

# **EVALUATION OF TRAFFIC CRASH FATALITY CAUSES AND EFFECTS**

## **PROBLEM STATEMENT**

The number of highway fatalities in Florida is comparatively high, with 40% more fatalities per vehicle mile than the national average in 1999. Heavy trucks are overrepresented in fatal crashes in the state, with more than twice the percentage of fatalities than in passenger car crashes. FDOT's Crash Analysis Reporting (CAR) system is a tool that can be used for crash analysis and countermeasure planning. However, the data currently available from the CAR database is limited and often lacks detail, especially with regard to driver attitudes and actions, which makes differentiating causative factors and assigning fault difficult.

## **OBJECTIVES**

The principal objective of this research was to provide an in-depth analysis of the causes of fatal traffic crashes and traffic fatalities so that appropriate actions can be initiated to improve safety on Florida's highways. To determine the actual causes of a crash, it is necessary to obtain detailed data, including data from Traffic Homicide Investigation (THI) reports, video log and crash scenes photographs, and site visits, as necessary. All fatal crashes on state roads in 2000 were investigated, in addition to crashes involving heavy trucks in 1999 and 1998. Crash data related to both behavioral and roadway-related causes of fatal traffic crashes was collected in an Oracle database and studied through case study, dynamic behavior, and statistical analyses. Various countermeasures, both behavioral and roadway-related, were recommended.

## **FINDINGS AND CONCLUSIONS**

A total of 2,080 cases were reviewed in this project. Run off the road (32%) and intersection crashes (28%) were the common crash types, followed by pedestrian (16%) and rear-end/sideswipe (14%) crashes. Almost a quarter of the at-fault drivers were younger than 25, and over 13% were over age 64. About three-fourths of involved drivers, at-fault drivers, and pedestrians in the fatal crashes were male. Human factors were the primary causative factor in 94% of the fatal crashes; the most common human factors were alcohol and/or drug use and driver errors, including inattention and decision errors. Around 30% of the crash contributing factors (including secondary and tertiary factors) were roadway, environmental, and vehicle factors. Tire tread separation/blowout was the most common vehicle factor by far.

Not wearing a seat belt is the most common cause of fatality found in this study, contributing to fatality among 63% of vehicle occupants, especially in conjunction with ejection. Among drivers wearing seat belts, the most common contributing factors to the fatality were age, nearside impacts and vehicle-vehicle impact (as opposed to fixed object and overturning crashes, which were less frequently harmful to belted occupants). In heavy trucks, 50% of fatalities occurred in vehicles that rolled over, and 26% occurred in vehicles that caught fire. Trailer rear and side underrides accounted for almost 28% of the fatal impacts among occupants in vehicles impacting trucks.

Heavy trucks were overrepresented in multi-vehicle and multi-fatality crashes. Vehicle defects (other than tire defects) were highly overrepresented in heavy trucks. Trucks were at-fault in only about 30% of the crashes in which they were involved. Overall, the most common factor in crashes where a truck was at fault was inattention, which was the primary contributing factor in almost 40% of the crashes. In crashes where the

truck driver was at fault, a tendency was seen toward “taking” of right-of-way by the commercial motor vehicle.

Substantial numbers of run off the road (ROR) crashes occurred on rural limited access facilities, involving younger drivers (aged 15-24) and those under the influence of alcohol. Alcohol, speed, and abrupt steering input (including overcorrection and evasive maneuvers) are the most common driver-contributing factors in all ROR crashes. Approximately 25% of the ROR crashes in the study set involved subsequent overcorrection. ROR crashes were highly overrepresented on all limited access facilities. Rumble strips were present in only about 15% of the fatal ROR crashes, being most common on rural toll roads and interstates. However, overcorrection was about 50% more likely to occur in ROR crashes on road segments with rumble strips. The most common harmful outcomes of ROR crashes were overturning (40%) and fixed object impacts (30%). SUV's were found to have the highest rollover rates. Large vans and compact pickup trucks also had higher than average rollover rates, with high rates of tire tread separation and tire blowouts in the SUV rollovers. Overall, approximately 45% of the rollovers were tripped by grass or soft soil.

Left turning vehicle movements were the most likely to cause a fatal intersection crash. Almost one half of the fatal intersection crashes involved a left turn by one of the drivers involved in the crash. Seventy percent of left turn-oncoming crashes at signalized movements were classified as permissive left type crashes. Inattention was the most common primary contributing factor to fatal intersection crashes, followed by driving under the influence, and decision errors. In almost 20% of the fatal intersection crashes, there were roadway issues that had a direct bearing on the occurrence of the crash, mostly as secondary and tertiary issues. Sight distance was the most common roadway issue, followed by location of stop bars, wide or confusing design/geometry, lack of turn lanes/storage, and signal timing issues.

The most common types of pedestrian crashes were pedestrians crossing a roadway not in a crosswalk (53%) and pedestrians that had exited a vehicle prior to the fatal event (13%), followed by pedestrians who were crossing at intersections (10%). Pedestrian behavior is the first contributing cause of over 80% of the pedestrian crashes in this study. Where alcohol use was determinable, 69% of pedestrians crossing at non-intersection locations were under the influence. Among drivers, the most common contributing factor was speeding followed by driver alcohol/drug impairment. Lighting condition plays a major role in pedestrian cases. In nearly half of the roadway crossing cases, pedestrians were attempting to cross the road within 600 ft of a crossing location with a traffic signal. A total of 15% of the pedestrian crashes occurred on limited access facilities (interstate, toll road, other limited access facility, or ramp); half resulted from a disabled vehicle.

Researchers developed educational, enforcement, engineering, and other countermeasures specifically as relevant to the primary contributing factors and with regard to particular vulnerabilities (e.g., countermeasures calling for various transit-oriented solutions targeted at the elderly driver population in consideration of their increased susceptibility. It should be noted that the study studied only causes of fatal traffic crashes. Consequently, solutions developed in this study do not address traffic volumes and other exposure measures that should be considered before implementing state-wide programs. In addition, proposed strategies vary according to critical issues identified at particular crash sites, so care needs to be taken that while addressing the subject critical issues, other issues are not compromised.

## **BENEFITS**

The results of this research can be used to develop educational, enforcement, and engineering countermeasures to address broad categories of crashes and contributing factors identified as occurring frequently on state roadways in Florida. The results can also be used to direct additional research projects into specific areas of need identified by this research. The primary benefit to the state of Florida should be a reduction in the number of fatalities on state roadways in Florida. A table highlighting key findings is appended to this summary.

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Notable Contributing Factors in Fatal Crashes on State Roads in Florida

| Crash Factor                                  |  | Crashes | Fatalities |            |               |
|---|--|---------|------------|------------|---------------|
|   |  | Num.    | Num.       | % of Total | % of Category |
| Fatal crashes in study                        | All fatal crashes                                      | 2080    | 2350       | 100        | 100           |
|   | At-fault driver age < 25                               | 419     | 505        | 21         | 21            |
|   | At-fault driver age 25 – 64                            | 1056    | 1195       | 51         | 51            |
|   | At-fault driver age ≥ 65                               | 301     | 337        | 14         | 14            |
|   | At-fault driver under influence of alcohol             | 463     | 536        | 23         | 23            |
|   | At-fault driver under influence of drugs               | 121     | 149        | 6          | 6             |
|   | At-fault driver inattentive or distracted              | 454     | 513        | 22         | 22            |
|   | Motor vehicle fatalities (vehicle types 01 through 09) | 1540    | 1790       | 76         | 76            |
|   | Unbelted occupants                                     | 986     | 1126       | 48         | 63            |
|   | Ejections  | 419     | 460        | 20         | 41            |
|   | Occupant age ≥ 65                                      | 338     | 370        | 16         | 21            |
|   | Motorcyclist fatalities                                | 133     | 140        | 6          | 6             |
|   | Motorcyclist at fault                                  | 75      | 78         | 3          | 56            |
|   | Bicyclist fatalities                                   | 62      | 62         | 3          | 3             |
|   | Bicyclist at fault                                     | 47      | 47         | 2          | 76            |
|   | Pedestrian fatalities                                  | 345     | 350        | 15         | 15            |
|   | Pedestrian at fault                                    | 284     | 286        | 12         | 82            |
| Truck crashes                                 | All truck crashes                                      | 575     | 680        | 29         | 29            |
|   | Truck at fault   | 178     | 225        | 10         | 33            |
|   | Inattentive truck driver                               | 63      | 88         | 4          | 39            |
|   | Truck driver “taking” ROW                              | 38      | 45         | 2          | 20            |
|   | 1998   | 199     | 238        | 10         | 35            |
|   | 1999   | 198     | 241        | 10         | 35            |
|   | 2000   | 178     | 201        | 9          | 30            |
| Non truck                                     | All non-truck crashes                                  | 1505    | 1670       | 71         | 71            |
| ROR Crashes                                   | All ROR crashes  | 682     | 780        | 33         | 33            |
|   | Driver age < 25  | 203     | 241        | 10         | 31            |
|   | Driver under influence of alcohol                      | 221     | 253        | 11         | 32            |
|   | Driver under influence of drugs                        | 62      | 74         | 3          | 9             |
|   | Abrupt steering input                                  | 221     | 253        | 11         | 32            |
|   | Interstate   | 272     | 319        | 14         | 41            |
|   | With no rumble strips                                  | 193     | 230        | 10         | 72            |
|   | Median crossover                                       | 64      | 88         | 4          | 28            |
|   | Rural 2-3 lane   | 87      | 95         | 4          | 12            |
|   | Tight curve (≤ 1500')                                  | 67      | 72         | 3          | 76            |
|   | Overcorrect  | 177     | 194        | 8          | 25            |
|   | Interstate   | 73      | 84         | 4          | 43            |
|   | With no rumble strips                                  | 44      | 53         | 2          | 63            |
|   | Fixed object impact                                    | 380     | 421        | 18         | 54            |
|   | Tree   | 118     | 134        | 6          | 32            |
|   | Interstate   | 45      | 53         | 2          | 40            |
|   | Guardrail  | 79      | 91         | 4          | 22            |
| Overturn                                      | 365  | 412     | 18         | 53         |               |
| Tripped on grass shoulder or soft soil        | 164  | 189     | 8          | 46         |               |
| Tripped on fixed object                       | 92   | 100     | 4          | 24         |               |
| Intersection Crashes                          | All intersection crashes                               | 699     | 775        | 33         | 33            |
|   | Signalized movement                                    | 252     | 279        | 12         | 36            |
|   | Left turn w/ gap judgment                              | 97      | 110        | 5          | 39            |
|   | Red light running                                      | 91      | 104        | 4          | 37            |
|   | Stop sign  | 228     | 259        | 11         | 33            |
|   | Left turn w/ gap judgment                              | 98      | 108        | 5          | 42            |
|   | Stop sign running                                      | 42      | 50         | 2          | 19            |
| Unsignalized movement                         | 217  | 235     | 10         | 30         |               |
| Left turn w/ gap judgment                     | 105  | 118     | 5          | 50         |               |
| Pedestrian                                    | All pedestrian crashes                                 | 353     | 350        | 15         | 15            |
|   | Daytime  | 81      | 78         | 3          | 22            |
|   | Intersection crossings                                 | 10      | 10         | 0          | 13            |
|   | Crossings within 600' from intersection                | 16      | 16         | 1          | 21            |
|   | Crossings greater than 600' from intersection          | 15      | 16         | 1          | 21            |
|   | Nighttime w/street light                               | 135     | 134        | 6          | 38            |
|   | Intersection crossings                                 | 15      | 15         | 1          | 11            |
|   | Crossings within 600' from intersection                | 44      | 44         | 2          | 33            |
|   | Crossings greater than 600' from intersection          | 41      | 42         | 2          | 31            |
|   | Nighttime w/out street light                           | 123     | 124        | 5          | 35            |
| Intersection crossings                        | 6  | 6       | 0          | 5          |               |
| Crossings within 600' from intersection       | 24   | 24      | 1          | 19         |               |
| Crossings greater than 600' from intersection | 45   | 46      | 2          | 37         |               |
| Rear-end/sideswipe                            | All rear-end/sideswipe crashes                         | 359     | 410        | 17         | 17            |
| Truck involved                                | 197  | 238     | 10         | 58         |               |
| Head-on/oncoming                              | All head-on/oncoming                                   | 248     | 310        | 13         | 13            |
| Truck involved                                | 110  | 131     | 6          | 42         |               |