SMART CITIES

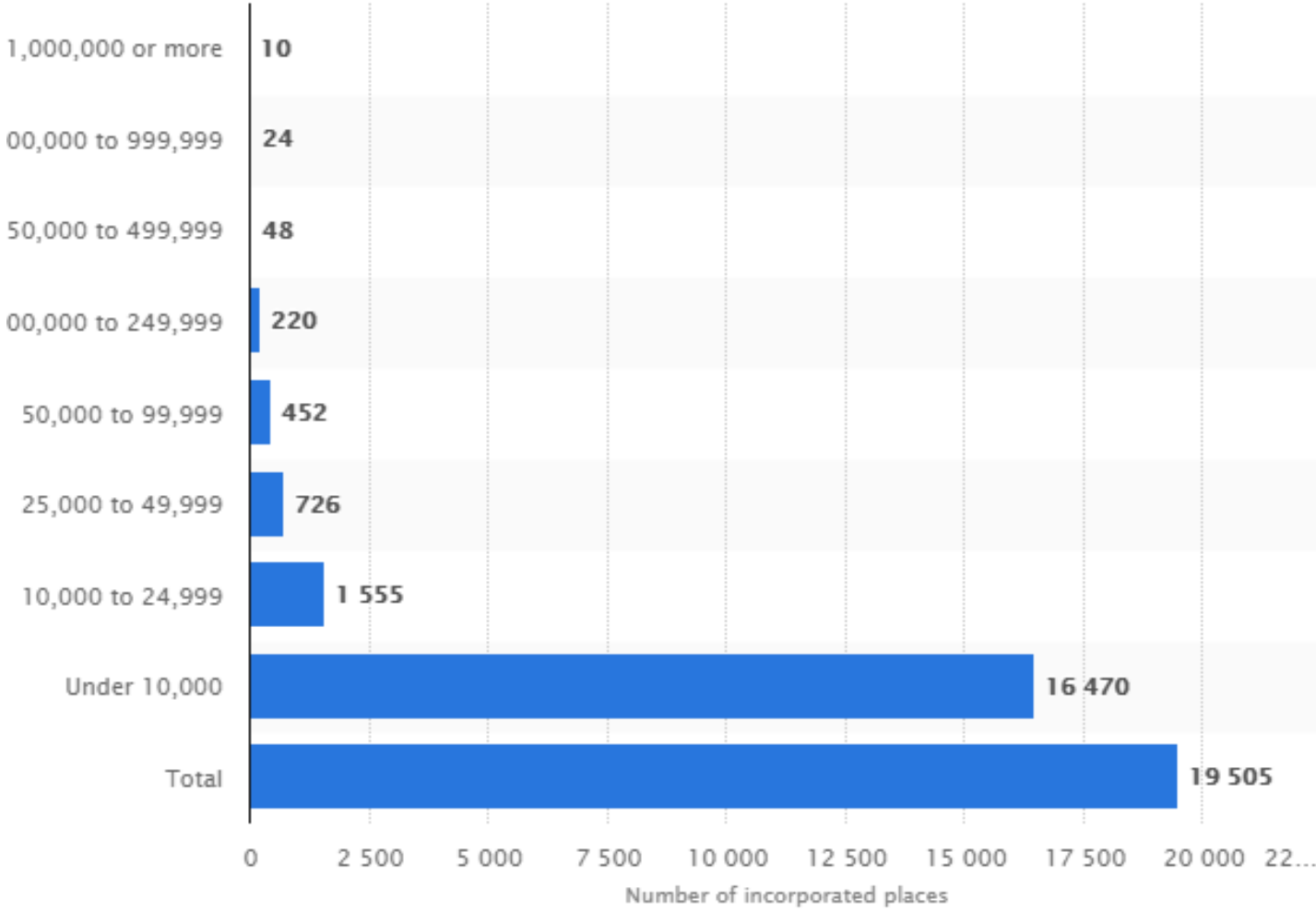
ONE SIZE DOESN'T FIT ALL

Penn State : Traffic Engineering and Safety Conference – December 5, 2018

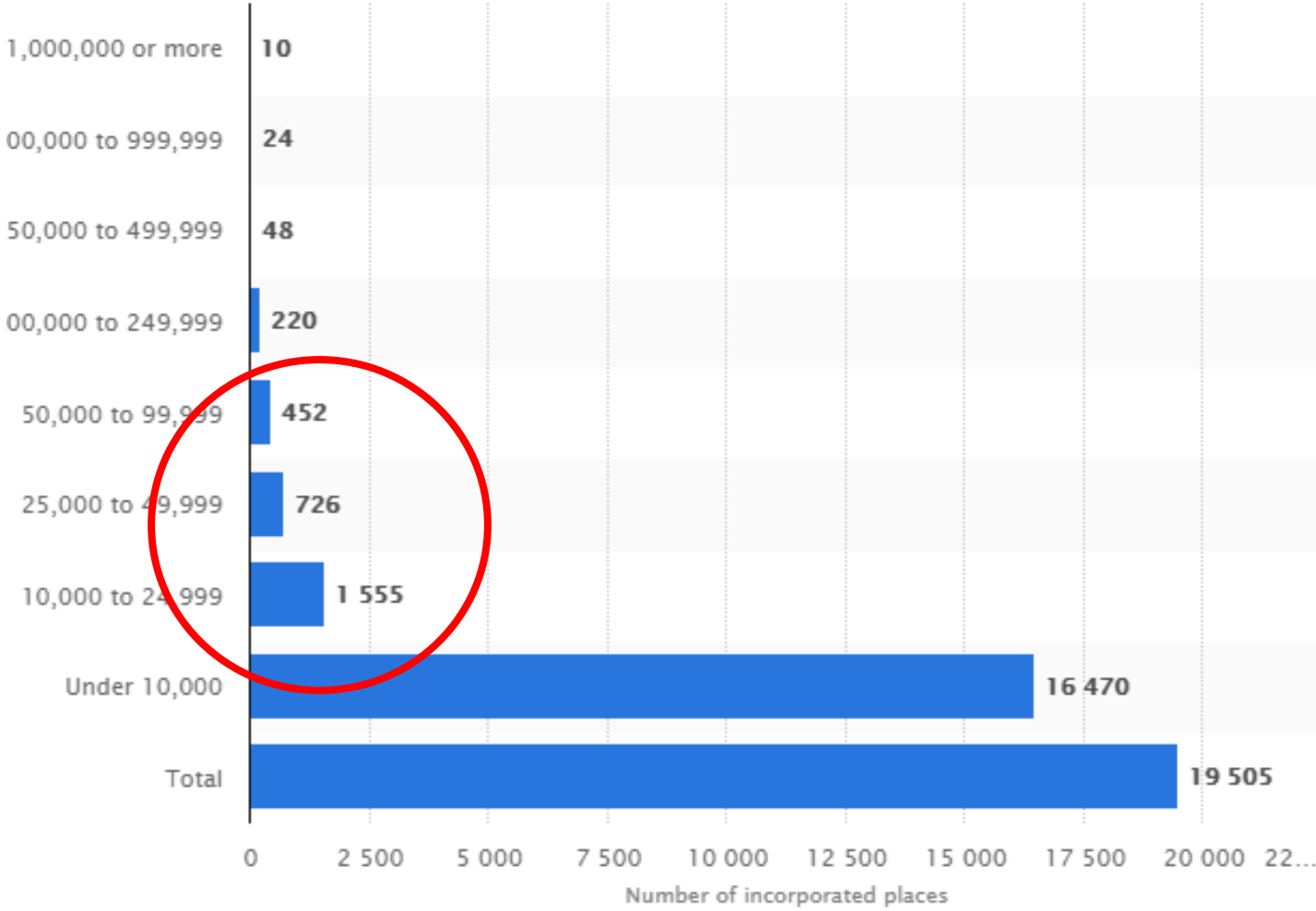
Tom Timcho – Assistant VP –Connected and Automated Vehicles


$40 MILLION
78 APPLIED • COLUMBUS WON
SMART CITY CHALLENGE
THE CITY OF COLUMBUS
ANDREW J. GINTHER, MAYOR
SMART COLUMBUS
U.S. Department of Transportation

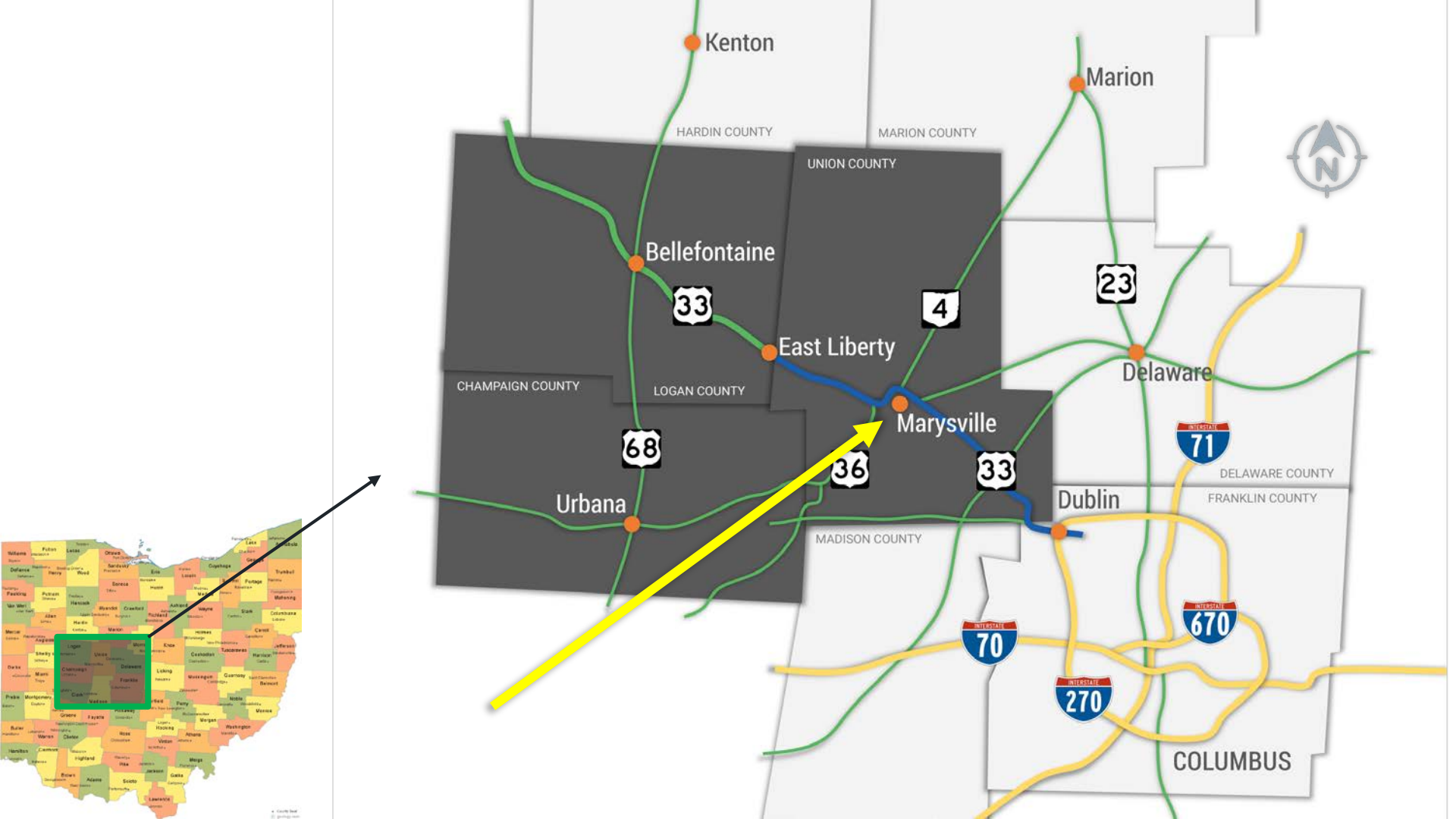
US City Population



US City Population




MAIN ST
NO TURN ON RED
SOUTH
NORTH
38
31
ROAD
CLOSED


Kenton
Marion
HARDIN COUNTY
MARION COUNTY
UNION COUNTY
Bellefontaine
33
4
East Liberty
23
Delaware
CHAMPAIGN COUNTY
LOGAN COUNTY
Marysville
68
36
33
71
DELAWARE COUNTY
Urbana
Dublin
FRANKLIN COUNTY
MADISON COUNTY
70
670
270
COLUMBUS

FACTS ABOUT MARYSVILLE

- Population: 22,000
- Area: 16.5 square miles
- Union County Seat
- Home of Honda’s largest manufacturing and R&D facilities in North America
- Represents Anytown, USA

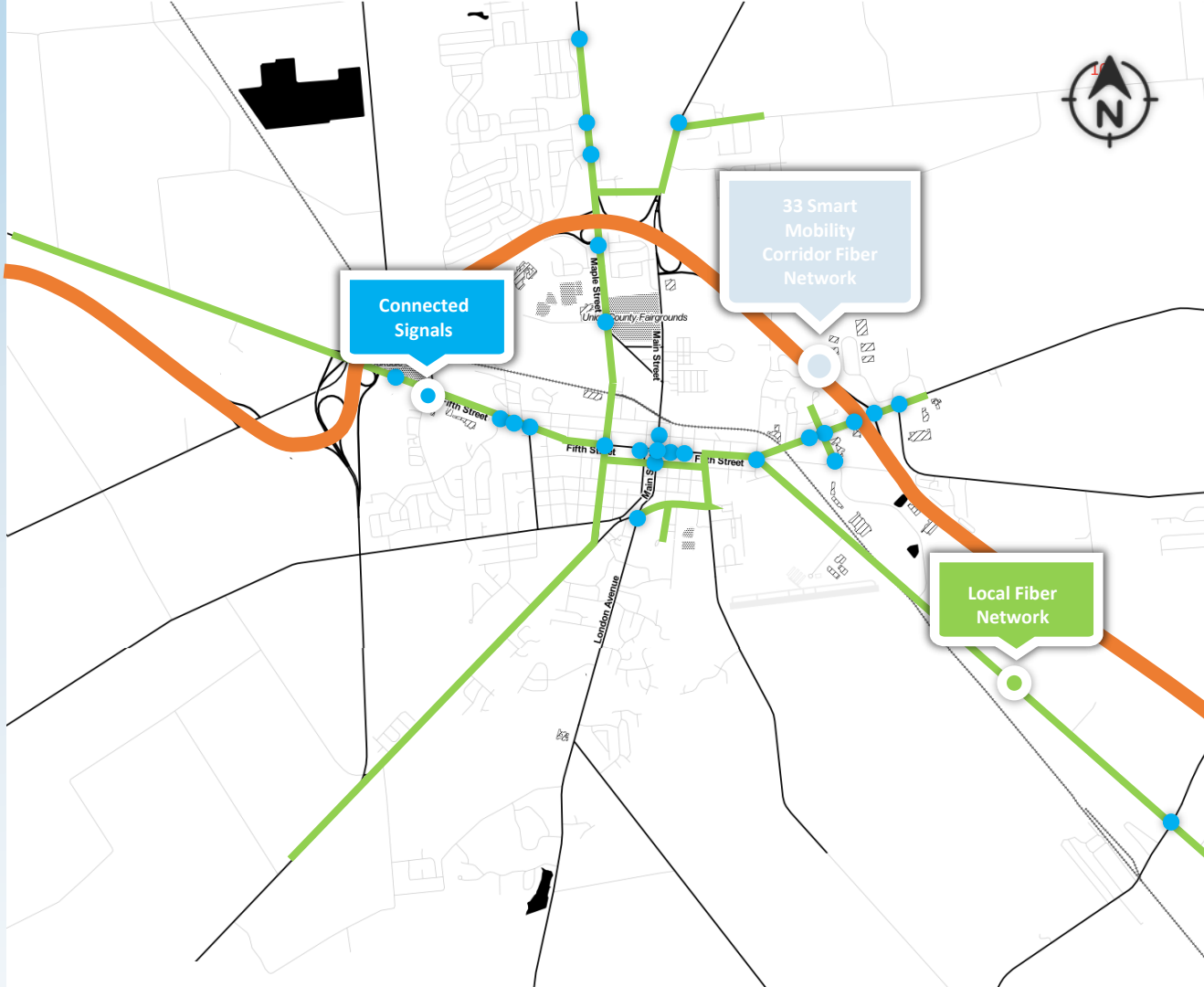
WHY MARYSVILLE, OHIO?

- US 33 Smart Mobility Corridor
  - ODOT, TRC, OSU, Union County, Marysville, Dublin
  - $5.9 Million ATCMTD Grant, $16 Million ODOT Investment
- Small Town, Lower Traffic Volumes
  - > 10% Penetration Rate with 1,200 vehicles
  - Connected vehicles won’t get lost in the crowd
- Home of Honda’s largest manufacturing and R&D facilities in North America
  - End user feedback allows for “right size” design

PLAN

- 27 Traffic Signals outfitted with RSUs
- 1,200 vehicles outfitted with OBUs
- Redundant Fiber Network
- Robust Design of Experiment
- Online repository for collected data from vehicles

Connected Maryville



What does the City hope to learn?

- Evaluate the performance of selected/installed CV applications
  - *Does the application provide the right information at the right time?*
- Understand the effectiveness of selected applications
  - *Behavior changes/enhancements due to provision of additional information*
- Exploration of data use cases for traffic and infrastructure management using advanced data/machine learning techniques
  - *Travel time estimation, safety analysis, communication performance, pavement monitoring, behavioral analysis, etc.*

Performance Measures

- Safety:
  - *Safety risk hotspots (potential crash points with high frequencies) identified using the horizontal acceleration data generated by connected vehicle devices and/or extracted from video cameras; risks can be measured using surrogate safety measures*
  - *Crash frequencies*
- Efficiency:
  - *Vehicle travel times or delays*
  - *Delay, queue lengths and intersection saturation (e.g., volume-to-capacity ratio*
- Environmental impact:
  - *Fuel consumption data or estimation*
  - *Local air quality detection (e.g., RWIS sensors) through potential environmental sensors to be deployed at the roadside*

Proposed Applications

- Pedestrian in Signalized Crosswalk Warning (PCW)
- Spot Weather Impact Warning (SWIW)
- Curve Speed Warning at interchange ramps
- Queue Warning (Q-WARN)
- Reduced Speed Zone Warning / Lane Closure (RSZW/LC)
- Red Light Violation Warning (RLVW)
- Ramp Wrong-Way (tentative)
- Railroad (tentative)

CV Data Collection

- Three progressive levels of data acquisition
  - *BSM Part 1: ▪ Contains the core data elements (vehicle size, position, speed, heading acceleration, brake system status) ▪ Transmitted approximately 10x per second*
  - *BSM Part 2: ▪ Added to part 1 depending upon events (e.g., ABS activated) ▪ Contains a variable set of data elements drawn from many optional data elements (availability by vehicle model varies) ▪ Transmitted less frequently*
  - *Aggressive Integration: Non-standard data from vehicle CANbus*
- OEM provided data via their cellular network

Data Items

- Connected vehicle data:
  - *Obtained directly from equipped vehicles, providing vehicle kinematic and geospatial information and trip summaries.*
  - *BSM data containing vehicle attributes (e.g., location, speed, heading, brake application, status of wipers)*
  - *RSE data that consists of messages transmitted or received by RSEs, including BSMs, signal phase and timing (SPaT) messages, and traveler information messages (TIMs).*
- Additional system data:
  - *Weather data*
  - *Traffic mobility data (e.g., counts, travel time)*
  - *Network safety data (e.g., occurrence of crashes)*
  - *Network data events (e.g., incidents, work zones, other special events)*
  - *Naturalistic driving data that are collected from onboard cameras that records driver behavior*
  - *Survey data (e.g., stated preference) on driver's attitudes toward CV technologies, such as acceptance and willingness-to-pay*

Data Use

- Traffic System Analysis & Evaluation
- Infrastructure Safety Assessment
- Infrastructure Pavement Assessment
- Connectivity/Communication Performance (V2I & V2V)
- Others
  - *Willingness-to-pay for CV technologies*
  - *Highway Capacity Manual (HCM) Additions*
  - *Calibration of simulation models*

ACKNOWLEDGEMENTS

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Questions

Thank You!

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