Baby, It’s Hot Outside!
The Hottest Topics in Our Dynamic Industry

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This article will discuss four of the hottest topics in transportation. Specifically, the areas of interest will include the following: (1) recruiting younger drivers and its effects; (2) advantages and disadvantages of technology; (3) spoliation of evidence against Plaintiffs; (4) marijuana legalization and impaired driving. The Report below was prepared by The American Transportation Research Institute (ATRI) which specifically highlights and addresses in detail the critical issues in the Trucking Industry in 2018. ATRI is the trucking industry’s non-for-profit research organization.

**Critical Issues in the Trucking Industry – 2018**

The strengthening economy and robust freight demand have made 2018 a strong year for the trucking industry. However, the economic activity fueled, in part, by federal tax reform has not been without challenges for motor carriers and professional drivers. The driver shortage continues to exacerbate industry capacity and the questions of how to fund transportation infrastructure continue to go unanswered, leaving roads in a state of disrepair and congestion levels at all-time highs.

The implementation of the Electronic Logging Device (ELD) mandate at the end of 2017 has allowed trucking industry stakeholders to shift to other issues on the legislative and regulatory agenda, such as the Federal Motor Carrier Safety Administration’s (FMCSA) Hours-of-Service (HOS) provisions, tolls, and the federal preemption of state regulation of interstate trucking (F4A).

The long-running economic expansion gained momentum in 2018 with the passage of significant corporate and personal tax cuts in December 2017. Due to this growing
economic activity, the trucking industry is thriving in a business environment characterized by strong demand for freight and industry capacity constraints.¹ These capacity constraints, attributable to shipper demand exceeding truck volume capacity and truck driver availability, have resulted in substantial increases in driver compensation – pay,² benefits, and bonuses³ – as well as commensurate increases in the rates charged to shippers.⁴ With the economic consequences of the driver shortage and growing levels of driver turnover clearly articulated, the capacity constraints have provided national attention to these critical trucking industry issues.

Moreover, driver turnover has continued to impact fleet operations. The structural, demographic factors that underpin the truck driver shortage crisis remained firmly in place over the past year, and viable solutions to this pervasive staffing challenge have been slow to emerge. One potential solution – the DRIVE-Safe Act – was proposed this year in the U.S. House of Representatives. This legislation proposes to create an entry-level path for truck drivers between the ages of 18 and 21.⁵ While the potential implementation of such a policy may mitigate the effects of an aging truck driver workforce by recruiting younger drivers to the industry, its deployment will require strong industry and government partnerships to ensure success.

The final implementation of FMCSA’s ELD mandate on December 18, 2017 ended a heated debate within the trucking industry that made its way all the way to the U.S. Supreme Court. Since implementation, the industry’s focus has quickly shifted to the closely related issue of HOS reform. In response, FMCSA issued an Advanced Notice of Proposed Rulemaking (ANPRM) in August seeking public comment on several HOS provisions, including split sleeper-berth, in an effort to add more flexibility to the regulations.

The trucking industry has also had to fend off the expansion of tolls, targeted specifically at trucking, to fund much-needed infrastructure improvement. Rhode Island, for instance, imposed tolls on out-of-state tractor-trailers to fund a $5 billion program to repair and upgrade roads and bridges throughout the state. While Rhode Island is currently being sued by the trucking industry over this funding approach, a similar plan was recently announced in Indiana. The state’s proposed $1 billion infrastructure plan will rely on an increase in the rates charged to trucks classified as Class 3 and above on the Indiana Toll Road.

Given these and numerous other issues impacting the nation’s freight system, the American Trucking Associations (ATA) and its Federation partners in the State Trucking Associations (STA) continually seek opportunities to identify and prioritize the industry’s...
most pressing concerns. For the past 14 years, the industry has relied on the American Transportation Research Institute’s (ATRI) annual survey to better understand trucking’s most critical issues as well as to identify preferred strategies for addressing these issues.

ATRI’s Top Industry Issues report is based on a robust survey methodology. The initial issues and potential strategies are first identified by a collaboration of various trucking stakeholder groups. ATRI then conducted a large-scale survey distribution using its own contact database, ATRI’s regular Sirius/XM radio shows, major trucking industry trade press, and through the 50 State Trucking Associations.

Survey respondents were asked to select their top three choices from the list of 26 critical issues, and subsequently rank their top three preferred strategies corresponding to each selected issue.

As evidence of the numerous and varied challenges currently facing the industry, this year’s survey generated 1,539 responses. Respondents represented industry stakeholders across North America. A plurality of respondents were motor carriers (47.5%), with commercial drivers making up 41.3 percent of the respondent pool, and other industry stakeholders accounting for 11.2 percent. Recognizing that the top industry issues impact motor carriers and commercial drivers differently, this report includes separate “Top Ten” lists specific to commercial drivers and motor carriers, in addition to the overall ranking.

This report presents the findings of the 2018 annual survey and analysis, and compares the findings of previous years’ results (Table 3) – providing insight into both the changing and emerging priorities of the trucking industry.
Top Issues Summary

Among all respondents, the Driver Shortage held firmly atop the list of industry concerns while the potential for regulatory reform boosted the profile of the HOS rules as the second most-critical industry issue. Given the capacity constraints exacerbated by shortage of drivers, Driver Retention moved up two spots to become the number three issue in 2018. Post-implementation, the ELD mandate dropped two spots this year to the number four issue and the lack of safe parking locations for trucks moved down one spot to round out this year’s top five issues (Figure 1).

ATRI develops the “Top Ten” list using a formula assigning quantitative values to respondents’ rankings of issues facing the industry. An issue that is ranked by a respondent as most important receives three points, while an issue ranked second receives two points and an issue ranked third receives one point. Issues that were not ranked by respondents do not receive any points.

The total number of points for each issue are used to generate a prioritized list of industry concerns. The issue with the highest number of points is identified as the top industry issue and an Industry Concern Index (ICI) is presented to illustrate the relative level of concern from one issue to the next. The Top Industry Issue receives an ICI of 100, and then all other issues are indexed against this value. For example, if an issue receives an ICI of 50, it was calculated to have half the level of concern as the top issue.

Each respondent was asked to rank three strategies to address their top three issues. The strategies were identified by trucking stakeholders for their potential to impact or
mitigate each industry challenge. Values were assigned to respondents' rankings for each of the three strategies and an average score is calculated based on all of the rankings to determine the most preferred strategy.
Figure 1: Distribution of Industry Issue Prioritization Scores

[Graph showing the distribution of industry issue prioritization scores for various issues such as Driver Shortage, Hours-of-Service (HOS), Driver Retention, Electronic Logging Device (ELD) Mandate, Truck Parking, Compliance, Safety, Accountability (CSA), Driver Distraction, Transportation Infrastructure / Congestion / Funding, Driver Health and Wellness, and Economy.]
1. Driver Shortage

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The Driver Shortage, a perennial top industry issue, ranked as the industry’s top concern for the second consecutive year in 2018. Growing demand for truck transportation over the past year has exacerbated industry capacity constraints as carriers continue to struggle with recruiting and retaining a qualified truck driver workforce. The current driver shortage, which the American Trucking Associations (ATA) estimates to be over 50,000 drivers, and the competitive freight market have served to boost driver pay, benefits, and bonuses over the past year.

**Proposed Strategies (in rank order):**

a) *Advocate for Congress and federal agencies to develop an apprenticeship program to attract, train and retain safe 18-20-year-old interstate drivers to the industry.* With 28 percent of truck drivers age 55 and older, the aging demographic of the trucking industry’s workforce puts significant pressure on the industry to increase the available pool of qualified truck drivers. To combat the pending wave of driver retirements, nearly half of respondents (47.5%) indicated that the industry must continue to work with state and federal authorities to attract a new generation of qualified drivers to the industry. This strategy gained some traction this year with the introduction of the DRIVE-Safe Act to the House of Representatives. The DRIVE-Safe Act would lower the interstate commercial

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truck driving age to 18 in concert with on-the-job training for these potential new entrants to the trucking industry.\textsuperscript{14}

However, there are some who feel that the industry's focus on recruiting younger drivers may create additional safety concerns. To this end, ATRI is currently researching how to identify and recruit safe, younger drivers to the trucking industry.\textsuperscript{15} Building from a volume of research that has identified the characteristics associated with both safe and unsafe driving habits, this research seeks to develop an assessment tool the trucking industry can use to identify younger individuals whose personality traits more closely mirror those of safe, older drivers. ATRI's Driver Safety Assessment tool is currently being tested on experienced truck drivers to validate its efficacy.

b) \textit{Work with the U.S. Department of Transportation and the Department of Labor to harmonize regulations with the White House efforts to expand apprenticeships and other workforce development initiatives in the trucking industry.} With truck driving projected to be one of the occupations with the most job growth between 2016 and 2026, recruiting a steady flow of new drivers into the industry workforce will prove essential in the years ahead.\textsuperscript{16} Further corroborating the industry's significant recruiting needs is the estimated 898,000 new truck drivers that will be needed over the next decade, half of whom are needed just to replace retiring truck drivers.\textsuperscript{17} As such, one-third of respondents believe that the industry should focus on workforce development initiatives in concert with the


U.S. Department of Labor and Department of Transportation to meet the industry’s growing workforce needs.

c) Collect and analyze safety performance data on 18-20 year olds who operate commercial vehicles intrastate. Current law allows 18-20 year olds to operate commercial vehicles within state borders in 48 states. This means that a commercial driver 18-20 years of age can drive from Miami to Tallahassee, Florida (482 miles) but that same driver is not legally allowed to drive from Tallahassee, Florida to Thomasville, Georgia (34 miles). To better understand the real-world driving experience of commercial drivers 18-20 years old, 19.7 percent of respondents believe that research on the safety performance of those drivers would better inform the discussion of lowering the age for an interstate CDL.
2. Hours-of-Service (HOS)

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HOS is a top-three industry issue for the eighth consecutive year in 2018, as the final implementation of FMCSA’s ELD mandate in December 2017 has underscored the industry’s desire for increased flexibility in the current HOS provisions. The industry has continued to push for increased flexibility in the current sleeper berth provision over the past year, which was ranked as the top strategy to address HOS issues in 2017. These efforts have culminated in FMCSA’s ANPRM seeking comment on several HOS provisions, including split sleeper-berth.\(^\text{18}\)

**Proposed Strategies (in rank order):**

a) *Continue to push for increased flexibility in the current sleeper berth provision.* Added flexibility in the current sleeper berth rule was selected as the top strategy by a majority of respondents (54%). The current rule specifies that drivers using the provision must take at least eight consecutive hours in the sleeper berth, plus a separate two hours in either the sleeper berth, off duty, or any combination of the two.\(^\text{19}\) Additional flexibility in the rule would allow drivers to rest when tired and would provide an opportunity for drivers to adjust their driving schedules to avoid some of the worst congestion chokepoints. A recent ATRI study into the latter point identified potential productivity gains and industry operational cost savings ($150+ million) by using a more flexible 6-4 split rest schedule.

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to avoid operating during peak traffic congestion.\textsuperscript{20} FMCSA also has a pilot study underway assessing how more flexible split-rest provisions affect driver safety and fatigue.\textsuperscript{21}

b) \textit{Research and quantify the true safety and economic impacts of customer detention on truck drivers and trucking operations}. Concern over the adverse safety and economic impacts of driver delays at customer facilities resulted in 37 percent of respondents selecting this as the top strategy. This follows the release of the U.S. DOT Office of Inspector General's (OIG) audit of customer detention impacts, which found that dwell time increased crash risks and also reduced incomes for drivers and motor carriers in the for-hire sector.\textsuperscript{22} However, the OIG's report also emphasized the lack of accurate data on driver detention, and recommends improving future data collections to facilitate further study of driver detention issues. The ELD mandate may provide the opportunity for collecting this data in a more robust way than has been done in the past. Additionally, ATRI has collected commercial driver input on detention impacts on safety, productivity and HOS compliance and will publish the results of this study in early 2019.

c) \textit{Analyze how HOS rules might be modified for highly automated trucks, and identify what research and data would be necessary to justify future rules changes}. The U.S. Department of Transportation recently issued updated guidance on the deployment of

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highly automated vehicles.²³ As the federal and state role in highly automated vehicles continues to evolve, 10.7 percent of respondents believe that it will be important to define what changes might be necessary to the HOS rules once drivers are operating highly automated trucks. The current rules were developed to ensure adequate off-duty time for truck drivers operating large vehicles requiring full driver attention.²⁴ However, ATRI is conducting additional research into how these rules might be amended to allow for increased flexibility as more advanced automated technologies are adopted.

3. Driver Retention

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With a strong economy bolstering demand for both truck capacity and truck drivers, Driver Retention has continued to move up the list of critical industry issues. Driver turnover increased through the first half of 2018, particularly at large truckload carriers, and the industry is on pace to have the highest annual turnover rate since 2013.\textsuperscript{25} To combat turnover, which dramatically increases recruitment and training costs, motor carriers continue to seek new retention strategies, including raising sign-on and retention bonuses.\textsuperscript{26}

**Proposed Strategies (in rank order):**

a) *Research the relationship between driver compensation models and driver productivity.*

While driver pay is only part of the equation, it plays a leading role in maintaining and/or enhancing driver satisfaction. However, understanding the various truck driver compensation models and their relationship to driver productivity and retention is a necessary first step in advancing the most appropriate compensation schema. 48.3 percent of respondents believe an analysis of driver compensation approaches to be the best strategy for addressing Driver Retention.

b) *Study the effectiveness of carrier retention programs that financially incentivize drivers for performance in the areas of safety, fuel economy, and trip productivity.* Financial incentive systems that award the safest and most productive drivers in a fleet may


\textsuperscript{26} “ATA Driver Compensation Study.” American Trucking Associations. March 2018.
potentially boost driver retention; performance-based bonuses, in particular, could also improve overall fleet safety and productivity as more truck drivers in a fleet work toward receiving the bonuses. ATRI’s latest Operational Costs of Trucking analysis found that motor carriers paid drivers an average of $1,317 in safety bonuses in 2017, while drivers awarded on-time delivery bonuses received $2,542. 33.4 percent of respondents believe that understanding the role of such bonuses in driver retention is an important step in mitigating driver turnover.

c) Create an online compendium of retention strategies and best practices, customizable by carrier fleet size and sector. Once research into the effectiveness of carrier retention programs and compensation models has been completed, it will be important to establish a centralized repository for this information to facilitate the adoption of the best retention strategies and practices. Accordingly, roughly one-fifth of respondents (18.2%) indicated that compiling the results of this research was their preferred strategy to address the Driver Retention problem.

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4. Electronic Logging Device (ELD) Mandate

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After full implementation of the ELD Mandate at the end of 2017, concern over the mandate’s implications have begun to abate, dropping this issue two places to fourth overall in 2018. In the first full year of the mandate, the industry is beginning to assess how ELD deployment is affecting industry safety and productivity, while some concerns remain regarding how the data collected may be used beyond HOS compliance.

Proposed Strategies (in rank order):

a) Research and quantify industry impacts on safety and productivity from full deployment of ELDs. A majority of respondents (55.3%) indicated that further research is needed in order to fully assess the industry impacts of ELDs. In its Regulatory Impact Analysis, FMCSA projected that the industry would save $2.44 billion in administrative costs and save 31 lives annually.\(^{28}\) Additional research is needed that utilizes more robust ELD data to help the industry and FMCSA understand if the estimated benefits have been realized.

b) Assess the extent and impact associated with growing requests for ELD exemptions. As the April 1, 2018 hard enforcement date for the ELD Mandate approached, there were petitions filed with the agency by various industry groups requesting exemptions from the mandate. Included in these petitions was one submitted by agricultural haulers who were successful in obtaining a temporary exemption, and legislation has been proposed to

make this exemption permanent.29 As a result, nearly one-quarter of respondents (24.3%) selected assessing the extent and impact of these exemption requests as their top strategy in relation to the ELD Mandate.

c) Assess the landscape of appropriate and inappropriate uses of newly available ELD data. Given the scope of information that ELDs are capable of tracking and the scale of their adoption, concern remains regarding how this information will be used beyond the stated purpose of logging HOS. While language in FMCSA’s final rule prohibits driver harassment and provides a channel for drivers to file a complaint regarding harassment,30 21.8 percent of respondents indicated a desire to establish limitations on the use of ELD-generated data.

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5. Truck Parking

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The growing scarcity of available truck parking creates a dangerous and costly dilemma for truck drivers who are often forced to drive beyond allowable HOS rules or park in undesignated and, in many cases, unsafe locations. The Federal Highway Administration (FHWA) is preparing this year to update the original 2015 *Jason’s Law Truck Parking Survey Results and Comparative Analysis*, which confirmed that the lack of safe truck parking continues to be a major issue in the United States. FHWA has indicated that the new survey will include drayage and short-haul drivers in order to assess the parking situation around the nation’s port facilities. The results of this year’s top industry issues survey corroborate the truck parking challenges faced by drivers. While the issue is ranked fifth overall, it is the number two concern among truck driver respondents.

Proposed Strategies (in rank order):

a) **Identify strategic locations on the National Freight Network for new or expanded truck parking due to increased traffic congestion and industry/ regulatory changes.** A majority of survey respondents (50.2%) have indicated that identifying strategic locations to expand truck parking capacity is their preferred strategy for addressing the pervasive shortage of truck parking. In particular, re-opening shuttered parking facilities and investing in new facilities are the most direct strategies aimed at alleviating the chronic and growing shortage of truck parking along the National Freight Network. Other options,

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such as repurposing vacant urban and suburban land parcels for truck parking, are also being explored as potential solutions to this critical industry issue.33

b) Educate the public sector on the safety consequences that result from closing public parking facilities and/or failing to expand truck parking availability. The Jason’s Law Report first brought attention to the safety risks commercial drivers face as a result of the truck parking shortage, and more recent research continues to quantify the safety impacts of an inadequate supply of truck parking.34 ATRI’s truck parking diary research quantified the frequency in which drivers are forced to park in undesignated or unauthorized truck parking locations like highway shoulders or ramps, with 48.7 percent of drivers reporting that the parking shortage leads them to do so between three to seven times per week.35 As such, this is the preferred strategy for 38.2 percent of respondents, up from 29 percent in 2017, as a growing number of industry stakeholders hope that educating state and local officials on the critical need for safe truck parking facilities could lead to new investments.

c) Research the role and value of real-time truck parking information availability and truck parking reservation systems. Leveraging technological advancements to develop real-time truck parking solutions was the preferred strategy for a small, but growing percentage of respondents. The share of respondents selecting this strategy increased from 7.2 percent to 11.7 percent reflecting the considerable public sector interest and investment in these systems. ATRI initially designed the Truck Parking Information

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Management System concept (TPIMS) used by the Minnesota Department of Transportation, which was later expanded to the Mid America Association of State Transportation Officials (MAASTO) Truck Parking Information Management Systems (TPIMS), which is being funded through a $25 million TIGER grant. On track to be launched by the summer of 2019 after a soft launch this fall,\textsuperscript{36} the MAASTO TPIMS will deliver real-time truck parking availability information to commercial drivers in eight Midwest states when fully deployed.\textsuperscript{37}


6. Compliance, Safety, Accountability (CSA)

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CSA held steady as the sixth-ranked issue facing the trucking industry in 2018. Earlier this year, FMCSA withdrew a 2015 proposal to revise the safety-scoring program that was intended to better align BASIC scores with a carrier’s crash risk. Instead, the agency is now pursuing the recommendations proposed by the Congressionally-mandated National Academies of Sciences review of CSA. The recommendations include a carrier rating system based on Item Response Theory (IRT) and improving both data collection and the system’s transparency. Meanwhile, FMCSA continues to accept Requests for Data Review for eligible crashes as part of its Crash Preventability Demonstration Program.

Proposed Strategies (in rank order):

a) Advocate for FMCSA to expand the list of crash types currently available for review and reclassification as non-preventable as part of the federal crash accountability pilot program. ATRI’s crash accountability research quantified how carrier Crash BASIC scores can be impacted once non-preventable crashes are removed from the calculation and industry interest is high in ensuring that FMCSA’s pilot program delivers similar results. However, the pilot program has limited the types of crashes that are eligible for

39 Ibid.
review,\(^{42}\) and nearly half of respondents (49.1\%) indicated a desire to expand the pilot program to include more crash types as their top strategy for addressing CSA in 2018.

b) Advocate for CSA score reductions in existing BASICs rather than a new BASIC for carriers who choose to participate in FMCSA’s Beyond Compliance program. As proposed by FMCSA, motor carriers participating in the Beyond Compliance program would voluntarily implement programs that exceed regulatory requirements to reduce both the number and severity of crashes.\(^{43}\) The program was modeled after ATRI’s “Alternative Compliance” research from 2011, which listed among the potential incentives a reduction in corresponding CSA BASIC scores for participating carriers.\(^{44}\) However, the agency has proposed incorporating this credit into a newly created BASIC. As such, 28.6\% of respondents indicated that they would like to see the credit as a reduction in existing BASICs as opposed to creating a new BASIC, up from 20.3\% of respondents in 2017.

c) Work with FMCSA to ensure that the recommendations of the Congressionally-mandated National Academies of Sciences review of CSA are successfully implemented. The 132-page NAS study provided FMCSA with multiple recommendations to improve the evaluation of carrier safety performance.\(^{45}\) Chief among these recommendations is a call for adopting a data-oriented Item Response Theory model for assessing carrier

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crash risks.\textsuperscript{46} As this program is piloted by FMCSA, 23.7 percent of respondents indicate that it will be critical for the industry to remain actively involved to ensure that the recommendations are successfully implemented.

\textsuperscript{46} Ibid.
7. Driver Distraction

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Distracted driving and its impact on highway safety remained a top priority for the trucking industry in 2018, as the growing use of smartphones has raised the profile of distracted driving as a major public safety issue. According to data from the National Highway Traffic Safety Administration (NHTSA), 3,450 people were killed in motor vehicle crashes involving distracted drivers in 2016, while distracted driving was a factor in 14 percent of all police-reported traffic crashes.

Proposed Strategies (in rank order):

a) Encourage harsher penalties and more aggressive enforcement of distracted driving violations for drivers of all vehicle types. Although all 50 states now have some form of restriction on the use of mobile phones while driving, there are significant differences in how states define and enforce these provisions. Some states ban use for novice drivers, while other states classify it as a primary or secondary citable offense. Accordingly, 39.1 percent of respondents would like to encourage harsher penalties and more aggressive enforcement of existing laws as a means of reducing distracted driving, down from the 47.7 percent of respondents that selected this strategy as their top choice in 2017.

b) Advocate for national standards for distracted driving laws for all motorists. With varying definitions and enforcement strategies employed at the state level, uniformity in laws across state lines would reduce motorist confusion and promote more uniform enforcement. To this end, 37.7 percent of respondents indicated a desire to develop a national standard for distracted driving laws as the top strategy for addressing Driver Distraction, up nearly 10 percentage points from 2017.

c) Recognizing the growing role of onboard technologies, identify solutions that support safe technology usage in the truck cab. Use of in-cab technologies such as collision warning, automatic braking, and forward- and driver-facing cameras are proliferating throughout the trucking industry. In fact, roughly one-quarter of respondents (24.5%) believe that it would be counterproductive to ban certain telematics solutions that streamline decision-making and enhance vehicle safety. As such, it will be crucial to identify solutions that maintain this tenuous balance between technology-related safety and operational efficiency.
8. Transportation Infrastructure / Congestion / Funding

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Recognizing that the trucking industry hauls 70.2 percent of the nation’s freight tonnage and 79.3 percent of freight revenues, the state of the nation’s roadway infrastructure is a critical issue for trucking. Poorly maintained roads and traffic congestion create wear and tear on vehicles, waste fuel and increase emissions, create additional stress for drivers, and negatively impact industry productivity. ATRI research estimates that congestion-related delays cost the trucking industry $74.5 billion in added operational costs during 2016.

ATRI has also published research that details the significant and growing shortfalls to the Highway Trust Fund Highway Account -- resulting in a serious deterioration of the nation’s road network. This research documented federal fuel tax increases as the optimal mechanism to fund much-needed infrastructure improvements. While efforts to raise the federal fuel tax have stalled, multiple states have increased their fuel tax to help bolster local infrastructure budgets.

**Proposed Strategies (in rank order):**

a) Continue to advocate for long-term highway funding through an increase in the fuel tax or other direct user fees, and prevent additional diversion of revenue to non-highway...
projects. The persistent shortfall of highway funding in the United States is due, in part, to an erosion of federal motor fuels tax revenue. This erosion can be attributed to improvements in fuel economy, inflation and stagnant fuel tax rates.\textsuperscript{54} Research has demonstrated the administrative efficiency of the fuel tax,\textsuperscript{55} and as such, 40.8 percent of respondents selected an increase in the fuel tax or other user fees as their top strategy to improve the nation’s surface transportation infrastructure.

b) \textit{Create a new funding program to focus federal resources on truck bottlenecks along major freight corridors.} Another solution to address the broad range of transportation infrastructure issues is to target funding on transportation bottlenecks along major freight routes, a strategy that was selected by 30.5 percent of respondents. This is particularly timely as states are now required to identify and report on truck freight bottlenecks as part of FHWA’s Transportation Performance Management (TPM) program.\textsuperscript{56} To this end, ATRI monitors congestion at 300 freight-significant locations and produces an annual ranking of top truck bottleneck locations as a means for prioritizing infrastructure investments.\textsuperscript{57} For example, the Jane Byrne Interchange (formerly Circle Interchange) in Chicago is the focus of a $450 million reconstruction effort to improve truck freight mobility as a direct result of ATRI’s bottleneck research.\textsuperscript{58}

c) \textit{Utilize the Congressionally-mandated National Freight Policy and National Freight Network as tools to ensure adequate investment in critical highway infrastructure.} As part

\textsuperscript{55} Ibid.
of the MAP-21 authorization passed in 2012, Congress mandated that the U.S DOT develop a National Freight Policy and a National Freight Network to assist with long-term infrastructure planning and investment prioritization. Additionally, the FAST Act apportioned up to $10.8 billion for improvement projects that take place on the National Freight Highway Network.\textsuperscript{59} 29.9 percent of respondents considered this the best strategy for dealing with infrastructure funding in 2018, up from 21.8 percent of respondents in 2017.

9. Driver Health/Wellness

<table>
<thead>
<tr>
<th>Ranked 1\textsuperscript{st}</th>
<th>Ranked 2\textsuperscript{nd}</th>
<th>Ranked 3\textsuperscript{rd}</th>
<th>Total Share</th>
<th>Industry Concern Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>3%</td>
<td>4%</td>
<td>4%</td>
<td>10%</td>
<td>17.6</td>
</tr>
</tbody>
</table>

Driver Health and Wellness moved up one spot this year and now ranks as the ninth-biggest issue affecting the trucking industry. Many in the industry recognize the critical connection between improved driver health and wellness and the industry’s ability to retain qualified drivers -- as roughly 20 percent of drivers that leave their jobs cite health problems as a factor in their decision.\textsuperscript{60} In addition to obvious lifestyle benefits, an improvement in driver health may also have positive implications for industry safety as research has identified a positive correlation between driver health and driver safety.\textsuperscript{61}

**Proposed Strategies (in rank order):**

a) *Encourage increased availability of exercise facilities and healthy food choices at truck stops/travel plazas.* Encouraging more exercise facilities and healthier food choices at truck stops remained the top strategy, for six years running. To this end, a majority of all respondents (51.2\%) believe that healthier food options and exercise facilities will help mitigate the impacts of a sedentary occupation. This strategy ranked even higher among driver respondents, with 60 percent of drivers selecting it as the preferred approach for addressing driver health and wellness concerns. As the industry continues to push for solutions to the truck parking shortage, it will be important to ensure that parking facilities are equipped with amenities that address driver health and wellness concerns.

\textsuperscript{60} “One in Five Truck Drivers Leaves Job Because of Health Issues, Survey Finds.” Transport Topics. 11 May, 2016. Available online: http://www.ttnews.com/articles/one-five-truck-drivers-leaves-job-because-health-issues-survey-finds

b) **Continue industry data collection and analysis on driver health-related issues to ensure that any future regulatory actions are based on recent and best available data.** Just under one-quarter of respondents (24.1%) believe that up-to-date data and analysis on health-related issues will prove essential in improving the efficacy of future regulatory actions on the trucking industry. FMCSA’s permanent suspension of the restrictive HOS restart provisions, in light of data showing that they did not lead to improved safety outcomes, is an example of how real-world industry data can be used to guide regulatory decisions.

c) **Undertake research that quantifies the return-on-investment for driver health and wellness programs.** Similar to the previous strategy, many in the industry want to utilize data to better understand and quantify the effectiveness of driver health and wellness programs. 21.5 percent of respondents indicated this to be their preferred strategy to address the issue of Driver Health and Wellness.
10. Economy

<table>
<thead>
<tr>
<th>Ranked 1st</th>
<th>Ranked 2nd</th>
<th>Ranked 3rd</th>
<th>Total Share</th>
<th>Industry Concern Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>2%</td>
<td>3%</td>
<td>3%</td>
<td>9%</td>
<td>14.6</td>
</tr>
</tbody>
</table>

U.S. economic activity has grown at a robust pace through the first half of 2018, matching growth rates last seen during the early years of the recovery from the Great Recession. However, the Economy has re-emerged as a top-10 critical issue for the trucking industry as the otherwise positive economic outlook has been clouded by uncertainty surrounding emerging trade disputes. The U.S., Canada and Mexico were able to reach deals revamping the North American Free Trade Agreement (NAFTA) after more than a year of tense negotiations.\(^{62}\) Meanwhile, the growing trade dispute between the U.S. and China may devolve into a protracted trade war, with the two parties currently imposing tariffs on a wide variety of goods.\(^{63}\) This has generated significant concern among industry stakeholders, many of whom depend on strong import and export activity to drive freight demand.

Proposed Strategies (in rank order):

a) **Advocate for reforming/repealing ineffective and burdensome regulations that add to industry costs without providing benefits.** Given the scope and scale of regulations affecting the trucking industry, over half of respondents (56.4\%) feel that regulatory reform is the best strategy for improving the economy and driving up the demand for freight. This is in line with the Trump administration’s goal to broadly reduce regulations and red tape

---


-- an effort that the White House estimates has already saved U.S. taxpayers roughly $1.6 billion annually.64

b) *Continue to advocate for policies that will further stimulate the economy.* Given the strong relationship between consumer spending and freight demand, 35.3 percent of respondents would like to see policies that boost consumer confidence and spending. The share of respondents selecting this strategy as their top strategy declined 5 percentage points over the year, likely due to the stimulus already provided to the economy with the passage of the Tax Cuts and Jobs Act at the end of 2017.

c) *Research and quantify the impacts of e-commerce on the trucking industry.* Consumer spending is the biggest component of the U.S. economy, accounting for over two-thirds of the nation’s total economic output.65 At the same time, e-commerce now accounts for nearly 10 percent of total retail sales in the U.S., and sales derived from e-commerce are growing more than three times as fast as overall consumer spending activity.66 As such, 9.7 percent of respondents indicated that they would benefit from research into the impacts of e-commerce on the trucking industry. To this end, ATRI is conducting research on emerging e-commerce trends and mapping the effects of these trends to the industry’s most critical issues.


Emerging Issues

As part of its analysis of the most critical industry issues, ATRI also tracks the emerging topics that generate significant industry interest but fall just outside of the top 10 concerns (Table 1). This analysis can provide insight on the issues that may emerge in the future as a top industry issue.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Issue</th>
<th>ICI</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Highway Safety and Crash Reduction</td>
<td>13.4</td>
</tr>
<tr>
<td>12</td>
<td>Tort Reform</td>
<td>10.9</td>
</tr>
<tr>
<td>13</td>
<td>Automated Truck Technology</td>
<td>10.7</td>
</tr>
</tbody>
</table>

Highway Safety and Crash Reduction ranks as one of the industry’s emerging issues for the first time since this study’s inception, as the trucking industry continues to place an emphasis on its safety record. Fatal crash rates for large trucks have been on a downward trend since 1975, declining 71 percent over the last four decades. However, the rate has started to climb again since reaching an all-time low in 2009. As a result, respondents would like to gain a better understanding of truck crash increases by causal factors and vehicle type.

Last ranked as a top industry issue in 2011, Tort Reform is re-emerging as a critical industry issue, particularly among motor carriers. While Tort Reform ranks 12th overall, it is the 8th biggest issue from the perspective of motor carrier respondents (Table 2). This is driven, in part, by recent large jury awards against motor carriers regardless of

---


3860935.1
negligence. Additionally, there are initiatives at the state level to address tort reform, including an item on the ballot in Arkansas aimed at capping attorney fees and damage awards in lawsuits (Arkansas Issue 1). 68

Automated Truck Technology ranked as one of the industry’s emerging issues among all respondents again in 2018 after cracking the list for the first time in 2017. Driver-assistive technologies have seen increased deployment in recent years, while high-profile demonstrations of emerging automated technologies continue to generate significant attention among industry stakeholders. 69 For drivers, in particular, the potential job-changing impacts from greater deployment of automated truck technologies is creating concern. Previous research conducted by ATRI on Automated Truck Technology hinted at what truck drivers might expect from increased deployment of driver-assistive technologies. 70 ATRI will be delving further into the effects that automated technologies will have on truck drivers in the year ahead, as this topic is one of ATRI’s Research Advisory Committee top research priorities for 2018.

68 “Arkansas Issue 1, Cap on Attorney’s Fees and Damage Awards in Lawsuits Amendment (2018).” Ballotpedia. Available online: https://ballotpedia.org/Arkansas_Issue_1,_Cap_on_Attorney%27s_Fees_and_Damage_Awards_in_Lawsuits_Amendment_(2018).
Commercial Driver vs Motor Carrier Issue Rankings

The Top Industry Issues report details the results of the overall industry survey of industry stakeholders including company and independent drivers, motor carriers, and other trucking industry stakeholders. However, each of the stakeholder groups surveyed have different levels of involvement in and perspectives on how these topics impact them. As a result of these varied experiences, the selection and ranking of issues will differ across these groups. To account for the wide-ranging experiences of the ATRI survey sample, particularly those between commercial drivers and motor carriers, ATRI provides a break out to illuminate how these rankings differ by stakeholder (Table 2).

The rankings of industry issues by commercial drivers and motor carriers are invariably influenced by their day-to-day experiences. A divergence of opinions between these two groups can provide deeper insight into the consequences of an industry issue and allow for more targeted strategies to address those issues. The Driver Shortage, for instance, ranks as the top issue for motor carriers, but ranks as the ninth-biggest issue from the perspective of truck drivers (Table 2). The divergence of opinions on this issue is to be expected: drivers benefit from the shortage through more competitive compensation, as wages, benefits, and bonuses increase, as cited in ATRI’s most recent analysis of motor carrier cost data.71 At the same time, these growing compensation packages are

squeezing profit margins for motor carriers, limited their ability to expand capacity in a strong market for truck transportation.\textsuperscript{72}

There are also regulatory and legal issues that rank highly in the minds of motor carrier respondents but have not gained much traction among commercial drivers. Tort reform and F4A, for instance, are top-ten issues for motor carriers, but were ranked as critical industry issues by only a handful of commercial drivers. Conversely, drivers placed a greater emphasis on their health (Driver Health and Wellness) and the potential impact that Automated Truck Technology may have on their careers, relative to motor carrier respondents.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Commercial Drivers</th>
<th>Motor Carriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hours-of-Service (HOS)</td>
<td>Driver Shortage</td>
</tr>
<tr>
<td>2</td>
<td>Truck Parking</td>
<td>Driver Retention</td>
</tr>
<tr>
<td>3</td>
<td>Electronic Logging Device (ELD) Mandate</td>
<td>Hours-of-Service (HOS)</td>
</tr>
<tr>
<td>4</td>
<td>Driver Distraction</td>
<td>Transportation Infrastructure/Congestion/Funding</td>
</tr>
<tr>
<td>5</td>
<td>Driver Retention</td>
<td>Electronic Logging Device (ELD) Mandate</td>
</tr>
<tr>
<td>6</td>
<td>Compliance, Safety, Accountability (CSA)</td>
<td>Compliance, Safety, Accountability (CSA)</td>
</tr>
<tr>
<td>7</td>
<td>Driver Health and Wellness</td>
<td>Driver Distraction</td>
</tr>
<tr>
<td>8</td>
<td>Transportation Infrastructure/Congestion/Funding</td>
<td>Tort Reform</td>
</tr>
<tr>
<td>9</td>
<td>Driver Shortage</td>
<td>Truck Parking</td>
</tr>
<tr>
<td>10</td>
<td>Automated Truck Technology</td>
<td>Federal Preemption of State Regulation of Interstate Trucking (F4A)</td>
</tr>
</tbody>
</table>

That said, there are several instances in which the perspectives of commercial drivers and motor carriers are aligned – the ELD Mandate and Hours-of-Service ranked as top-five issues for both groups again in 2018. These stakeholder groups share a mutual concern regarding the flexibility of current HOS provisions, as well as how the move to ELDs is affecting industry safety and productivity. Driver Distraction, Driver Retention, CSA, and Transportation Infrastructure / Congestion / Funding round out the remaining similarities between the respective top ten lists compiled by commercial drivers and motor carriers.
Table 3: Top Industry Issue Rankings, 2009 – 2018

<table>
<thead>
<tr>
<th>Year</th>
<th>Issue Rank</th>
<th>Issue</th>
<th>Rank</th>
<th>Issue</th>
<th>Rank</th>
<th>Issue</th>
<th>Rank</th>
<th>Issue</th>
<th>Rank</th>
<th>Issue</th>
<th>Rank</th>
</tr>
</thead>
</table>

Note: Bold indicates first year in top ten.
Marijuana Legalization and Impaired Driving: Solutions for Protecting our Roadways

March 2019

Prepared by the American Transportation Research Institute
Marijuana Legalization and Impaired Driving: Solutions for Protecting our Roadways

March 2019

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ACKNOWLEDGEMENTS

The American Transportation Research Institute (ATRI) would like to thank Annette Sandberg for her important contribution to this report. Ms. Sandberg is a former administrator for the Federal Motor Carrier Safety Administration, and currently leads TransSafe Consulting LLC, an organization providing consulting services for transportation, safety and security.
## LIST OF ACRONYMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AACC</td>
<td>American Association for Clinical Chemists</td>
</tr>
<tr>
<td>AAN</td>
<td>American Academy of Neurology</td>
</tr>
<tr>
<td>ARIDE</td>
<td>Advanced Roadside Impaired Driving Enforcement</td>
</tr>
<tr>
<td>ATRI</td>
<td>American Transportation Research Institute</td>
</tr>
<tr>
<td>BAC</td>
<td>Blood Alcohol Content</td>
</tr>
<tr>
<td>BrAC</td>
<td>Breath Alcohol Concentration</td>
</tr>
<tr>
<td>CBD</td>
<td>Cannabidiol</td>
</tr>
<tr>
<td>CDL</td>
<td>Commercial Driver’s License</td>
</tr>
<tr>
<td>DEA</td>
<td>Drug Enforcement Administration</td>
</tr>
<tr>
<td>DEC</td>
<td>Drug Evaluation and Classification Program</td>
</tr>
<tr>
<td>DOT</td>
<td>Department of Transportation</td>
</tr>
<tr>
<td>DRE</td>
<td>Drug Recognition Expert</td>
</tr>
<tr>
<td>DUI</td>
<td>Driving Under the Influence</td>
</tr>
<tr>
<td>FARS</td>
<td>Fatality Analysis Reporting System</td>
</tr>
<tr>
<td>FAST Act</td>
<td>Fixing America’s Surface Transportation Act</td>
</tr>
<tr>
<td>FDA</td>
<td>Food and Drug Administration</td>
</tr>
<tr>
<td>FMCSA</td>
<td>Federal Motor Carrier Safety Administration</td>
</tr>
<tr>
<td>GC-MS</td>
<td>Gas Chromatograph-Mass Spectrometry</td>
</tr>
<tr>
<td>HGN</td>
<td>Horizontal Gaze Nystagmus</td>
</tr>
<tr>
<td>HOA</td>
<td>Homeowner Association</td>
</tr>
<tr>
<td>IACP</td>
<td>International Association of Chiefs of Police</td>
</tr>
<tr>
<td>LAPD</td>
<td>Los Angeles Police Department</td>
</tr>
<tr>
<td>LC-MS</td>
<td>Liquid Chromatography-Mass Spectrometry</td>
</tr>
<tr>
<td>LOC</td>
<td>Lack of Convergence</td>
</tr>
<tr>
<td>LSD</td>
<td>Lysergic Acid Diethylamide</td>
</tr>
<tr>
<td>MMUCC</td>
<td>Model Minimum Uniform Crash Criteria</td>
</tr>
<tr>
<td>ng/mL</td>
<td>Nanograms per Milliliter</td>
</tr>
<tr>
<td>NHTSA</td>
<td>National Highway Traffic Safety Administration</td>
</tr>
<tr>
<td>NTSB</td>
<td>National Transportation Safety Board</td>
</tr>
<tr>
<td>OLS</td>
<td>One Leg Stand</td>
</tr>
<tr>
<td>RAC</td>
<td>Research Advisory Committee</td>
</tr>
<tr>
<td>SFST</td>
<td>Standardized Field Sobriety Test</td>
</tr>
<tr>
<td>THC</td>
<td>Tetrahydrocannabinol</td>
</tr>
<tr>
<td>WAT</td>
<td>Walk and Turn</td>
</tr>
</tbody>
</table>
INTRODUCTION

Large trucks, automobiles and other vehicles share the nation’s highways and surface streets, accumulating more than 3 trillion vehicle-miles-traveled each year. Of these miles, drivers of large trucks accumulate more than 180 billion miles in order to move the nation’s freight and earn their living.

To operate a large truck, drivers must hold a commercial driver’s license (CDL) and are subject to drug testing rules due to their safety-sensitive employee designation. The vehicles operating alongside large trucks are predominately automobiles that are driven for non-commercial purposes. While automobile drivers must hold a driver’s license, there is no requirement to pass a drug test or to be randomly tested for drug use.

To ensure a safe driving environment, however, all drivers are subject to state laws that prohibit impaired driving that results from drug or alcohol consumption. Driving while under the influence carries large penalties including fines, loss of driving privileges and even jail sentences. That said, an impaired driver must be identified by law enforcement, the impairment must be documented and the individual must be successfully prosecuted in order to face such consequences.

Marijuana is one of many drugs that, when consumed, can cause significant and dangerous driving impairment.1 As states have legalized recreational use of marijuana over the past decade, there has also been an increase in passenger vehicle drivers testing positive for marijuana.2

This is concerning to the trucking industry considering the large percentage of truck-involved crashes caused by the actions of car drivers. Further exacerbating this concern is the difficulty faced by law enforcement in deterring marijuana-impaired driving. While there exist accurate tools to test for and prosecute drunk driving, widely tested and accepted tools and methods are not currently available for marijuana impairment testing. As a result, truck drivers in many states now face the significant risk of having legal marijuana users drive impaired (and illegally) alongside their trucks.

Recognizing the criticality of this issue, the American Transportation Research Institute’s (ATRI’s) Research Advisory Committee (RAC)3 selected transportation safety issues associated with marijuana as a top research priority in 2018. As stated earlier, central to this issue are states that have legalized marijuana possession and use, but have not fully documented and implemented procedures for effectively addressing marijuana-impaired driving. The goal of this research is to identify the most promising methods for improving safety on our nation’s highway by identifying and deterring marijuana-impaired driving.

3 ATRI’s Research Advisory Committee RAC is comprised of industry stakeholders representing motor carriers, trucking industry suppliers, federal government agencies, labor and driver groups, law enforcement, and academia. The RAC is charged with annually recommending a research agenda for the Institute.
BACKGROUND

After decades in which marijuana was an illegal substance in the U.S., the majority of states (33) have legalized marijuana for medical use and 10 states have legalized recreational use of the drug. While the states have made these changes, the U.S. federal government still considers the production, sale, possession and use of marijuana to be a criminal activity.

While it may be legal to consume marijuana in various settings and scenarios, operating a vehicle on public roads while impaired is a criminal offense. This is due to the intoxicating effects of tetrahydrocannabinol (THC), a component of marijuana. Issues associated with marijuana impairment and driving include:

- Poor judgment;
- Decreased motor coordination; and
- Decreased reaction time.

Likewise, marijuana impairment while driving is likely to become a larger problem as legal access to the drug increases. Recent national statistics for marijuana-positive drug tests, for instance, indicate that 2.6 percent of drug tests were marijuana-positive in 2017 – a 4.0 percent year-over-year increase from 2016. Marijuana-positive drug tests for federally-mandated, safety-sensitive occupations have also increased by nearly eight percent from 2016 to 2017 (0.78% in 2016 to 0.84% in 2017). The largest increases in marijuana positivity rates were observed in states that recently enacted recreational marijuana laws.

Driving Under the Influence (DUI)

Driving under the influence (DUI) is a significant safety concern – in 2016 more than 28 percent of all traffic fatality incidents included at least one driver who was operating a vehicle under the influence of alcohol. Marijuana likely contributes to the nation’s fatal crash statistics as well. As will be discussed in this report, however, identifying alcohol impairment is well established and far less complex than identifying marijuana impairment. The data on marijuana-involved crash rates, particularly those involving fatalities, simply are not collected at the same rate or with the same level of confidence as those involving alcohol impairment.

To deter impaired driving and prevent crashes, laws for driving while under the influence of alcohol and drugs carry serious penalties, including fines, jail time and loss of driving privileges. Proving that a driver is impaired due to alcohol consumption is relatively straightforward – there is a limit on the amount of alcohol that can be present in the blood in order to legally drive, and

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4 The increased access to marijuana domestically is mirrored by national-scale legalization legislation for Canada and Mexico, with Canada legalizing recreational marijuana in 2018 and Mexico legalizing medical marijuana in 2017.
7 Ibid.
8 Also commonly referred to in the U.S. as DWI, which stands for either driving while intoxicated or driving while impaired.
9 https://www.cdc.gov/motorvehiclesafety/impaired_driving/impaired-drv_factsheet.html
well-established methods for testing a person for these limits are utilized by law enforcement and accepted by the scientific community. These clear-cut laws, practices and tools to combat DUI have contributed to an approximately 50 percent decrease in annual alcohol-related traffic deaths today versus the 1980s. As will be discussed in this report, however, marijuana is processed by the body in a far different manner than alcohol, and therefore different approaches are needed to identify and prosecute marijuana-impaired driving.

Proof of Impairment - Marijuana Testing

Standard drug testing mechanisms today can easily identify past marijuana use by measuring metabolites. Though not generally indicative of intoxication, a positive test for past marijuana use can lead to employee termination by many employers, particularly those with strict anti-drug policies or those who employ safety-sensitive transportation workers.

But the aforementioned testing is not evidence of active impairment or intoxication. Thus, a simple blood or breathalyzer test – commonly employed by law enforcement when alcohol impairment is suspected – is not ideal for identifying drivers operating under the influence of marijuana. This is due to the body’s mechanisms for processing marijuana’s intoxicant agent, THC.

Of the states that have legalized recreational marijuana, most have chosen to set limits on the amount of acceptable THC in blood tests when testing for driver impairment. However, there are several issues related to such tests. The National Highway Transportation Safety Administration (NHTSA), for instance, offers evidence that some state laws allow an individual to be charged with a DUI if they test positive for THC derivatives in urine following arrest, which indicates marijuana use in the past 30 days but not necessarily recent marijuana use.

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11 “Since the early 1980s, alcohol-related traffic deaths per population have been cut in half with the greatest proportional declines among persons 16-20 years old.” See: https://report.nih.gov/nihfactsheets/ViewFactSheet.aspx?csid=24
12 Federal laws require marijuana testing for truck drivers who possess an interstate commercial driver’s license (CDL); if a driver tests positive there are a series of steps that must be taken which will negatively impact and may ultimately end a driver’s career.
LEGALIZATION TRENDS

The U.S. Drug Enforcement Administration (DEA) classifies marijuana as a Schedule 1 drug under the Controlled Substance Act. Schedule 1 drugs are considered to have no known use for medicinal purposes and “high potential for abuse.” Marijuana, as well as heroin, LSD and ecstasy are all considered Schedule 1 drugs at the federal level. Despite its Schedule 1 classification, many state governments have legalized marijuana for medical use and, in the case of 10 states, recreational use.

Medical Marijuana Laws

Medical marijuana has been approved to treat a substantial number of medical conditions in 33 states and the District of Columbia. Other states have more restrictive medical marijuana laws where only a select few conditions qualify an individual for medical marijuana. Figure 1 highlights those states where comprehensive medical marijuana legislation has been enacted.

States with medical marijuana laws require patients to have an ID card and/or enroll in a patient registry in order to obtain marijuana. This database of patients is also utilized by law enforcement to ensure those who are legally carrying medical marijuana are not mistakenly arrested for illegal possession. The majority of states with medical marijuana laws have certain health conditions that are covered under their medical marijuana legislation. States vary in their recognition of medical marijuana patients from other states.

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14 Ibid.
According to the American Academy of Neurology (AAN), two forms of marijuana have been approved by the Food and Drug Administration (FDA) in pill form for medical use. Studies have also been conducted to review the effectiveness of smoked marijuana, cannabidiol (CBD) extract or a combination of CBD and THC in pill form. Ongoing medical trials are being conducted to understand the effectiveness of marijuana in treating:

- Disease symptoms;
- Drug side effects; and
- Pain in cancer and chemoradiation patients.

Although additional studies are needed for conclusive evidence, diseases in which marijuana has had moderate success in treating symptoms include multiple sclerosis, epilepsy, Crohn’s disease, and inflammatory bowel disease.

Recreational Marijuana Laws

Ten states and the District of Columbia have passed legislation that allows for recreational marijuana use (Figure 2). All 11 jurisdictions require a person in possession of marijuana to be 21 years of age or older and prohibit the use of marijuana in public places. Similar to alcohol, drivers and passengers cannot actively consume marijuana in a motor vehicle that is in operation. Local laws, workplace rules, Homeowner Associations (HOAs) and rental tenants may be subject to additional regulations. Each state has separate laws regarding possession of marijuana and marijuana plants. Some states, for instance, specify whether marijuana plants can be grown on private property, where on the property they must be retained (not in public view from the street), and the number of plants each person or residence can grow in a household.

It is illegal to possess marijuana for recreational purposes according to federal law, and thus the movement of commercial marijuana over state lines (including between two states where recreational use is legal) is illegal.

Figure 2: States with Recreational Marijuana Laws
Taxation

States with legalized recreational marijuana have a tax on the drug paid by either consumers and/or producers of marijuana. A summary of state tax revenues generated by recreational marijuana, and how these funds are used is shown in Table 1. Tax revenues generated by recreational marijuana cultivation and sales are often allocated to marijuana regulatory agencies, law enforcement, substance abuse treatment/prevention programs, and state General Funds. Some states, such as California, also permit local jurisdictions to levy taxes on marijuana.

Table 1: Recreational Marijuana Tax Revenue and Allocation

<table>
<thead>
<tr>
<th>State</th>
<th>Retail Recreational Sales</th>
<th>Annual Tax Revenue (Millions)</th>
<th>Tax Revenue Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>Yes</td>
<td>$5.4</td>
<td>Recidivism Reduction Program; General Fund</td>
</tr>
<tr>
<td>California</td>
<td>Yes</td>
<td>$345.20*</td>
<td>Marijuana Production/Sales Regulation; Recreational Marijuana Legalization Impacts Research, California Highway Patrol; Social/Medical Programs; Substance Abuse Education/Prevention/Treatment Programs; Environment Programs to Prevent/Mitigate Marijuana Cultivation Environmental Impacts</td>
</tr>
<tr>
<td>Colorado</td>
<td>Yes</td>
<td>$266.5</td>
<td>Education Fund; General Fund</td>
</tr>
<tr>
<td>Maine**</td>
<td>No</td>
<td></td>
<td>General Fund; Highway Fund; Other Special Revenue Funds</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>Yes (11/2018)</td>
<td></td>
<td>General Fund; Commonwealth Transportation Fund; Marijuana Regulation Fund</td>
</tr>
<tr>
<td>Michigan</td>
<td>Pending</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nevada</td>
<td>Yes</td>
<td>$69.8</td>
<td>School Account; Rainy Day Fund</td>
</tr>
<tr>
<td>Oregon</td>
<td>Yes</td>
<td>$82.2</td>
<td>State School Fund; Mental Health, Alcoholism and Drug Services; Oregon State Police; Oregon Health Authority for Drug Treatment and Prevention</td>
</tr>
<tr>
<td>Vermont**</td>
<td>No</td>
<td></td>
<td>Education Fund; State Administrative Agencies and Municipalities; Public Safety/Prevention/Intervention Programs</td>
</tr>
<tr>
<td>Washington</td>
<td>Yes</td>
<td>$528.2</td>
<td>Marijuana Legalization Cost-Benefit Analysis; Public Education on Marijuana Health/Safety Risks; Drug Enforcement; Local Jurisdictions</td>
</tr>
</tbody>
</table>

*California tax revenue includes a cultivation tax levied on both recreational and medical marijuana. The majority of marijuana tax revenue in California (90%) is generated by excise and sales taxes levied exclusively on recreational marijuana sales.

**While Maine and Vermont do not currently have retail marijuana sales, legislation/regulatory agencies have already decided how recreational marijuana tax revenues will be allocated.

18 Citations for tax revenue and allocations can be found in Appendix A.
In 2017, federal excise taxes on alcohol generated $10.7 billion in revenue, while domestic tobacco excise taxes generated $13.0 billion in revenue. While unlikely due to federal prohibition legislation and policy currently in place on marijuana, levying similar taxes on recreational marijuana cultivation and sales at a federal level has the potential to generate significant tax revenue. While legalizing recreational marijuana has generated significant tax revenues, there are also significant costs associated with marijuana industry regulation and enforcement, and other marijuana-related issues (such as impaired driving enforcement). States with legal recreational marijuana are applying for federal funds for numerous areas impacted by increased access to marijuana, including:

- Law enforcement training to better identify drug-impaired driving;
- Law enforcement overtime for drug-impaired driving enforcement;
- Phlebotomy technicians to draw blood samples from suspected impaired drivers;
- Drug toxicology personnel, equipment and facilities to test suspected impaired drivers for drugs;
- Judge and prosecutor training on drug-impaired driving; and
- Public outreach on the dangers of drug-impaired driving.

The legalization of recreational marijuana has not successfully eradicated the black market for marijuana either – some marijuana producers opt to continue illegal enterprises to avoid the costs of regulatory requirements and taxes. Therefore, adequate funding for marijuana regulation and enforcement is critical to states legalizing recreational marijuana use.

**Product Labeling**

The marijuana regulatory agencies in each state have established a variety of warning label requirements for retail marijuana products. A summary of label warning requirements is shown in Table 2.

Additionally, the symbols that indicate a product contains marijuana vary by state. Consistency from state to state would ensure that marijuana users are aware of the risks, as well as ensuring that people are aware that a product contains marijuana.

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19 “Federal Excise Taxes or Fees Reported to or Collected by the Internal Revenue Service, Alcohol and Tobacco Tax and Trade Bureau, and Customs Service” (Internal Revenue Service, n.d.), accessed February 19, 2019.


Table 2: Marijuana Label Warning Requirements

<table>
<thead>
<tr>
<th>State</th>
<th>Vehicle Operation Warning</th>
<th>Age Restriction (21+) Warning</th>
<th>Pregnancy / Breastfeeding Warning</th>
<th>Delayed Onset of Effects Warning</th>
<th>Habit-Forming Warning</th>
<th>Illegal Outside of State Warning</th>
<th>Keep Away from Child / Pet Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>California</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Colorado</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Maine*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Michigan**</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nevada</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Oregon</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Vermont***</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Washington</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

*Maine requires warning labels but does not specify label requirements.
**Label requirements were not found for Michigan.
***Label requirements are not required in Vermont, due to no current retail sales of marijuana. Labeling requirements may be enacted per the recommendations of the Governor's Marijuana Advisory Commission.

Nearly every state with recreational marijuana requires labels to warn users that marijuana impairs driving abilities, and therefore not to drive. Again, these warnings vary by state. The labeling requirements related to vehicle operation are shown in Table 3.
<table>
<thead>
<tr>
<th>State</th>
<th>Driving and Machinery Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska</td>
<td>“Marijuana impairs concentration, coordination, and judgment. Do not operate a vehicle or machinery under its influence.”</td>
</tr>
<tr>
<td>California</td>
<td>“Consumption of cannabis products impairs your ability to drive and operate machinery. Please use extreme caution.”</td>
</tr>
<tr>
<td>Colorado</td>
<td>“Do not drive a motor vehicle or operate heavy machinery while using marijuana.”</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>“It is against the law to drive or operate machinery when under the influence of this product.” Or “Marijuana can impair concentration, coordination and judgment. Do not operate a vehicle or machinery under the influence of this drug.”</td>
</tr>
<tr>
<td>Nevada*</td>
<td>“Marijuana or marijuana products can impair concentration, coordination and judgment. Do not operate a vehicle or machinery under the influence of this marijuana or marijuana products.”</td>
</tr>
<tr>
<td>Oregon</td>
<td>“Do not drive a motor vehicle while under the influence of marijuana.”</td>
</tr>
<tr>
<td>Washington</td>
<td>“It is illegal to operate a motor vehicle while under the influence of marijuana.”</td>
</tr>
</tbody>
</table>

*Written notification provided to customer at time of purchase.*
THE SAFETY AND LEGAL IMPLICATIONS OF DRIVING UNDER THE INFLUENCE OF MARIJUANA

Safety Implications of Impaired Driving

The signs and behaviors of driver impairment include poor judgment, decreased motor skills and delayed reaction times. Impairment while driving can increase the likelihood of a vehicle crash, leading to property damage, personal injury or death.

There were 37,133 motor vehicle-related fatalities in 2017, and alcohol impairment was determined to be a factor in more than a quarter of these deaths. While the relationship between vehicle crashes and alcohol is well documented, drug use among those involved in crashes is not. NHTSA, for instance, states the following:

“[T]here is little State level data about the prevalence of use of marijuana by drivers being collected. As States continue to change their laws regarding marijuana use in general and as it relates to driving, this lack of State level data prevents evaluation of the effect of policy changes on driver behavior, including willingness to drive while under the influence of marijuana, as well as the effect of marijuana on crashes, deaths and injuries.”

The dearth of marijuana-related driving data severely hinders the traffic enforcement communities' ability to respond appropriately. Data is critical to understanding numerous impacts of marijuana legalization on roadway safety, and is important in identifying methods for deterring marijuana-impaired driving.

Key state and national data required to better understand the marijuana-impaired driving problem include the following:

- Prevalence of marijuana use while driving;
- Statistics on number and type of drug tests given by law enforcement, including rates of positive tests;
- Number of crashes involving marijuana impairment; and
- Number of marijuana-related DUI citations and convictions, as well as final charges for marijuana DUI citations.

Deterring marijuana-impaired driving is critical to highway safety. While there are myriad examples of negative safety impacts, one recent example – a crash investigated by the National Transportation Safety Board (NTSB) that resulted in 13 fatalities – stands out. In this case a pickup truck driver was operating erratically for a considerable distance, eventually drifting from his lane and crashing head-on into a medium-size bus carrying 13 passengers and a driver. All but one occupant of the bus were killed. It was found that the pickup truck driver (who survived

the accident and was found to be at-fault) had operated his vehicle erratically “due to impairment from the combined use of marijuana and a prescription medication.” This is just one example of the significant impact that operating a vehicle while impaired by marijuana use can have.

While the overall severity of the aforementioned crash led to comprehensive testing of a single at-fault driver, not all drivers involved in a vehicle crash are tested for marijuana due, in part, to a void of widely accepted testing methods.

Colorado, where recreational marijuana is legal, is one example where marijuana testing is often conducted for drivers involved in a fatal crash. In 2016, the state found that 13 percent of fatal crashes involved a driver who was actively under the influence of marijuana, and in 2017 the figure was 8 percent of fatal crashes. To qualify as a driver actively under the influence of marijuana in this instance, however, THC concentrations in the blood were set at 5 nanograms per milliliter (ng/mL) or more, which follows Colorado impaired-driving laws. Some disagree, however, that this measurement is indicative of impairment, with NHTSA stating the following based on current research:

“A number of States have set a THC limit in their laws indicating that if a suspect’s THC concentration is above that level (typically 5 ng/mL of blood), then the suspect is to be considered impaired. This per se limit appears to have been based on something other than scientific evidence. Some recent studies demonstrate that such per se limits are not evidence-based.”

In contrast to alcohol, marijuana impairment while driving is very complex.

1) The measurement of ng/mL of THC in blood is not consistently indicative of driver impairment.
2) From a primary research perspective, the possession and consumption of marijuana was consistently illegal for decades. Thus, a significant research barrier existed for testing impacts, which limited the type and amount of research conducted.
3) Regarding secondary research, crash statistics may be incomplete because testing drivers for drug use is and has been limited. Crash reporting measures must be improved to better understand the extent and impacts of marijuana-impaired driving.
4) Additionally, the legal consequences of DUIs provide a strong incentive for drivers to not self-report marijuana impairment.
Thus, a review of the literature on this topic concludes that past research on the impact of marijuana impairment on roadway safety have inconsistent (and sometimes contradictory) findings on the crash risk associated with marijuana impairment.\textsuperscript{27}

The literature review found that a number of methods have been employed to investigate the impact of marijuana on driver safety.\textsuperscript{28} The utility of experimental studies (assessing on-road performance/simulator performance of marijuana-impaired drivers) is limited, as participants are aware they are being observed. Experimental studies provide insight on the limits of marijuana-impaired driver capabilities, rather than how impaired drivers \textit{actually} behave on the road.

Observational studies, which attempt to identify the impact of marijuana impairment on driving safety using real-world data such as NHTSA’s Fatality Analysis Reporting System (FARS), are ill-equipped to address the impact of marijuana impairment on safety outcomes due to bias.\textsuperscript{29} A multitude of factors may be the source of bias, but ultimately bias in research prevents the accurate estimate of the impact of marijuana impairment on crash risk.

An example of bias in many studies is measuring marijuana impairment through urine drug test results – which indicate past, but not necessarily recent use. In research using this method of determining impairment, any findings related to the effects of marijuana impairment could be called into question.

Another potential source of bias is how drivers are selected. Existing datasets typically only identify marijuana-intoxicated drivers if they are engaging in dangerous behaviors such as roadway violations or are involved in a crash. Therefore, research based on these datasets is unable to ascertain whether another group of drivers that are not engaging in unsafe behaviors exists (as these drivers would not be identified through traffic enforcement). This systematic exclusion of drivers that may be under the influence of marijuana has the potential to bias research on safety outcomes associated with marijuana intoxication.

Culpability and case-control studies are preferred, due to the ability to control for more potential sources of bias.

“Culpability studies compare the rate at which crash-involved, drug-positive drivers and drug-negative drivers are deemed to be at fault for their crashes. Case-control studies compare drug use by crash-involved drivers to drug use by non-crash involved drivers.”\textsuperscript{30}


\textsuperscript{28} Ibid.


However, culpability/case-control studies historically suffer from issues related to how marijuana impairment is measured. Studies have previously relied on self-report measures, as well as testing methods that detect past marijuana use rather than recent marijuana use. As background, the psychoactive component of marijuana, THC, remains detectible in the body for only a few hours after smoking marijuana, and longer for orally ingested marijuana. This is the component of marijuana that results in impairment. Over time THC is broken down by the body forming derivatives called metabolites. Though marijuana-related metabolites in the body do not cause impairment, they can be detected for weeks and in some states can result in a DUI. Marijuana tests traditionally have been used to detect drug use through the testing of metabolites (e.g. for employment purposes); such tests are not an indicator of impaired driving, though the presence of metabolites can have significant consequences for a driver based on location.

A recent meta-analysis of research on the crash risk associated with marijuana intoxication found an increase in crash risk of 20 to 30 percent. This meta-analysis improved upon prior research by acknowledging potential sources of bias and attempting to reduce the impact of sources of bias in other studies. A recent study found that drivers testing positive for marijuana – THC blood content of more than 1 ng/mL – were 65 percent more likely to have a role in causing a fatal crash. However, characteristics of the individuals who decide to drive under the influence of marijuana are often difficult to control for and may still introduce bias.

There are a number of confounding factors that may be impossible to rectify. Marijuana-impaired individuals tend to overestimate impairment resulting from marijuana use. Therefore, marijuana-impaired drivers may represent the low-end of the impairment continuum, as acutely-impaired individuals are less likely to drive.

On the other hand, it is possible that individuals who decide to drive while impaired by marijuana may be prone to taking risks in general. A recent NHTSA study of the effects of marijuana impairment on crash risk found no increased risk associated with marijuana impairment, after controlling for demographics characteristics (age, gender and ethnicity) and blood alcohol content (BAC). Additional research is needed to assess the role that marijuana impairment – not past use, demographics or individual risk preferences – has on driver safety.

31 Ibid.
38 BAC is sometimes referred to as blood alcohol concentration.
Despite some mixed findings of studies on the impact marijuana impairment has on crash risk, research indicates that cognitive functions essential for driving tasks are negatively impacted by marijuana intoxication.

Additionally, identification of marijuana impairment through blood tests and other biological testing methods is not viable for the following reasons:

1) Unlike alcohol, where impairment level is easily predicted by BAC, the severity of impairment resulting from marijuana use depends on a number of factors, including the frequency of marijuana use and consumption method.\textsuperscript{39,40} While higher doses of marijuana often result in greater impairment, this relationship is less predictable than that of alcohol and impairment.\textsuperscript{41,42,43}

2) Peak subjective marijuana impairment does not coincide with peak THC blood concentrations.\textsuperscript{44}

3) THC deteriorates rapidly in a user’s blood.\textsuperscript{45}

4) Low levels of THC in a user’s blood are not necessarily indicative of recent use.\textsuperscript{46}

The perception of the driving safety risks associated with marijuana intoxication varies by age, with younger drivers being the most likely to indicate that marijuana intoxication does not impact crash risk.\textsuperscript{47} Accordingly, drivers who believe marijuana-impaired driving is not risky are more likely to engage in marijuana-impaired driving.\textsuperscript{48} To combat these perceptions, outreach to educate the public is being conducted by many states and by NHTSA at a national level.\textsuperscript{49,50}


\textsuperscript{44} Ibid.

\textsuperscript{45} Ibid.

\textsuperscript{46} Ibid.


Colorado’s Drive High, Get a DUI advertising campaign includes advertisements at marijuana retail stores (also known as dispensaries), effectively targeting individuals that are likely to engage in drug-impaired driving.

Studies have found that marijuana intoxication impairs a number of critical cognitive functions for safe driving. While the full studies are cited in Appendix B, among the key findings of marijuana’s impact on behavior and driving-related cognitive functions are the following:

*Divided Attention.* Driving requires the ability to focus on numerous stimuli, prioritize stimuli and respond to potential roadway risks appropriately. Examples of the numerous, competing stimuli include road signs, roadway conditions and the actions of other drivers. Marijuana intoxication impairs divided attention, and may impact a driver’s ability to monitor and respond to relevant risks appropriately.

*Reaction Times.* Numerous studies have documented that marijuana intoxication slows reaction times. Driving safety relies on quick reactions to changing conditions to avoid risks. The slower reaction times resulting from marijuana intoxication may impact the ability of a driver to have a timely response to roadway risks.

*Increased Following Distance.* Marijuana-intoxicated drivers (provided they are not also under the influence of alcohol) recognize impairment and may attempt to compensate for impairment. Drivers increase following distance and are less likely to pass other vehicles.

*Maintaining Lane Position.* Driving simulation studies have concluded that marijuana intoxication negatively impacts a driver’s ability to maintain their vehicle’s position in the center of the lane.

*Alcohol and Marijuana Consumption.* Numerous studies have identified that DUI of both marijuana and alcohol increases crash risk significantly.

While a large body of research has not demonstrated a definitive relationship between marijuana intoxication on driving safety outcomes, the need to better understand the role that marijuana intoxication plays in crash causation is becoming a critical issue as numerous state governments, Canada and Mexico legalize recreational and/or medical marijuana.
Driving Under the Influence Laws

DUI is generally dictated in the U.S. by state laws that were initially put in place to address crashes and fatalities related to drunk driving. Laws for driving while under the influence of alcohol are relatively straightforward. Laws exist that limit the amount of alcohol that can be present in the blood in order to legally drive, and well-established methods for testing a person for these limits are utilized by law enforcement and corroborated by the scientific community. These clear-cut laws and practices to combat DUI have contributed to an approximately 50 percent decrease in annual alcohol-related traffic deaths today versus the 1980s.51 Over the years, the application of these laws has expanded to include legal and illegal drug use.

DUI charges stem from two types of violations: per se (which relates to the quantity of a substance in the body) and impairment (which relates to behavior that is exhibited).

*Per Se*

A ‘per se’ violation is one where DUI is proven through the measurement of alcohol or drugs in a person’s body. The most prominent example of this is a BAC measurement which quantifies the amount of alcohol per volume of blood. While per se violations related to drinking are fairly straightforward, quantifying marijuana consumption to show impairment is not as clear due to a lack of standard practices and scientifically valid testing as demonstrated in the literature. The greatest challenge is that unlike alcohol, which is detectable in blood for less than 24 hours, the derivatives of marijuana are detectible in urine for weeks.

The concept of implied consent is central to testing a driver for alcohol, and in many cases for drugs as well. Under implied consent laws in all states, by holding a driver’s license a driver has given consent to be tested in some manner for alcohol concentrations in the body. Implied consent laws vary from state to state, both in terms of the controlled substances included in tests and the circumstances under which tests may be conducted.52 A majority of states extend implied consent to include controlled substances.

The laws related to per se marijuana testing, however, differ widely by state. Information on per se marijuana limits, zero tolerance laws and implied consent is shown in Appendix C. In some states testing for marijuana use is generally not practiced. For instance, Alabama relies on observation of impairment, and not per se testing, to determine marijuana impairment; implied consent for testing does not apply to suspicion of marijuana impairment and therefore testing is not a consideration.53 Other states have far stricter laws. Georgia is one state that has per se laws where there is “zero tolerance” for illegal substances in the body of a driver. Georgia law states “a person is guilty of a DUI if that person drives a vehicle and that person has any amount of controlled substance present in the person’s blood or urine, including the metabolites and derivatives of

51 “Since the early 1980s, alcohol-related traffic deaths per population have been cut in half with the greatest proportional declines among persons 16-20 years old.” See: https://report.nih.gov/nihfactsheets/ViewFactSheet.aspx?csid=24
each or both.54 Thus a positive test for non-intoxicating metabolites, which indicate past use, are per se evidence of DUI. This could apply to a person who has not been intoxicated for several weeks.

Finally, there are states where per se testing is conducted to show evidence of impairment (and not simply past use). Colorado, Montana, Nevada, Ohio, Rhode Island and Washington State have per se laws that limit THC content in a driver’s blood. The majority of states have not established legal ng/mL blood limits, but maintain that operating any motor vehicle under the influence of marijuana is illegal and unsafe.

Similar to the legal limit (0.08) of blood alcohol level for an individual operating a motor vehicle, Washington State uses a per se limit on THC blood content. A driver is legally intoxicated while driving if “the person has, within two hours after driving, a THC concentration of 5.00 [ng/mL] or higher” in a blood sample.55

**Impairment**

While per se violations rely on measurement of a substance in the body, impairment-based violations require the collection of visually observed evidence. Key factors leading to impairment violations include driving behavior (e.g. erratic driving) and the behavior of the driver while interacting with police.

Field sobriety tests are typically conducted to identify impaired speech or movements. A driver that is impaired may not understand simple statements or be able to complete simple movement tasks. The condition of eyes may also be a factor – red eyes, “glazed-over” eyes or large/small pupils may indicate intoxication and therefore impairment. Methods for identifying marijuana impairment through observation will be discussed in detail in Section 3.

**Federal Laws on Marijuana Use and Testing by CMV Drivers**

The Federal Motor Carrier Safety Administration (FMCSA) regulates driver use of and testing for marijuana through CFR 49 §382 (Controlled Substances and Alcohol Use and Testing) and §40 (Procedures for Transportation Workplace Drug and Alcohol Testing Programs). Through §382.109, in particular, state and local laws are preempted by federal law.

Under the federal laws, CDL holders in safety-sensitive positions (i.e. truck drivers) must be tested in a specific manner for the presence of marijuana. Testing occurs for the following reasons:

- Pre-employment screening;
- Post-accident (if accident is fatal, results in an injury, or requires a tow-away);
- Random testing throughout the year;
- Reasonable suspicion; and
- Return-to-duty and follow-up (for those testing positive in order to resume driving).

This type of marijuana test identifies past use of marijuana, and not intoxication, because it is a measure of marijuana metabolites. The testing cutoffs are listed in §40.87 for CFR 49, and

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54 Id. § 40-6-391(a)(6).
indicate that a person fails the marijuana test when marijuana metabolites are found at 50 ng/mL in the initial test and 15 ng/mL in a confirmatory test.

Employers are responsible for ensuring that tests are conducted and that drivers who fail or do not comply with testing are removed from safety-sensitive positions. An employer will face penalties for not following the U.S. Department of Transportation (U.S. DOT) regulations, ensuring compliance with these federal regulations.

In 2016, random drug testing identified drugs in 0.7 percent of commercial drivers. Drivers may also test positive for marijuana as a result of CBD product use. Recently, a truck driver sued a CBD company claiming to have removed all THC from their products after losing his job as a result of failing a drug test for marijuana.

While testing hair for drugs is not the best practice for determining if a driver is currently impaired by marijuana (see Section 3 for more information), hair tests provide critical information to motor carriers by revealing if applicants are “lifestyle” users that pass pre-hire urine drug tests though short-term abstinence from drugs. Some larger fleets are now performing both urine and hair tests on applicants to identify habitual users. JB Hunt reports that in the ten years they have been testing both hair and urine for drugs, over 4,700 drivers passed urine drug tests but not hair drug tests. Similarly, Schneider National reports conducting over 100,000 pre-employment drug tests, of which 0.37 percent of urine tests were positive for drugs and 3.82 percent of hair tests were positive for drugs. While these companies are attempting to keep unsafe drivers from operating trucks, it is likely that applicants failing the hair tests simply seek jobs at other companies that do not require hair testing.

56 “Results from the 2016 Drug and Alcohol Testing Survey” (Federal Motor Carrier Safety Administration, January 2018).
MARIJUANA-IMPAIRED DRIVING: COLLECTING EVIDENCE FOR PROSECUTION

Increased access to legal marijuana is associated with an increase in the prevalence of impaired driving. From 2007 to 2014, the prevalence of THC in weekend nighttime drivers increased from 8.6 percent to 12.6 percent.60 This increase is a relatively reliable surrogate for driving after recent marijuana use, as THC was detected in driver blood and/or oral fluid, but not necessarily impairment. Preliminary results from a survey of 11,000 anonymous marijuana users in Colorado found that 69 percent have driven under the influence of marijuana in the past year, of which 27 percent of respondents report driving under the influence of marijuana daily.61,62

As discussed in Section 2, marijuana-impaired driving is dangerous and illegal. Supported by state laws, it is the role of law enforcement to deter people from using drugs or alcohol before driving, thus preventing crashes, injuries and fatalities.

Identifying, documenting and prosecuting marijuana-impaired drivers, depending on state law, can be achieved through one or more of the following enforcement activities:

- Observation and documentation of behavior;
- Physical evidence;
- Drug testing in states where there are THC limits or zero tolerance laws.

Training and Methods for Identification of Marijuana-Impaired Driving

Typically a law enforcement officer’s first encounter with a marijuana-impaired driver is due to a traffic stop or after a crash. A law enforcement officer may use his or her knowledge from standard field sobriety test (SFST) training to first determine if a vehicle should be pulled over or if further investigation is needed at the scene of a crash.

Standard Field Sobriety Test

Only 21 states have trained all law enforcement officers in SFST.63 SFST was developed to identify alcohol-impaired driving and is a common first step for identifying impairment resulting from other drugs. When an impaired-driving suspect tests negative for alcohol, a law enforcement officer may check for other causes of observed impairment.

There are three phases involved in determining a DUI violation. The first phase is known as Vehicle in Motion. A law enforcement officer must gather enough evidence of a potential DUI

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62 Since the survey was non-random in selection of participants, the findings of this survey may not reflect marijuana users as a population.
offence by observing the driver or a vehicle while it is in motion. A few cues can lead to an officer stopping a vehicle for further investigation, including:\(^64\)

- A moving traffic violation;
- An equipment violation;
- An expired registration or inspection sticker;
- Unusual driving actions such as weaving within a lane or moving at a slower than normal speed; and
- Evidence of drinking or drugs in vehicle.

Based on the above observations of the vehicle, a law enforcement officer can choose to stop the vehicle, continue monitoring the driver/vehicle or ignore the vehicle. If an officer chooses to pull over an observed vehicle, evidence of alcohol or drug impairment can also arise during this procedure. Once the vehicle has been stopped and engagement with the driver has been established, there are several clues to help the officer gather additional evidence as to whether or not the operator of the vehicle is impaired.\(^65\)

The second phase when detecting a DUI is Personal Contact. This phase usually allows for definitive proof as to whether or not a driver is impaired via drugs or alcohol by observing the driver’s behavior while approaching and interviewing the individual. The three primary observations include what the officer sees, what the officer hears, and any smells an officer may detect. Depending on different state laws, an officer may ask a driver to exit the vehicle based on the discussion with the driver and the evidence observed in phase one.\(^66\)

The third phase of DUI detection is SFST. The SFST consists of three tests: Horizontal Gaze Nystagmus (HGN), Walk and Turn (WAT), and One Leg Stand (OLS). The HGN test allows an officer to determine if the driver is under the influence of alcohol and/or the potential to detect recent drug use. During this test, an officer slowly moves a pen/penlight or similar object, 12-15 inches from the driver’s face, from left to right, to observe if the eyes of the driver involuntarily jerk (“nystagmus”) as he/she follows the object.

The sooner the nystagmus occurs during the test, the greater the driver’s impairment. The WAT and OLS are both psychophysical tests to assess how the driver handles dividing their attention while doing a physical task. During the WAT and OLS tests there are behaviors or “clues” (eight clues in the WAT test and four clues in the OLS test) that a law enforcement officer should note as potential evidence of alcohol or drug impairment. Failing to complete either the WAT and/or the OLS can result in the law enforcement officer classifying the driver’s BAC at 0.08 or higher (the per se limit for BAC in many jurisdictions). In each phase of DUI detection, the ability to recall and clearly describe any evidence to a judge or lawyer is of the utmost importance to prosecution of an impaired driver.\(^67\)

\(^{65}\) Ibid.
\(^{66}\) Ibid.
\(^{67}\) Ibid.
Advanced Roadside Impaired Driving Enforcement

The Advanced Roadside Impaired Driving Enforcement (ARIDE) program, developed by NHTSA and the International Association of Chiefs of Police (IACP), seeks to bridge the gap between SFST and Drug Recognition Expert (DRE) evaluations of impairment. A recent survey found that only 17 states had more than 20 percent of law enforcement officers trained in ARIDE. ARIDE requires 16 hours of classroom instruction and trains law enforcement officers in assessing impaired-driving suspects at the roadside. Additionally, ARIDE seeks to better use DRE resources or, where DREs are not available, give law enforcement officers the critical information needed to test, document and report drug-impaired driving. ARIDE educates law enforcement officers in a number of topics, including:

- A refresher on SFST;
- The effects of drugs, or a combination of drugs/alcohol, as well as illnesses/injuries with symptoms similar to drug impairment (e.g. strokes);
- How to identify, document and describe impairment-related observations leading to arrest/release decisions; and
- Provide testimony on impairment related to drugs, alcohol, or a combination of drugs and alcohol.

Drug Recognition Experts

Drug Recognition Experts (DREs) are specially trained law enforcement officers who are certified in recognizing and assessing individuals who are under the influence of drugs and/or alcohol. DREs are a key method that many U.S. states, Canada and the European Union use to determine marijuana impairment. DRE impairment determinations are supported by toxicology screening, which includes oral or saliva swabs, urine testing and blood sample testing. Documentation of driver impairment through DRE evaluation is critical to prosecuting DUI suspects, since biological tests for marijuana do not definitively prove whether an individual is currently impaired by marijuana, versus having consumed marijuana previously.

DRE training and certification includes three phases: DRE Pre-School (16 hours), DRE School (56 hours) and DRE Field Certification (40 to 60 hours). Coordinated by IACP, DREs are certified by the International Drug Evaluation and Classification Program (DEC) with help from NHTSA. The program originated in Los Angeles in the 1970s, when the Los Angeles Police Department (LAPD) began noticing an increased number of impaired driving arrests with low blood alcohol concentration. As a result, the LAPD implemented the DRE program to help police officers determine the classification of drugs causing impairment. In 2017, there were


\[71\] Ibid.


\[73\] http://www.decp.org/drug-recognition-experts-dre/
8,606 DREs in the U.S. and a total of 30,989 examinations conducted for enforcement activities.\textsuperscript{74} Marijuana was the most frequently identified substance in these examinations.

Once a law enforcement officer has determined the need for a DRE after a SFST, a 12-step procedure is followed in order to determine the category of drug(s) causing impairment. Using the standardized 12-step procedure is necessitated by a number of factors including:

- The potential need to submit observations to support the need for toxicology screening;
- Some courts do not consider low BAC or Breath Alcohol Concentration (BrAC) in conjunction with observed impairment as supportive of the need for toxicology screening;
- A suspect may deny the request for toxicology screening;
- Toxicology screening can indicate relatively recent use rather than current impairment;
- Toxicology screening is expensive; and
- Suspected drug-impaired drivers may not be under the influence of drugs or alcohol, but experiencing injury or illness that requires immediate medical attention.\textsuperscript{75}

The use of DREs to identify drug-impaired driving has been validated in a number of studies. The controlled laboratory experiment testing the validity of DRE drug determinations found that the DREs could reliably predict high-doses of drugs, but were less reliable for weak doses.\textsuperscript{76} The field test of 173 suspected impaired drivers that provided blood samples for toxicology screening supported the reliability of DRE determinations – blood tests supported 78 percent of cases where the driver was determined to be under the influence of marijuana.\textsuperscript{77} Arizona also conducted a DRE validation study, which found that 86.5 percent of DRE determinations were supported by urine toxicology tests.\textsuperscript{78}

The 12-step method includes interviewing the individual, observing behavioral signs, taking vitals, conducting psychophysical tests and finally toxicological tests. For marijuana specifically, DRE training covers the following topics:

- How marijuana is consumed (high potency forms, smoking, eating, topical creams);
- Marijuana effects;
- The onset and duration of marijuana effects;
- The long-term effects of marijuana use; and
- Identifying impairment.

For the psychophysical tests and observations used in the DRE evaluation, marijuana impairment is evident in Lack of Convergence (LOC) presence (where the suspect’s eyes do not “cross” as an object they were told to focus on is moved closer to the suspect’s nose), dilated

\textsuperscript{74} “Drug Evaluation and Classification Program 2017 Annual Report” (IACP, n.d.).
\textsuperscript{76} Identify Types of Drug Intoxication: Laboratory Evaluation of a Subject Examination Procedure, May 1984 Final Report. George E. Bigelow, Ph.D. et al. Behavioral Pharmacology Research Unit, Department of Psychiatry and Behavioral Sciences.
pupils, increased pulse and increased blood pressure.\textsuperscript{79} Other indicators – such as body
tremors, eyelid tremors, altered perceptions of time and distance, disorientation and lack of
concentration – should also be noted. DRE training also educates law enforcement officers on
identifying impairment from multiple drugs and how interactions between different drug
combinations may impact the results of each
evaluation step.

Criticism of the practice of DRE
identification of impaired drivers relates
primarily to the use of law enforcement
officers without medical training to make
medical determinations. \textit{Katelyn Ebner, Princess Mbamara and Ayokunle Oriyomi vs Cobb County} is a lawsuit filed by
individually arrested for marijuana-
impaired driving. These individuals
received DRE evaluations that did not
follow the standards established by the
IACP. The DRE evaluations were
performed in an uncontrolled
environment and did not follow the
standard 12-step procedure. The
plaintiffs all tested negative for marijuana
and their drug-impaired driving charges
were later dismissed. However, the
plaintiffs’ arrest records still show an
arrest for drug-impaired driving.

Preparation for adjudication of drug-impaired
driving is also addressed, through education on
preparing the narrative report on the DRE
evaluation, establishing credentials as an expert
witness, teaching common defense tactics and
providing guidance on case preparation and
testifying in court.\textsuperscript{80}

DRE certification is contingent on meeting a
number of standards developed by the IACP,
which include passing a number of written
examinations and successfully completing
evaluations supported by toxicology results.\textsuperscript{81}
DRE certification must be renewed every two
years.\textsuperscript{82}

NHTSA is currently creating a DRE allocation
model to give states the information needed to
have geographically accessible DREs available
when suspected DUIs occur.

Marijuana Testing Methods

Testing for marijuana use can be done using a number of methods. Testing methods that
identify recent marijuana use (blood, oral/saliva) are discussed first, followed by methods that
identify use over a greater time span (urine, hair) and mass spectrometry methods that can be
used on any biological specimen. Table 4 summarizes the benefits and drawbacks of each
testing method for supporting drug-impaired driving investigations.

\textsuperscript{79} Rebecca L. Hartman et al., “Drug Recognition Expert Examination Characteristics of Cannabis Impairment,”
\textsuperscript{80} National Highway Traffic Safety Administration, International Association of Chiefs of Police, and Transportation
\textsuperscript{81} DEC Program Technical Advisory Panel and IACP Highway Safety Committee, “The International Standards of the
\textsuperscript{82} Ibid.
Blood

Testing for THC in the blood is not only invasive, but challenging due to the procedural delays associated with blood testing after an arrest. THC does not stay stable in the blood after being consumed, and can be too low in concentration for a lab test after only a few hours. The American Association for Clinical Chemists (AACC) suggests other cannabinoid markers are more sensitive to detection in the blood, but may not be appropriately reflected in the test results depending on how the individual consumed the marijuana – smoked, inhaled or ingested.

Oral / Saliva

According to AACC, the most popular manner in which to test for cannabinoid use is with an oral/saliva sample. This type of test is easily administered and is able to detect many of the cannabinoids that are present in saliva after use. Michigan recently conducted a five-county pilot of this technology, testing suspected impaired drivers at the roadside and recommends conducting a larger pilot of the technology encompassing all Michigan counties. However, this type of testing also presents some challenges. One common side effect of recent marijuana use is dry mouth. Therefore, the ability to get an appropriate amount of saliva during an oral test may be challenging. In addition, AACC has found that the testing devices may hinder positive results due to plastic tubes and testing pads that absorb THC when the testing device is in use. This instrument failure could result in a lower reading of the presence of the drug than what is realistic with the impaired individual.

Urine

Urine testing can result in the presence of cannabinoids, but does not indicate impairment, as detection of these metabolites can be for days, even weeks, after marijuana has been consumed. In addition, urine testing can be completed roadside, but is more vulnerable to tampering. While urine testing is not a viable method for identifying current impairment, it is helpful to identify lifestyle marijuana users for hiring decisions for trucking companies.

Hair

Hair testing is a noninvasive method to test an individual’s marijuana use. However, using hair to test impairment at the time of arrest is ineffective. Hair tests can result in a false-positive for an individual who is not a marijuana user, but was in the vicinity of an individual smoking marijuana. The hair should be cut close to the scalp and all elements of color, weight, length

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84 Ibid.


and additives, such as dyes or bleach, should be recorded, as they can impact the result. According to the Society of Hair Testing, a positive result would contain 0.1 ng/mg of THC.\(^90\) Again, while marijuana-positive hair tests are not ideal for identifying current impairment, these testing methods are effective for identifying lifestyle marijuana users applying to become truck drivers.

**Mass Spectrometry**

To confirm a drug’s presence and the amount of the drug in any biological specimen type (blood, saliva, urine, hair), mass spectrometry is frequently utilized. Gas chromatograph-mass spectrometry (GC-MS) and liquid chromatography-mass spectrometry (LC-MS) are two of the more regularly used methods that detail the quantity and the molecular structure of the drug.\(^91\) This testing method is particularly useful if a police officer determines an individual is impaired, but an oral sample had a negative THC result. A secondary test with a mass spectrometer can help to identify the drug and the amount resulting in impairment.\(^92\)

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### Table 4: Pros and Cons of Testing Types for Identifying Current Impairment

<table>
<thead>
<tr>
<th>Type of Testing</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
</table>
| Blood | • Regularly utilized and proven to test for marijuana presence | • Does not necessarily indicate impairment  
• Very invasive  
• THC presence in blood deteriorates rapidly |
| Oral / Saliva | • Non invasive  
• Can detect recent marijuana use  
• Can be done quickly and roadside  
• Commercial devices are becoming more universal  
• Potential to reduce costs of testing DUI suspects | • Dry mouth as a side effect to smoking marijuana can create challenges of getting sufficient amount of saliva to test  
• Testing equipment issues |
| Urine | • Testing via urinalysis is a proven method to detect cannabinoids | • Detection does not mean impairment  
• Detection can be a couple days or even weeks  
• High vulnerability to tampering |
| Hair | • Room temperature storage  
• No “shelf-life” in terms of testing time frame after collection  
• Detection of marijuana is much longer\(^{93}\) | • Does not necessarily mean impairment at the time of arrest  
• Can create positive result when just in the vicinity of smoked marijuana  
• Products used in hair coloring, can interfere with the result\(^{94}\) |
| Mass Spectrometry | • Can help to determine molecular compound  
• Can help to indicate the amount of the drug in individual’s system | • A highly sensitive mass spectrometer is often needed |

Biological testing of DUI suspects for controlled substances is relatively uncommon.\(^{95}\) When alcohol intoxication is confirmed, drug testing often is not performed. Insufficient funding for law enforcement agencies also poses issues in identifying drug-impaired drivers. The cost of biological testing is significantly higher than that of testing for alcohol. Blood tests for alcohol are estimated to cost $25 to $35, while drug panels range from $100 to $300. Grants from the Fixing America’s Surface Transportation Act (FAST Act), are being used to mitigate issues associated with testing suspected drug-impaired drivers. Examples include training police officers as phlebotomists to reduce the time between arresting a suspect and obtaining physical evidence, and funding toxicology programs to test more samples and reduce wait times.\(^{96}\)

\(^{93}\) Frank Musshoff and Burkhard Madea, “Analytical Pitfalls in Hair Testing,” Analytical and Bioanalytical Chemistry 388, no. 7 (August 2007): 1475–94.


\(^{95}\) Lindsay S. Arnold and Robert A. Scopatz, “Advancing Drugged Driving Data at the State Level: Synthesis of Barriers and Expert Panel Recommendations” (AAA, March 2016).

Prosecution

The Prosecuting the Drugged Driver and Protecting Lives/Saving Futures courses were developed by the National Traffic Law Center to better identify and prosecute impaired drivers.97 These courses train both law enforcement officers and prosecutors, providing insight into the challenges associated with prosecuting drugged driving cases and how to mitigate them.98 Protecting Lives/Saving Futures features extensive content on the science behind sobriety testing and toxicology, while Prosecuting the Drugged Driver features a mock trial to provide feedback.99 FAST Act funds are being used to educate both prosecutors and judges on drug-impaired driving cases.100

However, efforts to prosecute drug-impaired driving have been met with numerous setbacks. For example, Arizona requires “proof” of impaired driving but does not have per se limits on THC blood concentrations.101 Conversely, Massachusetts has challenged the ability of field sobriety tests to accurately identify marijuana impairment.102

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98 Ibid.
99 Ibid.
CONCLUSIONS

The increasing use of medical and recreational marijuana necessitates a better understanding of the relationship between marijuana use and roadway safety. In gaining this understanding, approaches to deterring, identifying, and prosecuting marijuana-impaired driving can begin.

While increased access to marijuana has not directly impacted the trucking industry in terms of truck drivers testing positive for marijuana, the increased frequency of marijuana-positive drivers operating on the same roadways as trucks makes marijuana-impaired driving a critical safety issue for the trucking industry.

Several areas are emerging where federal leadership and cooperation with state and local governments, law enforcement and the legal system would benefit as described below.

Data Collection

Documenting the prevalence of drug-impaired driving is critical to understanding the magnitude of this issue. Whether or not the federal government recognizes the legality of marijuana, it should take the lead on related federal data collection programs. Key to this role is identifying and conveying standards for state- and local-level data collection by law enforcement and the criminal justice system. Building upon programs that exist for alcohol-impaired driving within the Departments of Transportation, Health and Human Services, and Justice, systems for collecting marijuana-impaired driving statistics could be developed or further developed in several areas, including:

- Number of crashes, injuries and fatalities;\(^{103}\)
- Number of drug tests given, rate of positive drug tests, rate of negative drug tests, what drugs were tested for;
- Number of marijuana-related DUI charges, conviction rates and information on what charges DUI suspects are ultimately convicted of; and
- Prevalence of marijuana use while driving.

Public Information

Educating the public on the dangers of marijuana-impaired driving, and of the legal consequences, is critical to preventing drugged driving. Marijuana users – particularly younger users – do not perceive marijuana as having an impact on driving safety, and in a smaller number of cases, they may believe that marijuana improves driving safety. These beliefs are in direct contrast to the documented effects that marijuana has on driving-critical cognitive functions.

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\(^{103}\) As an example, the Model Minimum Uniform Crash Criteria (MMUCC) 5th Edition (2017) establishes guidelines for the minimum crash data requirements and NHTSA offers technical assistance to improve state crash data. Currently, the MMUCC recommends that the officer investigating the crash identify if drugs were involved or suspected to be involved in the crash, and include the results of any drug tests conducted. Changing the MMUCC to require drug tests of all drivers and non-motorists involved in fatal crashes, as well as indicate what drugs were tested for – rather than just what drugs involved parties tested positive for – would provide critical improvements to our current understanding of the role of drugs in fatal crashes.
Safety Campaigns

In 2018, NHTSA launched the If You Feel Different, You Drive Different advertising campaign to address the perception that drugged driving is not dangerous. Additionally, a number of states are performing public outreach on the dangers of marijuana-impaired driving, and the legal consequences of driving under the influence of marijuana. Empirical research on the impact of drugs on driving safety outcomes is crucial to convincing the public that drug-impaired driving is a serious roadway safety issue.

Publication of Statistics

Currently, many states do not differentiate between drug-impaired driving and alcohol-impaired driving when documenting DUI citations. A similar lack of distinction is present in the court system for recording DUI offenses in many locations. While some national crash databases record information on suspected drug use and drug test results, the information gaps make researching the impact of drugs through existing databases unreliable. For example, FARS suffers from insufficient data on the role of drugs in fatal crashes, as it is not standard procedure in all states to test all drivers and non-motorists involved in a fatal crash. Even for crashes where drivers and non-motorists are tested for drugs, the FARS database fails to indicate which drugs are involved.

Product Labeling

States with legalized recreational marijuana do not have consistent labeling standards to indicate that a product contains marijuana or warnings of the effects of marijuana consumption. Consistent labeling standards that warn users of potential dangers are necessary to educate marijuana users as well as to prevent accidental consumption of marijuana.

Law Enforcement Training

Unlike alcohol, THC levels in blood are not reliable indicators of driver impairment. This lack of reliability renders per se limits ineffective for enforcing laws prohibiting driving under the influence of marijuana. Without clear toxicology standards for marijuana-impaired driving, law enforcement officer training and observations become critical for identifying, prosecuting and convicting marijuana-impaired drivers. Law enforcement officers must have the knowledge and tools needed to identify marijuana-impaired driving, document their observations and effectively testify in court.

Providing law enforcement officers with the training needed to identify impaired drivers is critical to reducing the incidence of marijuana-impaired driving. The proliferation of different methods for using marijuana necessitates training law enforcement in how to effectively identify marijuana impairment. Not all law enforcement officers are trained in SFST. Additionally, the reliability of SFST for effective identification of marijuana impairment must be examined. Currently, DRE examinations use elevated blood pressure, elevated pulse and the presence of LOC to identify physiological signs of marijuana impairment. Incorporating LOC tests and checks for eyelid/body tremors into SFST has the potential to improve roadside identification of marijuana-impaired drivers. Some states have adapted their SFST procedure to target marijuana impairment as well as alcohol impairment.
Training law enforcement officers in ARIDE and as DREs goes a step further, as the ARIDE and DRE programs focus on identifying drug impairment. Positioning DREs to be geographically accessible to where assessments are needed is also critical.

Law enforcement officers also need additional resources to support DUI investigations with biological testing. The rapid degradation of THC in blood necessitates testing a DUI suspect for drugs quickly. Adoption of roadside testing of saliva/oral fluid may help mitigate this issue. Some states do not include drugs in implied consent, which presents another obstacle to testing DUI suspects for marijuana intoxication. Finally, the expense of testing DUI suspects for drugs is considerable in relation to alcohol.104

**Criminal Justice System Action Items**

*Training*

To better address drug-impaired driving in court, judges and prosecutors need to be educated on how drugs impact driving safety, and how to understand expert witness testimony. Drug-impaired driving prosecution also requires additional expert testimony relative to alcohol-impaired driving.105

*Funding*

*Allocation of Tax Revenue*

Currently, recreational marijuana tax revenue is typically allocated for state General Funds, marijuana regulatory agencies, law enforcement agencies, and drug treatment/prevention programs. State tax revenues from recreational marijuana cultivation and sales represents an opportunity to provide law enforcement agencies with the funds needed to combat drug-impaired driving.

In 2017, federal excise taxes on alcohol generated $10.7 billion in tax revenue and taxes on domestic tobacco generated $13.0 billion in tax revenue.106 The sale of recreational marijuana, however, is not recognized as a legal activity by the federal government, and a tax directly on recreational marijuana from the federal government would therefore be unlikely. That said, taxation of recreational marijuana cultivation and sales at the federal level could help fund programs to combat drugged driving.

However, black market marijuana production and sales persist in states that have legalized recreational marijuana to avoid the costs associated with regulatory requirements and taxes. Potential benefits from recreational marijuana taxes rely on effective enforcement of regulations and collection of taxes on recreational marijuana businesses.

105 Ibid.
106 “Federal Excise Taxes or Fees Reported to or Collected by the Internal Revenue Service, Alcohol and Tobacco Tax and Trade Bureau, and Customs Service” (Internal Revenue Service, n.d.), accessed February 19, 2019.
Summary

The nation’s highways are the trucking industry’s workplace. Many safety aspects of the highway environment can be managed by both truck drivers and trucking companies; poor weather conditions can be avoided, tired drivers can take rest breaks and safety technology can be installed on vehicles. But the actions and activities of other drivers are far more difficult to predict. Thus it is left to law enforcement and the criminal justice system to protect sober drivers, including large truck operators, from those who chose to use marijuana and drive.

Through state and federal leadership, mitigating marijuana-impaired driving begins with a deeper understanding of the problem through the collection of data and distribution of public information. Additionally, better equipping law enforcement and the court system to ensure safe highways will help prevent marijuana-involved crashes through prevention and deterrence. Finally, programs can be funded through tax revenue sourced from marijuana sales.
## Appendix A: Recreational Marijuana Tax Revenue and Allocation Citations

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<td>California Department of Tax and Fee Administration Reports Cannabis Tax Revenues for Fourth Quarter of 2018,” accessed February 20, 2019,</td>
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Appendix B: Marijuana Impacts on Driver Cognition and Behavior

Divided-attention tasks


Reduced ability to maintain vehicle position in the center of the lane


Slower reaction times


Increased following distance


Decreased likelihood of passing other vehicles

Effects of Marijuana Intoxication with Alcohol


Summaries

Appendix C: State Laws – Implied Consent, Zero Tolerance and Per Se Limits\textsuperscript{107,108}

<table>
<thead>
<tr>
<th>State</th>
<th>Implied Consent Under Normal Circumstances Includes Controlled Substances</th>
<th>Zero Tolerance Law</th>
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