Leading the way to seamless mobility
November 14-15th, 2017 | Tampa, Florida
# Urban mobility challenges
A view on safety and congestion

## Trend

- Cities grow by two inhabitants per second
- Aging and individualism

More and more people and goods need to be moved predominantly by an aging rail and road infrastructure

## Challenges

<table>
<thead>
<tr>
<th>Challenge</th>
<th>United States</th>
<th>2030 Car density will increase …</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road traffic slows</td>
<td>Average speed in big cities will drop further</td>
<td>12 mp/h</td>
</tr>
<tr>
<td>Road deaths/100T &amp; years</td>
<td>11.4</td>
<td></td>
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<tr>
<td>Road congestion costs increase</td>
<td>$160 billion</td>
<td></td>
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<tr>
<td>Fuel wasted</td>
<td>3.1 billion gallons</td>
<td></td>
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<tr>
<td>Wasted time in traffic jams</td>
<td>42 hours a year</td>
<td></td>
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<tr>
<td>Wasted time in finding parking</td>
<td>30%</td>
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Consume the existing infrastructure efficiently
And we cannot tolerate more traffic.
Today:
We have a number of solutions for intelligent traffic management…

State-of-the-Art Traffic Management

- Enforcement Solutions: Bus Lane, U-Turn, Intersections
- Section speed control
- Intersection Control
- Magnetic in-ground sensors
- LED signals
- Intelligent public transport prioritization
- Video detection and CCTV integration
- Loop detection
- Adaptive traffic control
- Variable message signs
- Intelligent parking solutions
- City tolling solutions
- Center-2-Center communication
- ANPR applications
- Section speed control
- Intelligent public transport prioritization
- Variable message signs
Digitalization of Traffic Management and Autonomous Vehicles – Two Trends shaping the future of Road Traffic

Proprietary Past | Today | Digital Future

Hardware Focus | Software/Data Focus | Function/Operations Focus

1. Traffic Management

2. Autonomous vehicles

3. New Traffic Modes and Management

Intelligent Traffic System Evolution over time

Vehicle Evolution over time

...and traffic management centers communicating with the infrastructure – Tomorrow with everything!
Leading the way to... seamless mobility
Leading the way to... connected mobility
USDOT Connected Vehicle Milestones
USDOT Connected Vehicle: How does it work?

Vehicles broadcast to Vehicles:
- Location, direction, speed, elevation

Infrastructure broadcast to vehicles:
- Map of intersection lane placement
- Traffic Signal States and countdown to change

Once vehicles know trajectories to other vehicles
- Vehicle safety systems warn drivers and avoid collisions

Once vehicles know signal color & time to change
- Drivers warned of red light violations before they occur

Once vehicles know trajectories to smart phones
- Vehicle safety systems warn of pedestrians, cyclists

Once vehicles, signals and phones are connected
- Estimated 80% reduction in non-impaired crashes
- Input to future automated vehicle algorithms
## USDOT Connected Vehicle Cyber Security:
Security and privacy designed in from the beginning, in addition …

<table>
<thead>
<tr>
<th>Guide</th>
<th>Implement</th>
<th>Assure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oversee</strong> the entire security implementation</td>
<td><strong>Harden</strong> system components</td>
<td><strong>Monitor</strong> component vulnerabilities</td>
</tr>
<tr>
<td><strong>Ensure</strong> security experts are available for consultation for all project participants</td>
<td><strong>Integrate</strong> certificate management system</td>
<td><strong>Assess</strong> interactions and subsystems</td>
</tr>
<tr>
<td><strong>Define</strong> security and privacy program</td>
<td><strong>Train</strong> operational personnel</td>
<td><strong>Perform</strong> red / blue team and incident response exercises.</td>
</tr>
</tbody>
</table>

Ensure the project and system achieve the desired protection level

Protect individual elements and interactions adequately

Enable operational confidence with robust testing and validation

Source: Siemens Corporate Technology
USDOT Connected Vehicle Pilot, Tampa FL
6 Use Cases of 14 applications at 43 locations

- Transit Signal Priority
  - Approach/Depart Alert
- Turning Right in Front of Bus
- Ped in Crosswalk
  - Mobile Accessible
- Intelligent Traffic Signal System
- Intersection Movement Assist

- Ramp Deceleration
- Curve Speed Warn
- Wrong Way Warning
- Red Light Violation
- Probe-Enabled Traffic Monitoring
- Emergency Elect. Brake Light
- Forward Collision Warning

Source: Siemens Industry Inc.
USDOT Connected Vehicle Pilot, Tampa FL
Not R&D, but rather measuring effectiveness of existing CV apps

Fully-realized Connect Vehicle system that fulfills the project Scope

- **Identify** existing real-world safety and mobility issues
- **Measure** the Current Situation: “Before” metrics
- **Apply** existing CV technology as mitigation
- **Measure** the Effect: “After” metrics
- **Data log**: Archive trajectories, warnings, incidences
USDOT Connected Vehicle Pilot, Tampa FL
Equipment for roadside and vehicles

OBU interfaces: Composite video, drivers for telltales, and blue tooth audio

Source: Siemens Industry Inc.

Specific Warnings - Telltale Indicators and audio

Bluetooth Battery operated

Source: Brand Motion
Effectiveness and Interoperability
Seeds for 50-state Connected Vehicle safety, mobility and weather

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