10. Central software shall exclude data from traffic detectors with high amounts of invalid data from ramp metering decisions.

11. Central software shall automatically turn On and Off metering based on measured traffic conditions and programmed thresholds.

12. Central software shall implement continuity check of traffic data values with user defined thresholds before turning On or Off ramp metering.

13. Central software shall automatically adjust metering rates in each calculation interval based on measured traffic conditions.

14. Central software shall smooth adjustments to metering rates. For example, the system shall change metering rates over several calculation intervals and intermittent changes in traffic conditions.

15. Central software shall support dynamic bottleneck location assignments along corridors. Dynamic bottlenecks means the software determines the current location of bottlenecks along the corridor used to adjust the ramp metering rates. Bottleneck locations can move each calculation interval and may be located at any station along the corridor, including stations without a ramp associated with it.

16. The central software shall determine the metering rate based on a forecast. The user must be able to define the amount of previous data to use and how far into the future to predict.

17. The central software shall operate as a system, based on bottlenecks and propagation of downstream conditions to modify locally generated rates. Propagation of downstream conditions shall be controlled by tunable parameters that define the degree of propagation.

18. Users shall be able to define ramp metering plans.

19. Central software shall support the following ramp meter operating modes:

    g. Local manual
    h. Central manual
    i. Local holiday/event (fixed timing)
    j. Central system wide corridor
    k. Local traffic responsive
    l. Local time of day (fixed timing)

20. Central software shall have variable minimum metering rate tables for each ramp independent of plan schedules. Minimum metering rates shall be in periods of 30 minutes or less, cover 24 hours days, and each day of week.

21. User shall be able to select groups of ramp meters to operate as corridors.

22. Ramp meter corridors shall support a minimum of 60 stations.

23. Users shall be able to select detector stations from another group as input for the system wide corridor plan.

24. The central software's management user interface shall operate on ODOT's standard PC build. It is desirable for the central software to operate on ODOT's standard server build.

25. Central software shall enable administrators to configure user rights and access levels. Such rights shall be:

    - User management (create accounts, delete accounts, change passwords)

- Define user groups
- Access rights management
- Remote access
- System configuration
- Traffic data
- System logs
- Monitor alerts
- Monitor system status
- Monitor system performance
- Change metering values
- Create new ramp meters

26. Users shall be able to add/configure a new ramp meter without resetting or restarting the central software.

27. Users shall be able to add/configure a new traffic sensor without resetting or restarting the central software.

28. Users shall be able to configure groups of ramp meters in the central software.

29. Users shall be able to issue commands to:

    - Individual ramp meter controllers
    - Group of ramp meter controllers
    - All ramp meters in the system

30. Users shall be able to manually command ramp meter controllers to:

    - Turn On and Off ramp metering (by ramp and by corridor)
    - Disable and enable ramp metering (by ramp and by corridor)
    - Switch operating modes (by ramp and by corridor)

31. The central software shall be able to query the ramp meter controllers for:

    - Hardware version number
    - Operating system version number
    - Ramp meter application version number

32. Users shall be able to upload and download all ramp meter controller parameters by:

    - All variables
    - Selected variables
    - Specified ramp meter controllers
    - All controllers in a corridor

33. Users shall be able to view central system logs and make ramp meter timing adjustments.

34. The central software's management user interface shall display current traffic data, detector status, and ramp meter status.

35. The central software's management user interface shall display recent history of traffic data, detector status, and ramp meter status.

36. The central software's management user interface shall display the recent logs by the controller.

37. The central software's management user interface shall display corridor stations with recent relevant traffic and system wide corridor algorithm values.

38. Users shall be able to create reports based on logged data, settable and observable parameters.

39. The central software's management user interface shall display the following ramp meter status:

    - Time of day
    - Metering state (metering and non-metering)
    - Metering rate
    - Metering operating mode
    - Communications status and history
    - Detector status
    - Cabinet door status

40. The central software shall make traffic data available to external data services through a web service interface.

41. Traffic data provided by the central system to external data services shall include at a minimum:

    - Station identifier (unique number or roadway/location/direction)
    - Time and date
    - Average speed per mainline lane
    - Volume per mainline lane and ramp lane
    - Percent occupancy per mainline lane

42. Calculation intervals for traffic data and status data shall be user configurable on a system level:

    - Default 20 seconds
    - Minimum 10 seconds
    - Maximum is 255 seconds

Appendix B – NTCIP Requirements

Standard	OID	Min	Max	Index 1	Index 2	Default	OID Type	Table Size
NTCIP 1201	globalSetIDParameter	0	65535	0	0	0	Integer 2	
	globalMaxModules	1	255	0	0	0	Integer 1	
	moduleNumber	1	255	10	0	0	Integer 1	
	moduleDeviceNode	0	50	10	0	0	Integer 1	
	moduleMake	0	50	10	0	0	Integer 1	
	moduleModel	0	50	10	0	0	Octet	
	moduleVersion	0	50	10	0	0	Octet	
	moduleType	0	255	10	0	0	Integer 1	
	controllerBaseStandards	0	256	0	0	0	Octet	
	dbCreateTransaction	0	255	0	0	0	Integer 1	
	dbVerifyStatus	0	255	0	0	0	Integer 1	
	dbVerifyError	0	255	0	0	0	Octet	
	globalTime	0	4294967295	0	0	0	Counter	
	globalDaylightSaving	0	255	0	0	0	Integer 1	
	maxTimeBaseScheduleEntries	1	65535	0	0	0	Integer 2	
	timeBaseScheduleNumber	1	65535	16	0	0	Integer 2	
	timeBaseScheduleMonth	0	65535	16	0	0	Integer 2	
	timeBaseScheduleDay	0	255	16	0	0	Integer 1	
	timeBaseScheduleDate	0	4294967295	16	0	0	Integer 4	
	timeBaseScheduleDayPlan	0	255	16	0	0	Integer 1	
	maxDayPlans	1	255	0	0	0	Integer 1	
	maxDayPlanEvents	1	255	0	0	0	Integer 1	
	dayPlanNumber	1	255	12	8	0	Integer 1	
	dayPlanEventNumber	1	255	12	8	0	Integer 1	
	dayPlanHour	0	23	12	8	0	Integer 1	
	dayPlanMinute	0	59	12	8	0	Integer 1	
	dayPlanActionNumberOID	0	50	12	8	0	OID	
	dayPlanStatus	0	255	0	0	0	Integer 1	
	timeBaseScheduleTable_status	0	65535	0	0	0	Integer 1	
	globalLocalTimeDifferential	-43200	43200	0	0	0	Integer 4	
	controllerStandardTimeZone	-43200	43200	0	0	0	Integer 4	
	controllerLocalTime	0	4294967295	0	0	0	Counter	
	maxEventLogConfigs	0	65535	0	0	10	Integer 2	
	eventConfigID	1	65535	60	0	0	Integer 2	
	eventConfigClass	1	255	60	0	0	Integer 1	
	eventConfigMode	1	6	60	0	0	Integer 1	
	eventConfigCompareValue	0	65535	60	0	0	Integer 2	
	eventConfigCompareValue2	0	65535	60	0	0	Integer 2	
	eventConfigCompareOID	0	50	60	0	0	OID	
	eventConfigLogOID	0	50	60	0	0	OID	
	eventConfigAction	1	4	60	0	0	Integer 1	
	maxEventLogSize	0	65535	0	0	500	Integer 2	
	eventLogClass	0	255	5	200	0	Integer 1	
	eventLogNumber	1	255	5	200	0	Integer 1	
	eventLogID	0	65535	5	200	0	Integer 2	
	eventLogTime	0	4294967295	5	200	0	Counter	
	eventLogValue	0	25	5	200	0	Opaque	
	maxEventClasses	0	255	0	0	5	Integer 1	
	eventClassNumber	1	255	5	0	0	Integer 1	
	eventClassLimit	0	255	5	0	0	Integer 1	
	eventClassClearTime	0	4294967295	5	0	0	Counter	
	eventClassDescription	0	50	5	0	0	Octet	
	eventClassNumRowsInLog	0	255	5	0	0	Integer 1	
	communityNameAdmin	8	16	0	0	0	Octet	
	communityNamesMax	1	255	0	0	0	Integer 1	
	communityNameIndex	1	255	3	0	0	Integer 1	
	communityNameUser	6	16	3	0	0	Octet	
	communityNameAccessMask	0	4294967295	3	0	0	Gauge	
	auxIOTableNumDigitalPorts	1	255	0	0	0	Integer 1	
	auxIOTableNumAnalogPorts	1	255	0	0	0	Integer 1	
	2auxIOPortType	0	255	3	15	0	Integer 1	
	2auxIOPortNumber	1	255	3	15	0	Integer 1	
	auxIOPortDescription	0	255	3	15	0	Octet	
	auxIOPortResolution	1	32	3	15	0	Integer 1	
	auxIOPortValue	0	4294967295	3	15	0	Integer 4	
	2auxIOPortDirection	0	255	3	15	0	Integer 1	
	auxIOPortLastCommandedState	0	4294967295	3	15	0	Integer 4	
	globalModuleTable							10
	timeBaseScheduleTable							16
	timeBaseDayPlanTable							96
	eventLogConfigTable							60
	eventLogTable							1000
	eventClassTable							5
	communityNameTable							3
	sensorZoneTable							8

Standard	OID	Min	Max	Index 1	Index 2	Default	OID Type
NTCIP 1203	dmsSWReset	0	1	0	0	0	Integer 1
	dmsStatDoorOpen	0	255	0	0	0	Integer 1
	tempMinCtrlCabinet	-128	127	0	0	0	Integer 1
	tempMaxCtrlCabinet	-128	127	0	0	0	Integer 1

Standard	OID	Min	Max	Index 1	Index 2	System-Wide Central Software Default Values	OID Type	Table Size	PRL
NTCIP 1207	rmcMaxNumMeteredLanes	0	255	0	0	3	Integer 1		X
	rmcNumMeteredLanes	0	255	0	0	1	Integer 1		X
	rmcMeterNumber	0	255	2	0	0	Integer 1		X
	rmcCmdSourcePriorityOrder	0	255	2	0	5	Integer 1		X
	rmcMinMeterTime	0	255	2	0	0	Integer 1		X
	rmcMinNonMeterTime	0	255	2	0	0	Integer 1		X
	rmcAbsoluteMinMeterRate	0	65535	2	0	300	Integer 2		X
	rmcAbsoluteMaxMeterRate	0	65535	2	0	1000	Integer 2		X
	rmcSystemMinMeterRate	0	65535	2	0	0	Integer 2		X
	rmcSystemMaxMeterRate	0	65535	2	0	0	Integer 2		X
	rmcStartAlert	0	65535	2	0	40	Integer 2		X
	rmsStartWarning	0	65535	2	0	0	Integer 2		X
	rmcStartGreen	0	65535	2	0	0	Integer 2		X
	rmcStartYellow	0	255	2	0	0	Integer 2		X
	rmcStartRed	0	255	2	0	40	Integer 2		X
	rmcMinRed	0	255	2	0	20	Integer 2		X
	rmcMinGreen	0	255	2	0	20	Integer 2		X
	rmcMaxGreen	0	255	2	0	50	Integer 2		X
	rmcYellow	0	255	2	0	0	Integer 2		X
	rmcShutNormalRate	0	65535	2	0	0	Integer 2		x
	rmcShutWarning	0	255	2	0	0	Integer 1		X
	rmcShutTime	0	65535	2	0	0	Integer 2		X
	rmcPostMeterGreen	0	65535	2	0	0	Integer 2		X
	rmcQueueAdjustUsage	0	255	2	0	0	Integer 1		X
	rmcMeterMode	0	1	2	0	1	Integer 1		X
	rmcCommActionStatus	0	255	2	0	1	Integer 1		X
	rmcCommPlan	0	255	2	0	0	Integer 1		X
	rmcCommRate	0	65535	2	0	0	Integer 2		X
	rmcComVehiclesPerGreen	0	255	2	0	0	Integer 1		X
	rmcDefaultAction	0	255	2	0	3	Integer 1		X
	rmcDefaultPlan	0	255	2	0	0	Integer 1		X
	rmcDefaultRate	0	65535	2	0	900	Integer 2		X
	rmcDefaultVehiclesPerGreen	0	255	2	0	1	Integer 1		X
	rmcDemandMode	0	255	2	0	0	Integer 1		X
	rmcRequestCommandSource	0	255	2	0	0	Integer 1		X
	rmcImplementCommandSource	0	255	2	0	0	Integer 1		X
	rmcImplementAction	0	255	2	0	0	Integer 1		X
	rmcImplementPlan	0	255	2	0	0	Integer 1		X
	rmcImplementRate	0	65535	2	0	0	Integer 2		X
	rmcImplementVehiclesPerGreen	0	255	2	0	0	Integer 1		X
	rmcRequestAction	0	255	2	0	0	Integer 1		X
	rmcRequestPlan	0	255	2	0	0	Integer 1		X
	rmcRequestRate	0	65535	2	0	0	Integer 2		X
	rmcRequestVehiclesPerGreen	0	255	2	0	0	Integer 1		X
	rmcCommAction	0	255	2	0	0	Integer 1		X
	rmcBaseMeterRate	0	65535	2	0	0	Integer 2		X
	rmcActiveMeterRate	0	65535	2	0	0	Integer 2		X
	rmcTBActionStatus	0	255	2	0	0	Integer 1		X
	rmcTBPlanStatus	0	255	2	0	0	Integer 1		X
	rmcTBRateStatus	0	65535	2	0	0	Integer 2		X
	rmcTBVehiclesPerGrnStatus	0	255	2	0	0	Integer 1		X
	rmcActiveInterval	0	255	2	0	0	Integer1		X
	rmcTBCMinMeterRateStatus	0	65535	2	0	0	Integer 2		X
	rmcTBCMaxMeterRateStatus	0	65535	2	0	0	Integer 2		X
	rmcOperMinMeterRateStatus	0	65535	2	0	0	Integer 2		X
	rmcOperMaxMeterRateStatus	0	65535	2	0	0	Integer 2		X
	rmcDemandStatus	0	255	2	0	3	Integer 1		X
	rmcMaxNumQueueEntries	0	255	0	0	0	Integer 1		X
	rmcNumQueueEntries	0	255	0	0	0	Integer 1		X
	rmcQueueNum	1	255	2	2	0	Integer 1		X
	rmcQueueType	0	255	2	2	0	Integer 1		X
	rmcQueueDetectMode	0	255	2	2	0	Integer 1		X
	rmcQueueLengthUpLimit	0	255	2	2	0	Integer 1		X
	rmcQueueLengthLowLimit	0	255	2	2	0	Integer 1		X
	rmcQueueOccUpLimit	0	65535	2	2	0	Integer 2		X
	rmcQueueOccUpDelay	0	255	2	2	0	Integer 1		X
	rmcQueueOccLowLimit	0	65535	2	2	0	Integer 2		X
	rmcQueueOccLowDelay	0	255	2	2	0	Integer 1		X
	rmcQueueQOccUpLimit	0	65535	2	2	0	Integer 2		X
	rmcQueueQOccUpDelay	0	65535	2	2	0	Integer 2		X
	rmcQueueQOccLowLimit	0	65535	2	2	0	Integer 2		X
	rmcQueueQOccLowDelay	0	65535	2	2	0	Integer 2		X
	rmcQueueAdjustMode	0	255	2	2	0	Integer 1		X
	rmcQueueAdjustRate	0	65535	2	2	0	Integer 2		X
	rmcQueueAdjustRateLimit	0	65535	2	2	0	Integer 2		X
	rmcQueueAdjustRateDelay	0	255	2	2	0	Integer 1		X
	rmcQueueAdjustRateIter	0	255	2	2	0	Integer 1		X
	rmcQueueAdjustLevel	0	255	2	2	0	Integer 1		X
	rmcQueueAdjustLevelLimit	0	255	2	2	0	Integer 1		X
	rmcQueueAdjustLevelDelay	0	255	2	2	0	Integer 1		X

Standard	OID	Min	Max	Index 1	Index 2	System-Wide Central Software Default Values	OID Type	Table Size	PRL
NTCIP 1207	rmcQueueAdjustLevelIter	0	255	2	2	0	Integer 1		X
	rmcQueueReplaceRate	0	65535	2	2	0	Integer 2		X
	rmcQueueErraticCount	0	255	2	2	0	Integer 1		X
	rmcQueueMaxPresence	0	65535	2	2	0	Integer 2		X
	rmcQueueNoActivity	0	65535	2	2	0	Integer 2		X
	rmcQueueFlag	0	1	2	2	0	Integer 1		X
	rmcQueueStatus	0	255	2	2	0	Integer 1		X
	rmcMeteringLevel	0	255	2	3	0	Integer 1		X
	rmcMeteringRate	0	65535	2	3	0	Integer 2		X
	rmcOccupancyThreshold	0	65535	2	3	0	Integer 2		X
	rmcMaxNumTBCActions	0	255	0	0	255	Integer 1		X
	rmcNumTBCActions	0	255	0	0	0	Integer 1		X
	rmcActionNum	1	255	5	0	0	Integer 1		X
	rmcActionMode	0	1	5	0	0	Integer 1		X
	rmcMeterActionNum	0	255	5	0	0	Integer 1		x
	rmcMaxNumMeterTBCActions	0	255	0	0	0	Integer 1		X
	rmcNumMeter TBCActions	0	255	0	0	0	Integer 1		x
	rmcMeterActionIndex	1	255	5	2	0	Integer 1		X
	rmcMeterActionMode	0	1	5	2	0	Integer 1		x
	rmcTBActionCtrl	0	255	5	2	0	Integer 1		X
	rmcTBPlanCtrl	0	255	5	2	0	Integer 1		X
	rmcTBRateCtrl	0	65535	5	2	0	Integer 2		X
	rmcTBVehiclePerGrnCtrl	0	255	5	2	0	Integer 1		X
	rmcTBCMinMeterRateCtrl	0	65535	5	2	0	Integer 2		X
	rmcTBCMaxMeterRateCtrl	0	65535	5	2	0	Integer 2		X
	rmcMeterCfgTable							2	X
	rmcMeterCtrlTable							2	
	rmcMeterStatTable							2	X
	rmcMeterQueueCtrlTable							4	X
	rmcQueueStatTable							4	X
	rmcMeteringPlanTable							6	X
	rmcActionTable							5	X
	rmcMeterActionTable							10	x

Standard	OID	Min	Max	Index 1	Index 2	Default	OID Type
NTCIP 1209	maxSensorZones	1	255	0	0	0	Integer 1
	sensorZoneNumber	1	255	8	0	0	Integer 1
	sensorZoneSamplePeriod	0	65535	8	0	300	Integer 2
	endTime	0	4294967295	8	0	0	Counter
	volumeData	0	65535	8	0	0	Integer 2
	percentOccupancy	0	65535	8	0	0	Integer 2
	speedData	0	65535	8	0	0	Integer 2
	zoneStatus	1	10	8	0	0	Integer 1