

The Advanced Transportation Controller (ATC) and applications for ODOT

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ODOT's Need for a Controller

- New Project - Ramp Metering in Eugene.
 - 110 miles away from ramp metering server in Portland
 - Gigabit Ethernet network.
- Ramp Metering System in Portland Needed to be Upgraded
 - 155 ramps all serially connected to central server
 - 170E controllers, Waipiti, SWARM
 - SWARM, part of ATMS, developed in the 90's. Software and server hardware outdated. Difficult to support.
 - Region 1 needed to convert from serial to IP for ITS field equipment.



Traffic Signal Controllers - Background

- NEMA TS₁ and TS₂
 - Functionality based. Fit and form specified only for interoperability
- 170E, 170 ATC, 170E HC11
 - Caltrans and NYDOT in the 1970's.
 - Caltran's TEES 1999, upgrades the CPU
 - Hardware and software specified in detail
- 2070E, 2070L, 2070 ATC
 - Caltran's TEES 2009 and Errata's
 - OS9
- Advanced Transportation Controller (ATC)
 - ITE, NEMA, AASHTO, USDOT
 - 2002 to current
 - Linux



Traffic Controller Community

- 2070E, 2070L, 2070 ATC, and ATC possible controllers for networked ramp metering.
- Reached out to the NEMA community at NTCIP Joint Committee meeting in 2009. Discussed 2070 and ATC pros and cons.
- Brought in several 2070 suppliers that also offer ATC's. Asked the question, "Instead of building to ODOT's (Caltrans) specifications, where are you putting your support and development at? What do you want to supply?"
- Participation in the ITE ATC Working Group.



ITE ATC Standard

- “This standard describes a family of advanced, ruggedized field communications and process controllers that are configurable for a variety of traffic management applications.”
- “The goal of this standard is to provide an open architecture design for the next generation of transportation controller applications.”



Suggested Usage for the ATC in the ITE Standard

- Traffic Signal
- Traffic Surveillance
- Lane Use Signals
- Communications
- Field Masters
- Ramp Meter
- Dynamic Message Signs
- General ITS beacons
- CCTV Cameras
- Highway Rail Intersections
- Speed Monitoring
- Incident Management
- Highway Advisory Radio
- Freeway Lane Control
- High Occupancy Vehicle Systems
- Access Control
- RWIS
- Irrigation Control



Request For Proposals (RFPs)

- ATC
 - Establish a 10 year price agreement contract
 - ITE ATC V 5.2b mandatories, V 6.0 (draft) desirables
 - Other standards (NEMA TS2 and TEES) used when ITE standards silent on subject.
- Ramp Metering Firmware
 - Establish a 10 year price agreement contract
 - Allows the procurement or development of other firmware for the ATC.



ATC Main Components

- Front Panel Assembly
 - I/O Module
 - Host Board
 - Engine Board
 - Chassis
 - Power Supply
 - Communication Module
- Interchangeability with 2070. To upgrade 2070, swap the Engine Board.



ODOT's ATC

- Linux Kernel Version 3.0
- DRAM – 64 MB
- Flash Memory – 52 MB
- Software Development Kit (SDK) and development tools
- No proprietary software. GPL v2
- Application Program Interface (API)
- Documentation including BOM



ODOT's Applications for the ATC

- Ramp Metering
- Traffic Signals
- Queue Warning Systems
- Overlength Detection Systems
- Weather Warning Systems
- Multnomah Falls Parking Management System
- Interstate Gate Systems
- Road and Weather Information Stations
- Drum Sign Control Upgrade– Snow Zones/Chain Restrictions



Ramp Metering Firmware

- Per NTCIP 1207, Ramp Meter Control
- Detection
 - Ramps – inductive loops
 - Mainline – inductive loops or Wavetronix microwave radar
- Traffic Data
 - Ramps – volume data
 - Mainline – Avg speed, volume, occupancy
 - Per NTCIP 1209, Transportation Sensor Systems



Ramp Meter Firmware-Web Interface



- Intersection Display
- Lanes Status
 - Metered Lanes
 - Mainline Lanes
 - Passage Detectors
 - Demand Detectors
 - Dependency Groups
 - Metered Queues
- TSS Data Collection
- Alarm Status
- Channel Status
- Input & Output Status
- Cabinet Status
- Peer Status
- Controller
 - General Config
 - Mainline Lanes
 - TSS Sensor Zones
 - Metered Lanes
 - Metered Lane Control
 - Metering Plans
 - Dependency Groups
 - Demand Detectors
 - Passage Detectors
 - Metered Queues
 - Historical Data Reset

Metered Lanes Status

Lane	1	2	3	4	5	6	7	8
Interval	Red	Red	Initialization	Initialization	Initialization	Initialization	Initialization	Initialization
Active Cmd Source	Manual	Manual	Default	Default	Default	Default	Default	Default
Active Base Meter Rate	300	300	0	0	0	0	0	0
Active Meter Rate	300	300	0	0	0	0	0	0
Active Action	Fixed Rate	Fixed Rate	Dark	Dark	Dark	Dark	Dark	Dark
Set Plan	0	0	0	0	0	0	0	0
Set Fixed Rate	300	300	0	0	0	0	0	0
Set Veh/Grn	1	1	0	0	0	0	0	0
Requested Cmd Source	Manual	Manual	Default	Default	Default	Default	Default	Default
Requested Action	Fixed Rate	Fixed Rate	Dark	Dark	Dark	Dark	Dark	Dark
Requested Plan	0	0	0	0	0	0	0	0
Requested Fixed Rate	300	300	0	0	0	0	0	0
Requested Veh/Grn	1	1	0	0	0	0	0	0
Current Demand	Working	Working	Other Error					
Cycle Count	0	0	0	0	0	0	0	0
Queue Adjust	None	None	None	None	None	None	None	None
Main Queue	False	False	False	False	False	False	False	False

[Next](#)



Ramp Meter Firmware - File Management



- Intersection Display
- Lanes Status
 - Metered Lanes
 - Mainline Lanes
 - Passage Detectors
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Backup Current Database

Database Name

Manage Databases

Factory Databases

332_Default
Default_Blank_Database

User Databases

USB Databases

Checking for USB key...

Upload New Database

No file chosen

Warning:

Selecting a new database as the active database will overwrite and abort any pending changes.

To save your current database enter a name for the database and select 'Backup'



Ramp Meter Firmware - Logging Data

Log Size (Kb) 3

Log Enabled	Enabled ▾
Log History (hours)	1
Delete Log File	NoAction ▾

Apply

CSV log format

- [hourly summary](#)
- [current hourly log](#)

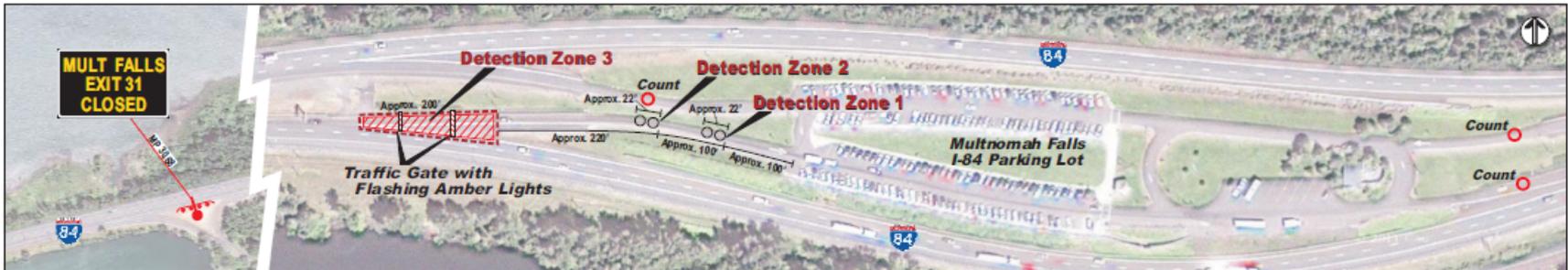
XML log format

- [hourly summary](#)
- [current hourly log](#)



Multnomah Falls Parking Management System

Site Detection Zones



Detection Zone 1 is used to identify initial vehicle queuing along the exit ramp.
 Detection Zone 2 is used to confirm vehicle queuing along the exit ramp and count vehicles entering the parking lot.
 Detection Zone 3 is used to ensure that the gate closure zone is not occupied so that the gates can safely close.
 Count Detectors are used to count vehicles entering and exiting the parking lot.

Criteria for Closing the Gate System

Logical Test Scenario	Test Result										
	A	B	C	D	E	F	G	H	I	J	K
Does parking occupancy exceed minimum threshold?	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Does parking occupancy exceed maximum threshold?	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Is detection zone 1 occupied?	No	Yes	No	No	Yes	No	Yes	No	Yes	No	Yes
Is detection zone 2 occupied?	No	No	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Gate Closure System Response	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Do Nothing	Activate System				

Scenarios A, B, C: typical off-season or off-peak conditions; low volume, low parking occupancy. Queuing on ramp indicates stuck detector or stalled/parked vehicle in one of the ramp detection zones. System will not be activated for any scenario that does not meet the minimum parking occupancy threshold.

Scenarios D, E, F, G: parking occupancy is above minimum threshold, but below maximum threshold. Indicates mid-level volumes and occupancy is nearing the threshold. Queuing on ramps within this threshold indicates vehicles are likely waiting for stalls to open in the south parking lot.

Scenarios H, I, J, K: typical busy season, high volume, high parking occupancy, queuing on the ramp and I-84 is imminent.

Interstate Gate Systems



Gate Controls

[I-84 WB](#) | [I-84 EB](#)

Ramp Gate: Traffic Gate at Union Interchange On-Ramp I-84 MP 265.26 EB [View Log](#)

Last image taken from site:

8/20/2013 9:44:59 AM



Last Poll: 8/20/2013 9:44:05 AM
Gate Status: OPEN
Last Change: 5/12/2013 5:24:06 PM



Queue Warning System

- Current System
 - Traffic Sensors
 - Variable Message Sign
 - Servers, PC's, software, databases
- With ATC
 - ATC could read the traffic data, algorithm, and sign activation locally
 - Not impacted by WAN network outages, database upgrades, server upgrades, IS outages.
 - Connection to the central for data acquisition purposes and message overrides.

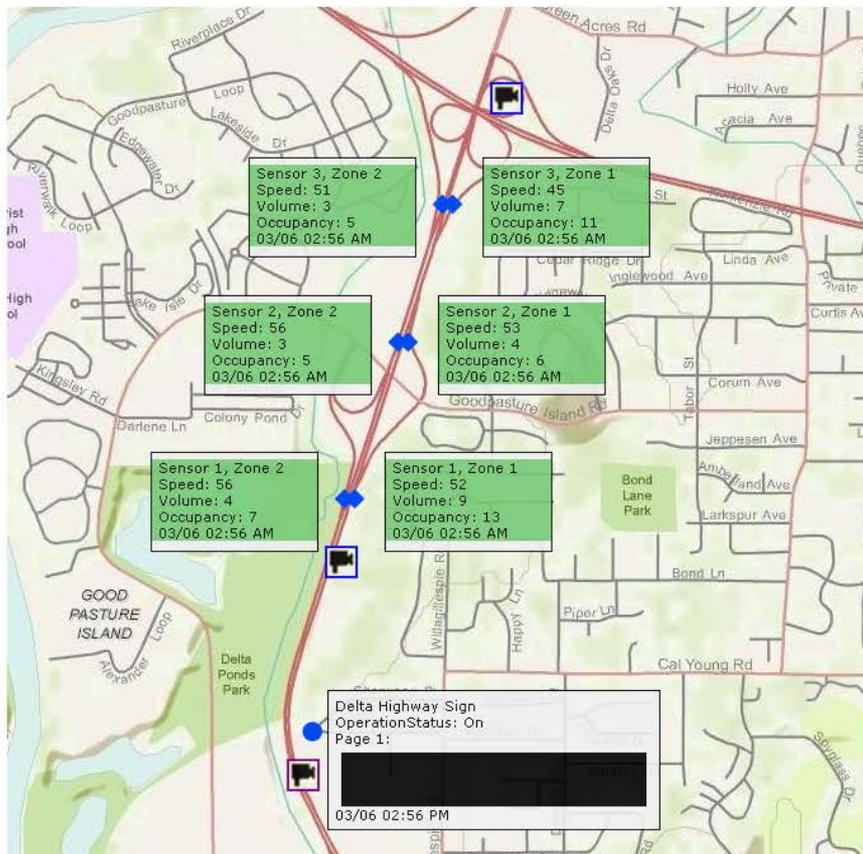


Delta Highway - Queue Warning System

Delta Highway Client

- [Home](#)
- [Devices](#)
- [Congestion Rules](#)
- [Delta Sensor Rules](#)

Delta Highway Overview



System Status

Instance: DeltaHighway.1
 Enabled: True
 Active: True
 Test Mode: False
Instance:
 Not found

Mode

Normal Mode
 Test Mode - disable sign
 [Apply]

History Reports

Legend

- Not congested
- Congested
- Disabled
- Error

Delta Hwy at Eugene - Valley River

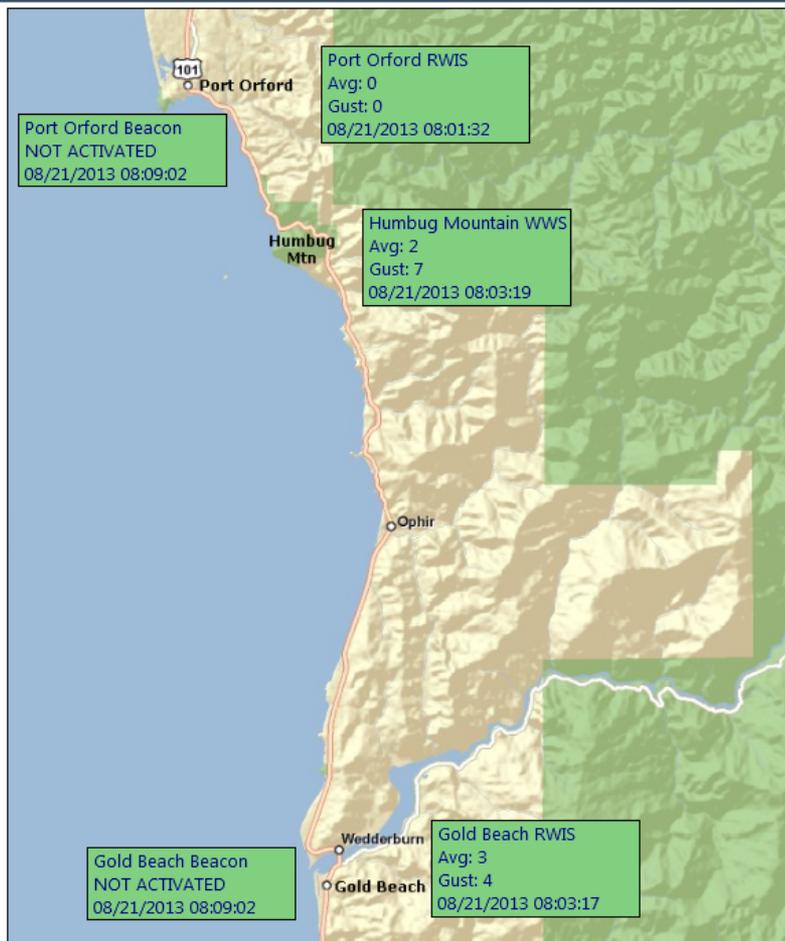
Updated: Aug 20 2013 10:49 AM

ODOT
 Elevation 0 TripCheck.com Milepost 1.00

Weather Warning Systems

PORT ORFORD WIND WARNING SYSTEM

Home Config Logs Help



System Status

- Enabled
- Disabled

Apply

Manual Override

- None
- Activate Beacons
- De-Activate Beacons

Apply

Note:

This screen auto-refreshes every 10 seconds.

Refresh

Legend

Stations	Beacons
Current Normal Wind	Current Deactivated
Current High Wind	Current Activated
Station Unavailable	Beacon Unavailable



Drum Signs – NTCIP Upgrade

Drum Sign Control

Refresh

Location: OR 331 SB @ Pendleton, MP 4.36

	Message	Last Change	By	Last Poll		Status
Drum Sign:	Condition A <input type="button" value="Activate"/>	1/1/0001 12:00:00 AM		2/23/2013 10:25:43 AM	<input type="button" value="Poll Device"/>	<input type="button" value="OK"/>

Current Message



Drum Sign



Summary

- The ATC is the next generation of field controllers for transportation applications.
- Linux OS is a common platform for development.
- OS-9 is problematic, limited on support and by the number of developers.
- API allows multiple programs to run on the ATC at the same time and share resources.
- SDK allows ODOT to develop in-house or contract out the development of other applications.
- Price agreement allows control over the hardware/software and provides a mechanism to solve tomorrow's problems.



Questions?

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