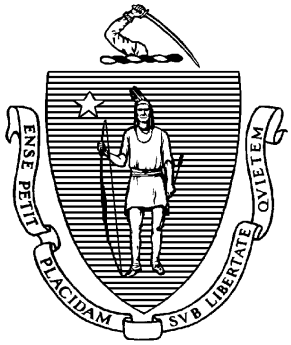

"Asleep at the Wheel"

Report of the Special Commission on Drowsy Driving

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Executive Summary

Operating a motor vehicle while overly-fatigued or sleep-deprived, commonly referred to as "drowsy driving," poses a serious risk not only for one's individual health and safety but also for that of others on the road. Recent research found that fatigue-related crashes account for 1.2 million accidents and 500,000 injuries annually – including 60,000 debilitating injuries and 8,000 fatalities. Why is the incidence of such crashes so high? Quite simply, people can't seem to stay awake behind the wheel. According to a Department of Transportation survey, 7.5 million drivers in the United States admit to having fallen asleep at the wheel within the past month, with another 7.5 million drivers admitting to having done so during the prior 2-6 months.

In an effort to capture an accurate account of the prevalence of this dangerous trend within the Commonwealth of Massachusetts, the Legislature convened the Special Commission on Drowsy Driving within the Junior Operator's Law (Chapter 428 of the Acts of 2006). The Commission was comprised of legislators, industry professionals, research experts, legal experts, law enforcement officials, and, unfortunately, victims of this avoidable problem.

Once assembled, the Commission examined the available data, conducted a comprehensive literature review, and received oral and written testimony at several public hearings. While there was significant research conducted about drowsy driving nationally, the Commonwealth of Massachusetts has very little data available. This is due to the lack of a reliable mechanism to obtain data, such as consistent crash form codes.

Current data indicates that those most susceptible to incidents of drowsy driving include young men aged 16-29, drivers with untreated sleep disorders, night-shift workers, commercial drivers, and persons working long shifts and long weeks. The Commission took this information into account when formulating its recommendations, and first thought it necessary to undergo a significant campaign to make the motoring public

aware of the dangers of driving while overly-fatigued. While the Commission recommends that those who drive while sleep-deprived be punished accordingly, they first propose educating new and current drivers of the dangers, as well as giving law enforcement officials the tools they need to recognize drowsiness, although there is no blood test for fatigue.

The Commission has endorsed several pieces of legislation filed for the 186th General Court, and urges swift passage of each in order to put the appropriate mechanisms in place to educate the motoring public, provide for responsible enforcement, and protect susceptible populations, including shift workers, commercial drivers, and many medical professionals. The Commission also recommends other reforms at agency levels or within state government to improve facilities and promote public-private partnerships. When implemented, these reforms will certainly go a long way toward promoting education and understanding of the important relationship between adequate sleep and safe driving.

Enabling Legislation – Junior Operator's Law

On June 26, 2002, a 19-year old driver collided with and killed Major Robert Raneri, who was on his way to work at the Devens Reserve Forces Training Area in Ayer, Massachusetts. The driver told police that he had not slept in 24 hours because he was up all night playing video games. Massachusetts Senator Richard T. Moore filed "An Act Relative to Drowsy Driving," otherwise known as "Rob's Law," to initiate enforcement of drowsy driving legislation. While the original bill never made it to the Governor's desk, recent legislation relating to young drivers incorporates many key provisions of Senator Moore's bill.

In the fall of 2006, the Massachusetts Legislature enacted the Junior Operator's Law (Chapter 428 of the Acts of 2006) that included a provision that established the Special Commission on Drowsy Driving. The Commission is mandated to conduct a full study of the impact of drowsy driving on the safety of the Commonwealth's roadways.

The legislation required the commission to be composed of: 3 members of the Senate, 1 of whom was appointed by the Minority Leader; 3 members of the House of Representatives, 1 of whom was appointed by the Minority Leader; the Secretary of Transportation or his designee; the Registrar of Motor Vehicles or her designee; the Commissioner of the State Police or his designee; the President of the Massachusetts District Attorneys Association or his designee; the President of the Massachusetts Association of Chiefs or Police or his designee; and 3 persons to be appointed by the Governor, 1 of whom shall be a member of the medical or academic community with expertise in sleep deprivation research, 1 of whom shall be a representative of the Massachusetts Trial Lawyers Association and 1 of whom shall represent victims who have been injured or killed by drowsy drivers. (A complete list of the Commission's membership is available on page 35)

The goals and objectives of the Commission were to study the impacts of drowsy driving on highway safety with respect to determining scientific and legal standards or other evidence that could be used by police officers and the courts in determining the effects of sleep deprivation on drivers, the appropriate sanctions for operating while sleep-deprived and the training requirements to be followed by licensed driver education programs and police training programs with respect to recognition of the symptoms and effects of sleep deprivation on drivers. The Commission was directed to provide a final report, including legislative and administrative recommendations to the General Court by December of 2008. (Chapter 428 of the Acts of 2006, Appendix A)

Methodology

To compile the information contained within this report, Commissioners and staff conducted an exhaustive review of literature on the impact of sleep deprivation on highway safety, and interviewed relevant and interested groups, advocates, and experts. Commissioners worked collectively with DPH to assimilate personal stories and recommendations for prevention of drowsy driving in the community. Community advocates included those that have been personally affected by drowsy driving and college health educators who play a key role in promoting healthy sleep habits to college students and youths. In addition to the existing commission members, community advocates were contacted and interviewed for their opinions and thoughts about enacting legislation to prevent drowsy driving in Massachusetts:

- Ms. Marian Berkowitz, sister of victim
- Ms. Sandy Shea and Dr. Michael Mazzini, Committee on Interns and Residents/SEIU
- Dr. Christopher Landrigan and Mr. Russell Sanna, PhD, Division of Sleep Medicine, Harvard Medical School
- Mr. John Rancourt and Mr. Darrel Drobnich, National Sleep Foundation
- Ms. Branwen Smith-King, Assistant Athletic Director, Tufts University
- Mr. Ian L. Wong, Director, Health Education, Tufts University Health Service
- Mr. Steven Sullivan, Teamsters Local 25 (Charlestown)

Commission staff also worked closely with Senator Richard T. Moore, Senate Chairman of the Joint Committee on Health Care Financing, and author of the original bill, "An Act Relative to Drowsy Driving (Appendix B)," which focused on enforcement actions against those found to be drowsy while driving. A comprehensive literature review of studies on drowsy driving was conducted with research sources provided by existing Commission members. In addition, Commission staff worked closely with the Massachusetts Highway Department and other state agency partners to craft ten important safety tips to prevent drowsy driving, which were published on the

Commonwealth of Massachusetts' web site (www.mass.gov) as part of activities for National Drowsy Driving Awareness Week in November of 2007.

The Commission also took oral and written testimony at a public hearing on November 6, 2008 to discuss a draft report, which was released weeks earlier. At the hearing, Commissioners discussed the issue of drowsy driving and the dangers associated with it. Discussion surrounded the health issues which may lead to drowsy driving, the need for increased education efforts, both for the motoring public and those learning to drive. Also discussed at length was the need for legislation limiting the work hours of health professionals and other at-risk occupations, such as police officers, firefighters, and shift workers. Given that many medical students and resident physicians are required to work lengthy and rigorous shifts, resulting in dangerous commutes home for them and their counterparts on the road, the Commission feels that it is important to implement the following recommendation of the recent Institute of Medicine (IOM) Panel on Resident Physician Work Hours. The panel recommended that academic medical centers and hospitals that employ resident physicians and have medical students "immediately begin to provide safe transportation options (e.g., taxi or public transportation vouchers) for any resident who for any reason is too fatigued to drive home safely."[1] Additionally, relevant research supported by the National Aeronautics and Space Administration (NASA) was presented to the commission, which revealed the hazardous effects of both acute sleep loss and chronic partial sleep loss on human performance.

Commission members also heard testimony from health professionals that highlighted the health risks that leave individuals susceptible to drowsy driving, including obstructive sleep apnea. While the ailment is easily detectible, the machinery used to treat it is expensive and cumbersome. The Commission discussed the possibility of requiring a screening for sleep apnea as part of an application for a new or renewed Commercial Driver License (CDL).

[1] Institute of Medicine, Committee on Optimizing Graduate Medical Trainee (Resident) Hours and Work Schedules to Improve Patient Safety. Resident Duty Hours: Enhancing Sleep, Supervision, and Safety. The National Academies Press, Washington, D.C., 2008.

The hearing was the final public meeting of the Commission prior to the release of this report, and served as a good indicator of the public interest and concern over the need to curb the growing trend of drowsy driving throughout the Commonwealth.

Personal Stories

The problem of drowsy driving in Massachusetts can be highlighted by the stories of victims, and their loved ones, who have experienced the impacts of drowsy driving personally.

Amy Huther was Major Robert Raneri's fiancée. She explains how Major Raneri was *…"killed by a 19-year old man who admittedly was awake for over 24 hours. Because of a drowsy driver, our wedding plans changed to funeral plans. Eight and a half months before her birth, I buried my daughter's father. The public needs to be educated on the effects of drowsy driving."*

Marian Berkowitz describes the story of her brother, who died on his way back to school in the fall of 1984: *"My brother was in his second year of law school at Wake Forest University in North Carolina at the time of his accident. It happened during the fall semester when he was driving back from Washington, D.C. to his school after interviewing for summer associate positions. He was under pressure to return to his school quickly as he learned while up in D.C. that he got into the quarter-final rounds of a moot court competition that were to occur that week. He was driving on a Monday night after the weekend of the fall clock change. There is no proof of a fatigue accident, but by all appearances, he fell asleep at the wheel and possibly the time change was a contributing factor in addition to his needing to drive alone over 5 hours that evening. We were told by the local police in Virginia where the accident occurred that his car swerved into the opposite lane and was hit by an oncoming bus. No one was injured except for him, and he died instantly."*

Residents from **CIR/SEIU** provided testimony relative to their experiences with driving while drowsy, but the residents also cautioned that they are required to work long hours by hospitals; unless hospitals can be forced to reduce the hours worked by residents, a drowsy driving enforcement threatens the residents' very employment. *"I was working in the intensive care unit … I came in at 7:15am and worked straight for 30 hours. There was no time for sleep. We were really busy, the unit was full of very sick patients and I*

was expected to care for them throughout the night. I finally left the hospital (the next day) about 1:00pm. Just as I was about to take a right from Center Street on the VFW Parkway, I fell asleep. I veered off to the left and on to the median strip, missed a tree, but hit a pole which went flying up over the windshield. I was almost seven months pregnant at the time. My rotation schedule in the intensive care unit is not unusual. Residents are working this kind of schedule (and worse) in every teaching hospital in the state. Residents do not choose to work these long hours. We are scheduled by our training program and the hospital depends on our being there to take care of patients. To refuse would be considered unprofessional. I am really lucky that I – and my baby – were not hurt when I fell asleep at the wheel. I don't think that this danger should just be an accepted and routine part of residency training."

Commercial vehicle operators have also experienced the effects of drowsy driving, considering that even a momentary lapse of attention while driving a truck has the potential for devastating consequences.[2] Fatigue-related crashes in commercial motor vehicles occur most commonly during nighttime hours.[3] The United States Department of Transportation has reported that the relative risk of a fatigue-related crash among commercial drivers – which is the leading cause of fatal-to-the-driver truck crashes – increases sharply after 10 hours of driving, such that there is a fifteen-fold increase in the risk of a fatigue-related crash among commercial vehicle operators driving more than 13 hours. Moreover, truck drivers are often chronically sleep deprived. A 1997 Federal Highway Administration and Trucking Research Institute study in which 80 commercial vehicle operators (approximately half of whom were union drivers from the United States and half of whom were Canadian non-union drivers) were monitored during 7,500 hours of truck driving revealed that the truck drivers averaged 5.2 hours in bed per 24 hours, and actually slept only 4.8 hours per 24 hours.[4] Video monitoring of the faces of those long-haul operators revealed that more than half (56%) experienced "at least 1 six-minute

[2] Harris W. Fatigue, circadian rhythm, and truck accidents. In: Mackie R, ed. Vigilance Theory, Operational Performance, and Physiological Correlates. New York: Plenum, 1977;133-146.
[3] Langlois PH, Smolensky MH, His BP, Weir FW. Temporal patterns of reported single-vehicle car and truck accidents in Texas, USA during 1980-1983. Chronobiology International 1985;131-46.
[4] Mitler MM, Miller JC, Lipsitz JJ, Walsh JK, Wylie CD. The sleep of long-haul truck drivers. New England Journal of Medicine 1997;755-61.

interval of drowsiness while driving". Finally, an estimated 42% of commercial motor vehicle drivers in the United States have a body mass index (BMI) of greater than 30, putting them at high risk of obstructive sleep apnea.

Mr. Steven Sullivan, speaking on behalf of the Teamsters Union, stated that a significant concern to his members is that when some trucking companies hire non-union drivers, they hire subcontractors, whom he characterized as "Larry, Moe and Curly." These subcontractors may be unlicensed and/or uncertified, and are paid by how much product they move in the least amount of time. For independent workers who are not unionized, there is constant pressure to work for 12-hour shifts without breaks, he said. Mr. Sullivan also advocated for corrective legislation or regulations to hold non-union drivers to the same standard as union operations. This would result in additional liability being placed on the employers. He argued that a "triple damages" law targeting companies that hire small subcontractors would prevent people from walking away from responsibility when an injury or crash occurs.

Existing Drowsy Driving Data and Evidence from the Literature

A comprehensive review of existing data was conducted as part of the Commission's directive to study the impact of drowsy driving on highway safety. Additionally, the Commission communicated with the National Sleep Foundation for guidance regarding recommended principles for enacting drowsy driving legislation in Massachusetts.

Current data suggests that, each year, drowsy driving is responsible for more than 100,000 police-reported crashes, 71,000 injuries, 1,550 deaths and $12.5 billion in diminished productivity and property loss, according to estimates by the National Highway Traffic and Safety Association (NHTSA). These numbers are likely an underestimate due to inconsistent data collection codes on crash forms, minimal training and education on drowsy driving recognition, unreliable self-reporting, and the lack of a "breathalyzer" test for drowsy driving. A 2005 National Sleep Foundation "Sleep in America" poll found that 60% of adult drivers (168 million people) reported driving while drowsy in the previous year, of whom 37% had fallen asleep at the wheel. An estimated 11 million drivers reported having had an accident or near accident when driving while drowsy. Several studies indicate that the impairment of reaction time induced by sleep deprivation is comparable to that induced by alcohol use, with 24 hours of sleep deprivation the equivalent to a blood alcohol content (BAC) of 0.10% (above the 0.08% threshold to be considered legally intoxicated in Massachusetts). Of note, at 17 hours of sleep deprivation, the BAC equivalent is 0.05%, which is the legal limit in some jurisdictions, including Australia.

Recent groundbreaking research using intensive observational methods further corroborates the risks of drowsy driving. In the 100-Car Naturalistic Driving Study, investigators from the Virginia Tech Transportation Institute – with support from NHTSA, Virginia Tech, the Virginia Department of Transportation, and the Virginia Transportation Research Council – equipped 100 vehicles with multiple cameras directed at the roadways and drivers, gathering approximately 43,000 hours of data on drivers, motor vehicle crashes, and their causes under routine non-commercial driving

conditions.[5] They found that the drivers experienced 82 crashes and 761 near-crashes over the course of a year. In 22% of all motor vehicle crashes and 16% of all near-crashes, the crash was directly attributable at least in part to drowsiness, a proportion far in excess of that suggested by police reports, and roughly equivalent to the proportion of crashes attributable to all other causes of distracted driving (such as cell phone use, eating, putting on makeup, etc.) combined. Moreover, since drowsiness can increase the propensity to become distracted[6] and to intentionally employ distractions (e.g. talking on a cell phone, turning up the radio) as a means of staying awake, drowsiness may explain an even larger proportion of distracted driving crashes than those directly attributed to it.

High Risk Groups

Youths aged 16-29 years, in particular young men, are about the highest-risk groups of those susceptible to drowsy driving. Sleep-related crashes are most common in this age group that tends to stay up late, sleep too little, and drive at night. A study of fall-asleep auto crashes in North Carolina in 1990-1992 indicated that in 55% of the crashes, drivers were aged 25 or younger and predominantly male. The National Center for Sleep Disorders Research found that this age group is also prone to having automobile crashes at night in comparison to other age groups.

Driver Age	Time of Occurence
16-25	Most sleep-related crashes occurred at night
25-45	Sleep-related crashes were less frequent, still mostly at night
45-65	Not as many sleep-related crashes at night, peak time is 7:00am
Over 65	Fewer sleep-related crashes at night; peak time is mid-afternoon

Other high risk groups include shift workers, in particular those working the night-shift and those who work extended duration shifts, for example, resident physicians. A study in the New England Journal of Medicine showed that resident physicians had twice the odds of falling asleep while driving or having a motor vehicle crash after working

[5] Neale VL, Dingus TA, et al. An Overview of the 100-Car Naturalistic Study and Findings, 2006
[6] Anderson C and Horne JA. Sleepiness Enhances Distracion During a Monotonous Task. Sleep 4-1-2006; 29 (4):573-6

extended shifts of 24 hours or more. A meta-analysis in *Sleep* found that sleep deprivation of 24 to 30 hours (which is approved by the Accreditation Council for Graduate Medical Education (ACGME)) leads to significant deterioration of residents' cognitive and clinical performance, to approximately the 7th percentile of their baseline rested performance on average. Other risk groups include persons working more than 60 hours per week (which includes hospital residents who can work 80 hours per work or more according to ACGME professional mandates); according to the National Sleep Foundation, working more than 60 hours per week increases the risk of drowsy driving by 40%.

Commercial drivers are also at risk for drowsy driving; a recent study by the American College of Occupational and Environmental Medicine indicates that there is a high incidence rate of obstructive sleep apnea among commercial drivers that contributes to crashes. In a study of 2,342 commercial drivers in Australia, more than half (about 60%) of drivers had sleep-disordered breathing and about 16% had obstructive sleep apnea syndrome. 24% of drivers had excessive sleepiness.[7] Similarly, in a study of 1,391 commercial truck drivers, 28% were found to have obstructive sleep apnea syndrome, with more than 1/3 classified as moderate to severe.[8]

Untreated sleep disorders are commonly cited as a risk factor for drowsy driving. In a meta-analysis of studies examining the relationship between motor vehicle crashes (MVC) and obstructive sleep apnea syndrome, the odds ratio of the comparative risk of MVCs in drivers with the syndrome versus those without was 2.52, with previous studies reporting odds ratios between 1.71 and 7.43. In the year 2000, MVCs associated with obstructive sleep apnea syndrome were estimated to cost $15.9 billion and 1,400 lives.[9] Moreover, patients with obstructive sleep disordered breathing had 3 to 4.8 times the risk

[7] AM J Respir Crit Care Med. 2004 Nov 1; 170(9)
[8] Pack A, Dinges D, Maislin G. A study of prevalence of sleep apnea among commercial truck drivers. Federal Motor Carrier Safety Administration Publication DOT-RT-030 Washington, D.C. 2002
[9] Sleep. 2004 May 1;27(3):453-8

of MVCs associated with personal injury.[10] New national guidelines for screening commercial drivers for sleep disorders are currently under development.

Another relevant study, conducted in 1990 by the National Traffic Safety Board, examined 182 heavy truck crashes that were fatal to the driver. The study showed that 31% of the crashes in this sample involved fatigue - equal to fatal drug and alcohol related crashes in this sample combined. This number is frequently cited as an estimate of the incidence of fatigue in truck crashes that were fatal to the truck driver. In Massachusetts, the overall rate of fatal occupational injury was 2.1 deaths per 100,000 workers for the 7 year period (2000-2006). The rate of fatal occupational injury among truck drivers was more than four times the overall rate.

Risk Factors

Multiple studies indicate that insufficient sleep and untreated sleep disorders are the leading factors contributing to drowsy driving. The Institute of Medicine estimates that 50 to 70 million Americans suffer from a disorder of sleep and wakefulness. At least 7-9 hours of sleep every 24 hours is recommended by the National Sleep Foundation (NSF). Yet, according to a 2002 poll, conducted by NSF, 39% of Americans sleep less than 7 hours per night on weekdays, with 15% sleeping less than six hours on weekdays. Additionally, 24% of respondents reported that on weekdays, they get less than the minimum amount of sleep that they need in order to not feel sleepy the next day, with 91% of respondents recognizing that not getting enough sleep can put them at risk for injuries.

A case control study conducted in North Carolina compared drowsy police-reported crashes against non-drowsy police-reported crashes and non-crash drivers. The results indicated that work and sleep schedules were strongly associated. Those involved in drowsy driving crashes were more likely to work in more than one job and work non-

[10] Mulgrew AT, Nasvadi G, Butt A, Cheema R, Fox N, Fleetham JA, Ryan CF, Cooper P, Ayas NT. Risk and severity of motor vehicle crashes in patients with obstructive sleep apnea/hypopnoea. *Thorax.* 2008;63: 536-41

standard hours. The night shift increased crash odds six times; crash odds also increased as hours of sleep decreased.

Other factors include driving between 12:00am and 6:00am, driving for long hours, and use of sedating medications and alcohol. In 1998, NHTSA reported that the classic fall asleep crash is one in which a single vehicle with a driver alone in the vehicle leaves a high-speed roadway late at night, in the early morning or mid-afternoon, and in which the driver makes no attempt to avoid the crash. While this may represent the prototypic fall-asleep crash, more recent data indicates that it is not the most common. In the NHTSA 2006 landmark 100-car study, in which 241 primary and secondary drivers were observed using multiple video cameras while driving over 2,000,000 miles in instrumented vehicles during 43,000 hours of driving over a 12 to 13 month period, a majority of the drowsiness-related crashes occurred during the daytime in heavy traffic (during morning and evening commutes). The conclusion of the most recent NHTSA objective observational study is that "the risks of drowsy driving during the day may be slightly higher than at night due to higher traffic density".[11] Moderate to severe drowsiness, which accounted for 22% to 24% of MVCs and near crashes, increased the crash risk by 4 to 6 fold, or more than 500%.

Current Massachusetts Data and Comparison with Other States

Unfortunately, data are Massachusetts is limited due to the lack of education in recognizing drowsy driving and inadequate data collection. A current field code does not exist in the state's accident reporting forms to document driver fatigue and/or sleepiness. Also, while there is a field code on the Fatal Accident Reporting System (FARS) , a recent review indicates that these fields are not always completed. While nationwide statistics indicate that drowsy driving is increasing, FARS data shows an overall decrease in driver fatalities involving drowsy driving, as noted below.

[11] Klauer SG, Dingus TA, Neale VL, Sudweeks JD, Ramsey DJ. The impact of driver inattention on near-crash/crash risk: an analysis using the 100-car field experiment. DOT HS 810 593, 1-352. 2006. Washington, D.C., National Highway Traffic Safety Administration.

Drowsy Driving as a Contributing Factor in Fatal Massachusetts Auto Crashes

Year	Drowsy Driver – Fatal Crashes	Drowsy Driver – Fatalities	Total Motor Vehicle Fatalities in Massachusetts	% of Drowsy Driving Fatalities
2001	13	13	477	2.7%
2002	22	24	459	5.2%
2003	7	7	462	1.5%
2004	8	8	476	1.7%
2005	3	3	442	0.7%
TOTAL	**53**	**55**	**2,316**	**2.4%**

In 2007, the National Sleep Foundation conducted a review of all 50 states (Appendix F) and issued recommendations for state policies surrounding prevention of drowsy driving. Massachusetts was reviewed for the following nine different categories of prevention policies:

1. **Are there charges against a drowsy driver in a motor vehicle crash?** A negligent operation charge exists, and could be considered as "operating to endanger," although a designated charge for drowsy driving does not exist.
2. **Are there charges against a drowsy driver for causing a fatality?** There is an existing charge for vehicular homicide and negligent operation.
3. **Are there licensing limits due to medical conditions? Sleep disorders?** There are limits on medical conditions, but sleep disorders are not included.
4. **Are doctors required to report medical conditions?** No, doctors are not required to report.
5. **Is sleepiness or fatigue listed on a crash form?** There are fields for inattention and fatigued/asleep.
6. **Is training available for police on fatigue and drowsy driving?** Yes.

7. **Is there a graduated licensing program? Curfew?** Yes. A curfew exists for junior operators under 18 years of age.
8. **Is drowsy driving information mandated in driver education?** No.
9. **Is information on drowsy driving available in the driver's education manual?** Yes.

Of these nine categories, Massachusetts currently does not require doctors to report medical conditions, does not have a mandate for drowsy driving to be taught in driver's education, and does not place licensing limits due to sleep disorders.

The National Sleep Foundation has proposed the following recommended principles for statewide drowsy driving legislation:

1. Establish an expert panel to coordinate statewide drowsy driving prevention efforts; this panel should report directly to the governor;
2. Promote research to analyze police-reported crash data to provide estimates of the magnitude of the drowsy driving problem and to identify high-risk travel corridors and at-risk populations;
3. Establish uniform codes on motor-vehicle crash-report forms and additional documentation methods necessary for police officers to report fatigue-related crashes;
4. Provide for training of law-enforcement personnel in detecting and reporting drowsy driving as a factor in crashes;
5. Require that the state's RMV Medical Advisory Board include a sleep disorders specialist;
6. Fund the development and implementation of an ongoing statewide public awareness campaign that promotes the benefits of sleep and the prevention of drowsy driving and fall-asleep crashes;
7. Adopt night driving time curfews – from 10:00pm to 6:00am – for young drivers as part of graduated licensing laws;
8. Mandate that sleep and drowsy-driving prevention information be included in all state-sanctioned drivers' education and health education curricula;

9. Add accurate information on the impact of sleep deprivation and drowsy driving countermeasures to driver licensing manuals and testing materials;
10. Mandate the installation of continuous shoulder rumble strips along all appropriate expressways, highways, parkways, and rural interstates;
11. Incorporate recommendations regarding rest areas as outlined in the Federal Highway Administration's report to Congress *Study of Adequacy of Parking Facilities;*
12. Establish drowsy driving enforcement provisions that are in keeping with other state traffic safety laws, i.e. reckless or careless driving, and vehicular manslaughter.

Of these principles, the Massachusetts Junior Operator's Law provides for recommendations 1 and 7, while Senator Moore's original legislation, had it been enacted by the Legislature and signed by the Governor, would have addressed principles 4,5,8,9, and 12. Currently, New Jersey is the only state in the country with an enforceable law ("Maggie's Law") against drowsy driving; a summary of pending legislation in other states is below.

Pending State Drowsy Driving Legislation

State Bill Number	Summary
Illinois SB 104	A person who causes a fatal accident by operating a motor vehicle, all-terrain vehicle, snowmobile, or watercraft while he or she is aware of being fatigued is guilty of reckless homicide.
Kentucky HB 150	A person is guilty of reckless homicide when, driving while fatigued, he causes the death of another person
Massachusetts S 2072	Acknowledges that a driver of a motor vehicle who drives while they are sleep-deprived is just as impaired as the drug or alcohol-impaired driver. Applications for motor vehicle licenses will include information on the consequences of driving while sleep-deprived, and public safety officers

	will receive education on identifying the sleep-deprived driver. Violators will be charged under the criminal statute to the same extent as drug or alcohol-impaired drivers.
Michigan HB 4332	Includes driving while fatigued in definition of reckless driving.
New Jersey AB 2265	Requires the recording of driver distraction, including fatigue, on accident forms.
New Jersey AJR 86	Creates a commission to study highway rest areas for truck drivers.
New York A 970	Requires holders of commercial driver's licenses to submit to medical examinations and testing for sleep apnea
New York A 1234	Creates a misdemeanor for driving while drowsy; creates felony crime of vehicular homicide caused by driving while ability-impaired by fatigue.
New York A 2332	An Act to amend traffic law in relation to driving while fatigued
New York A 4134	Adds fatigue to definition of recklessness in vehicular assault and vehicular manslaughter statutes
Oregon HB 3021	Creates offense of driving while fatigued; punishes by maximum of 5 years imprisonment, $125,000 fine, or both; requires that fatigue be included on driver's license test.
Tennessee SB 71	Allows a judge or jury to infer fatigue as a cause in a traffic fatality when the defendant had not slept in the past 24 hours.

Source: National Sleep Foundation, 2007.

Prevention Strategies

Several studies have been conducted on how to prevent drowsy driving. As in other areas of injury prevention, strategies for prevention of drowsy driving fall into three major categories – education; enactment, and enforcement of drowsy driving laws and policies; and use of technology. Sleep and the diagnosis and treatment of sleep disorders are the number one strategy recommended by all studies. At least 7-9 hours of sleep is recommended every 24 hours by the National Sleep Foundation (NSF). If symptoms of drowsiness occur while driving, NSF recommends stopping driving and taking a 15-20 minute nap. Regular stops every two hours or 100 miles for breaks are recommended; in addition, caffeine in low doses (100-200 mg) combined with a nap, offer short-term benefits. There is no scientific evidence to suggest that turning on the radio, opening the window for cold air, or talking on the phone serve as effective strategies for prevention. Sleepy drivers are more likely to become distracted, which may increase the likelihood of a motor vehicle crash. A study by Professor Jim Horne found that when sleepy, people are unable to maintain focus on a simple task and increasingly sought distractions in the periphery, resulting in errors in performance and missed responses.[12] This becomes increasingly concerning when sleepy motorists drive along a monotonous road and may be easily distracted by cell phone use, navigation systems, or other distractions.

Several evidence-based interventions have been shown to reduce the risk of drowsy driving crashes. Diagnosis and treatment of obstructive sleep apnea which, when untreated, increases the risk of motor vehicle crashes by more than 500%, can significantly reduce the risk of such crashes. Rumble strips, which are raised or grooved patterns constructed on or in travel lane and shoulder pavements, can mitigate the risk of drowsy driver crashes. Vehicle tires passing over them produce a sudden rumbling sound and cause the vehicle to vibrate, serving as an effective alarm for drivers who are veering off the roadway. In particular, continuous shoulder rumble strips (CSR) placed on high-speed or rural roads have been shown to reduce crashes by 30-50%. In Pennsylvania, an innovative type of shoulder rumble strip called the Sonic Nap Alert Pattern (SNAP) has

[12] Anderson C; Horne JA. Sleepiness enhances distraction during a monotonous task. *SLEEP* 2006;29(4): 573-576

recently been installed which creates a distinct warning sound and vibration when drowsy or inattentive drivers' vehicles drift across the grooves of the rumble strip; after installation, drift-off-road accidents per month decreased by 70%. However, the tragic Greyhound Bus crash at Burnt Cabins, Pennsylvania reveals that drowsy drivers cannot safely rely on rumble strips alone to prevent sleep-related crashes. [13]

Other strategies include prevention education of high risk groups, especially youth. In addition to promoting rumble strips, NHTSA recommends education of young males aged 16-24 and shift workers about the risks of drowsy driving and how to reduce lifestyle-related risks. In addition, NHTSA recommends that employers, unions and shift work employees need to be informed about effective measures they can take to reduce sleepiness from shift work schedules, including shift work schedule changes. Testimony provided to the Joint Committee on Health Care Financing in December 2007 by the Committee of Interns and Residents/SEIU supports this recommendation:

"…multiple residents have fallen asleep while driving home from the hospital after working a 30 hour shift…the Accreditation Council for Graduate Medical Education allows 24 hour shifts plus and additional 6 hours to finish up work…residents do not choose to work these long hours but are scheduled by (their) training program and the hospital expects residents to work these hours…this danger should not be an accepted and routine part of residency training".

A major prevention strategy would be to revitalize and expand public rest areas. New York implemented an intensive campaign to revitalize rest stops in response to the increase in drowsy driving crashes. These included the construction of new rest areas, revitalization of existing facilities, expansion of parking for commercial vehicles, and enhanced security. The National Sleep Foundation also recommends revitalizing rest stops as part of their recommendations for state legislation. Recently, the Federal Highway Administration provided a detailed report to Congress looking at adequate parking facilities at rest stops as a result of recent data indicating that driver fatigue is a

[13] National Transportation Safety Board, 2000. Greyhound Run-off-the-Road Accident, Burnt Cabins, Pennsylvania, June 20, 2998. Highway Accident Report NTSB/HAR-00/01. Washington, D.C.

primary factor in 4.5% of large truck-involved crashes and a secondary factor in an additional 10.5% of large truck-involved crashes. The report found that inadequate rest by truck drivers is a strong factor contributing to crashes, and the availability of safe places to obtain needed rest must be addressed as part of a comprehensive safety agenda.

In the future, lane departure warning systems may be installed in automobiles to alert drivers when they begin to drift while driving. Recent studies indicate that these systems, designed to help reduce car crashes by alerting drowsy drivers that the vehicle has wandered out of the lane, may cut drivers' reaction time in half. The systems rely on the detection of the vehicle's position in relation to the road lane through the use of a camera installed in the vehicle; four different types of warning systems are being tested including a rumble strip sound recording, steering wheel vibration, a row of flashing red LEDs, and an automatic steering wheel torque to return the driver to the lane.

Treatment of obstructive sleep apnea syndrome with continuous positive airway pressure (CPAP) has been shown to reduce the motor vehicle crash (MVC) rate. In one study of 210 obstructive sleep apnea syndrome patients treated with CPAP for at least 3 years and compared with randomly selected control drivers, the rate of MVCs fell to the rate observed in control drivers following CPAP treatment.[14] In other words, the increased risk of MVCs due to obstructive sleep apnea syndrome can be substantially reduced following treatment with CPAP.

[14] Thorax. 2001 July;56(7):508-12

Commission Recommendations

Based on available research and the wealth of testimony presented, the Commission makes the following recommendations for legislative, policy, and procedural changes. Legislation that is referenced was filed for the 186th General Court.

- The Commission recommends passage of ***An Act Relative to Drowsy Driving***, which includes provisions aimed at educating the motoring public about the dangers of drowsy driving, enforcement efforts to curb the growing trend of this dangerous action, and the diagnosis of particular sleep disorders. It is imperative that any enforcement mechanism is preceded by an education and public awareness campaign targeted at high risk groups, including young and commercial drivers. Currently drowsy driving is not explicitly listed as an offense that constitutes reckless driving in the Commonwealth. Additional, the offense of vehicular homicide only constitutes a misdemeanor offense. This legislation would address both of these very important issues. For the safety of motorists, the legislation would also decrease the amount of time an abandoned vehicle can remain on state roadways, from 3 days to 4 hours. Rumble strips have proven to be helpful in preventing run-off-the-road accidents; however, abandoned vehicles left for days hinder their effectiveness, and at times have contributed to fatal accidents. Finally, the legislation requires those wishing to renew or obtain a commercial drivers license in the Commonwealth with a body mass index above 33, which is considered to be obese to undergo an objective diagnostic screening test for obstructive sleep apnea. Also included in this legislation is a requirement that accident forms be clarified to encourage data collection of fatigue-related crashes and fatalities. Though there is good reason to believe that drowsy driving is an important source of motor vehicle crashes in Massachusetts, as elsewhere in the United States, the lack of data in the Commonwealth makes it difficult to gauge precisely the extent of the problem of drowsy driving on the state's highways. The Commission also recommends that law enforcement officials be trained on how to recognize drowsy drivers.

The Commission recommends passage of this legislation in order to put mechanisms in place to educate the motoring public of the dangers of driving while impaired by drowsiness and to have a clear process of enforcement.

- The Commission also recommends passage of ***An Act Relative to Sleep Deprivation Avoidance and Promotion of Good Sleeping Practices***, which requires the Governor to issue a proclamation designating the 2nd week of March as "Massachusetts Sleep Awareness Week" and the 1st Sunday of March as "Massachusetts Sleep Awareness Day". The Governor would also be encouraged to use this week to bring attention the problems associated with sleep deprivation and fatigue, which includes impaired reaction time, judgment and vision, among other things.

  The legislation also calls for state agencies, and interested private organizations, to adopt policies associated with increasing public awareness about sleep, sleep disorders and the consequences related to sleep deprivation.

  Finally, the Governor would also be charged with designating the 2nd week of November as "Massachusetts Drowsy Driving Prevention Week". During this week, the Governor would bring special attention to the need for public awareness and action relative to the problems associated with drowsy driving and driver fatigue.

  Given that the Commission acknowledges there is a need for increased education and public awareness, this legislation is critical to achieving that goal. Therefore, the Commission also recommends also passage of this legislation.

- The Commission recommends passage of ***An Act Relative to Patient and Medical Intern and Resident-Physician Safety and Protection,*** which sets reasonable work hour limits for resident physicians and interns. This legislation incorporates recommendations based on reports from the American Council of Graduate

Medical Education (ACGME) and the Institute of Medicine (IOM) by creating an advisory council within the Department of Public Health. The council is charged with conducting an investigation into the duty hours and working conditions of resident physicians in the Commonwealth. Then, based on this study, the Department will adopt rules and regulations for the purpose of establishing an evidence-based standard duty hour. The lengthy investigation will look into both reports, especially the most recent IOM report, which suggests limiting the work hours of resident physicians and other trainees in clinical training programs to an optimal limit of 60 hours per week, but not more than 80 hours.

Based on their rigorous work hours, resident physicians and interns are very susceptible to driving while impaired by drowsiness, and thus putting themselves and other motorists at great risk. Unfortunately, resident physicians and interns are typically required to work such long hours by the institutions that host them. Therefore, the commission recommends swift passage of this legislation in order to ensure that resident physicians and interns are not adversely affected by the impacts of the above mentioned drowsy driving legislation.

- The Commission also recommends passage of ***An Act Relative to Health Care Provider Transportation,*** which is also based on the December 2008 report from the Institute of Medicine. The report recommended that academic medical centers and hospitals that employ resident physicians and have medical students "immediately begin to provide safe transportation options (e.g., taxi or public transportation vouchers) for any resident who for any reason is too fatigued to drive home safely." This legislation puts that suggestion in statute, and is closely aligned with ***An Act Relative to Patient and Medical Intern and Resident-Physician Safety and Protection***. Considering that resident physicians and interns are susceptible to driving while impaired by drowsiness, and it is largely the responsibility of their grueling work hours, the Commission recommends passage of this legislation.

- There is overwhelming evidence that ***highway revitalization*** is a successful strategy to prevent drowsy driving related crashes. The Commission recommends rumble strip implementation and expansion of existing rumble strips along all of Massachusetts' highways to further prevent crashes. In addition, as shown by the recent efforts in New York, expanding and revitalizing public rest stops also assist in preventing the act of drowsy driving. The Commission further recommends that Massachusetts consider construction of new rest areas, revitalization of existing facilities (including coffee at rest areas), expansion of parking for commercial vehicles and enhanced security.

  Given that highway revitalization is a costly endeavor, the Commission also notes that there is the possibility of matching funds available from the federal government to support state initiatives for safe roadways. The Federal Highway Administration has recommended that the federal government consider a range of legislative and administrative policy/procedural changes including innovative financing (low-interest loans and grants), commercialization/privatization of public rest areas and allowing states to use federal aid funds to operate and improve safety and security at public rest areas. Massachusetts may be able to use this federal support as a way to initiate revitalization of existing highway facilities toward prevention of drowsy driving.

- Finally, the Commission recommends that the Registrar of Motor Vehicles and the Executive Office of Public Safety explore ***public-private partnerships*** to promote public education and understanding of the important relationship of adequate sleep and safe driving. For example, businesses such as Massachusetts-based Dunkin' Donuts, and other coffee shops, could promote proper use of coffee as a temporary antidote to sleep deprivation by offering discount coupons at key times throughout the year, especially during designated dates proclaimed by the Governor, as referenced in ***An Act Relative to Sleep Deprivation Avoidance and Promotion of Good Sleeping Practices***. Dunkin' Donuts may also provide coupons and guidance for new licensees and, possibly, license

renewals, to stress the dangers of drowsy driving. Additionally, Pharmaceutical companies that advertise sleep aids could certainly contribute more to promote safe use of their products in their advertising efforts. The Commission recommends that the potential for public-private partnerships be sincerely explored by the Registry of Motor Vehicles and the Executive Office of Public Safety.

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Census of Fatal Occupational Injuries, Occupational Health Surveillance Program, MDPH

Fatal Accident Reporting System, Injury Surveillance Program, MDPH

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