

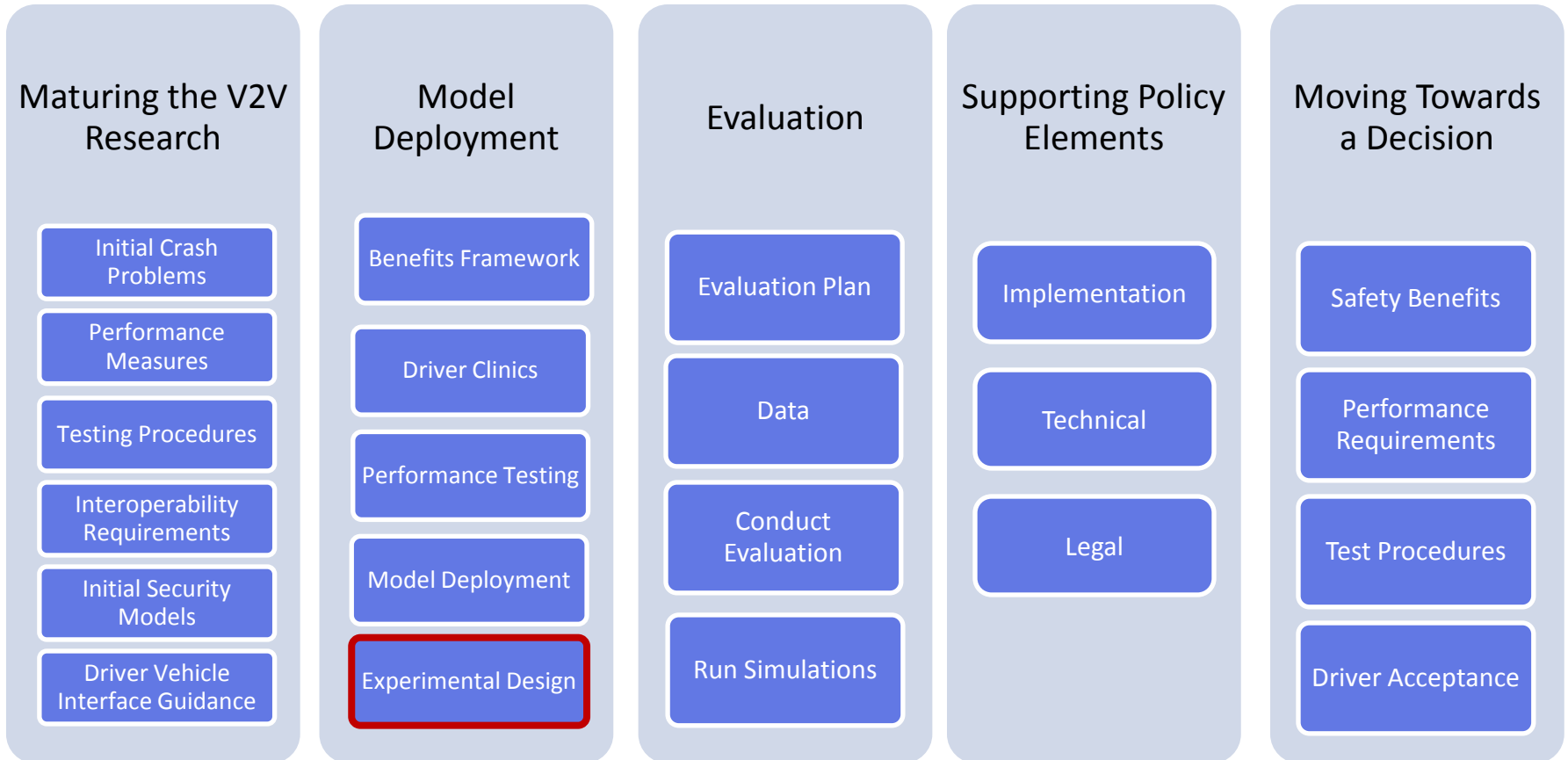
# Experimental Design



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# V2V Safety Framework



Moving Towards an Operation Model

Data Collection

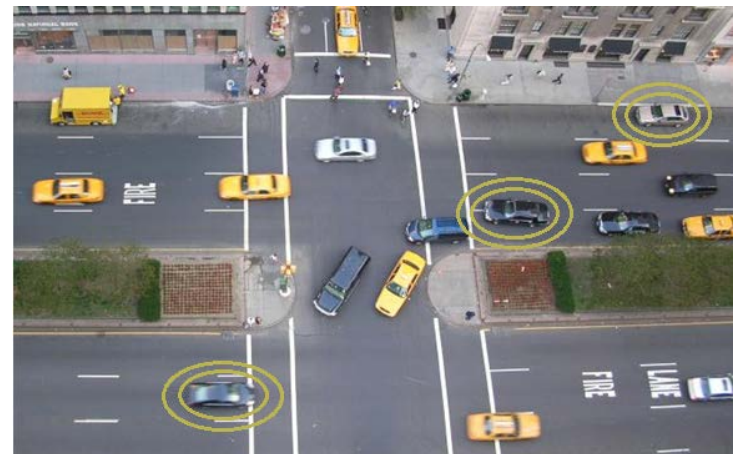
Data Evaluation & Analysis

Establishing an Operational Environment

Results

# Connected Vehicle Environment

- ❑ Full deployment – all vehicles capable of communicating with each other
- ❑ Model Deployment – subset of all vehicles capable of communicating with each other



***How do we know that the Model Deployment will obtain enough data for evaluation?***

# Scoping the Model Deployment

- ❑ Question: What should be the scope of the Model Deployment to gather enough data?



- ❑ Conducted analysis using prior field test results
  - 3 Forward Collision Warning alerts during treatment period

# Results of Scoping Analysis

Variable	Recommended	Actual
Test Subjects	108	128
Duration	5 months	6 months
Integrated Vehicles	55	64
Equipped Vehicles	2,500 – 3,000	2,772

- ❑ Requires careful selection of test area
- ❑ Requires careful selection of test participants as well to ensure interactions



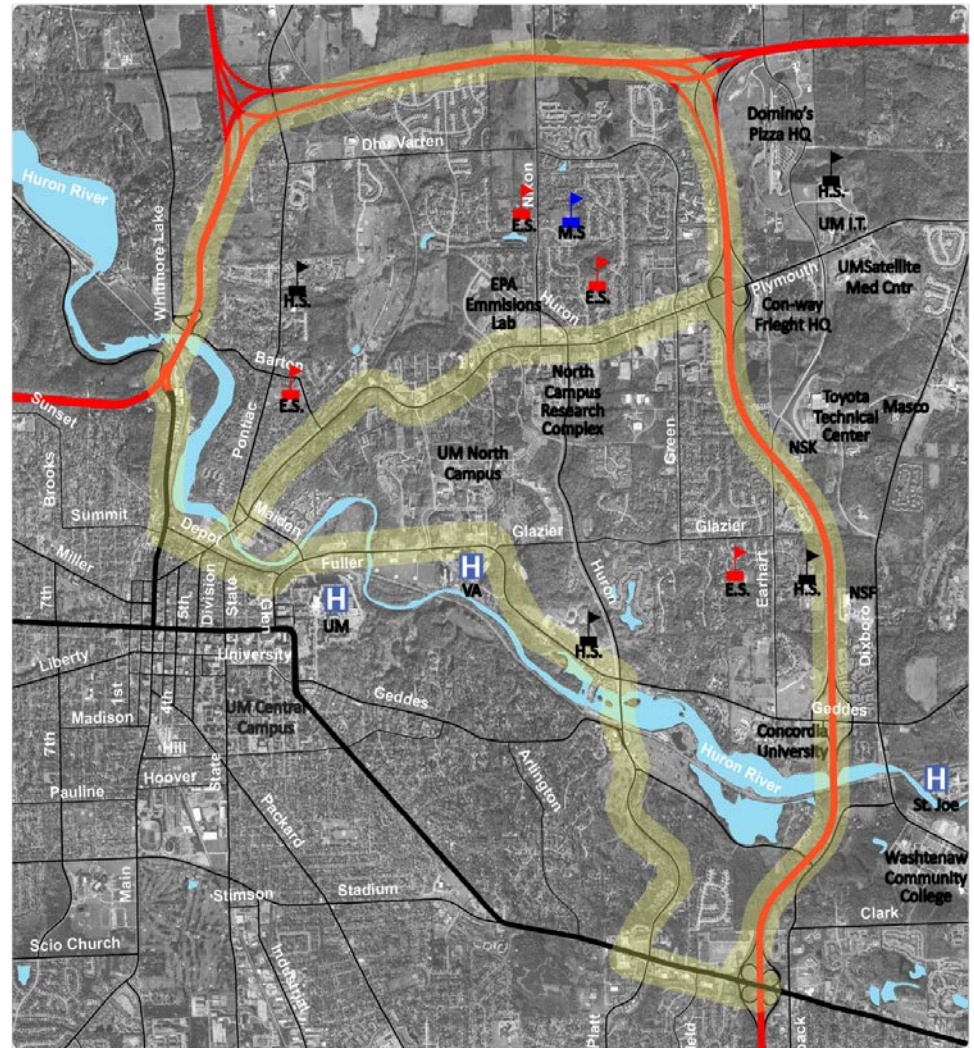
# Experimental Design – Recruitment

## ❑ Approaches for Recruiting Participants

- UoM Medical Center
- Ann Arbor city school system

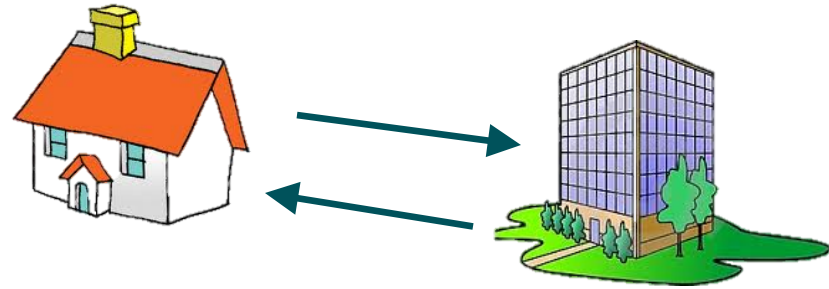
## ❑ Variety of Interactions

- Following
- Adjacent
- Crossing

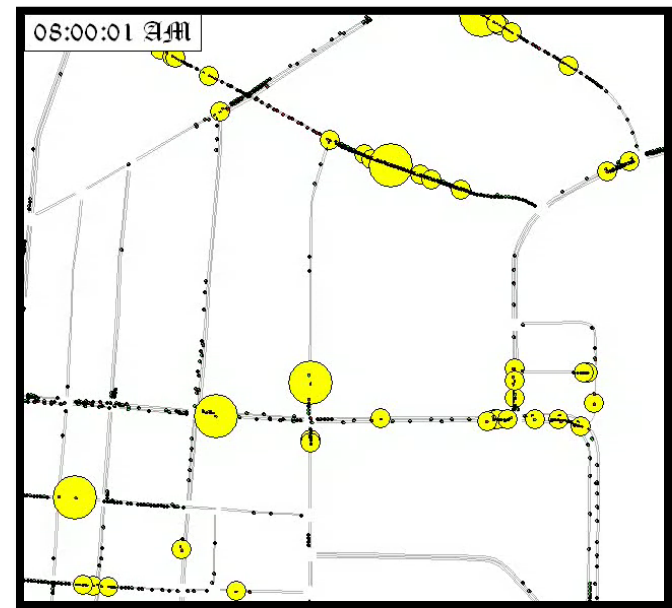


# Simulating the Experimental Design

- ❑ Ann Arbor Trip Tables
  - Provided by Washtenaw Area Transportation Study



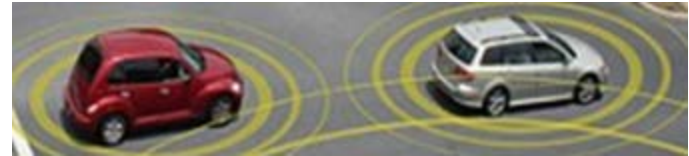
- ❑ TRANSIMS Model
  - Ran model for 24 hour period
  - Output included second-by-second positioning of vehicles



# Post Processing to Obtain Interactions

## ❑ Forward collision

- Same direction, same lane



## ❑ Lane change

- Same direction, adjacent lanes



## ❑ Intersection assist

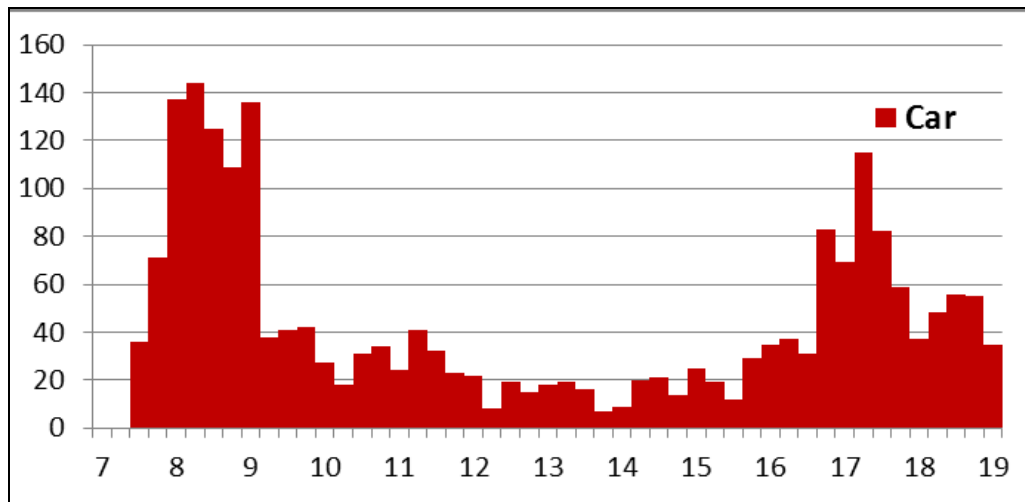
- Crossing paths





# Interactions by Time of Day

- ❑ 64 light vehicles equipped with safety applications
- ❑ 2,500 Vehicle Awareness Devices deployed
- ❑ Hourly estimates of interactions in a typical weekday



# Estimates of Daily V2V Interactions

- ❑ Assumptions for V2V interactions
  - 2,500 Vehicle Awareness Devices are deployed
  - Vehicle speeds > 25 mph
  - Vehicles are within 30 meters of each other

Host Vehicle	Daily Interactions	Monthly Interactions
Integrated Light Vehicles	250	5,000

# Total Safety Alerts Estimated

- ❑ How do the interactions relate to safety alerts generated by the applications?
- ❑ Developed estimates of the relationship between interactions and safety alerts.
- ❑ Estimated that over 6 months, each driver would experience ~3 alerts / safety application

The estimated volume of alerts per driver are consistent with scoping analysis!

# Interaction Results from Month 1

## ❑ Devices Deployed

- 64 Integrated light vehicles are deployed
- 738 Vehicle Awareness Devices are deployed

### Integrated Light Vehicles Summary

Performance Measure	Estimated	Observed
Interactions (30 meters)	1,400	1,196
All Safety Alerts	24	110

Thru Month 1, the observed results are comparable to the estimates from the traffic simulation model!

# Conclusion

- ❑ Observed results from the field are comparable with the simulated estimates
- ❑ Simulation Model estimated that the Model Deployment will generate sufficient data for evaluation

The results so far indicate that enough data will be collected for the evaluation!