Minnesota Mileage-Based User Fee Test Results

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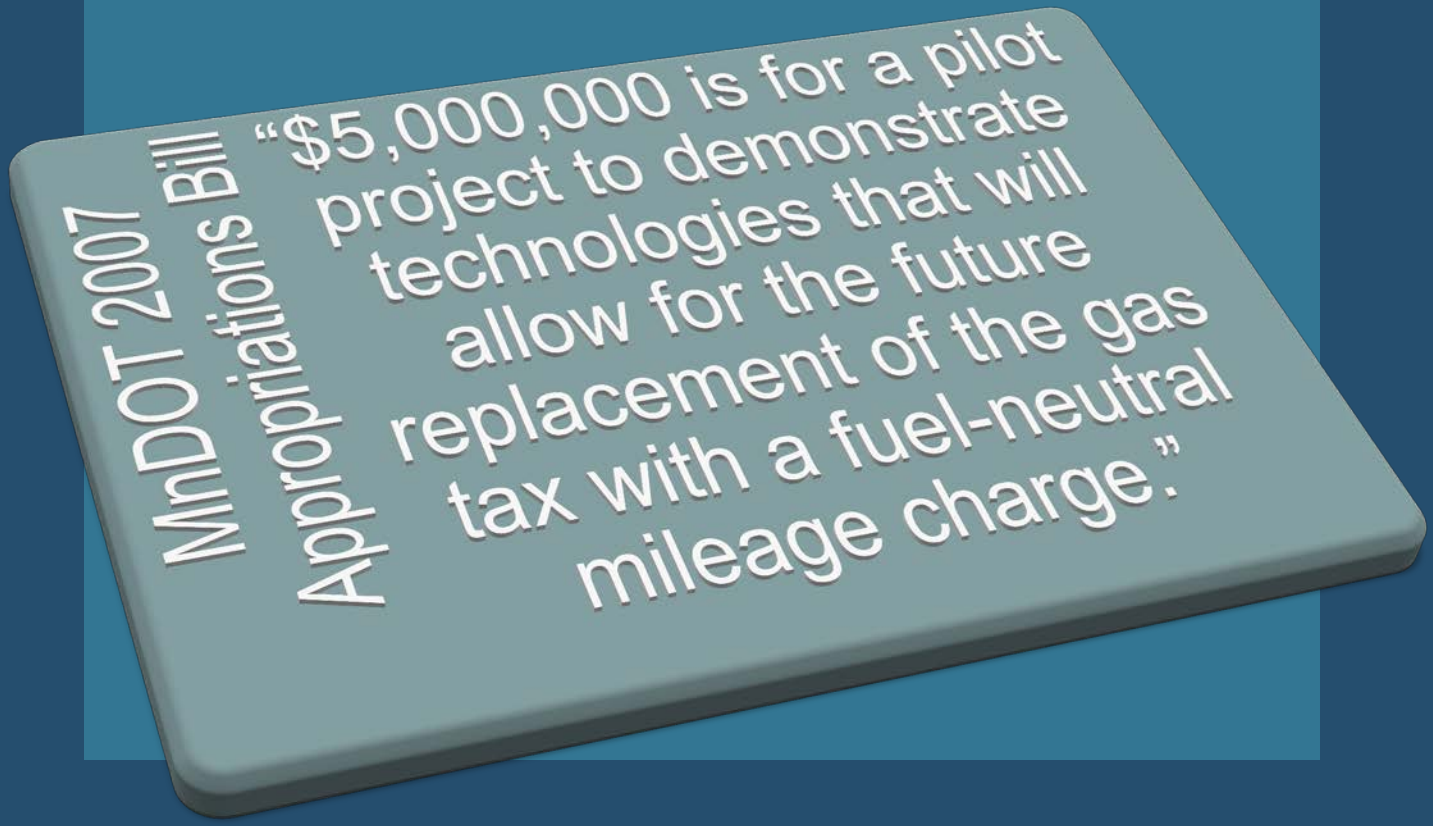
Your Destination...Our Priority

Statutory Direction



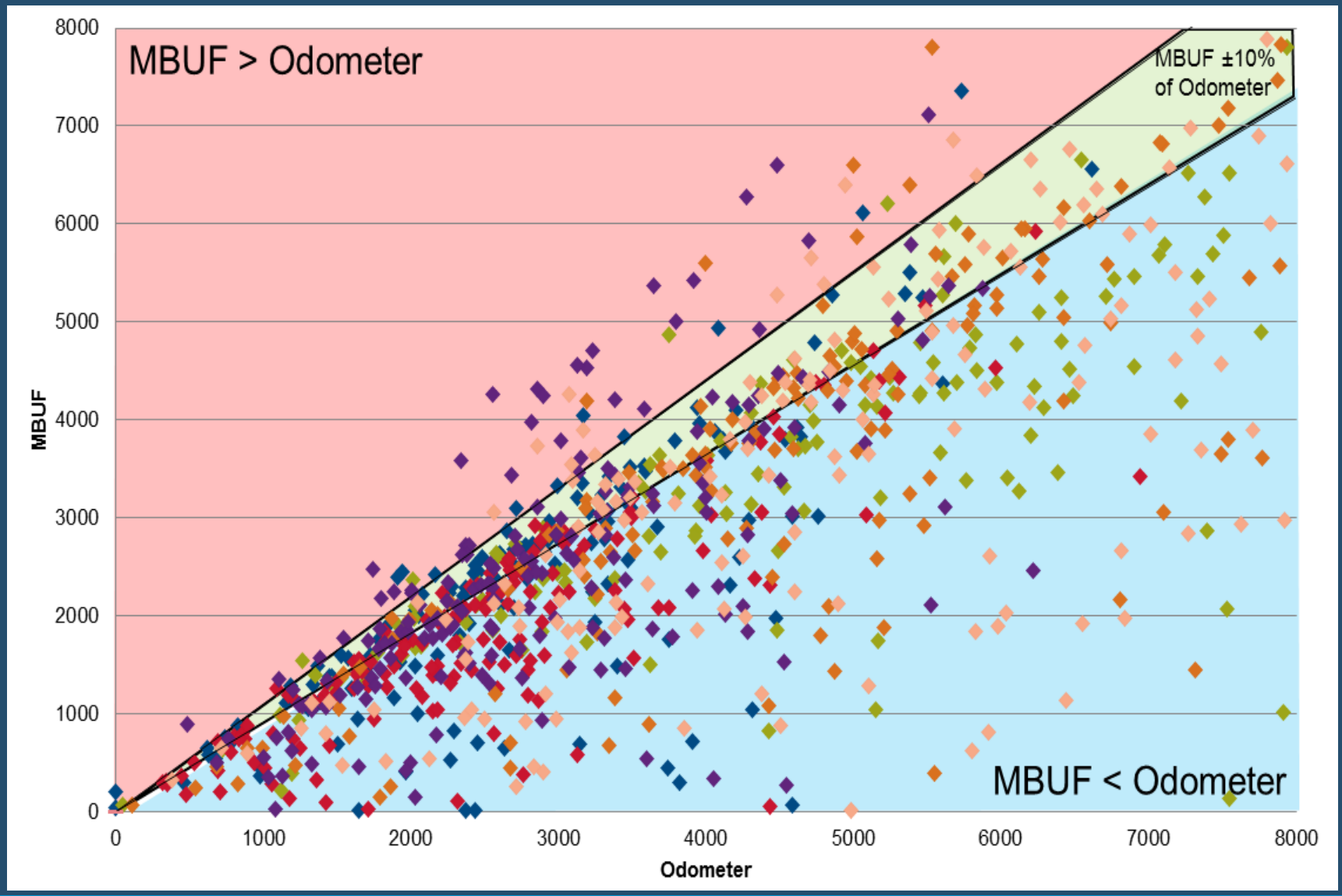
2-Part MBUF Research Effort

1. Technology Demonstration
   (Battelle, SAIC, Mixon Hill)
   - 500 volunteers
   - Utilize smart phones
   - "Opt-In" with odometer readings
   - Connected Vehicles Applications
2. Policy Study (U of MN)

OPERATIONAL CONCLUSIONS

Smart Phone

- Could be viable platform
- GPS issues
- Vehicle power port was not reliable trigger
- Post processing helped


MBUF > Odometer
MBUF ±10% of Odometer
MBUF < Odometer
MBUF
Odometer
0
1000
2000
3000
4000
5000
6000
7000
8000

User Support

- Field Support needs continued optimization
- Statewide Deployment would require significant help support

EVALUATION CONCLUSIONS

Opt-In Discount Approach

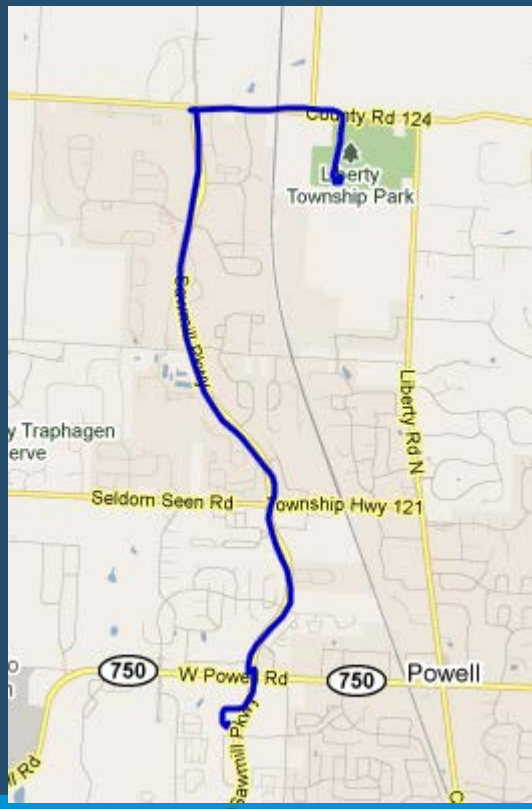
- Odometer non-device miles 3¢ / mile always
- Device miles
  - 3¢ / mile metro zone, peak times
  - 1¢ / mile non-metro or off peak
  - 0¢ outside Minnesota
- 77 % of odometer miles were also device miles
- Un-intentional non-device miles

Monthly Invoices

- $32,000 fees collected
- Average $12 / month
- 98% collection rate
- Would you prefer MBUF over fuel tax?
  - 37 % yes, everyone pays fair share
  - 48 % no, just one more monthly bill
  - 15 % undecided

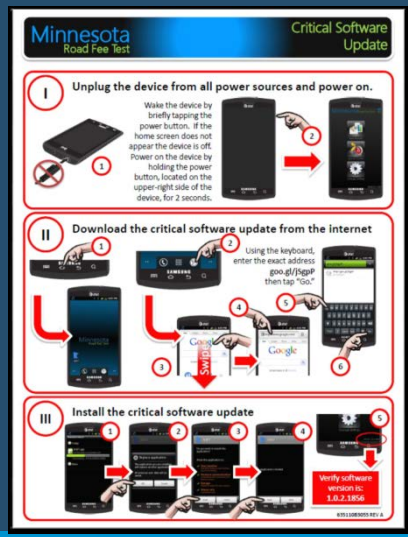
Privacy

- Privacy designed into system
  - Opt-in use of device
  - Only participant can link probe data to device
- Participants did not express fear related to privacy
- More concern about security, hacking



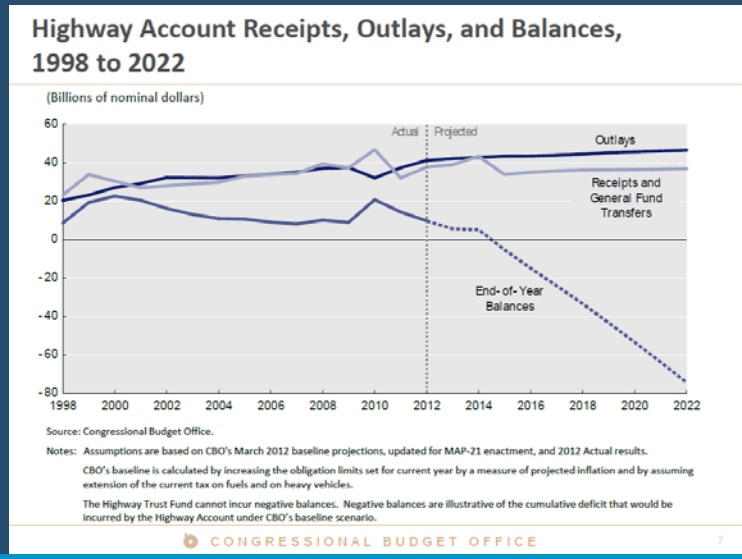
Customer Support

- Requires interaction with individual participants
- Participants were satisfied
- Thoroughly plan for customer support
- Real implementation may need to outsource
- Types of tasks:
  - Equipment distribution, installation, maintenance
  - Billing and receiving payments
    - Administrative



Transportation Funding

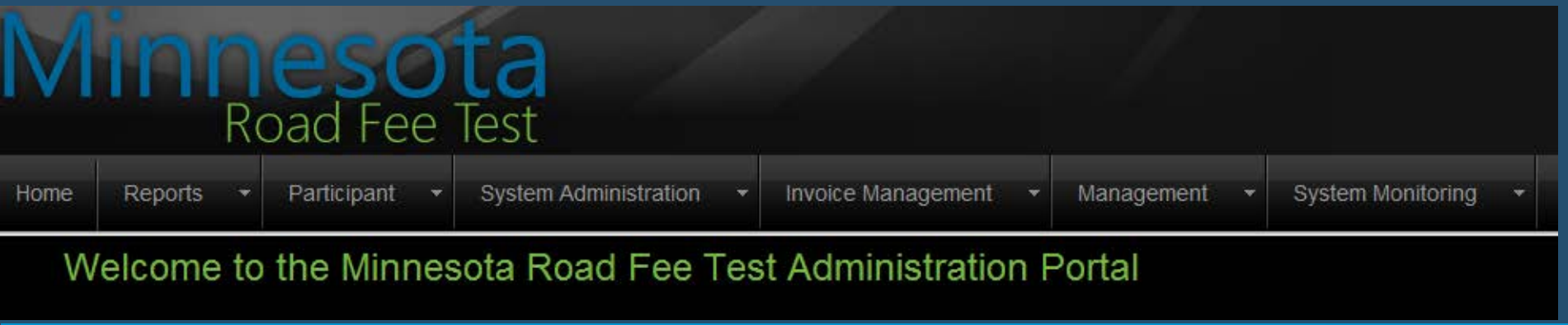
- Participants in the study came to understand the issues with fuel tax revenues, even though the project did not provide education on the topic
- The general population does not understand transportation funding



Administrative Resources

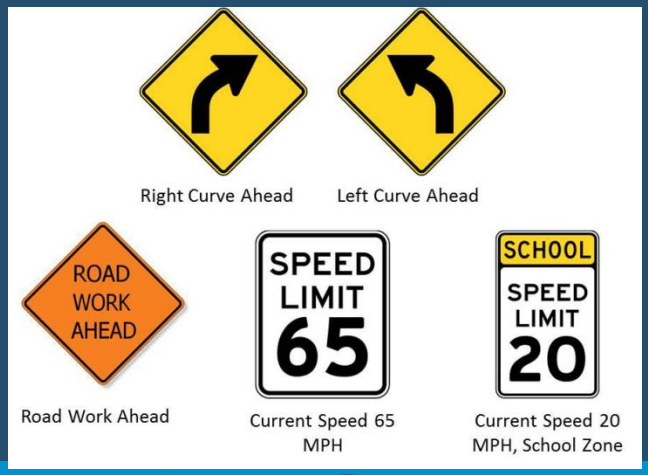
A real deployment would require many resources:

- Customer service
- Data management
- Multi-state groups to collect out-of-state fees



In-Vehicle Signing

- Speed-related safety alerts reduced speeds
- Visual and audible alerts both had benefit
- Audible alerts resulted in better compliance than visual
- Participants felt extra features should not be part of the MBUF system



Simplicity

- Fuel tax is simple
- Participants wanted technology integrated into the vehicle requiring little interaction

Summary

- Conducted a successful test that satisfied the Legislative directive
- The technology worked, but has it's limits
- Test participants used the system, shared their data, and paid their bills
- Policy makers were engaged
- System administration was labor intensive and focused on individual customers

Next Steps

- Share Minnesota test results
- Support legislative proposal for making participant data permanently non-public
- Observe other MBUF efforts especially in Oregon
- Lead transportation pooled fund project to continue to research the other MBUF concepts and related national issues

QUESTIONS or COMMENTS?

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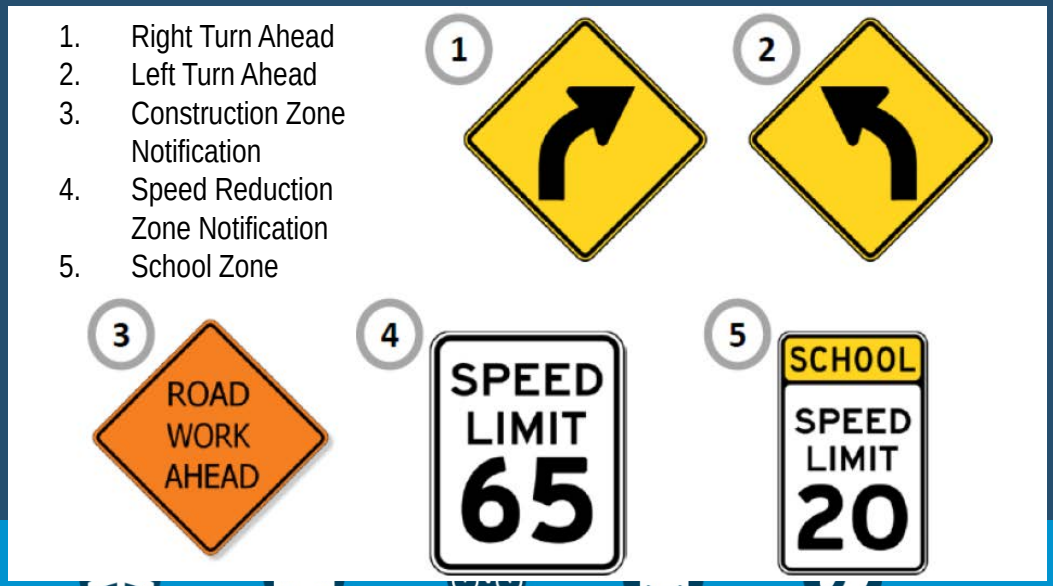
Reports Available at:

www.dot.state.mn.us/mileagebaseduserfee

Safety Signing

- 247 Participants studied to evaluate effectiveness
- Examined driving speeds before and after auditory notification was delivered in vehicle.

1. Right Turn Ahead
2. Left Turn Ahead
3. Construction Zone Notification
4. Speed Reduction Zone Notification
5. School Zone



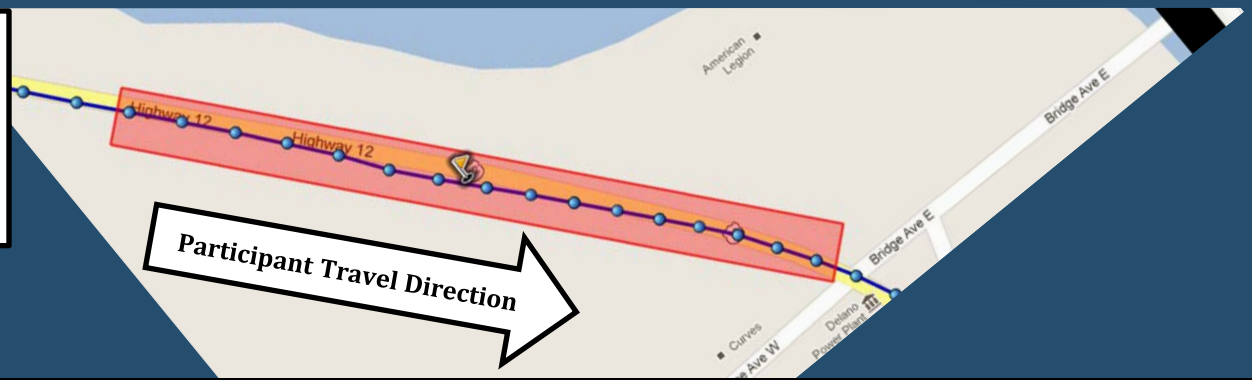
Behavior Type	Speed Limit Compliance, Before Alert (mph)	Speed Limit Compliance, After Alert (mph)	Difference in Speed (mph)	Number (Percentage) of Participants	Number (Percentage) of Trips
1-C	9.99	(2.06)	12.05	12 (5%)	66 (3%)
2-C	11.69	6.21	5.48	229 (93%)	2,104 (95%)
3-C	9.72	11.30	(1.59)	6 (2%)	40 (2%)
Grand Total	**11.56**	**5.93**	**5.93**	**227**	**5,503**

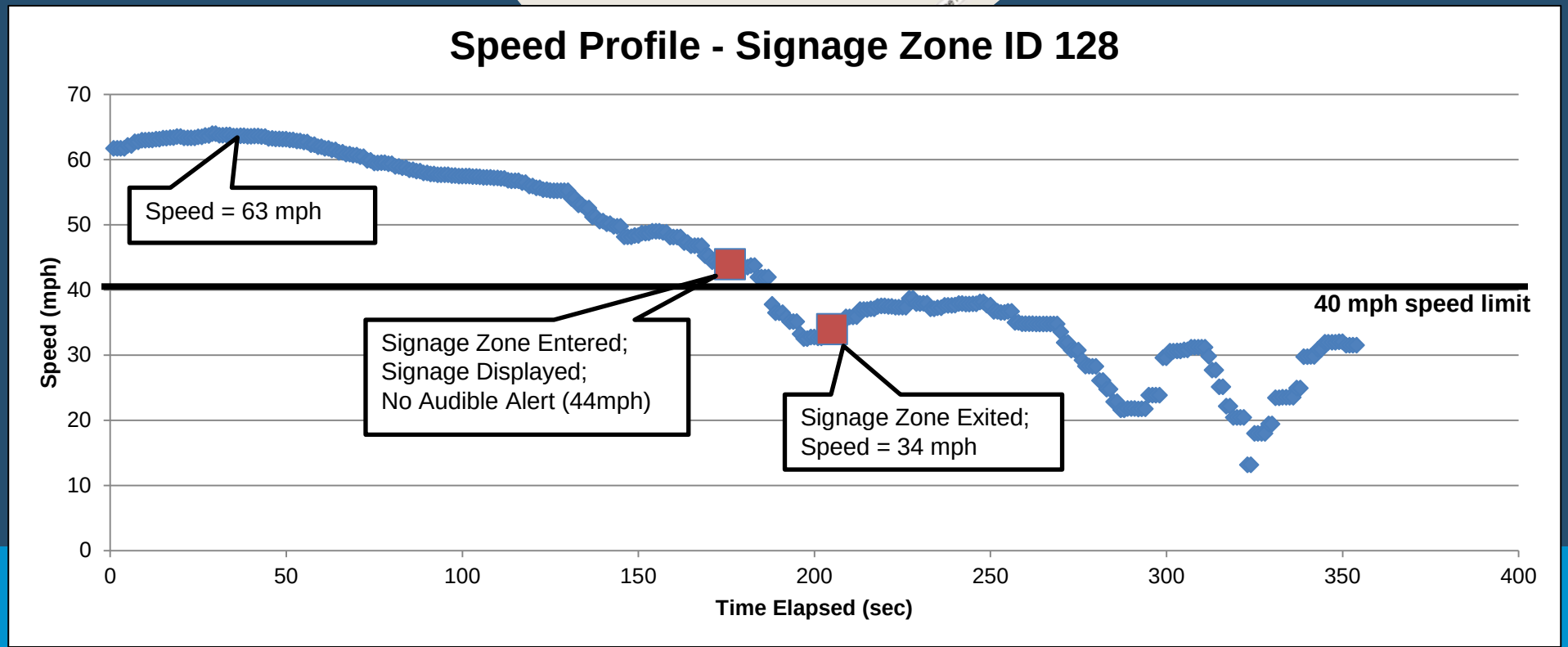
- On average, drivers exceeded the speed limit by 11.6 mph (+/- 9.9 mph) before receiving the alert and by 5.9 mph (+/- 13.2 mph) after receiving the alert. This reflects an overall average reduction in speed of 5.6 mph.
- Drivers on average were still not compliant with the speed limit in the time period immediately following receipt of the audible alert, although drivers did decrease to speeds more compliant with posted limits.
- 98% of drivers positively reacted (decreased speed) as a reaction to the in-vehicle audio/visual alerts.

Example of Speed Profile Data for One Trip Through a Signage Zone

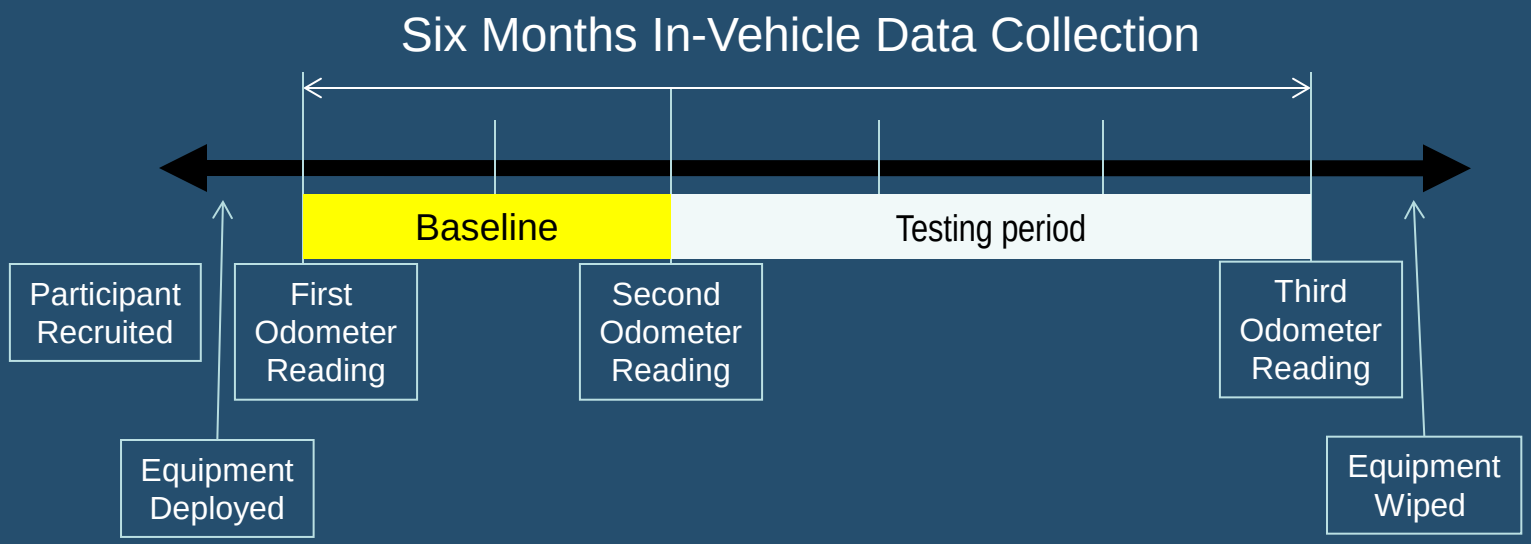
Signage Zone 128
Speed Zone
Speed Limit = 40 mph

US 12 - EB
near Delano, MN





Study Design Overview



- Monthly invoicing during testing period and final reconciliation at last odometer reading
- 3 waves from September 2011 to November 2012

MBUF vs Probe Data

MBUF Application	Probe Data
• Stores accumulated miles by road rate category in OBU • Transmits cumulative miles by category and vehicle ID to Infrastructure no more than once per day • No information on individual trips	• Latitude/Longitude on second-by-second basis • Transmitted to Infrastructure every 20 seconds • Contains a TRIP identifier (ID) but no information on vehicle or person

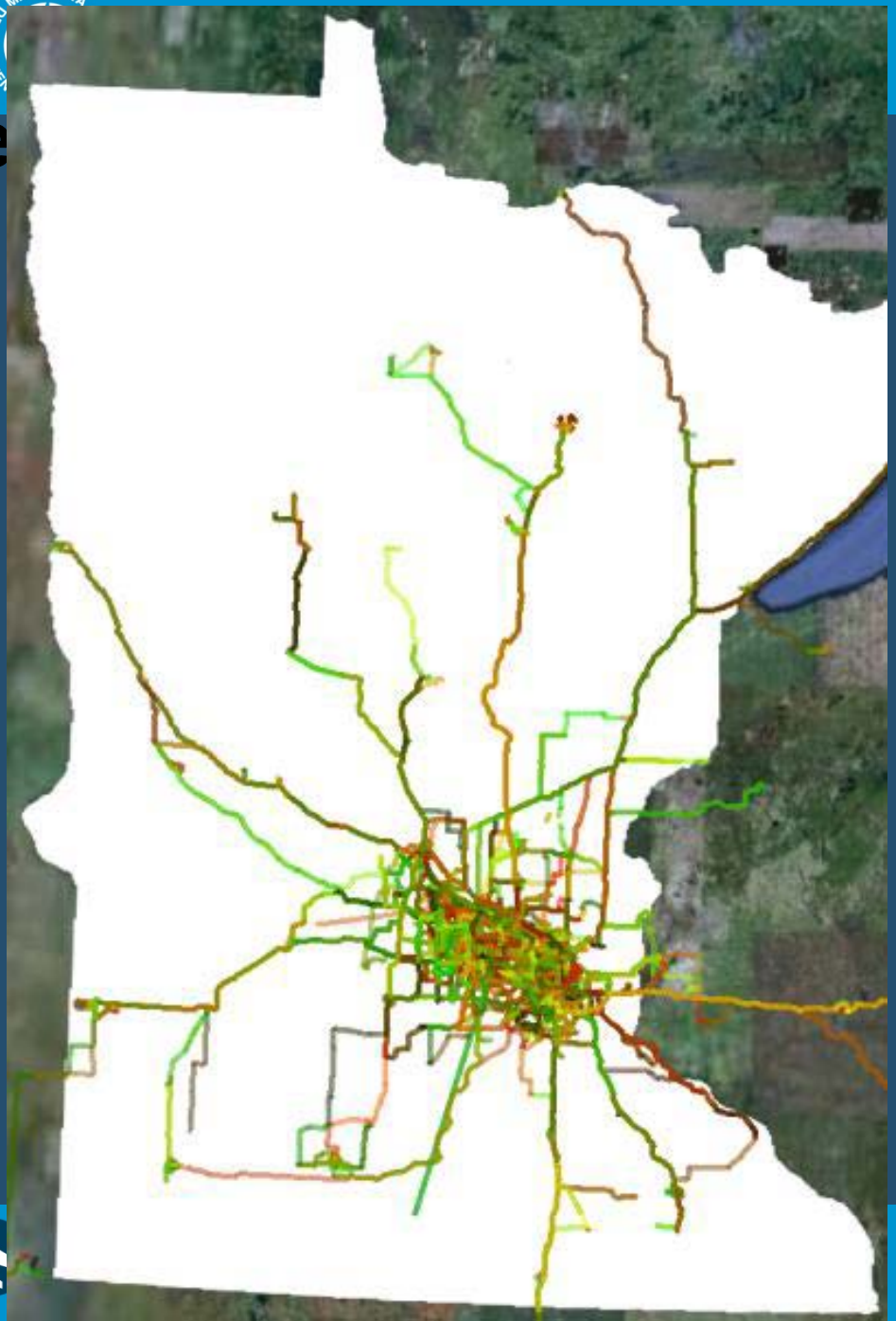
Only the participant can link probe data to the person

Demonstration Data Analysis

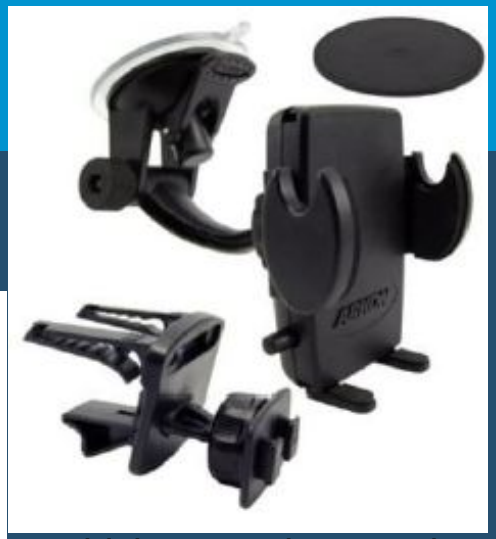
- Data Sources
  - System collected data
    - # of trips, # of miles, length of trip
  - Participant Perceptions
    - Surveys, focus groups, and interviews
  - Service request and Stakeholder Interviews
- Data Collection (478 participants)
  - 660 million trip data points
  - 4 million miles collected within 500,000 trips
  - 1,411 survey response, 432 interviews, and 6 focus groups with 63 participants

Where did they drive

- 800,000 snapshots per day for every 150 users
- November 2011
- 150 vehicles from Wave A



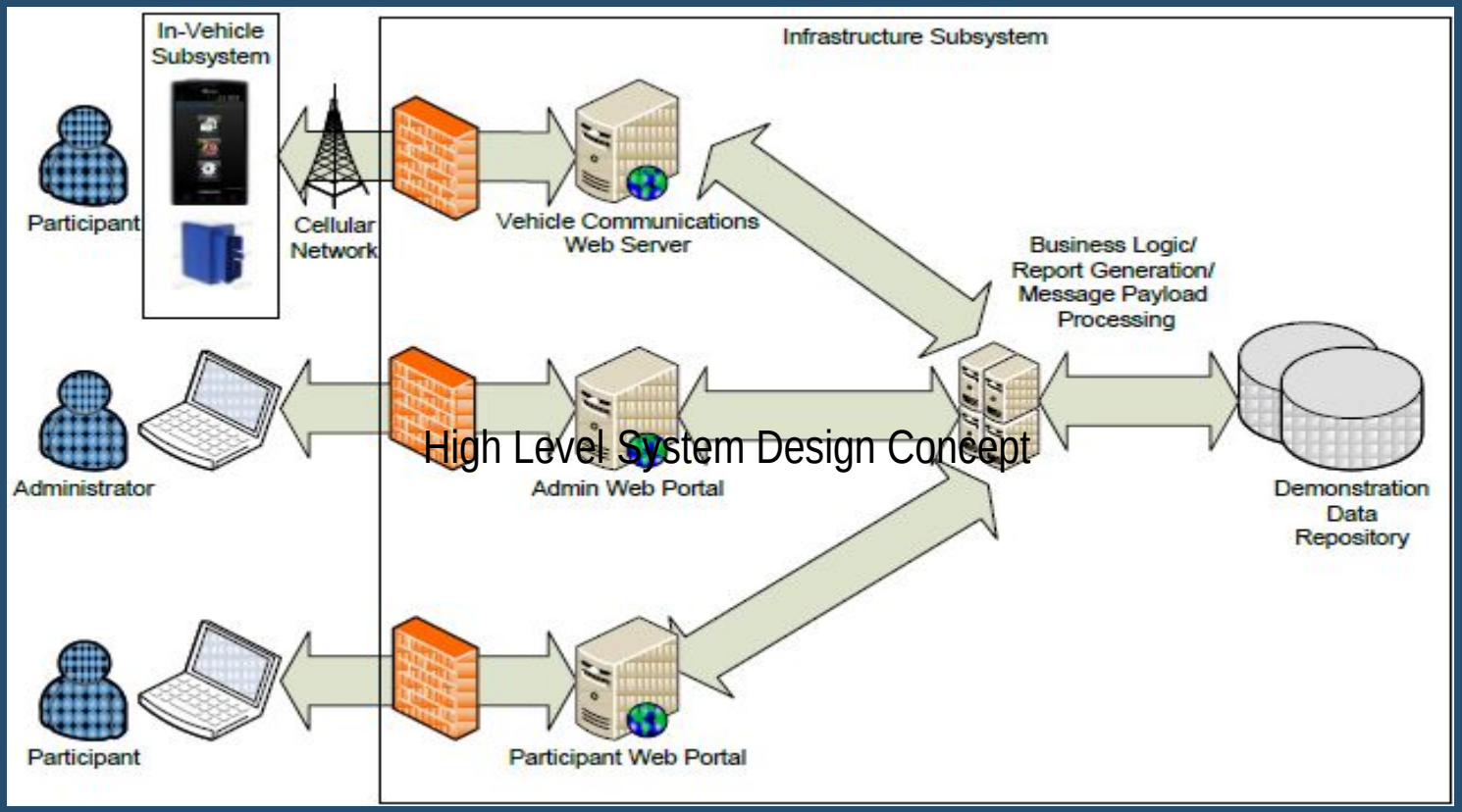
Samsung Captivate ™ Smartphone



In-Vehicle Mounting Brackets

Vehicle Identification (VIDM) Module

Power Cables



High Level System Design Concept

Participant Web-Portal Home Page

Capabilities

- The system was designed to:
  - Use the phone's onboard GPS capabilities to charge a mileage fee which could vary according to any time and location in North America
  - Display safety signage for 98 zones covering Wright County MN
    - 46 school, 17 curve, 7 construction, 28 speed reduction
    - 5 DSRC radios communicating with DSRC infrastructure, specifically CICAS intersections
  - Deliver travel time data for 3 predefined corridors in Northwest Twin Cities Metro Area

Participant Demographics

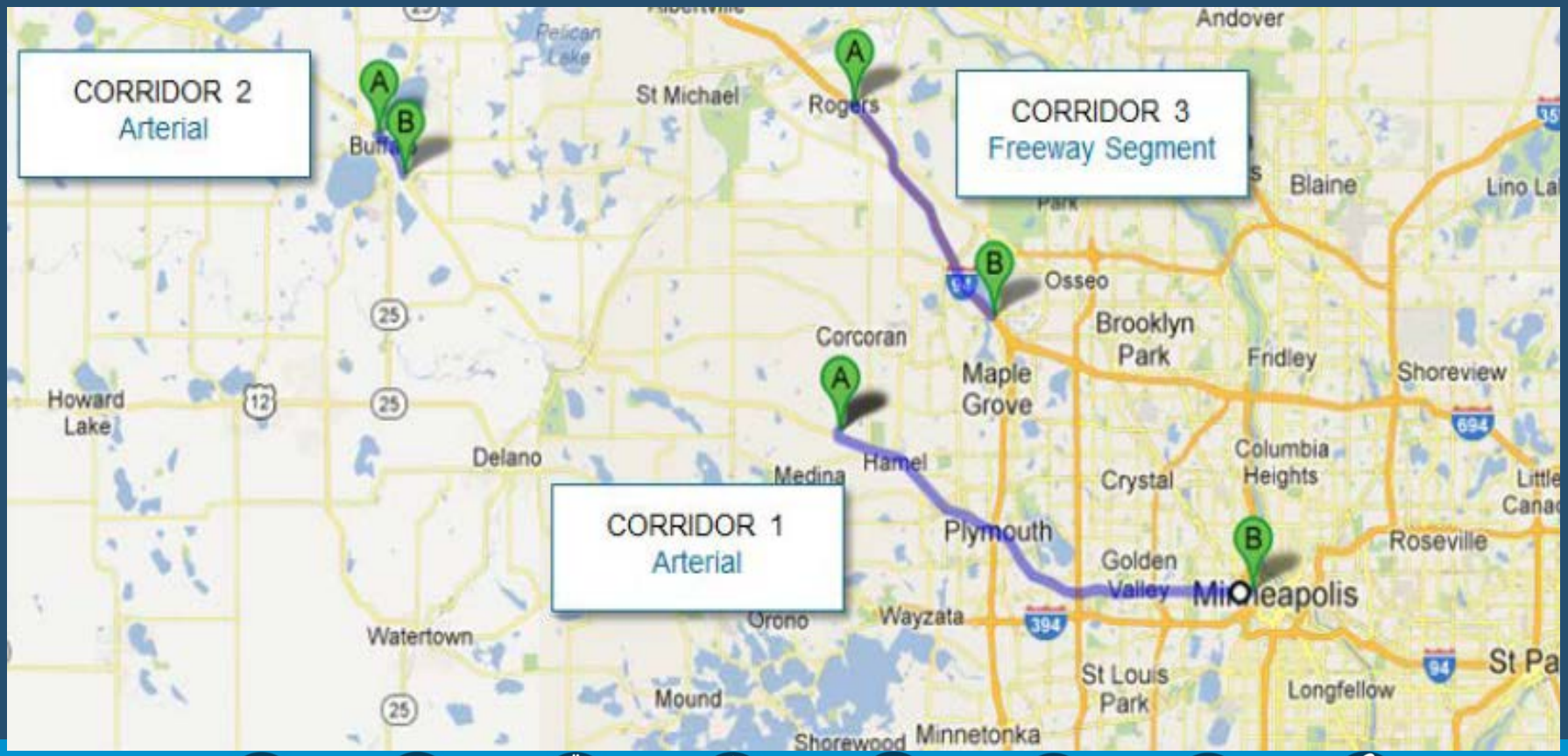
- Focus on Wright County, MN
- Recruiter made over 15,000 telephone calls
- Recruited over 650 participants to fill the 500 slots
- Paid average of $320 per participant

Gender	Test	Wright County
Male	46.4%	50.2%
Female	53.6%	49.8%
Age (years)	Test	Wright County
18 – 35	16.6%	22.1%
36 – 55	54.6%	47.7%
56 – 65	23.0%	15.1%
66 +	5.8%	15.1%
Income	Test	Wright County
<$35k	6.0%	20.7%
$35k – $49k	14.0%	12.7%
$50k – $74k	32.6%	23.7%
$75k +	47.4%	42.9%

Total: 500 (All Waves)

- Good balance except low income & younger drivers

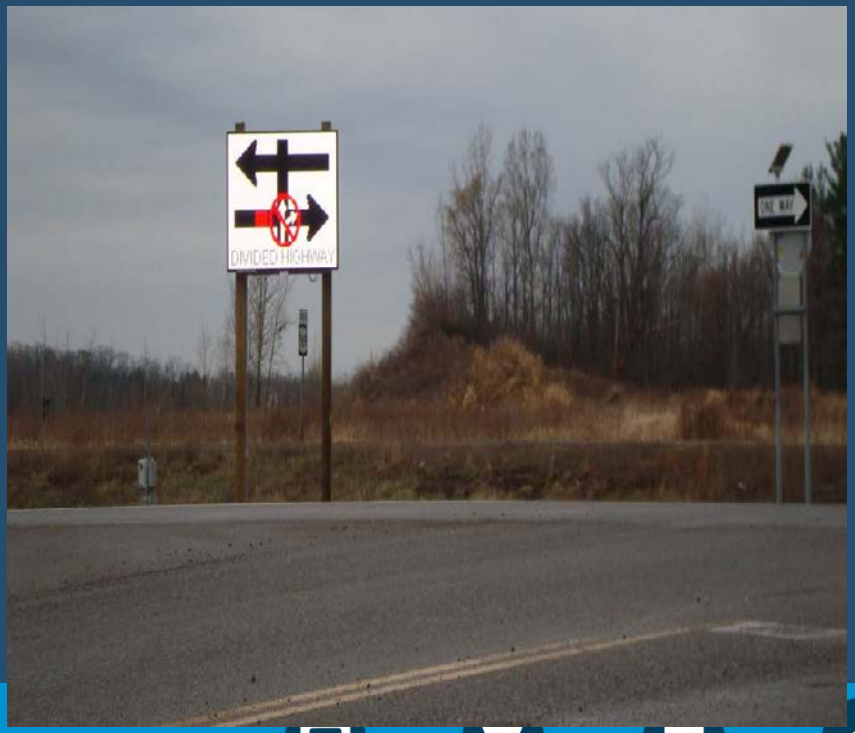
- Three corridors were identified as “travel time study corridors” according to the likely hood that they would be traveled during the study
  - Corridor 1 - A 16-mile segment of TH55 in Hennepin County from Arrowhead Drive near Hamel to N 7th Street in Minneapolis;
  - Corridor 2 - A 1.6-mile segment of TH55 in the City of Buffalo / Wright County that runs from Central Avenue / TH25 to County Road 34 / 10th Street; and
  - Corridor 3 - An 8-mile section of I-94 from TH 101/Main Street in Rogers to County Rd 109/Weaver Lake Road in Maple Grove.

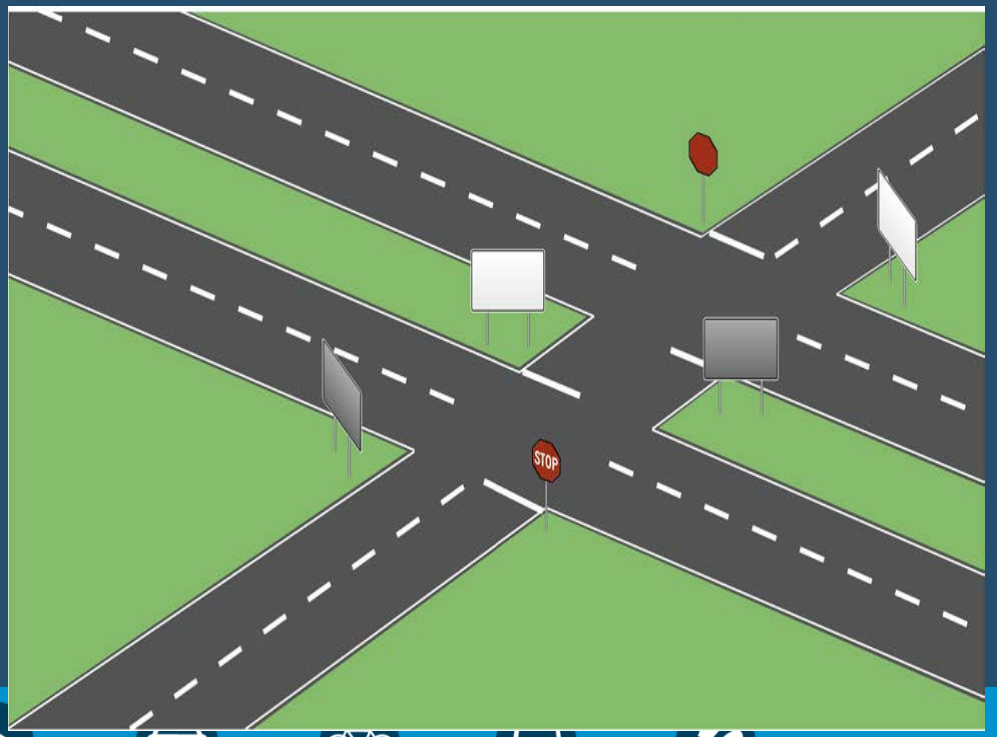


Source: Google Maps

CICAS Test

- At CICAS-SSA intersections, warning messages are presented to drivers via fixed digital signs at intersection points.





- The application developed for the program was capable of using DSRC devices to display the CICAS-SSA warning messages in the vehicle, providing drivers with an alternative to the existing signs.

Results

- The system successfully demonstrated that it was capable of receiving and displaying information from connected vehicle roadside equipment using DSRC technology.
- Participants found the In-Vehicle signage convenient, however did not have a strong preference between the In-Vehicle signs and the existing infrastructure signs.
  - It is worth noting that all participants in this study regularly used the intersection and thus were accustomed to using the existing signage as opposed to the In-Vehicle signage.