Development of a Prototype Adverse Visibility Warning and Control System for Operational Evaluation

THE GEORGIA AUTOMATED ADVERSE VISIBILITY WARNING AND CONTROL SYSTEM

2004 National Highway Visibility Conference
Introduction

• 14-mile stretch of I-75 in south Georgia

• Fog episodes
  – Peat bogs, air temperatures and humidity
  – Smoke from agricultural burning

• Previous actions
  – Street lights at 200-ft intervals
  – Stationary warning signs
  – Bulb-matrix changeable message signs
  – Detour signs and traffic cones available
System Overview

- Continuously monitors visibility and traffic
  - 19 fog sensors
  - 5 sets of traffic loops
  - Weather station
  - 4 changeable message signs
- Automatically displays fog and speed advisories
- Remote access for operators and administrators
Illustration of Fog Detection and Warning Concept
Hardware Layout

Legend

† visibility sensor

CMS changeable message sign

lighted area

light switch

traffic loops

fiber optics cable

buried cable

telephone line

control module

television camera

weather instruments
Visibility Sensor and Associated Electronics
Operator’s Remote Terminal Interface

Adverse Visibility Warning System

Environment
- Relative Humidity: N/A
- Temperature: N/A
- Wind Speed: N/A
- Wind Direction: N/A

Visibility Threshold Conditions
- Threshold 1: < 1100 ft
- Threshold 2: < 800 ft
- Threshold 3: < 500 ft
- Threshold 4: < 300 ft

Current Low Visibility: 6562 ft
Visibility Condition: Clear

Legend:
- FOG SENSOR
- LOOP
- REMOTE ACCESS SIGN
- MILE POST
- CAMERA
- LIGHT CONTROL
## Sampling and Logging Intervals

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Clear Conditions</th>
<th>Fog Episode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sample Interval</td>
<td>Log Interval</td>
</tr>
<tr>
<td>Visibility</td>
<td>1 min</td>
<td>15 min</td>
</tr>
<tr>
<td>Traffic</td>
<td>1 min</td>
<td>15 min</td>
</tr>
<tr>
<td>Weather</td>
<td>1 min</td>
<td>15 min</td>
</tr>
<tr>
<td>TV</td>
<td>None</td>
<td>Time-lapse VCR</td>
</tr>
</tbody>
</table>
Advisory Message Generation State Diagram

Threshold Levels: 1200 m, 800 m, 500 m, 200 m
Suggested speed: safe speed for current visibility
Timer: 5 minute timer delay between subsequent messages

Legend:
- = Current State
- = State Transition

- Start
- Acquire Data
- Visibility < threshold
- Calculate: average visibility, minimum speed & visibility
  visibility increased/decreased
  if first time THEN copy current data to previous data
  set previous visibility to clear
  clear first time flag
- Visibility increased or constant
- Timer done
- Visibility decreased
- Timer done
- Close Messages & timers
- log event
- Notify data collection process
- Turn off VCR
- Copy current data to previous
- Threshold change
- No Threshold change
- speed < suggested
- Speed increased
- Clear current data to previous
- Speed increase or constant
- Timer still going
- Timer done
- Not the first time
- Copy current data to previous
- Generate new message
  log event
  start timer
  Notify TMC
  Notify data collection process
  Turn on VCR
  Copy current data to previous

- Gary Gimmestad 404-894-3419 gary.gimmestad@gtri.gatech.edu
Speed Advisory Nomogram
Sample Image from Video Camera
Conclusions

• System has been operating as designed since 2001
• Good correlation between sensor readings and camera visibility
• Undergoing preliminary operational evaluations
• No studies yet on effects on driver behavior
• Model for other locations with visibility problems