CHARACTERISTICS OF SMART CITIES

- Cloud-based services
- Internet of Things (IoT)
- Network of Sensors and RFIDs
- Smart Cars
- Autonomous/Connected Vehicles
IMPACT OF AUTONOMOUS VEHICLES

- Reduced need to build roads and add lanes
  - 1800 vphpl → 7200 vphpl on Arterials
  - 14400 vphpl on Freeways

*Total Public Construction Spending in the U.S. as a Percentage of GDP*

*Source: Federal Reserve Bank of St. Louis, U.S. Global Investors*
PARKING IN CBD WILL BE REDUCED

NOW = 40% of urban land for roads and parking, needs up to 4 parking spaces/vehicle
PARKING IN CBD WILL BE REDUCED

FUTURE = Reduced to 1-2 parking spaces/vehicle = 75 Billion SF of parking spaces available

- Parking spaces reduced from 10’ to 7’ wide
Design of future malls will change

- Reduction of parking needs at malls and retail centers
  - E.g. 1 Million SF retail center with 5.0 parking/1000SF = 5,000 spaces = 750,000SF
  - Halved = 2,500 spaces saved = 30 acres of land
- Larger drop-off area needed at malls, offices, etc.
IMPACT OF AUTONOMOUS VEHICLES

- Reduction in pedestrian and auto accidents
  - 31 major pileups since 2011
- SOVs reduced
  - e.g. San Francisco 62% SOV dropped to 50% by 2015, 40% by 2019
- VMT will go up
- Car ownership drops

<table>
<thead>
<tr>
<th>Year</th>
<th>No of pileups</th>
<th>Pileups in USA</th>
<th>No. killed</th>
<th>No injured</th>
<th>Average No. vehicles</th>
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<td>7</td>
<td>2</td>
<td>20</td>
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<td>4</td>
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<td>13</td>
<td>170</td>
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<td>8</td>
<td>4</td>
<td>10</td>
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<td>6</td>
<td>4</td>
<td>7</td>
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<td>7</td>
<td>5</td>
<td>8</td>
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<td>4</td>
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<td>14</td>
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</tbody>
</table>

Total: 36 pileups, 19 killed, 72 injured, Average 82.3
IMPACT OF AUTONOMOUS VEHICLES

- Homebuilding in suburbs will increase
- Insurance
  - Now = owner/driver
  - Future = vehicle; user pay per trip cost
- Intercity Road Travel will go up
  - Short haul airfare about $0.5/mile
  - Cost of AV/CV less than $0.15/mile
  - Will go down in future
COST OF TRAVEL WILL GO DOWN

- Solar paneled roadway pavement providing cheaper free energy to cars
INTERCITY DRIVERLESS TRUCKS WILL REDUCE COST OF SHIPPING

Major shortage of long-haul truck drivers nationally

Average salary of truck drivers = $43,410 per year
Average salary of college graduates = $45,400
(Source: 2015 Census)

Most common job in each state in 2014
(Source: Planet Money)
IMPACT OF SHARED VEHICLES

• Reduction in fixed route transit usage
  • Increased shared use of vehicles
  • E.g. Las Vegas,
    • 2015 = 30% UBER utilization
    • 2016 = 60% to 70%

• Driverless buses and paratransit
• First and last mile connectivity for transit users
IMPACT OF SHARED VEHICLES

- Car utilization
  - Today = 5%
  - Future = 70%

- Cost of travel
  - $0.75-$1.5/mile $0.15/mile

- People will be more mobile
  - Today = 2.5 trips/day per person
  - Future = 4 to 5 trips/day per person

- VMT will go up

- Improved mobility for children, old, visually impaired, etc.

- Reduced infant mortality
  - especially in challenged residential neighborhoods as a result of lack of access to consistent prenatal care - Columbus Smart City Challenge
IMPACT OF INTERNET OF THINGS

- People become more connected through cloud computing
  - Reduced travel to work
  - Workstation at home connected to cloud server
  - Video conferencing
  - Virtual meetings
Wireless bandwidth will expand:

- 5G Telecom by 2020
  - Approved by FCC on 7/14/2016
  - 1GB/sec to 10GB/sec
  - Expand battery life x10
  - More secure connections
ENGINEERING DESIGN NEEDS TO ADAPT

- Smart Traffic Lights
- Smart Street Lights
- Smart Irrigation
SMART DISSEMINATION OF DATA

Palm Springs Earthquake Warning System
- 30 seconds advanced warning
- Allow garage door to open
- Elevators to suspend
- Emergency power to standby
- Gas valves to shut
THANK YOU!
Contact: LeoLee@Advantec-usa.com