



Stop Sign Gap Assistance At Rural Expressway Intersections

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Outline

- What is Stop Sign Gap Assistance?
- Part of Multi-State Effort
- Crash Data Analysis
- Driver Interface Human Factors
- Test Intersection
- Portable Data Collection System
- Cooperative Gap Algorithms/Communications
- Field Operational Test Approach
- Conclusion



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What Is Stop Sign Gap Assistance?



insufficient gap to enter or cross

Possibilities: Alert of approaching vehicles Inform of size of gap •Warn of insufficient gap Advise against unsafe actions



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Part of Multi-State Effort

Intersection Decision Support by IVI Infrastructure Consortium – 3 Focus Areas









- CA, GA, IA, MI, MN, NC, NH, NV, WI
- Stop Sign Gap Assistance
- CICAS
 - CAMP, Mn/DOT, Caltrans, (MDOT, VDOT)
 - 3 Focus Areas



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Minnesota IDS Accomplishments

- Crash Analysis
- Human Factors Study
 - Rated Roadside Sign Concepts
- Test Intersection
 - Measured Accepted Gaps with Factors
 - Provided Experience with Technology



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IDS Pooled Fund Tasks

- Participating States:
 CA, GA, IA, MI, MN, NC, NH, NV, WI
- Multi-State Crash Analysis
- Portable Data Collection System



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Minnesota CICAS Tasks

- Roadside Sign Design
 Human Factors Study
- Cooperative Gap Algorithms/Communications
 - Tailoring Gap to Driver/Vehicle/Maneuver
 - Real-time State Map into Vehicle
- Operational Test
 - Real Vehicles and Operational Signs



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Crash Data Analysis

- Crash Characteristics At Candidate Rural Expressway Intersections
 - Gap problem (87%) vs
 stop sign violation problem (0%), (13% unknown)
 - Far side of intersection(78%) vs near side (22%)





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8 channels
3D surround sound
Car body vibration
Force feedback steering
Power-assist feel on the brakes
3-axis electric motion system

U of M Driving Simulator

- Ability to model precise reproductions of geo-specific locations
- Resolution = 2.5 arc-minutes per pixel





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Hazard Sign – Provides Warning



No information about traffic or advice for action.



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www.dot.state.mn.us/guidestar



DANGEROUS

TRAFFIC

Icon Sign – Provides Advice



No information about traffic or warning of situation.



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Countdown Sign – Provides Information and Advice



No warning of situation.



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Map Sign – Provides Warning and Advice



No information about traffic.



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Compared to baseline, which concept is effective?



Baseline



Highway 52 at Goodhue County 9







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Cameras for Crossroad Surveillance - Visible and Infrared







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License Plate Reader





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•Measure gaps as vehicle clears stop line area.

•Add startup time to determine actual gap.

Correlate gap with:

•Vehicle Classification •RWIS Data

Turning MovementMedian Wait Time

- •Time of Day
- •Owner

Demographics



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Main Findings:

- Mean Accepted Gap = 7.0 Seconds (Ignoring gaps > 10 seconds)
- Accepted gap inversely related to traffic volume
- Accepted gap bigger with decreased visibility and with increased precipitation
- Accepted gap similar for all vehicle classifications (Artifact of measuring method)



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Portable Data Collection System





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Cooperative Gap Algorithms/Communications

- Infrastructure To Vehicle
 - Intersection Geometric Map
 - Intersection state map (location, speed, and heading of all mainline vehicles within range)
 - Road weather condition?
 - Infrastructure Gap warning state



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Cooperative Gap Algorithms/Communications

- Vehicle To Infrastructure
 - Vehicle classification and characteristics
 - Turn signal state
 - Driver gap acceptance parameters
 - Current in-vehicle gap warning state
 - Brake state (for future use)?
 - Antilock/traction control state?



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CICAS Operational Test (5 Years)





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Conclusions

- Stop sign gap acceptance is a real problem
- IDS/CICAS solutions have potential to address the problem
- Stop sign gap assistance systems are feasible in a reasonable time period



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Web Sites

• IDS Project:

http://www.its.umn.edu/research/applications/ids /index.html

Pooled Fund:

http://www.pooledfund.org/projectdetails.asp?id =306&status=4



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