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# Understanding the Safety Performance of Distracted Driving Crashes in Florida

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**Abstract:** Distracted driving remains a leading cause of roadway crashes and a significant public safety issue. This study analyzes five years of crash data from 2016-2020in Florida to examine the relationship between distraction and crash characteristics. Results show that crashes involving distracted drivers are more likely to result in injuries or fatalities compared to crashes caused by other factors. Front-to-rear collisions were the most common distraction-related crash type, accounting for over half of such incidents, while angle crashes were also significant. Most distraction-related crashes occur during clear weather and daylight, indicating that environmental factors play a smaller role than driver behavior. Most distracted drivers were sober and driving at normal speeds, showing that loss of focus alone is a major risk factor. The research also confirms that distraction combined with speeding or impairment will increase crash severity levels substantially. These findings highlight the urgent need for targeted education campaigns, strict enforcement ofdriving laws, and roadway engineering improvements to reduce distraction-related crashes. By understanding the conditions under which these crashes occur, policymakers and transportation professionals can develop more effective strategies to improve roadway safety and save lives.

**Keywords:** Distracted Driving, Crash Severity Analysis, Risk Factors, Traffic safety, Transportation Policy

## 1. Introduction

Distracted driving is a major contributor to road crashes and an escalating public safety concern. It arises when a driver's attention is diverted from vehicle operation by activities such as texting, eating, conversing with passengers, or manipulating in-vehicle controls [1, 4]. These behaviors reduce focus, slow reaction times, and increase the risk of serious accidents. Although it is more common among young and inexperienced drivers, distracted driving affects drivers of all ages [7, 10]. The National Highway Traffic Safety Administration (NHTSA) classifies distraction into visual, manual, cognitive, and auditory types, each of which interferes with a driver's ability to respond safely to changing road conditions[7].

Prior research has consistently indicated that driver distraction not only elevates the probability of crash occurrence but also exacerbates crash severity, particularly when interacting with contributory factors such as excessive speed, alcohol or drug impairment, inadequate illumination, and adverse weather conditions[6, 8, 9, 13, 14, 15]. Extensive investigations have examined the influence of mobile phone use, in-vehicle technologies, and environmental determinants on crash risk[10, 11, 18]. Nevertheless, despite the implementation of legislative measures and public awareness initiatives aimed at curbing distracted driving behaviors, the prevalence of distraction-related crashes remains persistently high, highlighting the necessity for continued research and the development of more effective countermeasures[12, 17].

The objective of this study is to conduct a comprehensive analysis of crash data to gain a deeper understanding of how distracted driving contributes to both crash occurrence and crash characteristics. Drawing on a five-year dataset, this research examines the interaction between distraction and other critical risk factors, including vehicle speed, weather conditions, roadway lighting, and alcohol or drug involvement[5]. By exploring these interactions, the study seeks to identify patterns that reveal how distraction amplifies crash likelihood and severity under varying roadway and environmental contexts. The insights generated from this analysis are intended to support transportation agencies, safety practitioners, and policymakers in formulating targeted, evidence-based interventions to mitigate distracted driving, reduce crash frequency and severity, and ultimately improve roadway safety for all users.

## 2. Literature Review

Recent studies indicate that while the overall number of motor vehicle crashes in the United States has decreased, crashes specifically caused by distracted driving have continued to rise, resulting in significant injuries and fatalities [3, 7].The National Highway Traffic Safety Administration (NHTSA) defines distracted driving as "any activity that diverts attention from driving, including talking or texting on your phone, eating and drinking, talking to people in your vehicle, or adjusting the stereo, entertainment or navigation system" [1]. Among the many potential distractions, the use of cellular phones and portable electronic devices has emerged

as the most critical concern, drawing considerable attention from researchers [2, 10]. Texting while driving is especially dangerous because it combines visual, manual, and cognitive distractions, significantly compromising a driver's situational awareness and reaction time[10, 18].

Research has traditionally categorized distraction into three main types: visual, manual, and cognitive. Visual distractions occur when drivers take their eyes off the road, such as when reading a text message or looking at a GPS device. Manual distractions involve removing one or both hands from the steering wheel, for instance, while eating or adjusting vehicle controls. Cognitive distractions occur when a driver's mind is not fully focused on driving, such as when daydreaming or engaging in a highly involved conversation [4, 7]. Many activities combine these elements. For example, texting while driving requires the driver to look away from the road, remove their hands from the wheel, and mentally focus on the message rather than their surroundings[10, 18].

Despite improvements in overall traffic safety, distracted driving remains a leading cause of roadway crashes. NHTSA reported that approximately 29% of all road crashes involve some form of distraction [7]. This is particularly concerning because distracted driving often results in high-severity crashes, especially during peak travel periods or in high-risk locations. Studies by the AAA Foundation for Traffic Safety have highlighted that mobile phone use while driving often leads to other risky behaviors, including speeding, which compounds the danger by further reducing reaction time and increasing crash severity[10, 15, 18].

Speeding itself continues to be a major contributor to traffic injuries and fatalities. According to NHTSA, speeding was a factor in 26% of all traffic deaths nationwide[15]. In Florida, this figure is even higher, with speeding-related crashes accounting for nearly 30% of all fatalities in 2021 [5]. Speeding is particularly dangerous on highways, where drivers often fail to adjust their speed to match weather conditions, road surfaces, or traffic patterns. Zhao found that speeding decreases the time drivers must react to sudden hazards and magnifies the force of impact during a crash[10, 17]. When drivers combine high speeds with distractions or alcohol impairment, the likelihood of fatal crashes rises dramatically, emphasizing the need for integrated safety strategies[6, 8, 9].

Other contributing factors, including alcohol and drug use, fatigue, and adverse weather, further increase crash risk. Alcohol-impaired driving remains a persistent issue, accounting for about one-third of all traffic fatalities in the United States [8]. Drug impairment has also been identified as a growing problem, with effects varying by substance. Cannabis, for instance, affects reaction speed and time perception, while stimulants such as cocaine and methamphetamine may cause reckless or aggressive driving. Opioids and painkillers are linked to drowsiness and impaired motor control[9]. These risks are particularly pronounced among males aged 21–34, especially during weekends and nighttime hours[8, 9]. While distracted driving occurs across all demographics, many drivers underestimate the dangers of multitasking, such as checking notifications or eating while driving, even though these behaviors can be just as deadly as driving under the influence[12, 18, 19]. Studies have demonstrated that multitasking creates cognitive overload, reducing situational awareness and increasing reaction time, making the combination of impairment and distraction especially hazardous[11, 12, 18].

Environmental conditions also influence distracted driving incidents. Poor lighting significantly increases cognitive workload as drivers struggle to see clearly while simultaneously managing distractions such as navigation systems. Research shows that roadway lighting improvements can reduce nighttime crashes by up to 30%, as better visibility lessens the cognitive demand placed on drivers [13, 14].

Collectively, past studies demonstrate that distracted driving is a complex public safety issue shaped by individual behavior, environmental conditions, and systemic factors. While laws restricting mobile phone use while driving have been implemented in many regions, findings suggest that legislation alone is insufficient to address the problem[7, 12]. Public awareness campaigns, stronger enforcement, infrastructure enhancements, and advances in vehicle technology must work together to create safer road environments[19, 20]. By understanding the complex interactions between distraction, speeding, impairment, and external conditions, transportation professionals and policymakers can develop more effective strategies to reduce crashes and save lives.

## 3. Data Collection and Methodology

The crash data for this study was obtained from the Florida Department of Transportation (FDOT) State Safety Office Geographic Information System (SSO GIS), as shown in Figure 1. This database compiles crash reports from law enforcement agencies, crash investigations, and traffic monitoring systems across the state. The latest 5-year available dataset is from 2017-2021. For this study, crash data were collected for the years 2016, 2017, 2018, 2019, and 2020. Data from 2021 excluded due to unusual traffic patterns caused by the COVID-19 pandemic, which could have affected the consistency of trends. These five years were selected to provide a comprehensive and balanced view of distracted driving crashes without major data gaps or external disruptions.

Each record contains over 125 data fields, including information on driver behavior, environmental conditions, and crash severity.

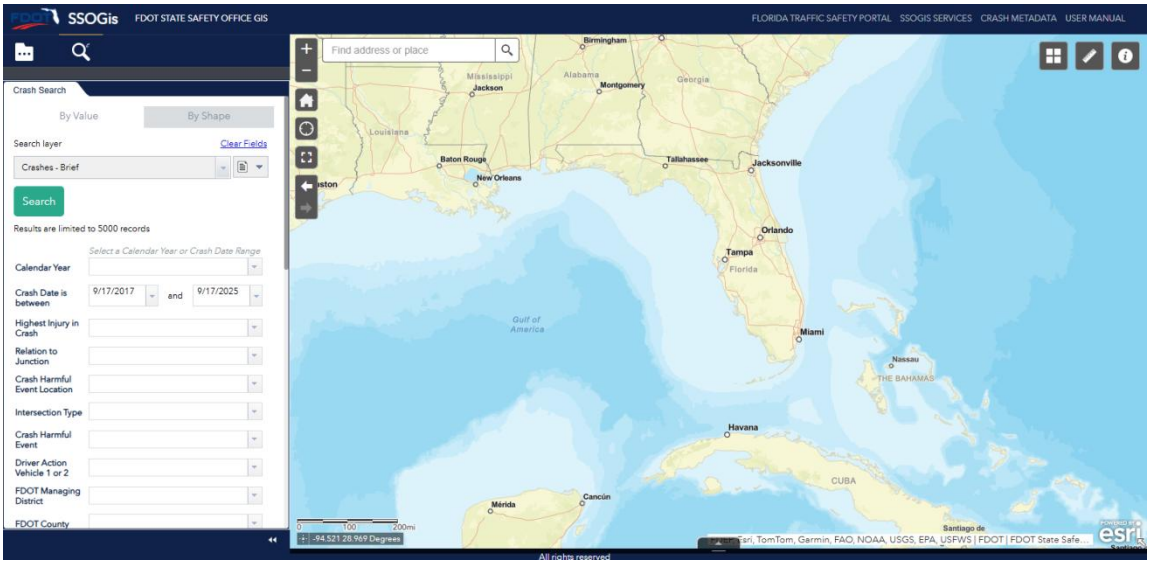


Figure 1 FDOT State Safety Office GIS portal

After collection, duplicate records were carefully removed. This cleaning step was critical because some crashes were initially reported more than once in the raw data.The cleaned dataset was then filtered to include only crashes where distracted driving was identified as a contributing factor. Key variables analyzed included crash type, severity, weather conditions, lighting conditions, speeding involvement, and alcohol or drug use. To identify trends and relationships, the variables were organized into pivot tables and clustered columns for analysis.

The final dataset provided a solid foundation for examining how distraction interacts with factors such as speed, weather, and visibility to influence crash outcomes. While the database is detailed, there are limitations. Some crash reports may not fully capture the exact cause of distraction, and certain distraction-related crashes may not have been correctly classified or reported. Additionally, all personal information was removed to protect privacy.Despite these limitations, the dataset offers valuable insights for improving road safety policies and strategies aimed at reducing the frequency and severity of distracted driving crashes in Florida. This quantitative research approachallowed for the identification of patterns and relationships between distraction and other behavioral or environmental factors, helping to guide future interventions and transportation safety planning.

## 4. Data Analysis

Crash data from 2016 to 2020 were processed and reviewed to understand how distracted driving contributes to roadway crashes. The analysis focused on six key categories: crash severity, crash type, weather, lighting, vehicle speed, and the involvement of drugs or alcohol. These categories were chosen to identify patterns and connections between distraction and other factors that affect crash outcomes. The analysis commenced with descriptive statistical procedures to quantify the frequency and distribution of distraction-related crashes and to characterize the environmental and roadway conditions under which they most occurred. Frequency tables and cross-tabulations were generated to identify patterns across variables such as lighting condition, weather, and roadway type.

For each category, tables and figures are provided below to show and illustratethe results clearly. These visuals make it easier to see trends, such as the most common crash types, how weather and lighting influence driver attention, and how speeding or substance use increases crash severity. After each table or figure, a written explanation discusses the findings, helping to show which factors have the greatest effect on distraction-related crashes and how this information can be used to improve roadway safety. Severity levels were sorted and grouped to be compared to overall crashes for all study years and the separated distracted driving crash data. Each was separated by number of crashes, then put in a percentile per year. Crash severity was ranked in six levels: PDO, Possible Injury, Injury, Incapacitating injury, Fatal and Others.

Table 1 summarizes the distribution of distraction-related crashes by severity level over a five-year period (2016–2020). Across all years, property damage only (PDO) crashes consistently account for most

distraction-related incidents, averaging 61% annually. Possible injury crashes make up the second-largest category, representing approximately 21% of cases, with relatively little fluctuation over time. Crashes resulting in non-incapacitating injuries (labeled as "Injury") represent roughly 12% of the total, showing a slight increase in 2018 but otherwise remaining stable. Incapacitating injuries are comparatively rare, consistently accounting for only 4% of distraction-related crashes each year. Fatal crashes are the least frequent, comprising approximately 1% of the total annually. The "Other" category accounts for about 2% of crashes, with a slight decline in 2019 and 2020.

Table 1: Summary of Crash Severity Distributionsfor 5-Year vs. Distracted Driving

| **Severity Levels** | **2016** | **2017** | **2018** | **2019** | **2020** | **Overall** | **Distracted Driving** |
|---|---|---|---|---|---|---|---|
| PDO | 61% | 62% | 58% | 62% | 60% | 61% | 0% |
| Possible Injury | 21% | 20% | 22% | 20% | 21% | 21% | 55% |
| Injury | 11% | 11% | 11% | 12% | 12% | 12% | 26% |
| Incapacitating Injury | 4% | 4% | 5% | 4% | 4% | 4% | 14% |
| Fatal | 1% | 1% | 2% | 1% | 1% | 1% | 4% |
| Other | 2% | 2% | 2% | 1% | 2% | 2% | 0% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

Figure 2 illustrates that the severity distribution of distraction-related crashes has remained relatively stable over the five-year period. Compared to overall crashes, distraction-related incidents show higher proportions of possible injury, injury, and incapacitating injury outcomes. This indicates that crashes involving distracted driving tend to be more severe and pose greater risk to road users. These results underscore the importance of targeted countermeasures, as mitigating driver distraction has the potential to substantially reduce both the frequency and severity of injuries, including fatalities.

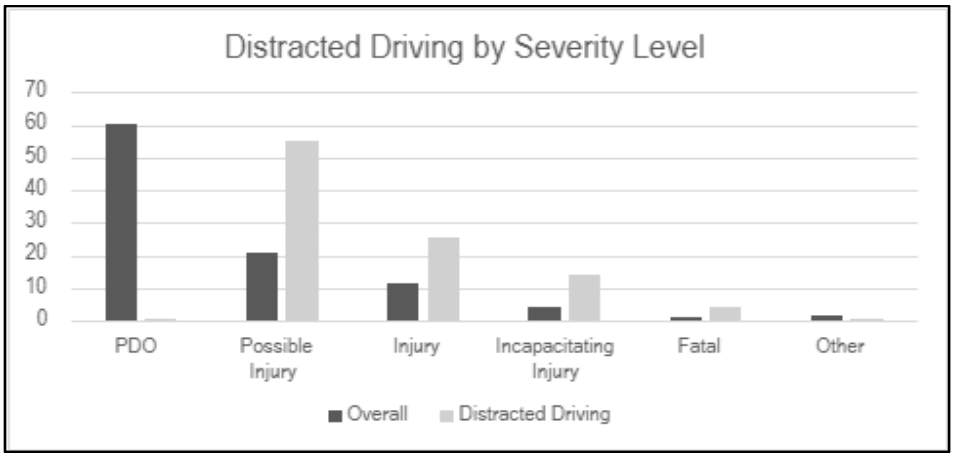


Figure 2: Crash Distributions of Crash Severity

Table 2 presents the distribution of distraction-related crashes by crash type over the five-year period from 2016 to 2020. Front-to-rear crashes are the most frequent, representing 36–39% of distraction-related crashes annually and accounting for 37% overall. Angle crashes are the second most common, averaging 24% of cases, with a gradual decrease from 25% in 2016 to 21% in 2020. Sideswipe (same direction) crashes represent approximately 13% overall, showing some fluctuation between 10% and 15% across the years. Front-to-front collisions make up only 3% of distraction-related crashes and remain steady across all five years. Rear-to-side and rear-to-rear crashes are exceedingly rare, together contributing less than 1% of total distraction-related incidents. The "Other" category accounts for about 22% of crashes, with some variability over time, peaking at 25% in 2018 and 2020.

Table 2: Summary of Crash Type Distributions for 5-Year vs. Distracted Driving

| Crash Types | 2016 | 2017 | 2018 | 2019 | 2020 | Overall | Distracted Driving |
|---|---|---|---|---|---|---|---|
| Front To Rear | 37% | 37% | 38% | 39% | 36% | 37% | 53% |
| Front To Front | 3% | 3% | 3% | 3% | 3% | 3% | 3% |
| Angle | 25% | 26% | 23% | 23% | 21% | 24% | 19% |
| Sideswipe, Same Direction | 13% | 14% | 10% | 15% | 15% | 13% | 9% |
| Rear To Side | 1% | 1% | 1% | 0% | 0% | 1% | 1% |
| Rear To Rear | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Other | 21% | 19% | 25% | 20% | 25% | 22% | 15% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

When compared with the overall crash distribution, front-to-rear crashes are markedly overrepresented among distraction-related crashes (37% overall vs. 53% for distracted driving), suggesting that inattention substantially increases the likelihood of rear-end collisions. In contrast, angle and sideswipe crashes are proportionally lower among distraction-related incidents compared with overall crashes, representing 19% and 9% respectively versus 24% and 13% in the overall crash distribution. These findings suggest that distracted driving disproportionately contributes to scenarios where failure to notice a slowing or stopped vehicle ahead results in a collision. This emphasizes the need for interventions—such as automated forward-collision warning systems, public awareness campaigns, and enforcement strategies—targeted specifically at reducing rear-end crashes caused by driver inattention.

Figure 3clearly indicates that distracted driving is strongly associated with front-to-rear crashes, highlighting its role as a key contributing factor to rear-end collisions. Addressing this safety issue will require a multifaceted approach that combines driver education programs, stricter enforcement of distraction-related regulations, and wider adoption of advanced vehicle technologies such as forward collision warning and automatic emergency braking systems. These measures can significantly reduce the frequency and severity of rear-end crashes attributed to driver distraction.

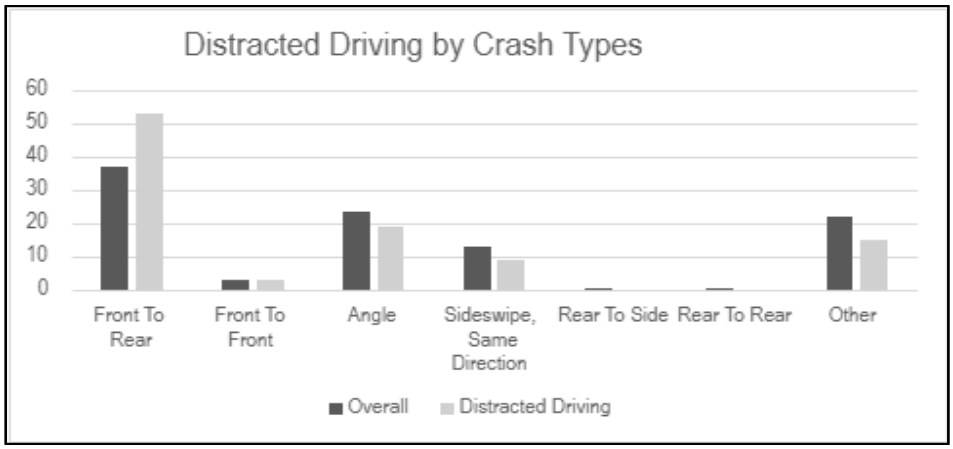


Figure 3: Crash Distribution of Crash Types

Table 3, as illustrated in Figure 4, indicates that crashes occurring under “daylight” conditions consistently represented most distraction-related crashes each year, ranging from 67% to 71%, with an overall share of 69%. This finding suggests that most distraction-related crashes occur during periods of high traffic volume and optimal visibility. Crashes under dark but lighted conditions followed, accounting for approximately 18–21% of cases, while those occurring in dark and unlighted areas remained relatively low at 5–8%. Dusk and

dawn conditions contributed to only 4–5% of crashes, with other lighting conditions representing a negligible share.

Table 3: Summary of Different Lighting Conditions Distributions for 5-Year vs. Distracted Driving

| Lighting Conditions | 2016 | 2017 | 2018 | 2019 | 2020 | Overall | Distracted Driving |
|---|---|---|---|---|---|---|---|
| Daylight | 70% | 67% | 70% | 71% | 68% | 69% | 70% |
| Dusk/Dawn | 5% | 5% | 4% | 4% | 5% | 5% | 5% |
| Dark-Lighted | 19% | 21% | 16% | 19% | 20% | 19% | 18% |
| Dark-Not Lighted | 6% | 6% | 8% | 5% | 6% | 6% | 6% |
| Other | 0% | 1% | 2% | 1% | 1% | 1% | 1% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

These results highlight the strong association between daytime travel patterns and distracted driving crashes, underscoring that driver behavior—rather than limited visibility—is a primary factor in crash occurrence. This pattern suggests that countermeasures should focus on driver education, enforcement, and technology-based interventions during peak traffic periods when distraction-related crash risk is greatest.

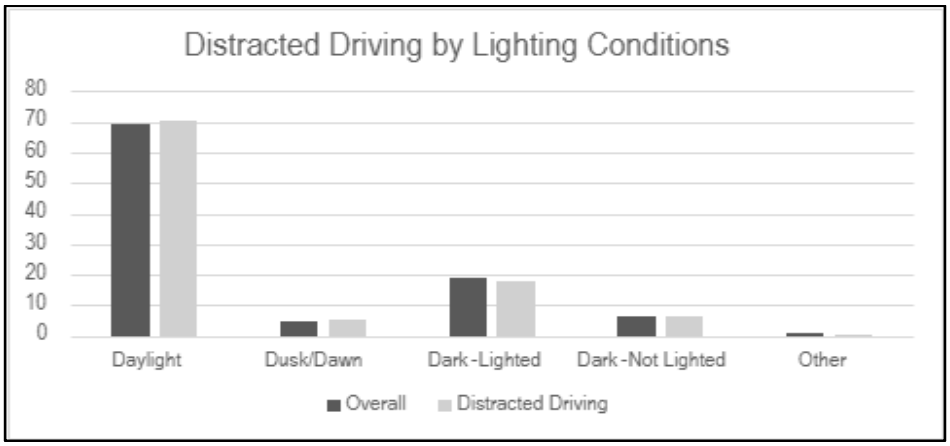

Figure 4: Crash distribution of Lighting Conditions

Table 4 highlights that most distraction-related crashes occurred under clear weather conditions, accounting for approximately 78% of cases across the five-year study period. This aligns with the overall crash distribution (78%), suggesting that distraction-related crashes are primarily a daytime and good-weather phenomenon. Cloudy conditions were the second most common, representing roughly 13% of distraction-related crashes, followed by rain at about 8%. Together, these three categories comprise nearly all weather-related distraction crashes, indicating that adverse weather plays a relatively limited role compared to human factors such as driver attention.

Year-to-year trends show only minor variation, suggesting a stable relationship between weather and distraction-related crashes. Clear conditions consistently ranged between 74% and 83%, peaking in 2017. Rain-related crashes fluctuated more noticeably, ranging from 5% in 2017 to 11% in 2020, potentially reflecting variations in annual rainfall or driving exposure during wet conditions. Cloudy conditions remained fairly steady, with a slight decrease observed in 2017 followed by a return to typical levels. This stability reinforces that distraction-related crashes are not highly sensitive to annual changes in weather patterns.

Table 4: Summary of Different Weather Conditions Distributions for 5-Year vs. Distracted Driving

| Weather Conditions | 2016 | 2017 | 2018 | 2019 | 2020 | Overall | Distracted Driving |
|---|---|---|---|---|---|---|---|
| Not Coded | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Clear | 77% | 83% | 74% | 79% | 75% | 78% | 78% |
| Cloudy | 14% | 11% | 15% | 12% | 13% | 13% | 15% |
| Rain | 8% | 5% | 10% | 8% | 11% | 8% | 7% |
| Fog, Smog, Smoke | 1% | 1% | 1% | 1% | 1% | 1% | 0% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sleet, Hail, Ice Rain | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Blowing Sand, Soil, Dirt | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Severe Crosswinds | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Other | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

Figure 5 lists all the weather conditions. The dominance of clear-weather crashes underscores that distraction is not primarily a function of adverse weather but rather a behavioral issue that persists regardless of external conditions. Since most incidents occur in conditions favorable for driving, interventions should focus on driver behavior modification through education, stricter enforcement of distraction laws, and in-vehicle technologies that reduce opportunities for distraction. The small proportion of crashes in fog, smog, or other hazardous weather suggests that weather-related visibility impairments, while important for overall safety, play a relatively minor role in distraction-related incidents.

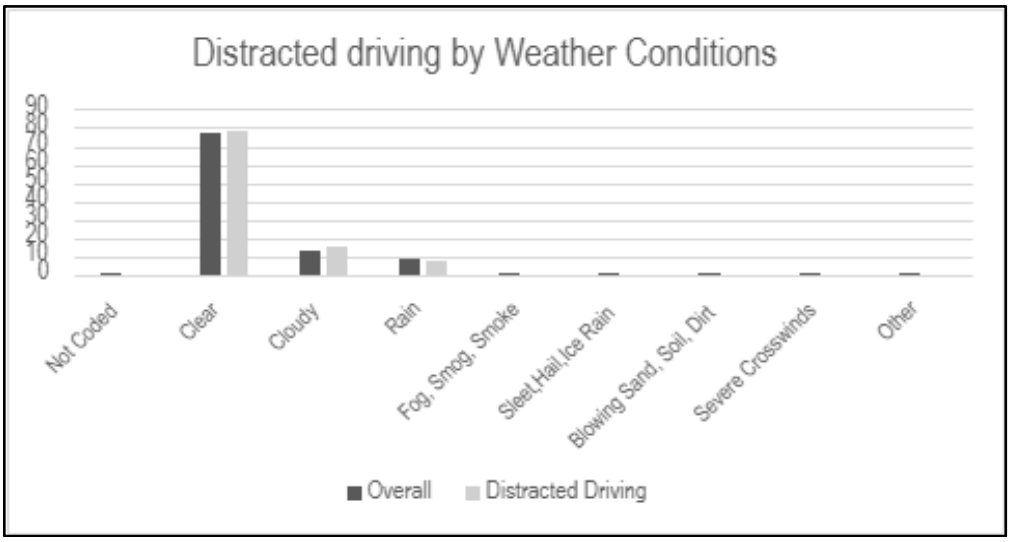


Figure 5: Crash distribution of Different Weather Conditions

Table 5 shows that most distraction-related crashes involved no alcohol or drug use, consistently accounting for 95–97% of cases across all five years. This indicates that distraction is an independent risk factor rather than one that frequently co-occurs with substance impairment. Alcohol-related distraction crashes made up about 3% of cases, while crashes involving drugs or a combination of alcohol and drugs were exceedingly rare, together comprising only about 1% of the total. These findings suggest that while impaired driving remains a critical public safety issue, its overlap with distraction-related crashes is limited.

Table 5: Summary of Crash Distributions of Drugs and Alcohol use for 5-Year vs. Distracted Driving

| **Drugs and Alcohol use** | **2016** | **2017** | **2018** | **2019** | **2020** | **Overall** | **Distracted Driving** |
|---|---|---|---|---|---|---|---|
| No | 97% | 97% | 95% | 97% | 96% | 96% | 95% |
| Alcohol | 3% | 3% | 3% | 2% | 2% | 3% | 3% |
| Drug | 0% | 0% | 1% | 1% | 1% | 1% | 1% |
| Alcohol/Drug | 0% | 0% | 1% | 0% | 1% | 0% | 1% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

As shown in Figure 6, the consistently low percentages of alcohol- and drug-involved distraction crashes highlight the need for distinct intervention strategies targeting distracted driving apart from traditional impaired-driving campaigns. Efforts such as public education, stricter enforcement of texting-while-driving laws, and technological interventions (e.g., hands-free systems, driver monitoring) should remain a priority. However, the presence of even a small proportion of cases involving combined impairment and distraction underscores a particularly dangerous subset of crashes where risk may be compounded, suggesting that integrated approaches addressing multiple risk behaviors simultaneously could offer additional safety benefits.

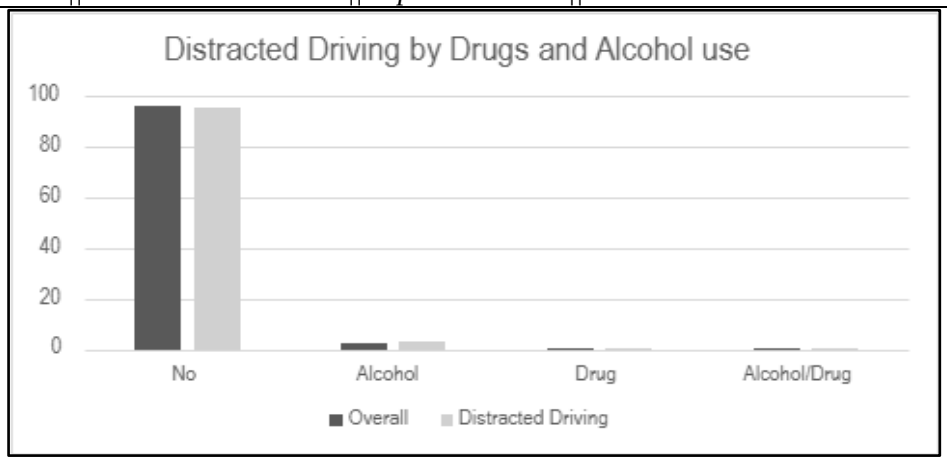


Figure 6: Crash Distribution based of Drugs and Alcohol Use

Table 6 indicates that most distraction-related crashes occurred when drivers were not speeding, consistently accounting for 96–98% of cases each year, with an overall share of 97%. Crashes involving drivers who were speeding represent a small fraction, ranging from 2% to 4% annually and averaging 3% overall. These findings suggest that while speeding remains an important risk factor for crashes in general, distraction-related crashes predominantly occur under normal speed conditions, emphasizing the independent role of inattention in crash occurrence.

Table 6: Summary of Crash Distributions of Vehicle Speeding for 5-Year vs. Distracted Driving

| **Speeding** | **2016** | **2017** | **2018** | **2019** | **2020** | **Overall** | **Distracted Drivers** |
|---|---|---|---|---|---|---|---|
| No | 98% | 97% | 96% | 98% | 97% | 97% | 97% |
| Yes | 2% | 3% | 4% | 2% | 3% | 3% | 3% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

Figure 7 compares the distributions of speeding for five years. The low prevalence of speeding among distraction-related crashes underscores that interventions targeting driver attention are critical, even in scenarios where speed is not excessive. Although these cases represent a relatively small proportion of crashes, impaired drivers pose a disproportionately high risk due to their increased likelihood of engaging in hazardous behaviors such as speeding or failing to yield. When combined with distraction, these behaviors substantially elevate the probability of severe injuries or fatalities, underscoring the heightened danger even within this limited subset of crashes.

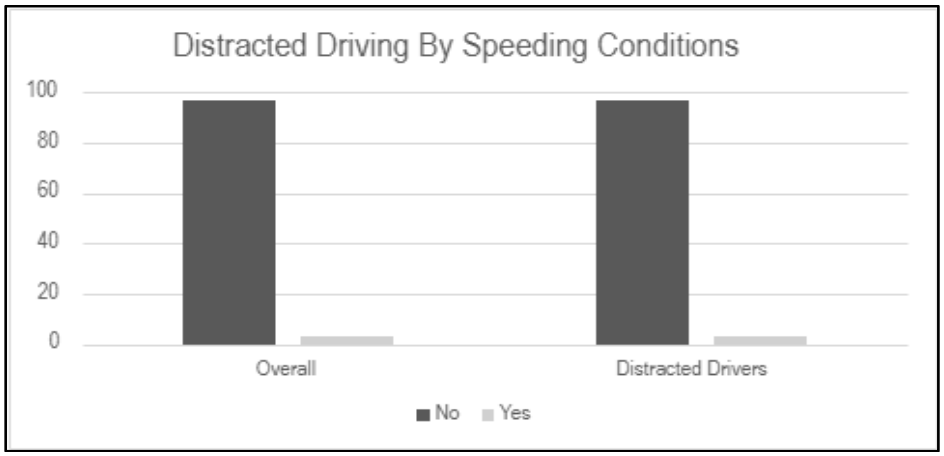


Figure 7: Crash Distribution of VehiclesSpeeding

Strategies such as driver education programs, enforcement of texting-while-driving laws, and in-vehicle technologies like forward-collision warning and automatic braking systems could be particularly effective. Although the contribution of speeding to distraction-related crashes is limited, the small percentage of incidents

involving excessive speed may represent more severe outcomes, highlighting the need for integrated approaches that address both distraction and high-risk driving behaviors.

## 5. Conclusion and Recommendations

The analysis of Florida crash data from 2016 to 2020 highlights that distracted driving is a significant contributor to traffic crashes and is strongly associated with elevated injury severity. Property damage only (PDO) crashes account for 61% of distraction-related incidents, while possible injury and non-incapacitating injury crashes represent 21% and 12%, respectively. Incapacitating injuries and fatalities, though less frequent, account for 4% and 1% of crashes, emphasizing that distraction substantially increases the likelihood of moderate to severe injuries. Front-to-rear collisions are the most prevalent crash type, comprising 37% of distraction-related crashes, followed by angle collisions at 19%, underscoring the impact of inattention on reaction time, following distance, and intersection decision-making. Sideswipe crashes and "Other" types represent 13% and 22%, respectively, while rear-to-side and rear-to-rear crashes are rare (0–1%).

Environmental and temporal analyses indicate that the majority of distraction-related crashes occur during daylight (69%) and under clear weather conditions (78%), with dark but lighted conditions accounting for 18–21%, and dusk or dawn contributing 4–5%. Crashes in adverse weather conditions such as rain (8%), fog/smog/smoke (1%), or other hazards are comparatively rare, highlighting that distraction is primarily behavior-driven rather than weather-dependent. Analysis of substance use and speeding reveals that most crashes involve drivers who were not impaired by alcohol or drugs (96%) and not speeding (97%), although the small fraction of cases involving alcohol, drugs, or speeding represents an elevated risk for severe outcomes when combined with distraction.

Collectively, these findings demonstrate that distracted driving is a pervasive risk factor across a range of crash types and environmental conditions, independent of traditional crash risk factors. The results highlight the need for multifaceted interventions, including public education, strict enforcement of distraction-related laws, and adoption of advanced in-vehicle safety technologies such as forward-collision warning and automatic emergency braking. Targeting both behavioral and environmental dimensions of distraction-related crashes can substantially reduce crash frequency and severity, ultimately enhancing roadway safety for all users, particularly vulnerable populations such as pedestrians and bicyclists.

Based on the research findings, the following measures are proposed to effectively enhance roadway safety and mitigate the risks posed by distracted driving:

1. Enhance Public Education and Awareness Campaigns: Since most distraction-related crashes occur during daylight and clear weather, education efforts should emphasize the risks of inattention during routine driving, even under optimal conditions. Campaigns should specifically address common distractions such as texting, smartphone use, and other in-vehicle activities that divert attention from the roadway.
2. Strengthen Enforcement of Distraction Laws: Enforcement efforts should be intensified to ensure adherence to existing distracted driving regulations. Focused enforcement in high-traffic zones, intersections, and locations with frequent rear-end collisions can effectively mitigate high-risk behaviors and reduce crash incidence.
3. Promote Adoption of In-Vehicle Safety Technologies: Advanced driver-assistance systems, including forward-collision warning, lane departure warning, and automatic emergency braking, can significantly reduce the risk of front-to-rear and angle collisions. Widespread implementation, especially in fleet and high-mileage vehicles, has the potential to markedly decrease both crash frequency and severity.

## 6. Acknowledgement

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