

Snow and Ice Accumulation on Vehicles

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Prepared by the American Transportation Research Institute



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Background

The Trucking Industry

The trucking industry drives the U.S. economy, delivering 87 percent of the nation's manufactured goods. In 2006, the industry represented a \$645.6 billion industry, comprising over 80 percent of the nation's freight bill¹. In addition, the U.S. trucking industry is one of the largest employers in the country, accounting for over 8.7 million industry-related jobs of which 3.4 million are truck drivers².

The trucking industry is extremely diverse; trucking company size ranges from an owner-operator with one truck to large carriers that operate thousands of trucks with dozens of terminals. Additionally, the industry consists of many sectors, each with very different operating environments. Though most fleets are comprised of van trailers, a sizable number of others are specialized carriers that utilize tanker trucks or flatbed trailers.

Throughout the industry, safety is a top concern for all stakeholders as evidenced by continued decreases in truck-involved crash rates. While economic growth in the U.S. has spurred the number of miles traveled by large trucks to increase 22 percent from 1996 to 2005, the number of large truck fatal accidents increased just 2.7 percent during the same period – dropping the large truck fatal crash rate by almost 16 percent³.

Snow and Ice Accumulation on Vehicles – A Safety Concern

During the winter months in regions that experience significant snowfall, snow and ice accumulates on the tops of all vehicle types, including automobiles, straight trucks, intermodal containers, large trucks, trailers and buses. This accumulation of snow and ice potentially causes a significant safety issue as chunks of ice may form when accumulated snow melts, then refreezes. During transit, a piece of ice may dislodge from the vehicle, potentially damaging vehicle components, causing property damage to other vehicles and even injuring other motorists.

However, the size and weight of ice sheets that may dislodge from larger vehicles in transit create a more significant safety concern for the trucking industry. Operational impacts from accumulated snow and ice are also possible, including size and weight limit violations and lowered fuel economy.

¹ American Trucking Associations. "Trucking Trends, 2007-2008." Arlington, VA.

² Ibid.

³ Ibid.

Removing snow and ice from the tops of trailers creates a series of safety and operational challenges, documented in detail later in this report. The simplest solution, requiring virtually no capital investment, is to have workers or drivers climb onto a trailer roof and manually remove snow and ice by shoveling or raking the trailer roof. However, this practice creates its own set of serious safety issues of slips and falls from trailers. Other methods for snow and ice removal can be more complex, require routine maintenance, or be cost-prohibitive to a significant portion of the industry.

Routinely removing accumulated snow and ice mitigates several safety-related risks including:

- snow blowing off the trailer roof and impairing motorist visibility;
- ice falling from a vehicle and causing injury or property damage to other motorists;
- violations of snow and ice removal laws or fines for falling ice;
- violations of other vehicle operations-related regulations.

Other benefits of routinely removing snow and ice accumulations are improved fuel economy (by reducing the weight of the accumulated snow and ice) and the reduction of potential insurance claims or civil litigation resulting from falling ice. However, the costs/benefits of routinely removing snow may be difficult to determine due to the fact that snow frequently (and harmlessly) blows off the vehicle while in transit.

While the safety risks from snow and ice dislodging from large commercial vehicles have been reported by the media, there is little empirical research on the scope of the problem, potential solutions and their respective value for industry safety and operations.

ATRI Research

At the request of several State Trucking Associations (STAs) and upon recommendation of its Research Advisory Committee (RAC)⁴, the American Transportation Research Institute (ATRI) initiated research in March 2008 to determine the scope of the problem, document current industry practices and quantify for the industry potential solutions for mitigating the safety risks of snow and ice falling from vehicles.

Specifically, the research objectives were to:

- document the extent of the problem;
- review current and proposed legislation targeted toward the problem;
- identify snow and ice removal methods for trucks and trailers and evaluate the efficacy of each;
- recommend potential solutions for the industry.

In support of these objectives, the following tasks were initiated by the ATRI Research Team:

1. Literature review of existing research;
2. Environmental scan of the current regulatory environment;
3. Documentation of the scope of the problem;
4. Development of a compendium of snow and ice removal tools, technologies and practices;
5. Development of a recommended industry action plan.

The research design focused on soliciting industry input from stakeholders in North America and Europe and included an online survey, internet searches, personal interviews and solicitation of commercial driver input through ATRI's biweekly XM Satellite Radio program. Stakeholder groups contacted included:

- Motor carrier safety and operations personnel;
- Large shippers/receivers;
- Law enforcement;
- Motor carrier insurers;
- Safety advocacy groups;
- Truck tractor and trailer manufacturers;
- Trucking industry associations.

⁴ The American Transportation Research Institute (ATRI) Research Advisory Committee (RAC) is comprised of industry stakeholders representing motor carriers, trucking industry suppliers, labor and driver groups, law enforcement, federal government and academia. The RAC is charged with annually recommending a research agenda for the Institute.

Research Findings – Literature Review and Regulatory Environmental Scan

Strong concern for the potential safety issues created by the dislodgement of snow and ice from moving vehicles has been expressed by state legislators, law enforcement, the trucking industry and the motoring public. However, despite this concern and periodic publicity of high-profile incidents involving serious injuries and significant property damage, the Research Team was unable to identify any research studies conducted on the issue of snow and ice dislodging from large commercial vehicles while in transit.

U.S. Federal Regulations

Currently in the U.S. there are no federal regulations specifically mandating the removal of snow or ice from a vehicle prior to transit. Additionally, there are no specific regulations in which a driver or motor carrier may be cited if snow or ice dislodges and causes injury or property damage to another motorist or pedestrian. In the absence of specific federal regulations, the research identified two areas where states are enforcing snow and ice removal:

- Law enforcement may cite drivers or motor carriers under several other commercial motor vehicle operation regulations; or
- Pursuing and/or enacting state or roadway-only legislation targeting *any* vehicle traveling with accumulated snow or ice or if snow or ice dislodges from a vehicle while in transit and causes property damage or injury.

State Regulations

The regulatory environmental scan identified five states with existing or proposed legislation related to snow and ice removal (Appendix A). However, the majority of states in the U.S. that experience substantial annual snowfall have enacted neither specific regulations requiring the removal of accumulated snow and ice prior to travel nor legislation to cite drivers for falling ice causing injury or property damage to other motorists or pedestrians.

Research indicates that many states as well as Canadian provinces do employ regulations covering the safe operation of commercial motor vehicles as a means for enforcing snow and ice removal from large trucks, often at the discretion of the investigating officer. For example, drivers or motor carriers may be cited for weight or height violations, operating a vehicle that is not in safe operating condition or in a manner that creates a potentially dangerous situation.

Canadian Regulations

In many ways, Canadian efforts to address this safety issue mirror those in the U.S., though some aspects are more progressive than the U.S. (likely due to the increased frequency and volume of snow and ice). For example, Canadian carriers may have agreements with distribution centers and other customers on

who is responsible for removing snow and ice from “dropped” or staged trailers⁵. Similarities shared by the two countries include:

- stakeholders agree this is a serious safety problem;
- some jurisdictions have specific legislation, while others do not;
- some jurisdictions rely on regulatory interpretation of cargo securement, safe motor vehicle operation and height/weight restrictions;
- tolerance of some additional weight/height from accumulated snow and ice is sometimes allowed at the officer’s discretion.

Similar to the U.S. with no specific federal regulation, snow and ice removal from vehicles resides at the provincial level in Canada. The majority of Canadian provinces do not have specific regulations either requiring the removal of snow and ice from vehicles prior to operation, or provisions to cite a driver if snow or ice falls from a vehicle and causes injury or property damage. However, Quebec has a regulation explicitly prohibiting vehicle operators from allowing snow or ice to fall from their vehicle (Appendix B).

The European Experience

The Research Team contacted several European governments and transportation stakeholder groups (from countries with significant snowfall) and the European Commission. Countries contacted included Sweden, Norway and Switzerland. All interviewees were unaware of specific legislation requiring snow and ice removal, though one contact indicated that there is an awareness of the problem and that some motor carriers use truck washes to remove snow and ice⁶.

Similar to the U.S. and Canada, enforcement may broadly interpret general regulations governing the safe operations of vehicles. These regulations include the roadworthiness of a vehicle and cargo securement regulations. One interviewee indicated that several civil cases have reinforced that motor carriers and drivers may be held liable if a piece of ice falls and causes injury or property damage⁷.

Another interviewee indicated that while this is an issue in Europe, there is no systematic approach for addressing snow and ice accumulation on large trucks⁸. Efforts to quantify the scope of the problem in Europe yielded similar findings for both the U.S. and Canada. A lack of quantifiable data on the frequency of events likely explains the lack of a systematic approach for addressing it. Anecdotal evidence alone may prove insufficient for enforcement, transportation agencies

⁵ Telephone Interview, Bruno Poirier, Genuine Parts Company, March, 2008.

⁶ Email correspondence, Claes Eriksson, Swedish National Road and Transport Research Institute (VTI), April, 2008.

⁷ Email correspondence, Soren Hedberg, Swedish Road Administration. April 2008.

⁸ Telephone interview with Skip Yeakel, Volvo North America, May, 2008.

and private industry to devote significant resources and funding to solving this problem.

Worker Safety

One of the most commonly discussed issues surrounding snow and ice removal is worker/driver safety. Many outside the industry believe that the solution to mitigating this safety risk is for drivers or maintenance personnel to ascend to the top of the truck or trailer to remove the snow and ice. However, the hazards of requiring a driver or maintenance personnel to climb 13-feet in the air, often in icy or snowy conditions, to remove snow and ice from a trailer is a significant safety concern for truck drivers and motor carriers. In many cases, this practice violates federal or state worker safety guidelines.

The U.S. Occupational Safety and Health Administration (OSHA) issues guidelines protecting worker safety and has jurisdiction over facilities defined as “workplaces.” OSHA has issued guidelines for protecting workers from falls and dictates personal protection equipment (PPE) standards for workers using raised platforms or catwalks to remove snow or ice from trailers. This standard is applicable to employees that:

“... are working atop stock that is positioned inside of or contiguous to a building or other structure where the installation of fall protection is feasible⁹.”

However, this standard is only applicable to locations where a fall protection system is feasible. Except in the above scenario:

“The current fall protection standard in general industry (Subpart D) does not specifically address fall hazards from the tops of rolling stock. The new proposed fall protection standard, 55 Fed. Reg. 13360, explicitly excludes rolling stock from coverage¹⁰.”

Rolling stock (i.e. vehicles or trailers) is exempted from this standard due to the nature of trucking and the fact that drivers may have to inspect or perform duties on numerous types of trailers, including van trailers, tankers, grain-hoppers and others. However, the underlying basis of OSHA jurisdiction, the OSHA Act, contains a “General Duty Clause” that:

“requires an employer to provide employees with a workplace that is free from hazards that are recognized by the employer's industry and that are likely to cause death or serious physical harm¹¹.”

⁹ U.S. Department of Labor. Occupational Safety and Health Administration. Standard Interpretations, 10/18/1996, Enforcement of Fall Protection on Moving Stock.

¹⁰ U.S. 29 CFR 1910.28(a)(1).

¹¹ The General Duty Clause, Section 5(a)(1) of the OSHA Act.

If OSHA is notified or an OSHA inspector witnesses a driver or any other employee at a company facility of climbing on top of a trailer without fall protection, the trucking company can be cited for violating the “General Duty Clause” of protecting workers from workplace hazards. Conversely, if the same behavior is reported or observed at a large distribution center, the distribution center can be cited for violating the clause¹². Requiring drivers to clear snow and ice from a trailer top has other implications and would require motor carriers to verify an employee is physically able to perform the job function and has been trained to do so.

Lastly, it should be noted that OSHA guidelines are not enforceable on public roadways, public weigh stations or public rest areas. These areas are not considered a “workplace,” and are therefore outside of OSHA jurisdiction. If an OSHA inspector observed a driver climbing on top of a trailer to clear snow or ice at a public facility, neither the carrier nor the driver could be cited under OSHA guidelines. However, due to worker/driver safety concerns, most carriers strongly discourage employees from climbing tractors or trailers to clear accumulated snow and ice.

Similar to the U.S., there are Canadian workers compensation guidelines that strongly discourage workers from climbing on top of trailers, a height greater than three meters, without a safety harness or restraint device¹³.

¹² Telephone Interview, Christina Cullinan, American Trucking Associations, May, 2008.

¹³ Menzies, James. “Heated Trailer Roofs Coming to Canada.” Truck News. April 2008.

Research Findings – Safety Impact Analysis

The Research Team found a dearth of research and statistics available to quantify the frequency of falling ice incidents, or the number of citations issued to drivers for snow- and ice-related issues. Stakeholders with in-depth knowledge of a variety of safety-related data sources were contacted to discern the availability of data on the frequency or severity of incidents caused by falling ice or snow. Data sources vetted include:

- U.S. federal and state traffic accident and fatality data sources;
- Royal Canadian Mounted Police accident statistics;
- Several state and provincial driver citation databases;
- Insurance industry claim frequency and risk mitigation databases;
- Motor carrier accident data;
- European accident data.

Frequency Analysis

According to the U.S. National Highway Traffic Safety Administration (NHTSA), in 2006 there were approximately 116,000 traffic collisions in which snow or ice was cited as a factor. Most involved property damage only (93,000); another 22,000 were crashes that involved injuries, while 463 crashes resulted in at least one fatality¹⁴. However, the data does not identify which of these incidents involved large trucks. Additionally, there are no details on how many of these accidents resulted from icy road conditions, impaired visibility due to accumulations of snow and ice on vehicles, or snow and ice dislodging from vehicles.

Media Reports

As incidents involving ice dislodging from a truck occur, the stories are often covered by the local media. Oftentimes these news reports are the impetus for state legislatures to pursue tighter regulations mandating snow and ice removal from vehicles, or penalties for drivers operating a vehicle in which snow or ice falls and causes injury or property damage to another motorist.

The Research Team identified the following articles anecdotally documenting the frequency of safety incidents involving snow and ice dislodging from vehicles.

- In February 2008, Canadian news carried reports of ice falling from the top of transport trucks causing serious damage to another truck and car¹⁵.
- In Massachusetts, there were six instances in two days of ice coming from trucks causing property damage to other motorists¹⁶.

¹⁴ National Highway Traffic Safety Administration. "2006 Motor Vehicle Crash Data from FARS and GES." Chapter 2, page 47.

- During the winter of 2007, one storm caused local transportation agencies to receive “dozens of reports of damage being caused by flying ice¹⁷.”

Other news articles offer insight into the scope of the problem of snow or ice falling from different types of vehicles.

- In Pennsylvania, a motorist’s vehicle was struck when a piece of ice dislodged from a school bus¹⁸.
- State police in Pennsylvania noted, during one winter ice storm, that 13 reports were received in one day of snow and ice falling from vehicles, mostly large trucks¹⁹.
- Another article notes that New York State Police recorded 15 accidents resulting from snow or ice dislodging following a winter storm²⁰.

Motor Carrier Interviews

U.S. and Canadian motor carriers representing a cross-section of the trucking industry were interviewed on the frequency of snow and ice issues, potential solutions and industry practice. Carriers interviewed included truckload (TL), less-than-truckload (LTL) and parcel/package carriers.

Motor carrier safety personnel were asked to provide details on the frequency and severity of these incidents. Of the 10+ carriers contacted, none were aware of any incidents related to ice falling from one of their trucks, though one carrier indicated that a piece of ice had fallen from a pickup truck and caused extensive body damage to a company tractor. However, carriers did note that it is not uncommon for truck drivers involved in one of these incidents to be unaware that a piece of ice has fallen from their truck or trailer.

The Canadian motor carriers contacted all agreed that snow and ice accumulation is a safety issue, though most had received few complaints and none had experienced a major incident.

¹⁵Belanger, Joe. “Ice Fell- Falling Ice Causing Problems; Truckers Warned to Clear Snow and Ice from Trailers.” The London Free Press, London, Ontario, Canada, Feb. 11, 2008.

¹⁶Graham, George. “Ice Flying Off Trucks Shatters Windshields.” Republican Newsroom, February 15, 2008.

¹⁷Bloomquist, Sarah. “Flying Ice Danger on Area Highways.” WPVI website, February 17, 2007.

¹⁸National Coalition for School Bus Safety. “School Bus Crash Reports 2007: Motorist Shaken By Ice Flying Off Bus.” March 20, 2007.

¹⁹Lehman, Pamela. “Ice from Truck Smashes into Pennsylvania Ambulance, Hurting 2 in Crew.” Fire Rescue News: Morning Call, December 21, 2007.

²⁰New York State Assembly. News from Assembly member Mike Spano, “Spano Reissues his Call for Passage of Legislation to Protect Motorists from Snow and Ice Debris.” December 19, 2007. (<http://assembly.state.ny.us/mem/>)

Research Findings – Industry Survey

To augment efforts to determine the scope of the problem and identify what solutions, if any, motor carriers are employing, the Research Team developed and made available an online survey targeting motor carriers with operations in areas of snow and ice accumulation. The survey was distributed via the American Trucking Associations Technology and Maintenance Council (ATA TMC) to member carriers. Additionally, the survey was distributed to the ATA's Technical Advisory Group, a formal group of carrier members that collaborate with ATA staff on technical and engineering-related issues. In total, 57 motor carriers, representing both the for-hire and private segments of the industry, responded to the survey.

Industry Survey Results

Less than half of the survey respondents (35%) indicated that snow or ice has fallen from one of their trucks or trailers causing injury or property damage to another motorist. Another 21 percent responded "not sure," underscoring the fact that drivers, and thus motor carriers, frequently are unaware a piece of ice has fallen while a vehicle is in-transit.

Of the 35 percent reporting that they had experienced snow or ice falling and causing injury or property damage, 65 percent indicated that the incident resulted in an insurance claim. Only one respondent indicated that falling snow and ice resulted in litigation. The high incident rates of respondents experiencing falling ice that causes injury or property damage which resulted in an insurance claim may indicate that carriers with past experience were more likely to complete the online survey.

Liability Issues

Research indicates that at least one civil case resulted from falling ice. This case was prompted when a motorist was injured by a dislodged piece of ice from a truck while in transit and was filed on the basis that the driver was liable for not performing a sufficient driver vehicle inspection report (DVIR)²¹. Plaintiffs contended that the driver was negligent in performing the DVIR for not inspecting the roof of the trailer for accumulated ice, even though ice was not observed hanging from top or sides of the trailer.

The investigating officer, a Pennsylvania State Trooper, issued two citations; one to the motor carrier for "systematically maintaining a vehicle with snow and ice on the top of the trailer in violation of the Federal Motor Carrier Safety Regulations (FMCSR) and another to the truck driver for the failure to secure a load (75 Pa.C.S.A. 4107(b)(2))."

²¹ Clark, Delia A. "Ice." Transportation Law Update, Volume 7, Number 4, 2006.

An expert witness contended that the driver violated FMCSR Section 396.13 and that, given the weather conditions, was negligent for not inspecting the top of the trailer for ice. Additionally, the expert witness suggested that the motor carrier should have provided a ladder, or some other means, for the driver to inspect the trailer roof. The court found it was not reasonable, nor was it industry practice, for drivers to inspect trailer roofs for ice accumulation, even though environmental conditions may exist that favor the formation of ice. Both the carrier and the driver were absolved of any negligence or liability.

Motor Carrier Insurers

Several major insurance carriers were contacted to provide insights into the scope of the problem. The Research Team requested data on the frequency of insurance claims for truck damage caused by falling ice as well as the frequency and amounts of insurance settlements for motorists suffering injury or property damage from falling ice. All interviewees indicated that insurance claims are not coded in such a way as to make this information available. One interviewee from a large insurer could not recall any large claims arising from a severe incident involving falling snow or ice²².

Premium Reductions

Some snow removal device vendors suggest in marketing materials that the installation and use of snow removal devices might result in lower insurance premiums for motor carriers. Insurance industry interviews indicate that this is not the case. No premium discounts are associated with installation of snow removal devices due to the inability to ensure that the devices are consistently and appropriately used in every situation that may pose a risk²³. Rather insurers note that if snow removal devices and practices reduce claims, then lower premiums will result.

²² Telephone interview with Dave Melton, Liberty Mutual Insurance, May 2008.

²³ Telephone interview with Wellington Roemer III, Roemer Insurance, May 2008.

Research Findings – Snow and Ice Removal Solutions

Though the risk of falling snow and ice is well recognized, there remains a lack of economically feasible, easily deployable solutions available to motor carriers. However, the industry survey does indicate that some carriers have either purchased or built devices or are using other approaches.

Snow Removal Devices Used – Survey Results

Forty-one percent of respondents listed at least one type of snow removal device used, consistent with the percentage of respondents that answered that they removed snow and ice sometimes or often (47%). Of these respondents, nearly two-thirds (61%) listed the use of one device, while another 39 percent listed the use of multiple devices for snow removal.

Drive-through scrapers were the most commonly used device, followed by some type of platform, truck washes and private contractors. Open ended responses listed under “Other” included a shop door opening and “shovel and elbow grease.”

Of the drive-through scrapers, about half were purchased and half were built in-house. Of the platforms, two-thirds were built in-house, while the remaining were purchased. The majority of respondents ranked the top three devices utilized as doing a “fair” job of removing snow and ice.

Use of Snow Removal Devices

Type of Device	Percent of Total Devices in Use	Percent of Devices at Company Facilities	Device Ratings, Percent of Respondents		
			Poor	Fair	Good
Drive-Thru Scraper	47%	100%	6%	65%	18%
Drive-By Platform (catwalk) or Mobile Lift (Skyjack)	17%	80%		67%	33%
Truck Wash	14%	50%	20%	80%	
Private Contractor	8%	n/a		33%	67%
Other *	14%	n/a	20%	20%	40%

* Does not total to 100% as not all respondents ranked system performance.

User perceptions of individual system advantages and disadvantages are included in the Snow and Ice Removal Devices and Techniques Compendium (Appendix C). The Snow and Ice Removal Devices and Techniques Compendium includes survey respondent feedback as well as anecdotal data collected from stakeholder interviews, including those conducted with:

- Motor carriers;
- Trucking and trucking-related associations;

- Provincial departments of transportation;
- Snow and ice removal experts from other industries.

Vehicle-Based Solutions

Interviewees also identified other potential vehicle-based solutions including:

- Redesigned trailer tops that minimize the thickness, size or likelihood of ice formation;
- Improved trailer aerodynamics that reduce the likelihood of falling ice;
- The use of emerging truck technologies such as ambient temperature sensors to warn drivers or motor carriers of the likelihood of ice formation.

Deicing

The Research Team also investigated the use of deicing in the aviation industry to determine applicability for commercial trucks. The use of deicing for commercial vehicles does not present a viable solution for several reasons:

- The properties of the chemicals needed are vastly different between aircraft and trailer tops.
- The stringent environmental standards which govern the use of deicing chemicals do not make their use practical for the hundreds of thousands of trucks traveling in snowy conditions on any given day.

A more detailed description of aviation deicing and its limitations for trucking is provided in Appendix D.

Research Findings – Industry Practice

The industry survey queried respondents on the frequency of snow and ice removal from the tops of trailers. Over half of motor carrier survey respondents (54%) never or rarely remove accumulated snow or ice. However, over a third of these respondents indicated that they are aware of existing legislation or new efforts to mandate the removal of snow and ice. Virtually all respondents who indicated that their companies never or rarely remove snow or ice had no driver training or snow and ice removal policies. These results may reflect several possible underlying factors:

- The lack of available snow removal devices;
- A lack of empirical evidence has stymied stakeholder efforts to address the problem in a comprehensive approach.

Of those respondents that often or sometimes remove snow or ice, 42 percent remove snow often while the remaining 58 percent remove snow sometimes. Of this group, half do not have policies or training for drivers – suggesting these companies may have an informal intracompany understanding of the need for snow removal, though policies and procedures are not fully integrated with core fleet operations.

Lastly, half of the respondents that remove snow and ice often or sometimes were unaware of existing or pending legislation – suggesting these practices were based solely on improving safety and mitigating safety risks.

When looking at survey respondents in total, nearly three-quarters (74%) do not have policies or training requiring drivers to remove snow or ice.

Carrier Practices

Question	Yes	No	Not Sure
Snow and ice removal policies for drivers?	19%	74%	7%
Arrangements with customers for dropped trailers?	2%	88%	11%

Canadian carriers interviewed report that, prior to travel, the carriers utilize various countermeasures (with varying degrees of success), including:

- Use of the company truck wash;
- Mechanics use long handled squeegee-type devices to push snow off the tops of trailers;
- 3rd party contractors are used to clear snow and ice, typically at a cost of approximately \$50-\$150 per truck (which can create delays for the drivers of several hours);
- Use of snow removal systems (see Appendix C).

These practices, however, only deal with the trailer as it leaves the company facility and do not address snow and ice removal while in transit.

Another commonality among Canadian interviewees was the incorporation of snow and ice removal, and the hazards of falling ice, into several core fleet operational areas including:

- Driver training programs;
- Procedures for removing snow and ice from trailers at company terminals;
- Dispatching/procedural guidelines for drivers picking up trailers with accumulated snow and ice;
- The development of internal and private contractor networks to maximize the availability of snow removal options;
- Driver disciplinary procedures for traveling with accumulated snow and ice on company vehicles or trailers.

Trucking Industry Customers – Shippers, Consignees and Distribution Centers

It appears that few trucking industry customers have snow and ice removal devices or procedures in use at shipping and receiving locations. Just one ATRI survey respondent indicated having an agreement with a customer to remove snow and ice from dropped trailers.

Carrier interviewees indicate that most of their customers consider accumulated snow and ice on trailers as the carrier's problem, namely because it is the carrier's equipment. Interviewees note that third-party contractors are most often used to clear snow and ice from trailers dropped at customer locations, at the carrier's expense. Lastly, interviewees note that there is a reluctance to press their customers for snow removal devices at distribution centers, namely due to initial and maintenance costs, and the concern that these customers will simply turn to the carrier's competitors for freight services.

However, one snow removal device vendor lists several distribution centers in the northeast United States as customers²⁴. As another example, one "home-made" device is located in the regional logistics center for a major hardware chain store. This device was designed and built to specifications at the local facility, which happens to be in a northern "snow-belt" location, about five years ago. This arrangement requires a truck and plow to move snow that has been pushed from trailer tops from the area. The logistics manager reports that every truck in the yard uses the device as needed and it has worked well. The original cost of the H-frame was estimated at \$8,000 and the industrial brushes are replaced from time to time at a cost of approximately \$400 each.

Truckstops and Rest Areas

The National Association of Truckstop Operators (NATSO) indicates that many truckstops operated by their members have truck washes that can be used to

²⁴ www.scrapersystems.com

remove snow, but very few offer any other type of fixed location snow removal devices²⁵. In addition, there is anecdotal evidence of a very small number of truckstops that offer other types of snow removal devices and typically charge \$10-\$30 per trailer. These facilities may play a role in developing a comprehensive network of snow removal options for motor carriers.

The Research Team did not find any evidence to indicate any type of snow removal devices located at traveler rest areas in the U.S., Canada or Europe.

²⁵ Email correspondence with Stephen Beaulieu, NATSO. June 18, 2008.

The Challenges for Snow and Ice Removal

The findings from the literature review, environmental scan, industry survey and interviews all serve to highlight the challenges associated with effectively dealing with or mitigating the safety concerns associated with snow and ice falling from large trucks.

Nature of Trucking

Freight transportation, and in particular trucking, is a 24/7 operation. Drivers work round the clock to deliver freight. However, federal rules regulate the number of hours drivers can work and drive, which means that at any given point in the day drivers will be parked to take off their required hours. This provides an opportunity for snow and ice to accumulate on the top of trailers.

Furthermore, drivers often wait to pick up and deliver freight at customer locations or drop a trailer and pick up a trailer that has been sitting at the customer's facility, again providing opportunities for snow and ice to accumulate on top of the vehicle. Drivers who operate across the U.S./Canadian border also experience long waits to navigate through the various customs and inspection facilities, which in winter months very likely means waiting in snow and ice, again allowing accumulation.

Identifying viable solutions which address the countless areas where drivers could experience an accumulation of snow and ice is perhaps one of the biggest challenges. Essentially, wherever it snows presents an area where snow and ice could accumulate on the top of large trucks.

Worker Hazards

Although drivers or other personnel present one of the lowest cost options for snow and ice removal, they also represent one of the most dangerous options. The tops of trailers are not designed to withstand the weight of a driver on top to clean the accumulated snow and ice. Furthermore, the potential for slips, falls and even death associated with individuals attempting to get to the tops of trailers covered in snow and ice to clean the trailer top far outweigh any potential benefits from this as a solution. The hazards for workers are recognized and in many cases regulated by agencies responsible for worker safety.

The use of platforms and catwalks helps mitigate the risk somewhat by providing safety harnesses for workers, but do not completely eliminate the hazards from the snow and ice. As documented through the interviews, the platforms and catwalks provide a fixed location solution for snow removal but removing ice is more difficult when it bonds to the trailer top.

Availability of Snow and Ice Removal Devices

As documented in the Snow and Ice Removal Devices and Techniques Compendium (Appendix C), there are several devices for snow and ice removal currently available, with patents pending and production forthcoming for additional devices. However, with the exception of one, the current devices all have limitations in terms of removing ice. The other, a Snow Thrower, is purported to do well in removing snow and ice, but has capital costs of over \$70,000, making its viability as a widespread solution extremely limited.

The other issue with fixed location devices, regardless of their efficacy in removing snow and ice, is that they only provide a solution for trucks with access to those locations. Given the 24/7, highly mobile nature of trucking, any widespread solution would likewise need to be available 24/7 to the majority of trucks operating in snow-prone areas.

Vehicle-Based Solutions

Vehicle-based solutions proposed by interviewees generally focus on redesigning trailers to impede the formation of ice sheets and/or improved trailer aerodynamics which would reduce the likelihood of ice falling from the trailer.

Contact with the trailer manufacturer industry group indicates an awareness of the potential safety issues related to snow and ice falling from trailers. However, staff from the Truck Trailer Manufacturers Association (TTMA) reported that TTMA members are unaware of any requests from customers to develop a solution. Additionally, the organization reports that there are no engineering or aerodynamic redesign efforts underway to mitigate the accumulation of ice or snow on truck trailers²⁶.

The challenge for a vehicle-based solution is the time horizon associated with fleets turning over their trailer fleet. Even if a redesigned trailer were engineered, tested, and on the market within 3-5 years, it would still be another 10-15 years before the majority of the existing trailer fleet were replaced, making a vehicle-based solution a more long-term proposition.

²⁶ Email correspondence with Jeff Sims, Truck Trailer Manufacturers Association. May 12, 2008.

Industry Action Plan

Challenges exist but the research has identified some potential action items which, when jointly undertaken by both private and public sector partners, may reduce the safety impacts from snow and ice falling from vehicles. The following outlines proposed actions for the short-, mid- and long-term.

Short-Term

The short-term proposals focus on outreach and education on the issue for all motorists and on exploring the potential for documenting a network of available snow removal devices.

In 2002, the Commercial Vehicle Safety Alliance (CVSA)²⁷ developed and distributed a pamphlet detailing the problem and solutions for removing accumulated snow and ice from commercial motor vehicles²⁸. Among the recommendations are for drivers to:

- anticipate inclement weather and load the vehicle to allow for extra weight accumulation;
- carry appropriate equipment during the winter months to help remove the accumulation of snow and ice;
- remove ice and snow when at a safe location, such as a truck stop or rest area;
- check load weights before ice and snow accumulate.

A revised outreach campaign could be developed which expanded on the original CVSA information by providing a compendium of available snow and ice removal devices and their location. A similar approach was initiated by the Ontario Trucking Association (OTA), with some challenges noted below²⁹.

In recognition of the safety risks inherent in snow and ice accumulation on large trucks, OTA has solicited participation from several stakeholder groups to make snow and ice removal devices available to all truck drivers operating throughout the province. Outreach efforts have targeted carrier members, the provincial government and trucking-related groups that include large shippers and distribution centers.

²⁷ The Commercial Vehicle Safety Alliance (CVSA) is a an international not-for-profit organization comprised of local, state, provincial, territorial and federal motor carrier safety officials and industry representatives from the United States, Canada and Mexico. The mission of CVSA is to promote commercial motor vehicle safety and security by providing leadership to enforcement, industry and policy makers.

²⁸ Commercial Vehicle Safety Alliance. "Ice and Snow." 2002.

²⁹ Telephone interview, Stephen Laskowski, Ontario Trucking Association, April, 2008.

The OTA indicates that there are no snow/ice removal devices at public facilities, like weigh stations or rest stops, or private facilities like truckstops. Several association members own and operate snow removal devices, typically accessible to company drivers only. The more commonly used devices include brush removal devices, snow and ice scrapers and truck washes. Lastly, the OTA has found that there are very few devices located at trucking industry customer locations such as distribution centers or large shippers.

Due to the lack of snow removal devices, the OTA promoted an initiative to develop and publicize a network of member-owned snow removal devices located throughout the province. The plan called for a compendium of devices, available via the internet that provided device location, cost to use (if any) and hours of operation.

However, development of the compendium stalled due to several concerns among member carriers including:

- Worker safety issues;
- Device maintenance costs and snow removal costs;
- Vehicle damage liability issues;
- Facility security-related issues and 24-hour availability;
- Violation of Customs-Trade Partnership Against Terrorism (C-TPAT) provisions;
- Potential safety issues with trucks waiting to use the device.

Though the OTA's vision of a network of snow removal devices has not yet materialized, the OTA continues to seek solutions to mitigate this safety risk and advocate a comprehensive solution available to all trucks traveling in Ontario.

In the U.S., the American Trucking Associations (ATA) could convene a stakeholder working group to explore the potential for a similar compendium, combined with an outreach and education component for all vehicle drivers, carriers, law enforcement, truckstop operators, distribution centers and others. Potential members for the stakeholder working group include:

- ATA
- American Automobile Association (AAA)
- CVSA
- State Trucking Associations
- NATSO
- FMCSA
- National Industrial Transportation League (NITL)

Mid-Term

One area regularly frequented by large numbers of trucks is state weigh stations and ports of entry. A mid-term solution would be to explore the possibility of installing snow removal devices at these facilities for use by all trucks passing through. This public sector approach has been implemented in the Canadian provinces of New Brunswick and Nova Scotia, where fixed snow removal devices are available at public weigh stations.

New Brunswick makes snow removal devices available at seven fixed, public weigh stations. If the weigh station is open, the scale operator may require a truck driver to clear snow and ice, or the driver may use the device voluntarily. The device consists of a platform/scaffolding which a driver uses to manually scrape off snow with a long-handled, heavy-duty scraper/squeegee, which the province has custom made.

Transportation officials report these devices are more effective at removing snow than ice³⁰. Officials indicate the cost of removing piles of snow near the devices are minimal and are included in the costs of using snowplows to clear the parking lot and access/egress ramps. Lastly, there is anecdotal evidence that, since these facilities are open year round, the catwalks are also used by drivers with flatbed or logging trailers to check the security of their loads while in transit. The safety features, including the safety harness, appear to be adequate as no safety incidents have been reported³¹.

New Brunswick DOT personnel indicate that the platforms, though low tech, have worked well and believe that the availability of these devices to all truckers have reduced snow and ice falling incidents. In addition, interviewees indicate that these devices have required little, if any, maintenance³².

Based on the success of this model in New Brunswick, Nova Scotia purchased two fixed scrapers from Scraper Systems, Inc. in 2007. One scraper is located in Amherst, while the other is located outside of Halifax. The devices are available to all trucks passing through the weigh stations.

Interviews with transportation industry professionals from these provinces indicate that these devices work well at removing snow and that there has been no reported safety problems associated with the operation of these devices.

The lack of proliferation of these devices across other Canadian provinces may be explained by three factors:

³⁰ Telephone interview with Nancy Lynch, New Brunswick Department of Transportation, April 2008.

³¹ Telephone interview, Diane Nash, New Brunswick Department of Transportation, July, 2008.

³² Telephone interview with Nancy Lynch, New Brunswick Department of Transportation. April 2008.

- 1) Cost of installation – ranging from \$12,000 for “catwalks” to \$18,000 or more for fixed scrapers;
- 2) Concerns over the ongoing costs associated with removal of snow that accumulates as the trailers are cleared;
- 3) Potential provincial liability for falls or injury from drivers falling from the platform or damage to vehicle equipment.

This mid-term solution clearly has associated costs, both capital costs for purchase and installation of the devices and ongoing maintenance and snow removal costs. However, it should be noted that the availability of the devices at public weigh stations should not be used as an opportunity to ticket drivers for overweight violations resulting from the accumulated snow and ice. Instead, the installation of devices at public sector facilities should provide a proactive safety solution by allowing drivers to clear the snow and ice prior to being weighed.

An industry working group comprised of motor carrier associations, law enforcement and state Departments of Transportation could collaborate to explore the viability of this potential solution.

Long-Term

Perhaps the greatest potential exists in vehicle-based solutions; redesigned trailers which impede the formation of ice sheets or lessen the potential for falling ice would eliminate the challenges with the 24/7, highly mobile nature of the trucking industry. The newer trailers would also eliminate the hazards associated with drivers or other personnel cleaning trailer tops.

However, given that the average trailer life is 10-15 years, widespread deployment of the redesigned trailers as the national trailer fleet turns over makes this solution a long-term proposal.

As a first step, a joint meeting with trailer manufacturers and motor carriers should be held to reach an understanding on the issue and explore potential solutions.

Appendix A – Existing and Proposed State Regulations

Connecticut: In 2008, three separate bills were introduced in the Connecticut legislature calling for tighter regulation of snow and ice on motor vehicles. One of the bills, sponsored by Governor Rell, would fine drivers \$200 to \$1,000 for ice that becomes dislodged and causes a crash or injury³³. A second proposal targeted only commercial motor vehicles, while the third bill would allow enforcement to cite vehicle operators for traveling with accumulated ice or snow. However, none of the three proposed bills were passed.

Massachusetts: In 2002, a piece of ice fell from a tractor-trailer and came through the windshield of a passing motorist, causing significant injury. The injured motorist has since been a vocal proponent of increased regulation of falling ice. In 2005, the state legislature considered, but did not pass, a proposal which sought to impose a fine of up to \$500 or a jail term of up to six months for drivers who “threaten public safety by failing to scrape their vehicle clean³⁴.”

While statewide legislation did not pass, Massachusetts does have a regulation exclusive to the Massachusetts Turnpike. The Massachusetts Turnpike Authority may prohibit vehicles from using the roadway if debris, including snow or ice, could fall from the vehicle and “endanger individuals or property³⁵.” The Massachusetts Turnpike Police have the authority to fine drivers \$100 for failing to clear vehicles, but the law is not applicable to other publicly owned roads and highways in Massachusetts³⁶.

New Jersey: In New Jersey, drivers may be fined \$200 to \$1,000 for autos and \$500 to \$1,500 for trucks if snow or ice dislodges from a moving vehicle and causes injury or property damage.

New Jersey Permanent Statutes

39:4-77.1 Snow, ice dislodged from moving vehicle causing injury, property damage; penalties.

1. When snow or ice is dislodged from a moving vehicle and strikes another vehicle or pedestrian causing injury or property damage, the following penalties shall apply: The operator of a non-commercial motor vehicle shall be subject to a fine of not less than \$200 or more than \$1,000 for each offense.

The operator, owner, lessee, bailee or any one of the aforesaid of a commercial

³³ Associated Press. “Trucking Group to Seek New Snow Removal Methods.” Boston Globe, March 11, 2008.

³⁴ Wall, Lucas. “Bill Aims to Clear Snow, Ice of Autos.” Boston Globe, September 14, 2005.

³⁵ Code of Massachusetts Regulations, Title 730, Chapter Seven, Section 7.05f.

³⁶ Graham, George. “Ice Flying Off Trucks Shatters Windshields.” Republican Newsroom, February 15, 2008.

motor vehicle shall be subject to a fine of not less than \$500 or more than \$1,500 for each offense (L.1997,c.124,s.1).

In 2005 and 2006, the New Jersey state assembly considered two similar bills mandating that drivers remove snow and ice from vehicles prior to travel³⁷. Neither bill passed. In January 2008, the Senate Transportation Committee released a 2007 version of the bill, closely resembling previous proposals that would allow police to cite drivers for failing to remove ice or snow from all vehicles³⁸. Violators would face fines of \$35-\$75, but no license points would be assigned. Under this proposed legislation, drivers would not be responsible for accumulation that occurred while the vehicle was in transit. Similar to past efforts, this proposal was not passed.

New York: In 2005, legislation was introduced in the New York General Assembly, similar to the New Jersey proposed laws, which imposes fines for motorists who do not remove snow and ice from their vehicles before driving. The proposal was prompted by a fatality that occurred in nearby New Hampshire when a 9-foot piece of ice dislodged and flew from the top of a large truck, causing the driver hit by the ice to lose control and crash into a third vehicle³⁹.

Fines would range from \$150 to \$850 for non-commercial vehicles and \$450 to \$1,250 for commercial vehicles. Under this bill, motorists would have three hours after the end of a snowfall to remove snow and ice from their vehicles. For safety purposes, drivers would not have to stop during a snowstorm to clean their vehicles. The General Assembly did not pass the proposal.

In 2007 Assemblyman Spano reissued a call for passage of this legislation, first proposed by Spano in 2001⁴⁰. Several bills were introduced in previous years by other assembly members calling for the removal of accumulated snow and ice prior to travel with penalties ranging from points against a driver's license to fines⁴¹. All of these bills were referred to the Transportation Committee, though none have been passed.

Pennsylvania: A Christmas 2005 fatality accident on State Route 209 was caused by an eight-inch thick piece of ice dislodging from a moving truck and striking another vehicle⁴². This incident garnered support and helped pass legislation which had previously failed in the Pennsylvania General Assembly.

³⁷ 2005- Assembly Bill No. 4012, 2006- Assembly Bill No. 959, 2007- Senate Bill No. 2640.

³⁸ Associated Press. "Law Would Require Ice, Snow to be Removed from Vehicles." The Star Ledger, January 28, 2008.

³⁹ New York State Assembly. "Tedisco Introduces Bill Requiring Vehicles Be Kept Free of Snow and Ice," January 10, 2005. <http://assembly.state.ny.us/mem/?ad=110&sh=story&story=12330>

⁴⁰ New York State Assembly. News from Assembly Member Mike Spano. "Spano Reissues his Call for Passage of Legislation to Protect Motorists from Snow and Ice Debris." December 19, 2007. <http://assembly.state.ny.us/mem/>

⁴¹ Bills introduced include A03741, A05233, A05773, A08049, S01742 and S03375.

⁴² Thenewspaper.com. "Pennsylvania Bill Would Ticket Cars, SUVs Covered in Snow." January 3, 2006. Article from: www.thenewspaper.com/news/08/874.asp

The legislation, adopted in 2006, subjects the operator of the vehicle to fines of not less than \$200 and not more than \$1,000 for each offense of a falling piece of ice causing serious injury or death⁴³.

Though currently there is no provision in Pennsylvania requiring drivers to clear vehicles of snow and ice prior to travel, legislation was proposed in 2007 that mandated snow removal as well as increased fines up to \$1,000 for non-commercial vehicles and \$1,500 for commercial motor vehicles for each offense of falling ice causing injury or property damage⁴⁴.

Other States

Though most states lack regulations specific to snow and ice, there are several related regulations that include:

- **Alaska:** snow and ice may not obscure windshield visibility.
- **Georgia, Iowa, Michigan, and Nebraska:** may issue citations if the vehicle is considered a danger.
- **New Hampshire:** may issue citations under negligence for snow and ice falling from a vehicle.
- **Washington D.C.:** enforcement may stop a motorist for traveling with accumulated snow and ice.

In addition to statewide regulations, there are a few roadway-specific regulations for removing snow and ice. To mitigate the dangers of falling ice, the Indiana, Massachusetts and Ohio Turnpike Authorities may deny a vehicle's access until accumulated snow and ice has been removed.

⁴³ Pennsylvania Consolidated Statutes. The Vehicle Code (Title 75), Part III, Chapter 37, Subchapter A, Section 3720.

⁴⁴ Thenewspaper.com. "Pennsylvania Bill Would Ticket Cars, SUVs Covered in Snow." January 3, 2006.

Appendix B – Canadian Provincial Regulations

Quebec: In 1986, the province of Quebec enacted legislation that prohibited motorists from allowing any substance to fall from their vehicle during travel on public roadways. Recently the regulation was amended to explicitly prohibit snow or ice falling from a vehicle.

Quebec Highway Safety Code, Section 498 (amended)

No person may dispose of, deposit or throw snow, ice or any other substance upon a public highway or allow any other person to do so or, when driving a vehicle, allow snow, ice or any other substance to fall from the vehicle onto a public roadway. Fine of \$60 for violation plus \$10 fee.

Other Provinces

Similar to states with no specific regulations, several Canadian jurisdictions broadly interpret regulations governing commercial motor vehicle operations to enforce the removal of accumulated snow and ice or to cite a driver if ice falls and injures a motorist or causes property damage. The most commonly employed regulations are cargo securement and maximum vehicle size/weight regulations.

New Brunswick, Nova Scotia and Ontario: None of these provinces have enacted legislation specifically requiring the removal of accumulated snow and ice from vehicles or penalties for operating a vehicle from which ice or snow falls causing property damage or injury to another motorist⁴⁵.

However, transportation officials in New Brunswick indicate that cargo securement regulations do not apply to falling snow and ice as it is not considered cargo, though drivers may be cited for height or weight violations caused by snow or ice buildup. Conversely, officials in Nova Scotia may cite drivers for operating a vehicle with an unsecured load⁴⁶. Similarly, in Ontario, drivers may be charged with load securement violations if snow or ice falls and causes property damage or injury to another motorist. A violation levies a fine of \$110⁴⁷.

⁴⁵ Telephone interview with Nancy Lynch, New Brunswick Department of Transportation. April 2008. Telephone interview with Don Evans, Nova Scotia Department of Transportation, July, 2008. Telephone interview, Stephen Laskowski, Ontario Trucking Association, May, 2008..

⁴⁶ Ibid..

⁴⁷ Belanger, Joe. "Falling Ice Causing Problems." London Free Press, February 11, 2008.

Appendix C – Snow and Ice Removal Devices and Techniques Compendium

Type of Removal	Description and Cost	In Use or Proposed	Advantages	Disadvantages
Snow Scraper	<p>Device mounted on H-type frame that a tractor-trailer can pull under to scrap snow from top of trailer. Devices use a blade or snow plow type device that can be raised or lowered (using a hoist system or manual operation) to accommodate varying heights of trailers. Blade device is sometimes tilted or in a “v” shape to allow snow to fall to side of trailer rather than behind trailer as it is removed.</p> <p>Several commercial versions available from vendors and a number of “home-made” devices are in use.</p> <p>Priced from \$15,000 - \$18,000 per scraper.</p>	<p>In various carrier locations in U.S. and Canada; over 100 installations in the Northeast and Midwest U.S and Canada.</p>	<p>Removes snow from top of trailer.</p> <p>Customers note a trailer can be cleared in one minute.</p>	<p>May not remove ice.</p> <p>Some models require further removal of snow that is scraped from the top of trailers.</p> <p>Available at fixed locations only; not available for trailers parked at shipper or other sites not on location.</p> <p>If privately owned, limited accessibility.</p> <p>Limited use with combination trailers; scraped snow left behind the trailer may raise the second trailer as vehicle drives through scraper, causing damage to the top of the second trailer.</p> <p>Only for use on trailers with flat roofs.</p> <p>Does not work well on intermodal containers with corrugated roofs.</p>
Snow Brusher	<p>Brushers utilize a frame similar to scraper devices. The brush rotates at high speeds, similar to brushes used</p>	<p>One device on the market, the Rooster⁴⁸.</p> <p>Another device, Durasweep, is</p>	<p>Less build-up of piles of scraped-off snow.</p> <p>Vendors estimate a trailer can be</p>	<p>May not remove ice.</p> <p>Available at fixed locations only; not available for trailers parked at shipper or</p>

⁴⁸ www.jdtrailerprotection.com

	<p>in a car wash.</p> <p>Priced from \$12,000 to \$15,000.</p>	<p>expected in 2009⁴⁹.</p>	<p>cleared in one to five minutes.</p> <p>Different types of brushes may be used for different vehicle types (for example, tanker trucks, and intermodal containers with corrugated roofs).</p>	<p>other sites not on location.</p> <p>If privately owned, limited accessibility.</p>
Snow Thrower	<p>The snow thrower utilizes an H-frame, similar to snow scrapers and snow brushes.</p> <p>Three tines rotate and throw the snow as far as 20 feet.</p> <p>Capital costs of approximately \$70,000.</p>	<p>Six currently in use, all located in Canada.</p>	<p>Removes snow and ice well⁵⁰.</p> <p>Less build-up of piles of scraped-off snow.</p> <p>Vendors and customers estimate a trailer can be cleared in less than one minute^{51 52}.</p>	<p>Available at fixed locations only; not available for trailers parked at shipper or other sites not on location.</p> <p>For use only on trailers or containers with a flat roof.</p>
Third Party Contractors	<p>Independent snow removal contractor on-call to remove snow from trailer tops as needed. Contractors generally use ladders and shovels.</p> <p>May cost \$50 or more for each trailer. Carriers report that one trailer can take up to 3 hours and cost \$150 depending on amount of snow.</p>	<p>In use by various carriers in Canada.</p>	<p>Snow removal as needed.</p> <p>No capital investment.</p> <p>Contractors have ability to travel to where trailers need cleaning.</p>	<p>Liability issue should contractor fall or become injured during removal.</p> <p>Time delay; 30 minutes to clear a trailer plus contractor travel time or possible delay.</p> <p>Significant time delay if several trailers need to be cleared.</p>
Truck Wash	<p>Use truck wash facilities to loosen and remove</p>	<p>Used by</p>	<p>Relative widespread</p>	<p>Available at fixed</p>

⁴⁹ www.durasweep.com

⁵⁰ Telephone interview, Serge Poulin, Transport Couture et fils, July, 2008.

⁵¹ www.yetisnowremover.com

⁵² Telephone interview, Serge Poulin, Transport Couture et fils, July, 2008.

<p>Facilities</p>	<p>snow and ice from trailer top.</p>	<p>several carriers.</p>	<p>availability. Snow and ice can be washed off quickly. No startup costs.</p>	<p>locations only. Driver must pay 3rd party locations at the time of wash; carrier do not necessarily reimburse driver for wash. May not remove all snow or ice.</p>
<p>Snow and Ice Removal Platforms and Catwalks</p>	<p>These devices consist of a mobile or fixed platform with scaffolding-type structures that allow trucks to pull along side. The scaffolding provides a safety harness for the driver and gives the driver access to the trailer top so that snow and ice can be manually removed. Local DOT personnel unaware of drivers falling from the platform⁵³. Priced from \$9,500 to \$18,000.</p>	<p>Used in Canada; available at permanent New Brunswick weigh stations and several carrier terminals.</p>	<p>Snow is easily removed. Very low maintenance⁵⁴. May be purchased or built. May be constructed of metal or wood. Also used by flatbed or specialized carriers to check load straps, bulk dry materials⁵⁵.</p>	<p>Ice removal is still difficult if ice has bonded to top of trailer. Driver may not be able to remove all snow and/or ice. Drivers or other employees risk falls from elevated platforms.</p>
<p>Driver slam on brakes while driving around the parking lot or truck yard prior to travel.</p>	<p>While at a company or customer facility, drivers are instructed to gain minimal speed and slam on the brakes to dislodge any accumulated snow or ice. This practice may be more effective if ice is broken into smaller pieces by “flexing” trailer body.</p>	<p>Anecdotal evidence suggests some carriers instruct drivers to do this.</p>	<p>No capital costs.</p>	<p>Practice may not dislodge ice. Cargo damage if trailer is loaded. Damage to vehicle components such as air-brake lines.</p>

⁵³ Telephone Interview, Nancy Lynch, New Brunswick Department of Transportation, April 2008.

⁵⁴ Telephone Interview, Diane Nash, New Brunswick Department of Transportation, July, 2008.

⁵⁵ Ibid.

<p>Heated Trailer Roof Tops⁵⁶</p>	<p>This system prevents snow and ice from collecting on the top of trailers by heating the trailer top. It uses a series of solar panels (10 for a 53' trailer) which capture solar energy stored in small watch-sized lithium batteries. When the temperature drops below 32° Fahrenheit the system turns on. When the temperature is above freezing it turns off. The batteries last up to 24 hours before needing to be recharged by the solar panels.</p> <p>The system is reported to weigh approximately 78 lbs and cost about \$300 per trailer.</p>	<p>Developed by UK company; testing scheduled for Fall, 2009.</p>	<p>Will keep snow from accumulating on trailer.</p> <p>Solar powered panels.</p> <p>System activates only when needed.</p> <p>System works automatically on tethered or untethered trailers.</p>	<p>Not yet available.</p> <p>Battery life is short, approximately 24 hours between charges.</p>
<p>Net Safety Top for Trailers⁵⁷</p>	<p>This patent is for a mesh cover that may be deployed on a permanent basis or unfurled as a trailer cover. It is based on the covers used on open trucks to prevent debris from being blown out. The mesh is designed to hold the snow and ice that collects on the top a trailer, forcing the ice accumulation to break into small lumps rather than dislodge in large sheets. The mesh top cover is held slightly above the top surface of the trailer and has free spacing in the mesh</p>	<p>Not currently in use.</p>	<p>Keep ice from bonding to trailer top in large slabs.</p>	<p>Not known.</p>

⁵⁶ Menzies, James. "Heated Trailer Roofs Coming to Canada." Truck News, April, 2008.

⁵⁷ <http://www.freepatentsonline.com/6485083.html>

	<p>such that any snow or ice that forms on the top of the trailer is captured in the mesh surface. The mesh can be attached to the top of the trailer by several different methods.</p>			
<p>Re-route Exhaust to Trailer Top⁵⁸</p>	<p>Exhaust from the tractor's smoke stacks could be routed via flexible hosing to a grid of piping covering the trailer roof. The heat generated by the exhaust would melt and/or keep ice from forming on the trailer top.</p>	<p>Not currently in use for snow and ice. However, the practice is in use by dump trucks that haul asphalt.</p>	<p>Renewable source of energy.</p>	<p>No solution for accumulations while trailer is parked.</p> <p>Unknown how long it would take for engine heat to loosen ice prior to start of trip if ice had accumulated to un-tethered trailer.</p> <p>Need for carbon monoxide detectors in trailers to detect leaks to protect fork-lift operators and any consumable loads.</p>

⁵⁸ Telephone Interview, Elmer Troyer, professional truck driver, response to Dave Nemo radio talk show on the topic of snow and ice accumulation on trailers, April 21, 2008.

Appendix D – Deicing in Aviation

Deicing serves two purposes; to melt the ice and to keep ice from forming on the surface. There are many types of chemical deicing in use in the aviation industry for clearing and deicing aircraft and in roadway maintenance for clearing and deicing pavement and bridge surfaces.

Ice can form and bond to any and every surface. The bond is typically strong enough that breaking it requires a great deal of heat or chemicals⁵⁹. Most aircraft deicing currently uses propylene glycol-based deicing fluids. These fluids are sprayed on aircraft to lift accumulated ice and prevent ice buildup. The deicing technologies for aircraft do not appear to be applicable to trailer tops as the requirements for deicing and the properties of the chemicals needed are vastly different in the two situations.

Deicing chemicals must comply with stringent standards put in place to protect critical structural areas on the aircraft. This includes immediately evaporating from the surface of aircraft. For commercial motor vehicles, there is a need for the chemical to melt the ice and then adhere to the surface to prevent ice from bonding to the surface⁶⁰. Furthermore, deicing chemicals are regulated by strict environmental standards governing their use and disposal to minimize impacts on the surrounding environment.

Another version of chemical-based deicing is a hybrid system that employs both deicing chemicals and hot air. This system greatly reduces the amount of deicing chemicals needed to deice an airplane. However, its effects are short-lived⁶¹.

Infrared Deicing Technology

Federal Aviation Regulations (FARs) prohibit takeoff when snow, ice or frost is adhering to wings, propellers, control surfaces, engine outlets and other critical surfaces of the aircraft. For situations where ice is a problem on aircraft the common practice involves a sequence of deicing prior to takeoff. In most cases this is accomplished by the use of heated aqueous solutions of freezing point depressant (FPD) fluids that are used for deicing, followed by anti-icing fluids which are thicker and have a lower freeze point.

These anti-icing fluids provide a protective film on the aircraft surface, which delays the reformation of ice, snow or frost. These fluids are usually composed of ethylene and propylene glycol combined with water and other ingredients. These deicing fluids create environmental problems as glycol runoff creates a

⁵⁹ Telephone Interview, Russ Alger, Institute of Snow Research, Keweenaw Research Center, Michigan Technological University, April 2008.

⁶⁰ Ibid.

⁶¹ Currents. "Blowing Hot Air." Summer, 2004, p. 45.

significant impact on nearby water systems. Glycol-contaminated storm water runoff can deplete dissolved oxygen levels and threaten aquatic life. Additionally, the deicing fluids contain corrosion and rust inhibitors that are considered toxic to biological systems.

In response to escalating environmental concerns and economic costs of chemical deicers, several groups have begun to look for alternative ways to deice aircraft. In the mid-1990s, Process Technologies Inc. (PTI) developed a gas fired radiant heat unit (patented Energy Process Unit) capable of melting ice/snow from the surfaces of an aircraft. Testing on aircraft components resulted in no observable degradation of materials.

Between 1995 and 1997 a series of tests using the system were conducted. One test demonstrated that approximately one quarter inch of ice coating was deiced in approximately 5 minutes inside a “drive-thru” shelter at an airport in upstate New York. In other tests the deicing times ranged from 5 to 9 minutes depending on power settings. Hourly fuel cost was estimated at less than \$100/hour.

In April 1997, PTI and Prior Aviation, the fixed-base operator (FBO) at the Buffalo, New York airport, jointly designed, built and operated the first infrared deicing facility. The FAA granted funding eligibility for this type system in July 1997. Also in 1997, Congress earmarked \$970,000 of FY98 Facilities & Equipment funding for the installation of an infrared deicing facility at Rhinelander, Wisconsin. This facility went online in February 1998.

While infrared heating technology may have some appeal for use on trailers, clearly the need for a “drive-thru” facility and the cost of construction of such a facility would make this technology economically and operationally not viable⁶².

Anti-Icing Coatings

Appealing Products, Inc., with funding from the National Science Foundation and the State of North Carolina, is developing a surface nanolayer which is designed to prevent icing. In the examples, aluminum was coated with polyurethane and an epoxy with carbon fiber surface was coated with polyurethane to prohibit the formation of ice on the surface⁶³. Further research is being pursued in this area and it appears that developments in this area might also have promise for the trucking industry as well. If ice does not form on the trailer top surface then removing snow will be a more effective way to control the ice slab problems for trailers.

⁶² Federal Aviation Administration. Airport Technology, Research and Development, information from web site <http://www.airporttech.tc.faa.gov/Safety/infrared.asp> (as of May 9, 2008).

⁶³ Information from Appealing Products, Inc. web site. www.appealingproducts.com as of May 8, 2008.



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