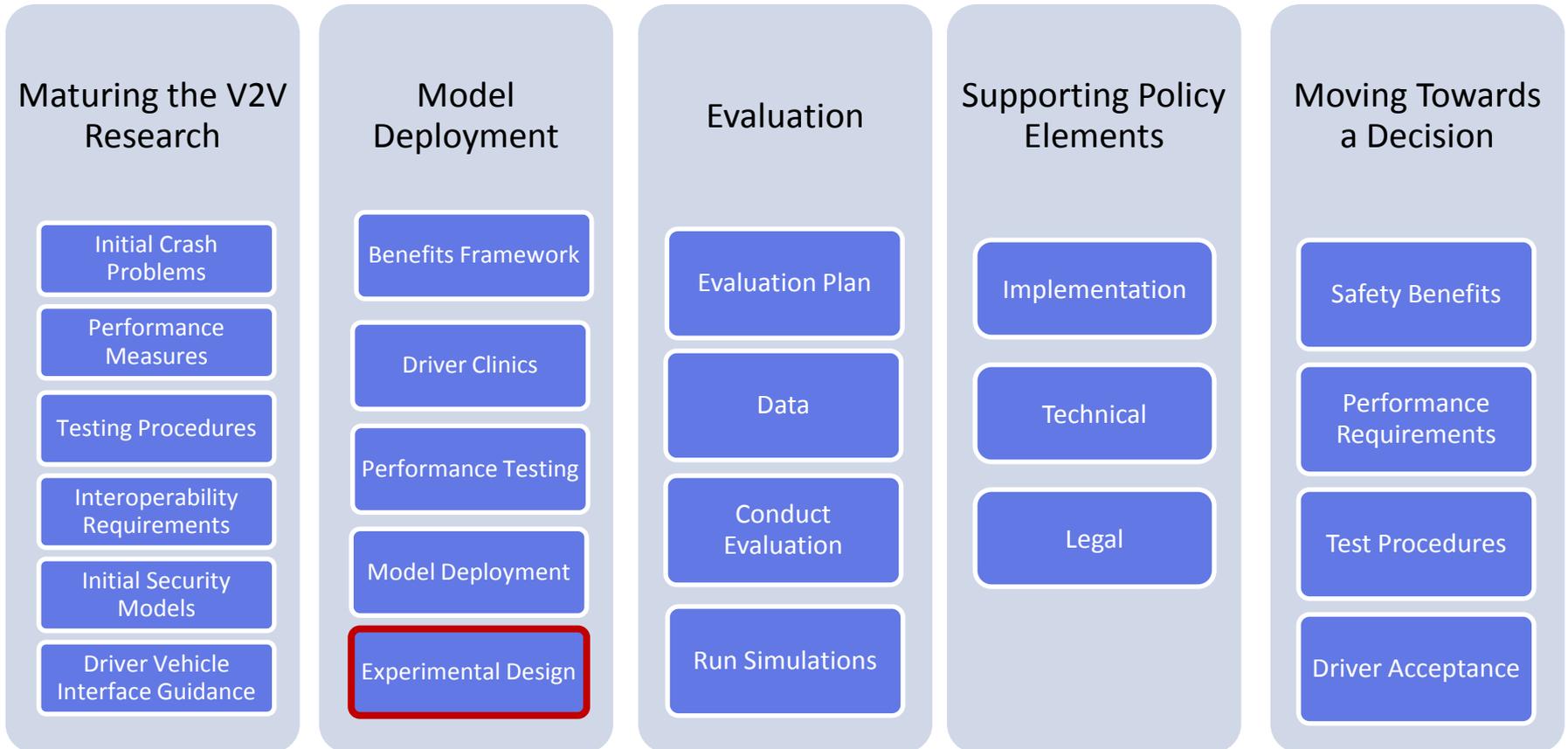


V2V Safety Framework



Moving Towards an Operation Model

Data Collection

Data Evaluation & Analysis

Establishing an Operational Environment

Results

Connected Vehicle Environment

Photo source: USDOT

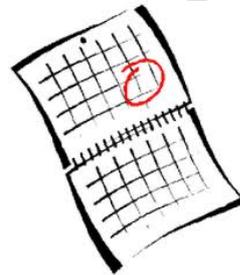
- ❑ Full deployment – all vehicles capable of communicating with each other
- ❑ Model Deployment – subset of all vehicles capable of communicating with each other



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

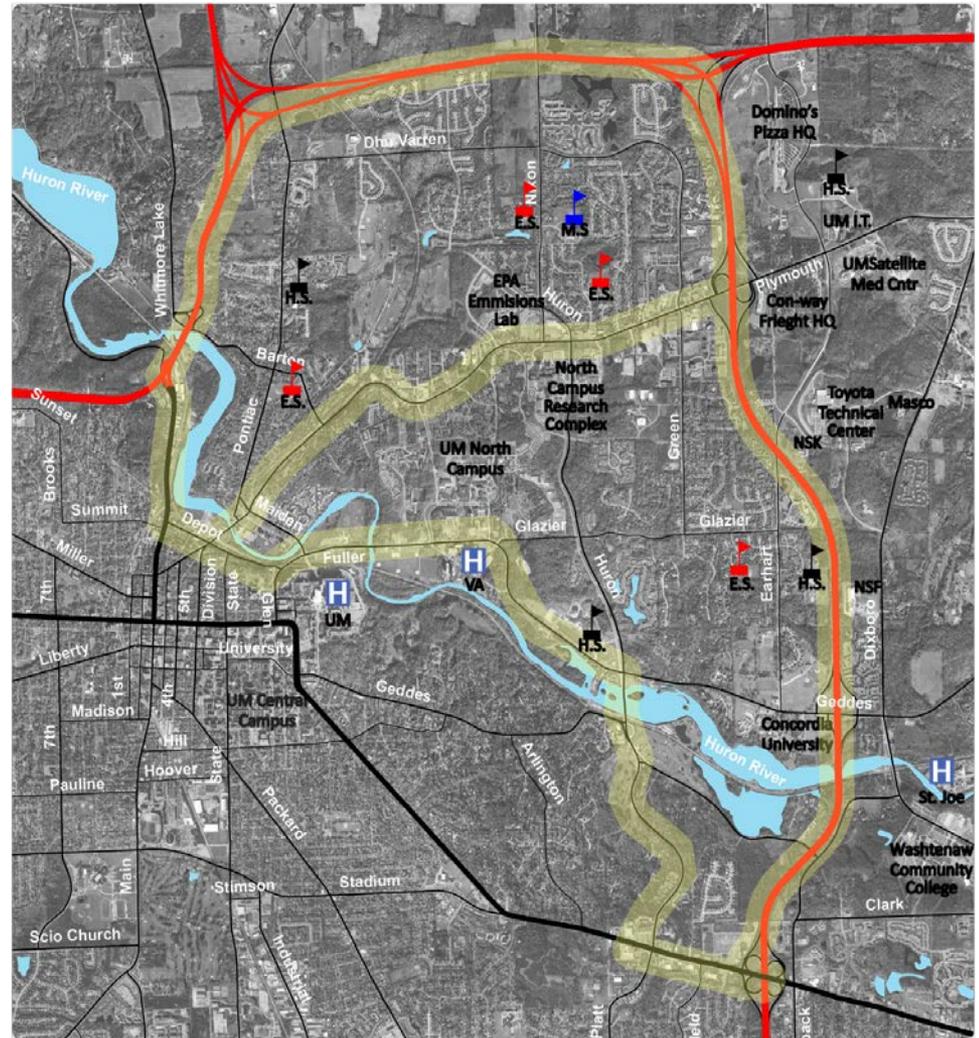
Experimental Design – Recruitment

❑ Approaches for Recruiting Participants

- UoM Medical Center
- Ann Arbor city school system

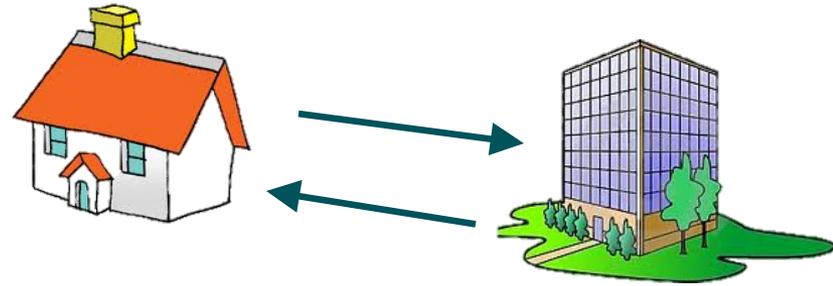
❑ Variety of Interactions

- Following
- Adjacent
- Crossing

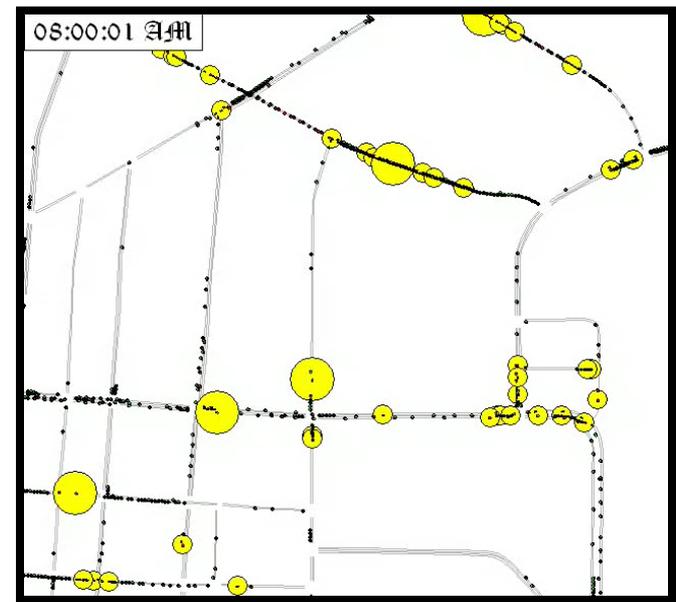


Simulating the Experimental Design

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



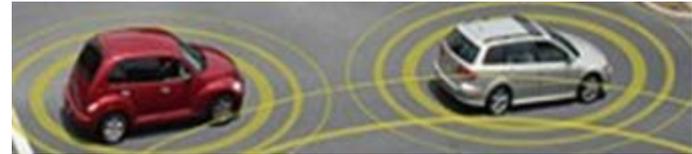
- ❑ TRANSIMS Model
 - Ran model for 24 hour period
 - Output included second-by-second positioning of vehicles



Post Processing to Obtain Interactions

❑ Forward collision

- Same direction, same lane



❑ Lane change

- Same direction, adjacent lanes



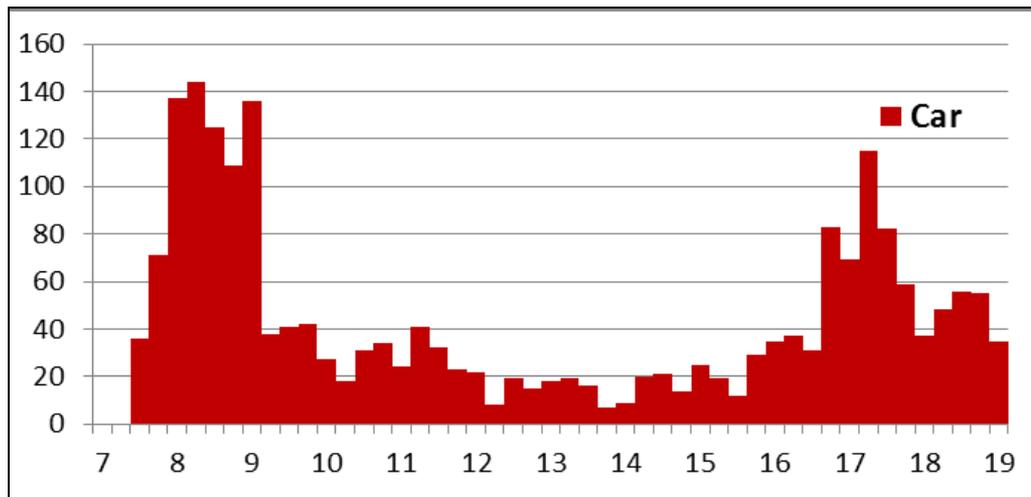
❑ Intersection assist

- 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 [‡]

‡ The number of alerts indicates the system triggered a warning; however, the specifics of the warning (i.e. repeat warnings) have not been analyzed yet.

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!