Truck Tractor Crash Analysis
Tribal Lands in Arizona 2009-2013

ITCA Tribal Epidemiology Center (TEC)
August 6, 2015

Source: azcentral.com
Topics

- Background
- Objectives
- Method
- Findings
- Strengths and limitations
- Recommendations

Source: azcentral.com
Definition: Truck Tractor

- Non-cargo carrying power unit in combination with a semi-trailer.
- Truck tractors and semi-trailer combinations, referred to as tractor/trailers.

Source: U.S. Department of Transportation, Federal Motor Carrier Safety Administration
Why Care about Truck Traffic Safety?

- Arizona is in the middle of a large, expanding trade triangle connecting Southern California, Texas and northern Mexico.
- Annually, commercial trucks make about 8 million trips into and out of Arizona with most on east-west interstate routes.
- North-south trade with Mexico and Canada is a major initiative nationally and for Arizona.
- By 2050, freight shipments are expected to triple in Arizona.
2010 Statewide Crash Analysis

- Utilized 1997-2006 reported crash data in the Arizona Location Identification Surveillance System
- Completed an analysis of n=27,382 crashes on tribal lands in Arizona
- Injury and fatal crash rates were about 5 times higher on tribal lands than statewide for:
  - Lane departure crashes involving truck tractors trailers (TTT)
  - Speed-related crashes involving TTT
2009-2013 Analysis of TTT Crashes on Tribal Lands in Arizona
Objectives

- Compare the number and percent of injuries and fatalities in TTT crashes on and off Tribal lands
- Identify high crash locations
- Identify differences between TTT crashes occurring on and off Tribal lands
Method and Results

- Utilized 2009-2013 reported crash data in the Arizona Location Identification Surveillance System
- Examined 12,557 total crashes on Tribal lands
  - Identified n=553 total TTT crashes on Tribal lands
  - 4% of crashes on Tribal lands involved TTT
  - 2% of crashes off Tribal lands involved TTT
Results: Location

- 94% of truck tractor crashes on Tribal lands occurred on interstates, US highways, and state routes
- 40% of truck tractor crashes occurred on I-10
- 12% of truck tractor crashes occurred on I-40
Results: Year

<table>
<thead>
<tr>
<th>Year</th>
<th>On Tribal Lands</th>
<th>Off Tribal Lands</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>18%</td>
<td>16%</td>
</tr>
<tr>
<td>2010</td>
<td>19%</td>
<td>22%</td>
</tr>
<tr>
<td>2011</td>
<td>22%</td>
<td>21%</td>
</tr>
<tr>
<td>2012</td>
<td>20%</td>
<td>21%</td>
</tr>
<tr>
<td>2013</td>
<td>21%</td>
<td>20%</td>
</tr>
</tbody>
</table>
Results: Month

- On Tribal Lands
- Off Tribal Lands
Results: Day of Week

<table>
<thead>
<tr>
<th>Day</th>
<th>Percent On Tribal Land</th>
<th>Percent Off Tribal Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>11%</td>
<td>8%</td>
</tr>
<tr>
<td>Tuesday</td>
<td>12%</td>
<td>15%</td>
</tr>
<tr>
<td>Wednesday</td>
<td>14%</td>
<td>17%</td>
</tr>
<tr>
<td>Thursday</td>
<td>16%</td>
<td>17%</td>
</tr>
<tr>
<td>Friday</td>
<td>16%</td>
<td>17%</td>
</tr>
<tr>
<td>Saturday</td>
<td>20%</td>
<td>17%</td>
</tr>
<tr>
<td>Sunday</td>
<td>10%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Legend: On Tribal Land, Off Tribal Land
Results: Injury Status

- **No Injury**
  - On Tribal Land: 78%
  - Off Tribal Land: 82%

- **Possible Injury**
  - On Tribal Land: 5%
  - Off Tribal Land: 6%

- **Non-Incapacitating Injury**
  - On Tribal Land: 9%
  - Off Tribal Land: 6%

- **Incapacitating Injury**
  - On Tribal Land: 3%
  - Off Tribal Land: 2%

- **Fatal**
  - On Tribal Land: 1%
  - Off Tribal Land: 0.8%

- **Unknown**
  - On Tribal Land: 3%
  - Off Tribal Land: 3%
Results: Injuries and Fatalities by Vehicle Type

- Injury, TTT: 6% (On Tribal Land), 13% (Off Tribal Land)
- Injury, Non-TTT: 94% (On Tribal Land), 87% (Off Tribal Land)
- Fatality, TTT: 39% (On Tribal Land), 28% (Off Tribal Land)
- Fatality, Non-TTT: 61% (On Tribal Land), 72% (Off Tribal Land)
Results: Vehicles per Crash

- Single Vehicle:
  - On Tribal Lands: 32%
  - Off Tribal Lands: 21%

- Multiple Vehicles:
  - On Tribal Lands: 68%
  - Off Tribal Lands: 79%
Results: **Time of Day**

![Graph showing the percentage of occurrences of events on tribal land and off tribal land, with single and multiple vehicle categories. The graph is color-coded to differentiate between OnTribal Land, Single Vehicle (Orange), OnTribal Land, Multiple Vehicle (Green), Off Tribal Land, Single Vehicle (Brown), and Off Tribal Land, Multiple Vehicle (Dashed Green).]
Results: **Collision Manner**

- **On Tribal Land**
  - Single Vehicle: 32%
  - Sideswipe, Same Direction: 18%
  - Right Turn: 13%
  - Sideswipe, Opposite Direction: 5%
  - Head On: 3%
  - Left Turn: 2%
  - Rear to Side: 2%
  - Unknown: 0.2%
  - Rear to Rear: 0.2%

- **Off Tribal Land**
  - Single Vehicle: 33%
  - Sideswipe, Same Direction: 21%
  - Right Turn: 9%
  - Sideswipe, Opposite Direction: 2%
  - Head On: 3%
  - Left Turn: 1%
  - Rear to Side: 2%
  - Unknown: 0.4%
  - Rear to Rear: 0.2%
## Results: Most Harmful Event

<table>
<thead>
<tr>
<th>MOST HARMFUL EVENT</th>
<th>On Tribal Lands</th>
<th></th>
<th>Off Tribal Lands</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TTT</td>
<td>Non-TTT</td>
<td>TTT</td>
<td>Non-TTT</td>
</tr>
<tr>
<td></td>
<td>Number</td>
<td>Rank</td>
<td>Number</td>
<td>Rank</td>
</tr>
<tr>
<td>Motor Vehicle in Transport</td>
<td>110</td>
<td>1</td>
<td>97</td>
<td>1</td>
</tr>
<tr>
<td>Overturn/Rollover</td>
<td>17</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Other, Non-Fixed Object</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Fire/Explosion</td>
<td>8</td>
<td>3</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Animal, Livestock</td>
<td>8</td>
<td>3</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Struck by Falling/Shifting Cargo</td>
<td>--</td>
<td>--</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Other, Non-Collision</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Cargo Loss/Shift</td>
<td>--</td>
<td>--</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Tree/Bush, Standing</td>
<td>--</td>
<td>--</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Parked Motor Vehicle</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Animal, Wild Game</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
Results: Road Grade

- Level: 80% On Tribal Land, 74% Off Tribal Land
- Downhill: 14% On Tribal Land, 9% Off Tribal Land
- Uphill: 9% On Tribal Land, 9% Off Tribal Land
- Hillcrest: 1% On Tribal Land, 1% Off Tribal Land
- Sag/Bottom: 1% On Tribal Land, 0% Off Tribal Land
- Unknown: 2% On Tribal Land, 2% Off Tribal Land

Source: http://www.mounta indirectory.com/md_slideshow/md_008.jpg
Results: **Road Alignment**

- **Straight:** 84% (On Tribal Land), 83% (Off Tribal Land)
- **Curve, Left:** 9% (On Tribal Land), 6% (Off Tribal Land)
- **Curve, Right:** 5% (On Tribal Land), 5% (Off Tribal Land)
- **Unknown:** 2% (On Tribal Land), 3% (Off Tribal Land)
- **Not Reported:** 0% (On Tribal Land), 3% (Off Tribal Land)

Source: [http://i.azcentral.com/commphotos/view/686936.jpg](http://i.azcentral.com/commphotos/view/686936.jpg)
## Results: Action at Time of Crash

<table>
<thead>
<tr>
<th>ACTION AT TIME OF CRASH</th>
<th>On Tribal Lands</th>
<th>Off Tribal Lands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TTT</td>
<td>Non-TTT</td>
</tr>
<tr>
<td>Number</td>
<td>Rank</td>
<td>Number</td>
</tr>
<tr>
<td>Going Straight Ahead</td>
<td>378 1</td>
<td>222 1</td>
</tr>
<tr>
<td>Negotiating a Curve</td>
<td>33 2</td>
<td>6 10</td>
</tr>
<tr>
<td>Making a Left Turn</td>
<td>29 3</td>
<td>24 4</td>
</tr>
<tr>
<td>Slowing in Trafficway</td>
<td>26 4</td>
<td>26 3</td>
</tr>
<tr>
<td>Changing Lanes</td>
<td>24 5</td>
<td>19 5</td>
</tr>
<tr>
<td>Avoiding Vehicle/Object</td>
<td>20 6</td>
<td>13 7</td>
</tr>
<tr>
<td>Unknown</td>
<td>18 7</td>
<td>11 8</td>
</tr>
<tr>
<td>Stopped in Trafficway</td>
<td>17 8</td>
<td>44 2</td>
</tr>
<tr>
<td>Making Right Turn</td>
<td>15 9</td>
<td>6 10</td>
</tr>
<tr>
<td>Overtaking/Passing</td>
<td>12 10</td>
<td>16 6</td>
</tr>
<tr>
<td>Other</td>
<td>-- --</td>
<td>8 9</td>
</tr>
<tr>
<td>Backing</td>
<td>-- --</td>
<td>-- --</td>
</tr>
<tr>
<td>Properly Parked</td>
<td>-- --</td>
<td>-- --</td>
</tr>
</tbody>
</table>
Results: **Low light conditions**

- **Daylight**: 65% (On Tribal Land), 69% (Off Tribal Land)
- **Dawn**: 2% (On Tribal Land), 3% (Off Tribal Land)
- **Dusk**: 1% (On Tribal Land), 2% (Off Tribal Land)
- **Dark, Lighted**: 4% (On Tribal Land), 10% (Off Tribal Land)
- **Dark, Not Lighted**: 27% (On Tribal Land), 16% (Off Tribal Land)
- **Dark, Unknown Lighting**: 1% (On Tribal Land), 0.3% (Off Tribal Land)

Sources:
- www.mybinc.com/blog/category/motor-vehicle-record-check
- www.corporatedriving.com/semi-truck-driving-safety/
Results: Safety Device Use

- Safety Device Used, TTT:
  - On Tribal Land: 87%
  - Off Tribal Land: 85%

- Safety Device Used, Non-TTT:
  - On Tribal Land: 87%
  - Off Tribal Land: 88%
Results: Driving While Fatigued

- **Fatigue, TTT**
  - On Tribal Land: 4%
  - Off Tribal Land: 2%

- **Fatigue, Non-TTT**
  - On Tribal Land: 2%
  - Off Tribal Land: 1%
## Results: Violation

<table>
<thead>
<tr>
<th>VIOLATION</th>
<th>On Tribal Lands</th>
<th>Off Tribal Lands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TTT</td>
<td>Non-TTT</td>
</tr>
<tr>
<td></td>
<td>Number</td>
<td>Rank</td>
</tr>
<tr>
<td>Speed Too Fast For Conditions</td>
<td>94</td>
<td>1</td>
</tr>
<tr>
<td>Inattention/ Distraction</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>Unknown</td>
<td>29</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>31</td>
<td>4</td>
</tr>
<tr>
<td>Failed to Keep in Proper Lane</td>
<td>22</td>
<td>5</td>
</tr>
<tr>
<td>Unsafe Lane Change</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Failed to Yield Right of Way</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Improper Turn</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Drove in Opposing Traffic Lane</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Followed Too Closely</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Other Unsafe Passing</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Disregarded Traffic Signal</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
Strengths and Limitations

**Strengths**
- 5 years of crash data
- Crash locations are accurate
- Crash data is complete

**Limitations**
- Many fields had data not reported
- May include tribal and non-tribal drivers

Source: Federal Highway Administration, FHWA-RD-01-159
Recommendations

- **Policy**: Strengthen tribal traffic codes pertaining to commercial traffic on tribal lands

- Participate in the heavy vehicle task force for the Arizona Strategic Highway Safety Plan implementation

- **Enforcement**: Train tribal police to become certified commercial vehicle inspectors

- **Education**: Conduct “Share the Road” training for tribal members to heighten awareness of driving near commercial vehicles

- **Engineering**: Utilize strategies on state routes through tribal communities
Traffic Calming in Tribal Communities

State routes through tribal communities may be “main streets”.

- Speed feedback signs caution drivers to lower speed
- Community gateway signs notify drivers they are entering a tribal community
Project Contacts

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- Esther Corbett, BS, Project Manager

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Crash map developed by Jonathan Davis, ITCA ArcGIS Fellow