PROJECT ID: EEMS018

U.S. DEPARTMENT OF ENERGY

SMARTMOBILITY

Systems and Modeling for Accelerated Research in Transportation

Extended Urban Modeling for Smart Mobility

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2017 ANNUL MERIT REVIEW
JUNE 7, 2017

Argonne NATIONAL LABORATORY

INL Idaho National Laboratory

BERKELEY LAB

OAK RIDGE National Laboratory

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Overview

Timeline

- Project start date: 10/1/2016
- Project end date: 9/30/2019
- Percent Complete: 15%

Budget

- Total project funding:
  - DOE Share: $360K FY17-19
  - Contractor share: NA
- Funding received in FY 2016: 0
- Funding for FY2017: $120K

Partners

- National Renewable Energy Laboratory

Barriers**

- Computational models, design, and simulation methodologies
- Transferability of traffic simulation models
- Advances in vehicle, sensors, and communication technologies

**Based on VTO Multi-year program plan 2011-2015

Relevance/Objectives

- Overall objectives
  - To enable the efficient transfer of analysis and case studies developed within SMART to interested cities
  - To develop a locally adaptive scalable simulation model using high resolution urban population density data
  - To leverage ORNL developed Toolbox for Urban Mobility Simulation (TUMS) and ORNL product LandScan: high resolution population data (temporal and spatial) for an approximate and rapid traffic modeling platform
- Objective this period (October 2016—March 2017)
  - Initial selection of urban collaborator/target city
    - Identification of data needs to build simulation using TUMS
    - Initiate partnership with target city
- Impact
  - Microscopic simulation for daily traffic using TUMS for cities in the United States

Energy Efficient Mobility Systems (EEMS) Initiative:
SMART Mobility Laboratory Consortium (SMLC)

- Task 2.3.3 of Urban Science Pillar
- Extending urban data and modeling
- POC:
  - Budhendra Bhaduri (bhaduribl@ornl.gov)
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Milestones and current status [Task 2.3.3]

Timeline	Milestone	Deliverables	Status
Second Qt. FY17: (03/31/2017)	Initial selection of urban collaborator for rapid development with TUMS	NA	**Complete** [Initiated collaboration with Columbus, Ohio]
Fourth Qt. FY17: (09/30/2017)	Initial TUMS model for target city	Demo and report on demo for the target city	On Track
FY18	Integration of U.S. synthetic population generation model with Toolbox for Urban Simulation (TUMS) for travel behavior modeling for the conterminous U.S. (ORNL)	Demonstration and report describing demographic model integration approach with Toolbox for Urban Mobility Simulation model for ten different cities across the U.S. (ORNL)	
FY19	Integrate fleet mix scenario models with Toolbox for Urban Simulation (TUMS) for assessing energy usage and GHG generation. (ORNL)	Demonstration and report describing energy usage and GHG generation model integration approach with Toolbox for Urban Mobility Simulation model. (ORNL)	

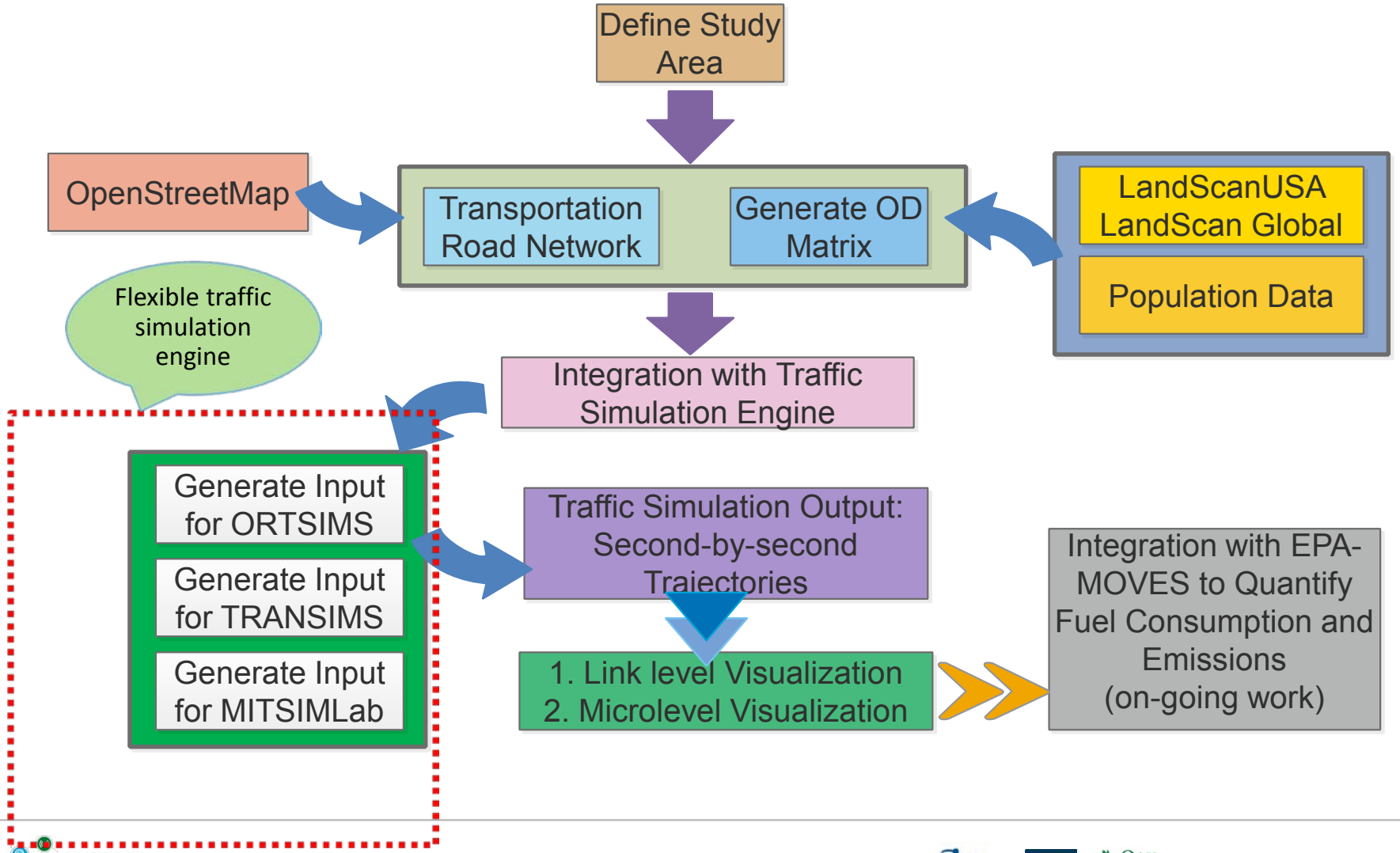
Approach/Strategy

- Initiate discussion** with Columbus, Ohio
  - Discussion with Mid Ohio Regional Planning Commission (MORPC)
  - Describing the SMART-EEMS initiative
  - Exploration and understanding the current state of transportation modeling practice by MORPC

- Preparing data needs for TUMS
  - Explaining TUMS framework to MORPC
  - Consistency in data input-output framework
  - Leveraging legacy travel demand data
  - Development of demo for Columbus, Ohio

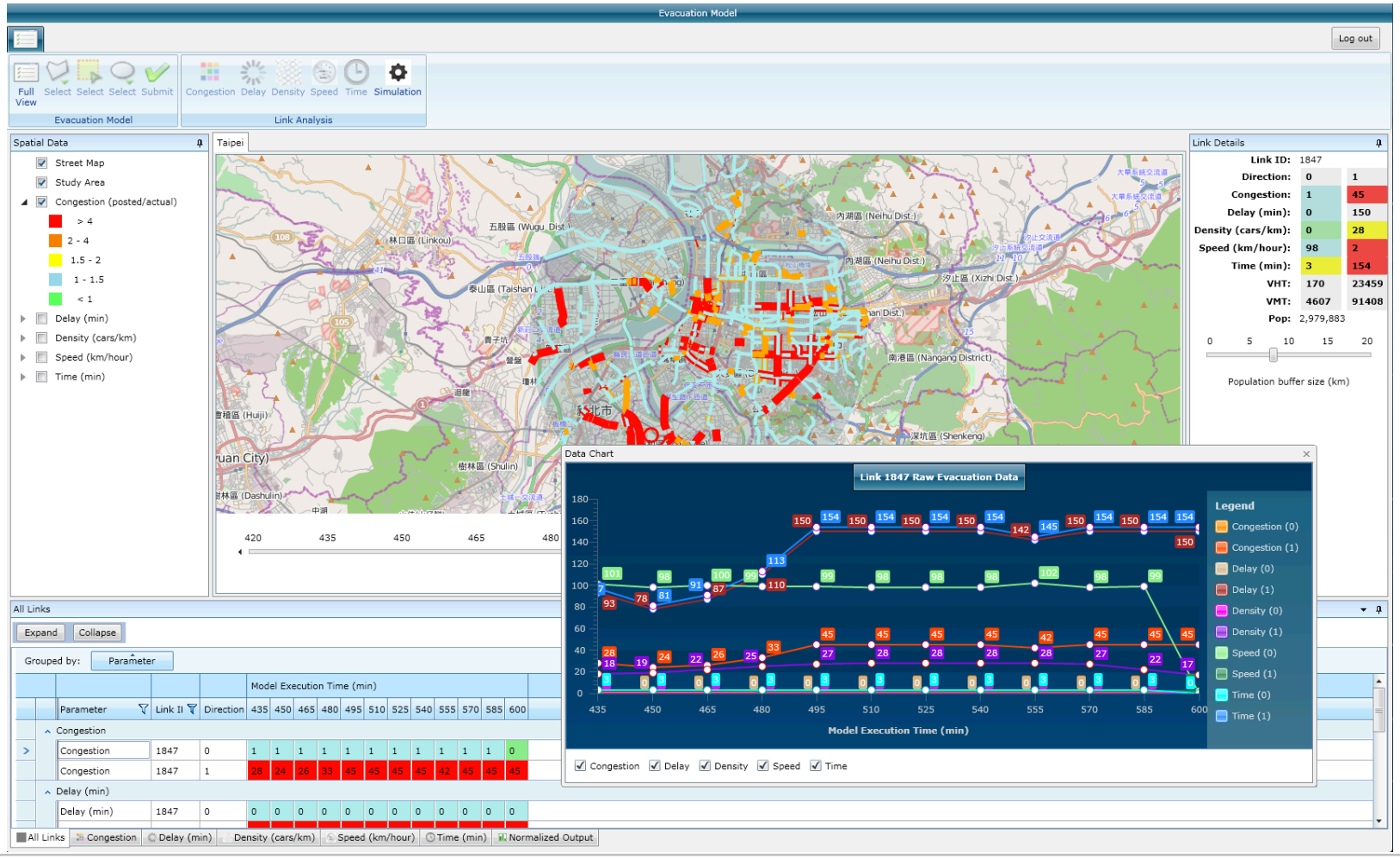
**The discussion is initiated by NREL. Dr. Stanley Young is bridging us with the Mid-Ohio Regional Planning Commission (MORPC)

Tools for Urban Mobility Simulation (TUMS) workflow



Link-based performance metrics

Link-based visualization provides network performance analysis for planning



Simulation demo

- TUMS Demo URL: http://tums.ornl.gov/tums/index.html

  – We have pre-built simulation of several cities across the world
  – Select a geographic location/city
  – Select simulation speed and run the simulation

Technical accomplishments [as of March 2017]

- ORNL hosted a workshop on: SMART Mobility Modeling & Simulation Tools [November 17-18, 2016]
- Insights gain from the workshop
  - Data is a major element for the transportation models accommodating connected and automated vehicles.
  - EPA-MOVES is the primary tool used by the transportation and traffic engineering community for emissions and energy consumption quantification.
- TUMS development and data needs
  - Significant data will be required for building the travel demand.
  - Calibration and validation will require data fusion from different sources including legacy traffic count data, origin-destination trip matrices data, and cellphone data.

Technical accomplishments [as of March 2017]

- Identifying data needs for city level traffic simulation using TUMS
  - Demographic data
  - Travel demand data
  - Road network
- We have selected our initial urban collaborator: Columbus, Ohio

- Traffic assignment framework for daily traffic

Response to Previous Year Reviewers' Comments

- This project was not reviewed last year.

Partners/Collaborators

- National Renewable Energy Laboratory
  - Stanley Young
  - Role: PI for the *Urban Science* pillar and providing directions for the project goals and active tasks
- University of Tennessee, Knoxville
  - Two graduate students will be working during summer 2017

Remaining challenges [FY17]

- Demonstration of traffic simulation for Columbus, Ohio
- Documentation of a general framework that describes the data needs of TUMS for rapid simulation of any geographical area in the conterminous United States

Proposed future research

Work-State	Timeline	Milestone	Deliverables	Status
On-Going	FY17 4th Quarter	Demo for Columbus, Ohio in TUMS	Traffic simulation demo using TUMS	On Track
Proposed	FY18 4th Quarter	Integration of synthetic population model for travel demand modeling	Demo and a report for applicability in Columbus, Ohio	
Planned	FY19 2nd Quarter	Comparison of TUMS output (after calibration and validation) with existing travel demand model output for cities	A report on comparison between TUMS output and existing travel demand model being used by the city	
Planned	FY19 4th Quarter	Assessing energy impacts with fleet mix scenarios	Demo and energy impact report	

Any proposed future work is subject to change based on funding levels

Summary

Relevance

- ❑ Rapid modeling of urban traffic and congestion with minimal population and employment density data, and asses the ***energy gains of SMART Mobility*** at city level

Technical accomplishments

- ❑ Columbus, Ohio is identified as the partner city
- ❑ Data needs is being identified for the traffic simulation

Approach (FY17)

- ❑ Identify urban collaborator
- ❑ Develop a traffic simulation demo for the partner city using Toolbox for Urban Mobility Simulation (TUMS)

Proposed future research

- ❑ Data Preparation, and integration of population synthesis models
- ❑ Scenario development through collaboration with other pillars

Any proposed future work is subject to change based on funding levels

Questions/Comments

This research is funded by the DOE Vehicle Technologies Office and ORNL appreciates the support and guidance provided by DOE program managers