Innovation in Action
Real-Time Insights from Deploying One of the First Connected Vehicle Pilots in the United States
We deliver cutting-edge technology, making our customers more efficient and productive

Market Leader in Connected Vehicle Technologies

Leading Global Industrial Software (PLM)

Manufacturing the most Light Rail systems in the US, made in USA

“World’s Most Efficient” Gas Turbines

Increasing Power Supply with High-Voltage DC transmission to New York City

Modernizing Carnegie Hall with Building Automation
Our long-term success rests on our ability to anticipate and engineer the future.

In 2016, Siemens Invested over $1 Billion in R&D in the U.S. and $5 Billion Worldwide

1914: First Electric Traffic Signal in Cleveland, Ohio
1959: First Introduced Microelectronics to Manufacturing
2002: First Integrated Traffic Management Center, Berlin
2007: Velaro Reaches 217 mph
Today: First Cloud-Based Traffic System
Today: Leading Integration of Software for Design to Manufacturing

“I won’t sell the future for short-term profit”

Werner von Siemens, 1864
Siemens has moved from developing Traffic Management integrated data platforms to full Vehicle Tracking and Interaction Platforms.

ITS Evolution over time:
- **Proprietary Past**: Hardware Focus
- **Today**: Software/Data Focus
- **Digital Future**: Data/Operations Focus

1. Traffic Management (with input from V2I)
2. Autonomous vehicles (Cooperative Intersections)
3. New Traffic Modes and Management

Vehicle Evolution over time:
- <2000
- 2000 – 2010
- 2010 – 2020
- 2020+
Advanced Traffic Management will be based on much higher connectivity and interactions with vehicles, including V2I
Siemens as a leading technology provider for the USDOT Connected Vehicle Pilots in 2015

Measure the Effect of CV Technology on Existing Safety and Mobility Issues

$41 M USDOT JPO Funding for 3 Pilot Sites:

- Central Business District: New York City
- Suburban Pilot Authority (THEA): Tampa Hillsborough Expressway
- Rural Pilot: Wyoming DOT / I-80 Heavy Truck Corridor

http://www.its.dot.gov/pilots/
USDOT Connected Vehicle Project – Tampa, Fl. Currently in implementation

Extensible Future Proof Solutions

CV Operations

- RSU management
- Crash Avoidance safety apps
- Pedestrian Mobility apps
- Agency Data: Travel Time, Incidences
- Future Autonomous Vehicle

Transit Operations

- Authenticate current bus locations
- Bus schedule
- Place/Match virtual transit detectors
Connected Vehicle Applications being Implemented in THEA

- Vehicle Turning in Front of Bus
- Transit Signal Priority
- Ped in Crosswalk Mobile Accessible
- Intelligent Traffic Signal System
- Intersection Movement Assist

- Variable Curve Speed Warning
- Red Light Violation Warning
- Probe-Enabled Traffic Monitoring
- Emergency Elect. Brake Light
- Forward Collision Warning
THEA Focused Pilot Deployment Area in Tampa, Florida

Source: HNTB
Use Case 1 – Morning Peak Hour Queues

Needs

• Reduce congestion/queuing on REL curve exit
• Reduce rear end and lane departure crashes
• Improve traffic movement

Apps

• Curve Speed Warning (CSW)
• Forward Collision Warning (FCW)
• Emergency Electronic Brake Light (EEBL)
• Intelligent Signal System (I-SIG)

Source: HNTB
Solution 1: Freeway Ramp Backups and Crashes—Application: End of Ramp Deceleration Warning
Solution 1: Freeway Ramp Backups and Crashes—Application: End of Ramp Deceleration Warning
Solution 1: Freeway Ramp Backups and Crashes–
Application: End of Ramp Deceleration Warning

Specific Warnings - Telltale Indicators and audio

Bluetooth Battery operated

OBU interfaces: Composite video, drivers for telltales, and blue tooth audio
Solution 1: Freeway Ramp Backups and Crashes–
Applications: Electronic Brake Light Warning
Solution 1: Freeway Ramp Backups and Crashes—Applications: Electronic Brake Light Warning
Solution 2: Wrong Way Warning, Crash Avoidance & Law Enforcement Alert–Application: Wrong-Way Violation Warning

- REL Wrong Way RLVW MAPs, Dwells in RED
- REL Open Lane RLVW MAPs, GREEN Phase

Twiggs at Meridian I-SIG MAPs
Solution 2: Wrong Way Warning, Crash Avoidance & Law Enforcement Alert—Application: Wrong-Way Violation Warning
Solution 2: Wrong Way Violation Warning—Application: Wrong-Way Warning to Violator
Solution 2: Wrong Way Crash Alert –
Application: Wrong-Way Warning to Oncoming Traffic
Solution 2: Wrong Way Law Enforcement Alert –
Application: Wrong-Way Warning to Law Enforcement
Solution 3: Pedestrian Safety: Mobility Assistance – Application: PED-SIG

CV: Mobile / Wearable Device

Select  Call  WALK  Warn  Extend
Solution 4: Transit Conflicts: Driver Alert, Pedestrian Alert – Application: Vehicle Turning Right in Front of Bus

1. Basic Safety Message (BSM) is sent to nearby vehicles and smart phone apps
2. Transit vehicle asks for green light using Signal Request Message (SRM)
3. Transit driver sees Signal Phase and Timing (SPAT) to green signal
4. At startup, Transit drivers see Signal Status Message (SSM), wait for green
5. BSM is sent / received to / from nearby vehicles & smart phone apps at startup
Solution 6: Traffic Progression—
Application: Multi-Modal Intelligent Traffic Signal System

Twiggs at Meridian I-SIG MAPs

REL Wrong Way RLVW MAPs, Dwells in RED

REL Open Lane RLVW MAPs, GREEN Phase
Connected Vehicle Concert –
Agency Data: Volume, Speed, Travel Time Prediction
USDOT-Funded CV Sites

1. Wyoming Rural CV Pilot
2. THEA Suburban CV Pilot
3. New York City Urban CV Pilot
4. Columbus Smart City
5. UMTRI
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Intelligent Traffic Systems
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www.usa.siemens.com/intelligenttraffic
Siemens Mobility serves customers with solutions for cities and agencies to manage multimodal systems and improve the traveler experience.

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Concert transport management</td>
<td>Management systems to create strategies for traffic management and provide</td>
</tr>
<tr>
<td>smartGuard</td>
<td>Web-based traffic control systems – “the largest cloud-based traffic</td>
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<tr>
<td>Connected vehicles</td>
<td>Cooperative systems using vehicles to infrastructure communication to move</td>
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<tr>
<td>Adaptive control with</td>
<td>Real-time adaptive traffic control to learn and optimize traffic without</td>
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<tr>
<td>Intelligent street lighting</td>
<td>Performance contracting and energy efficient street lighting solutions</td>
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<tr>
<td>Rail vehicles, train systems/</td>
<td>Modular, flexible and energy efficient rolling stock and electrification –</td>
</tr>
<tr>
<td>eHighway</td>
<td>System to supply power to electric HGVs with hybrid drives – “knows when</td>
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<tr>
<td>SiMobility Connect platform</td>
<td>Integration of information, route planning, booking and reservation across</td>
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<tr>
<td>Traveler analytics</td>
<td>Dashboards to interpret big data from SiMobility traveler information</td>
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<tr>
<td>Smart parking</td>
<td>Automated and integrated on-street parking space management</td>
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<tr>
<td>Bike and transit signal priority</td>
<td>Software and integration to provide priority on the roadway to bikes and</td>
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<tr>
<td>City tolling, speed enforcement</td>
<td>Dynamic express lane management, enforcement solutions for bus lane and</td>
</tr>
<tr>
<td>Integrated logistics and truck</td>
<td>Truck guidance and parking for ports and logistics hubs</td>
</tr>
<tr>
<td>Remote services &amp; asset</td>
<td>Remote diagnostics and maintenance of rolling stock, equipment and</td>
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Use Case 2 – Wrong Way Entries

Needs

- Warn wrong way driver
- Warn approaching “right way” driver(s)
- Communicate wrong way driver to law enforcement

Apps

- I-SIG
- Red Light Violation Warning (RLVW)
- Intersection Movement Assist (IMA)

Source: HNTB
Use Case 3 – Pedestrian Safety

Needs

- Reduce pedestrian/vehicle collision
- Reduce pedestrian/vehicle near misses

Apps

- I-SIG
- Pedestrian in a Signalized Crosswalk (PED-X)
- Mobile Accessible Pedestrian Signal (PED-SIG)

Source: HNTB
Use Case 4 –
Bus Rapid Transit Signal Priority Optimization, Trip Times and Safety

Needs
Improve bus schedule performance

Apps
• I-SIG
• Intersection Movement Assist (IMA)
• Transit Signal Priority

Source: HNTB
Use Case 5 – TECO Line Streetcar Conflicts

Needs

- Reduce trolley/vehicle collisions
- Reduce trolley/vehicle near misses

Apps

- I-SIG
- PED-SIG
- PED-X
- Vehicle Turning Right in Front of Transit (Trolley)
## Use Case 6 – Enhanced Signal Coordination and Traffic Progression

### Needs

- Improve drivers (commuters) travel times
- Improve pedestrian safety

### Apps

- I-SIG
- Intersection Movement Assist (IMA)
- Probe Enabled Traffic Monitoring

Source: HNTB