SMART CITIES
ONE SIZE DOESN’T FIT ALL
$40 MILLION
78 APPLIED • COLUMBUS WON

SMART CITY CHALLENGE

THE CITY OF COLUMBUS
ANDREW J. GINTHER, MAYOR

U.S. Department of Transportation
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
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
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Questions
Thank You!

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