Tornadoes Impacting Interstates: Service and Societal Considerations

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The views expressed are those of the authors and do not necessarily represent those of the National Weather Service.
✓ Quantify the frequency of tornadoes crossing Interstates in “Tornado Alley”

✓ Occurrences of vehicles/people impacted by Interstate tornadoes

✓ Investigate any additional factors that increased chances for impact

✓ Examine the recommended protective actions for motorists

✓ What can be done to improve message/services to travelers
Why Interstate Tornadoes?
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“We’re from Missouri and we get tornadoes. We have a basement but not on the highway.”

Cassie Barker, Lebanon, MO (KMBC-9 Kansas City)
Why Interstate Tornadoes?

Motorists on Interstates have increased vulnerability to weather hazards!

- Motorists lack immediate access to a substantial shelter.
- Few opportunities to change direction of travel or exit off the Interstate.
- Limited ability to obtain convective “warnings” or unaware/unable to access existing mobile services that provide warning information.
- Travelers likely unfamiliar with local towns and counties referenced in warnings, even if they have access to warning information.
- Interstates hold a relatively constant stream of vehicles (*e.g. potential for many eyewitnesses*). May offset some traditional underrepresentation of rural tornado events.
Methodology

1 Jan 1990 to 31 Dec 2008

Total number of Interstate Routes: 144
Total number of Interstate miles: 18,169
Interstate Tornadoes (1990-2008)

Total Tornadoes: 15,621 (822/year)

Interstate Tornadoes: 484 (25/year)
(3% all tornadoes)
Normalized Distribution by State per 100 Miles of Road
Normalized Distribution by State per 100 Miles of Road
Motor Vehicle Impacts

Defined as any motor vehicle “impacted” on an Interstate by a tornado.

(Broken windows, body damage, vehicles shifted or blown off the road, vehicle rolled, overturned, tossed, or destroyed.)

92 Vehicle Impact Tornadoes

Accounts for 19% of Interstate tornadoes

(~ 1 in 5 tornadoes struck vehicles based on the “existing” record)

Impacted Vehicles:

263 Total Vehicles
150 Semi-trailer Trucks

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EF Scale Distribution

- EF0: 62%
- EF1: 33%
- EF2: 30%
- EF3: 27%
- EF4: 24%
- EF5: 23%

Colors:
- Red: All TOR
- Blue: Vehicle Impact TOR
- Green: All US TOR
Time of Day Tornado Distribution

- **Day:**
  - All Tornadoes: 66.5%
  - Vehicle Impact Tornadoes: 57.6%

- **Night:**
  - All Tornadoes: 33.5%
  - Vehicle Impact Tornadoes: 42.4%
Interstate Killer Tornadoes

7 tornadoes resulted in 8 direct fatalities on the interstate.

<table>
<thead>
<tr>
<th>State</th>
<th>Date</th>
<th>EF</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas</td>
<td>3/1/97</td>
<td>EF4</td>
<td>day</td>
</tr>
<tr>
<td>Arkansas</td>
<td>11/27/05</td>
<td>EF3</td>
<td>night</td>
</tr>
<tr>
<td>Illinois</td>
<td>4/19/96</td>
<td>EF3</td>
<td>night</td>
</tr>
<tr>
<td>Illinois</td>
<td>6/1/99</td>
<td>EF3</td>
<td>day</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>5/3/99</td>
<td>EF5</td>
<td>day</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>5/3/99</td>
<td>EF4</td>
<td>night</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>8/27/94</td>
<td>EF3</td>
<td>night</td>
</tr>
</tbody>
</table>

~ 7% killer tornadoes per vehicle impact tornadoes
~ 1% killer tornadoes per all interstate tornadoes

(All killer tornadoes EF3 or greater intensity)
Were there specific circumstances that enhanced threat?

<table>
<thead>
<tr>
<th>Fatality Location</th>
<th>Mitigated?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 deaths under overpass</td>
<td>Outside of vehicles</td>
</tr>
<tr>
<td>2 deaths from debris inside vehicle</td>
<td>Body below windows?</td>
</tr>
<tr>
<td>1 death in semi at a rest area on Interstate</td>
<td>Was driver asleep?</td>
</tr>
<tr>
<td>1 death in the sleeper portion of a semi</td>
<td>No seat belt, asleep?</td>
</tr>
<tr>
<td>1 death in van with person ejected</td>
<td>No seat belt?</td>
</tr>
<tr>
<td>1 death from vehicle thrown upside down</td>
<td>---</td>
</tr>
</tbody>
</table>

263 Total Vehicles Impacted = Few Direct Fatalities
Recommended Protective Actions
If you are caught outdoors, you should seek shelter in a basement, shelter or sturdy building. If you cannot quickly walk to a shelter:

- Immediately get into a vehicle, buckle your seat belt and try to drive to the closest sturdy shelter.

- If flying debris occurs while you are driving, pull over and park. Now you have the following options as a last resort:
  - Stay in the car with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible.
  - If you can safely get noticeably lower than the level of the roadway, exit your car and lie in that area, covering your head with your hands.

- Your choice should be driven by your specific circumstances.
If you are caught outdoors, you should seek shelter in a basement, storm shelter or sturdy building. If you cannot quickly walk to a shelter:

- Immediately get into a vehicle, buckle your seat belt and try to drive to the closest sturdy shelter.

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Support Services and Technologies

Interstates are crucial points of reference to both travelers and local residents
NWS Support to Interstate Travelers

Mile markers (MM) are the universal language!

Initial tornado warnings (2005-2008) for confirmed Interstate tornadoes

95 Interstate Tornadoes

*Warnings*

87 Tornado Warnings
8 No Tornado Warning

*Mile Markers*

70 No MM Mention
17 MM Mention
5 Interstates mentioned in text

Only 23% tornadoes with reference to Interstates mentioned in TOR warnings
Future Tools - Collaboration Possibilities

Dynamic Message Signs
511 Service
Media/DOT Radio Broadcasts
Law Enforcement Road Closures
Cell Phones/Graphical Tools
Conclusions and Future Work

- Motorists traveling on Interstates (other roadways) have increased vulnerability to weather hazards.
- Interstates and Mile Markers serve as important references in disseminated warning information.
- Multi-agency collaboration and future technologies may help mitigate casualties/damage.
- Paradigm shift: New “last-resort” safety options training.
- Paper to summarize results and recommendations.

Thank You!

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