Project #5
Simulation Analysis of Traffic-Operation-Related Emission

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Bert Martini

Princeton High School

Gabrea Bender

Batavia High School

UNIVERSITY OF Cincinnati

Overview of Presentation

- Research
  - Background Information
  - Goal
  - Objectives

- Classroom Implementation Plan

Background Information

- The U.S. transportation conformity program requires all transit projects to confirm to the goals set forth by the statewide transportation improvement programs (STIP)

Background Information

- Transportations activities must **not**
  - Cause new air quality violations
  - Worsen existing violations
  - Delay attainment of the National Ambient Air Quality Standards (NAAQS) for traffic-generated air pollutants

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Background Information

- Types of traffic-generated air pollutants
  - Carbon monoxide (CO)
  - Particulate matters ($PM_{2.5}$)

Background Information

- Recent studies indicate that exposure to traffic emission increase the risk of adverse health effects for those near large roadways

- Of particular concern are young children attending schools near those large roadways

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Research Goal

- To explore the methodology for analyzing the impact of traffic flow operation on the on-road emissions by using a simulation approach

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Research Objectives

- Setting up microscopic traffic models under the simulation software environment

- Calibrating & validating the simulation models using field collected traffic data

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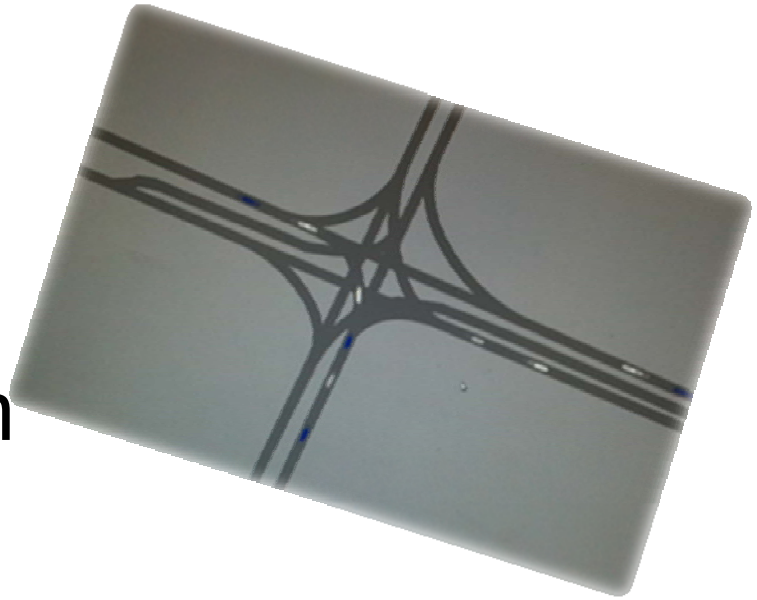
Research Objectives

- Inputting the simulation results into an emission factor simulator to estimate the on-road emissions

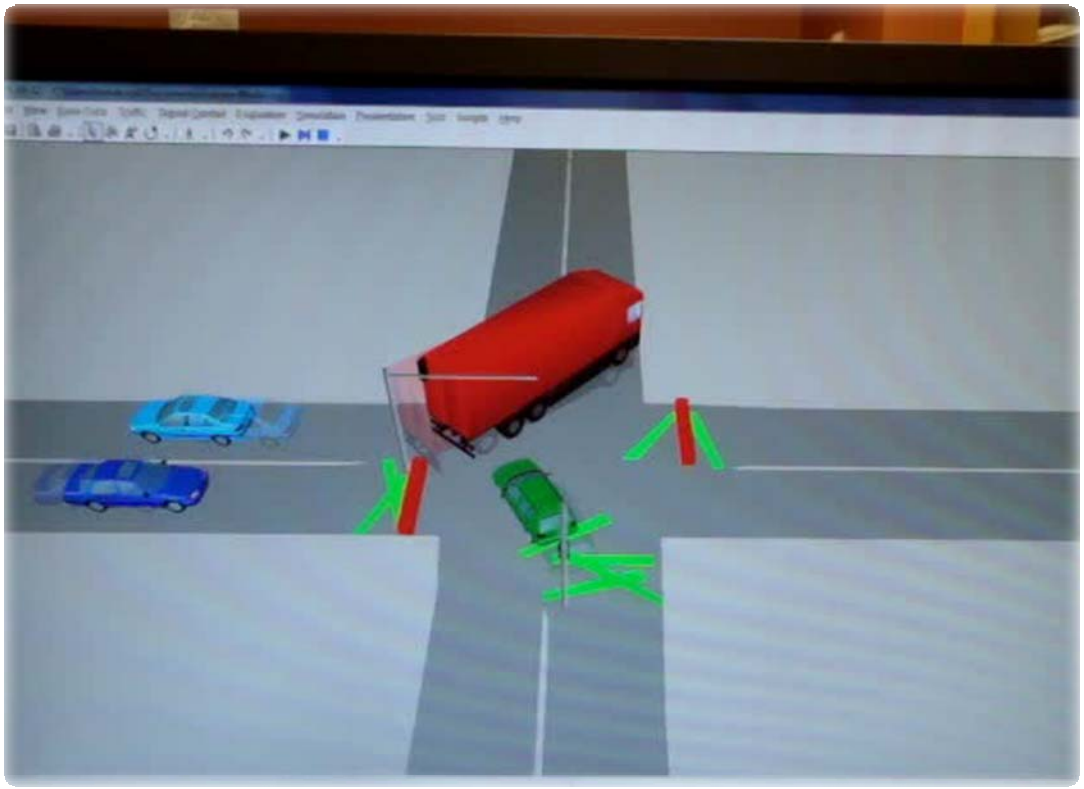
- Verifying the estimated on-road emissions using field collected emission data

VISSIM Software

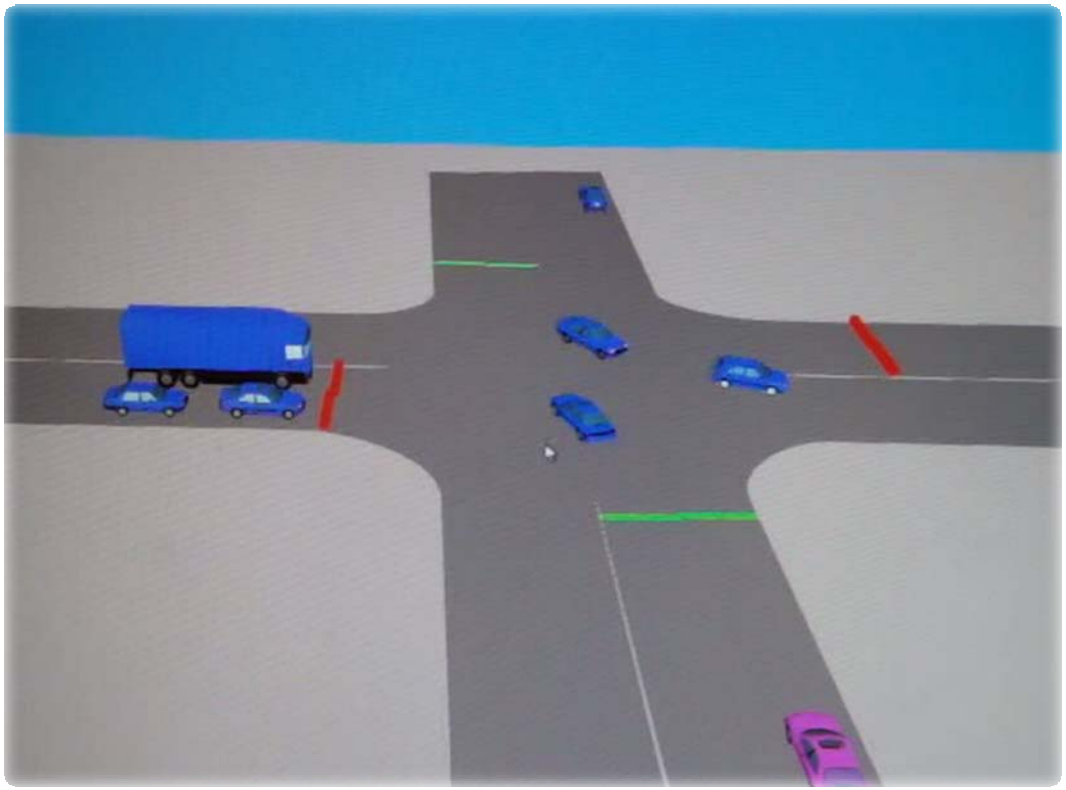
- A microscopic simulation program for multi-modal traffic flow modeling
- Accurately simulates urban & highway traffic, including pedestrians, cyclists and motorized vehicles



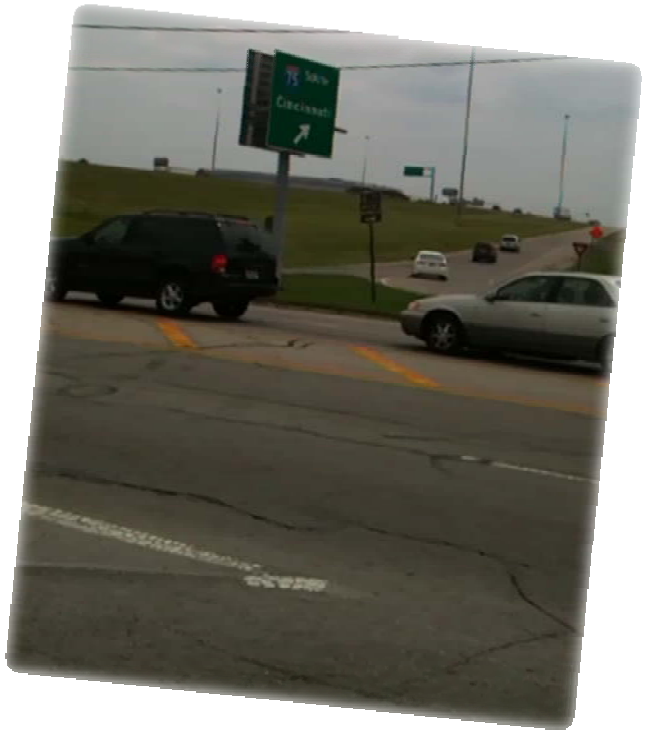
VISSIM Software



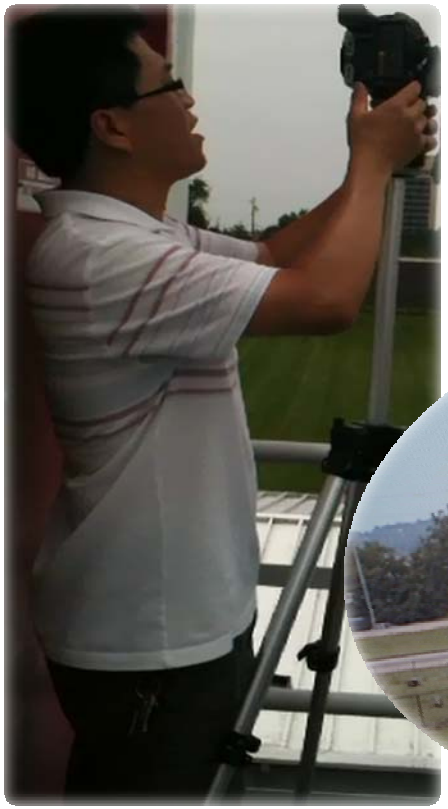
VISSIM Software



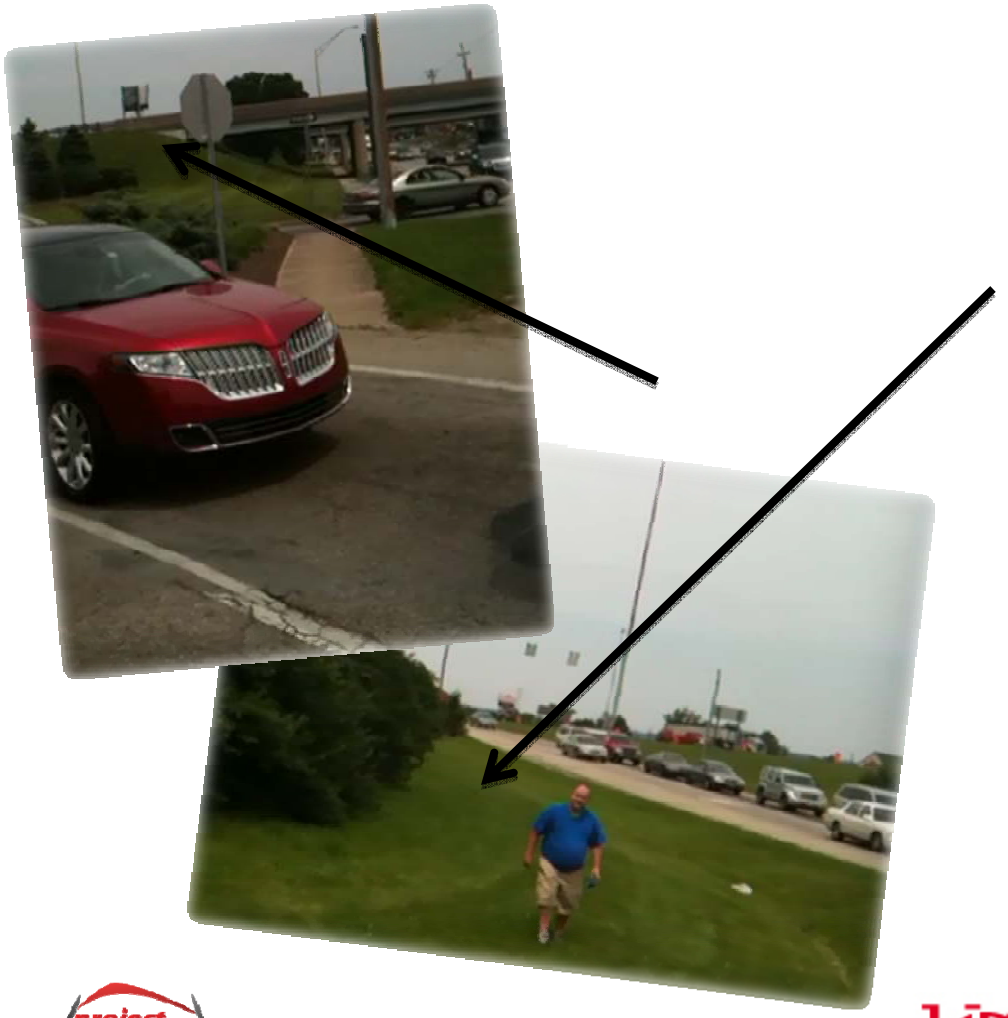
Field Collection – Survey Site



Field Collection - Camcorder



Field Collection – CO Sensor



Field Collection – GPS

Field Collection – Counting Cars

Calibration – VISSIM

MOVES ~ Modeling System

MOtor **V**ehicle **E**mission **S**imulator designed by the United States Environmental Protection Agency's (EPA)

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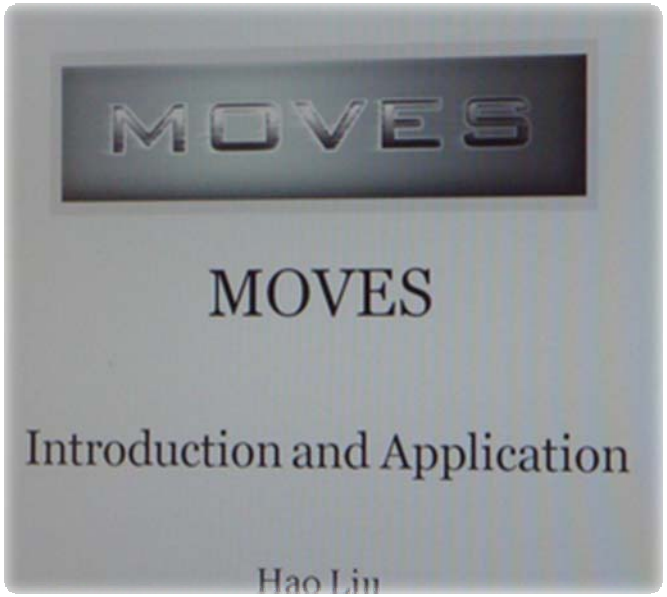
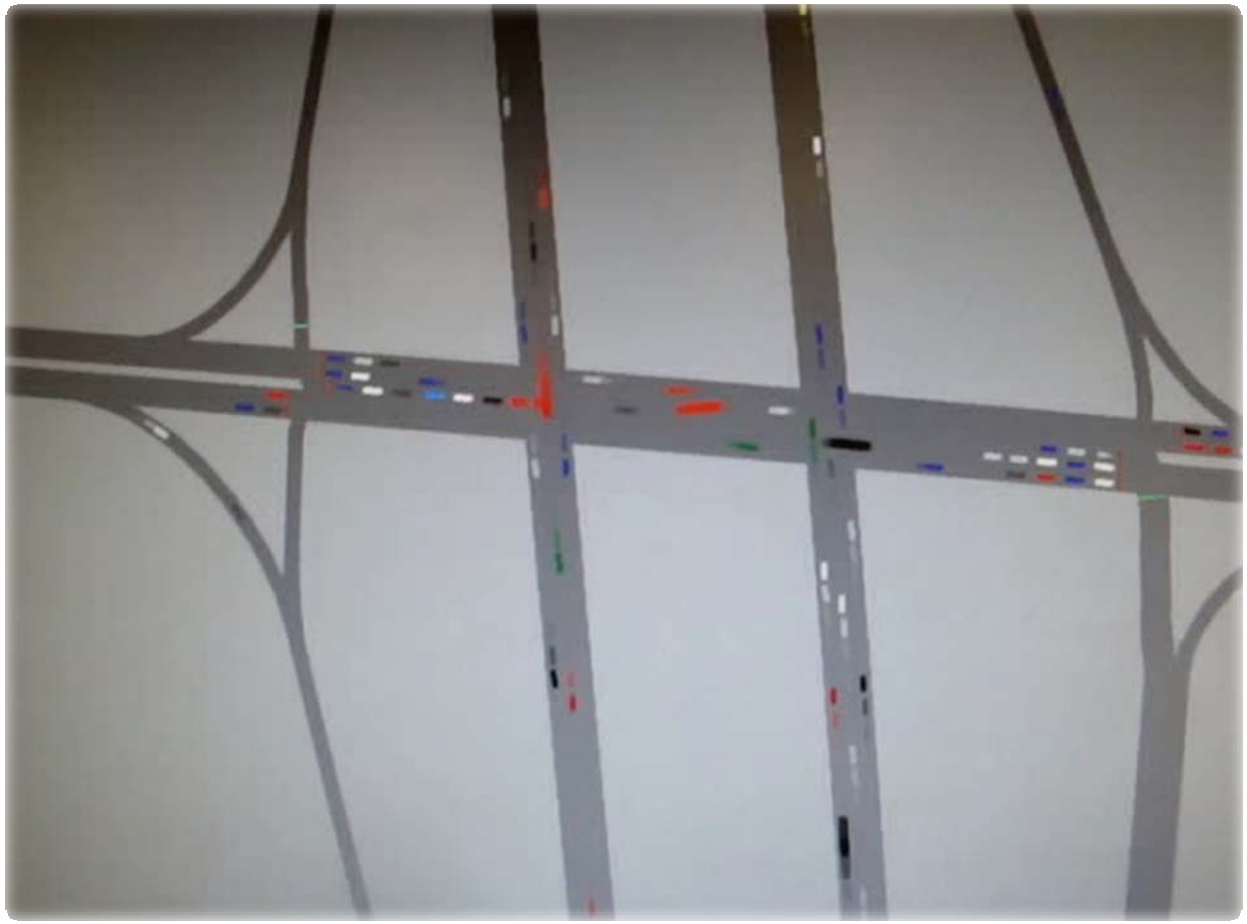
MOVES ~ Modeling System

- Data oriented vehicle emission calculator

- Produce emission inventory and emission factor



Final Simulation Model



Research Findings

- Our simulation model was accurate for predicting CO emissions.

- More research needs to be completed.

Classroom Implementation

Ohio Common Core State Standards

Mathematics » High School » Modeling

ACT Quality Core

B.1. Mathematical Processes Learned in the Context of Increasingly Complex Mathematical & Real-World Problems.

B.1.a. Apply problem-solving skills to the solution of real-world problems.

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Classroom Implementation

Algebra I Classroom

Engineering, Mathematics & Traffic Cooperative Learning

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Summary

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  - Background Information
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