

Truck Parking Needs at Rest Areas

Environmental Scan



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Jeannette Montufar, Ph.D., P.Eng.
Jonathan D. Regehr, P.Eng.
Garreth Rempel, EIT

*Montufar & Associates
Transportation Consulting
Winnipeg, Manitoba*

and

Benjamin Jablonski
Greg Blatz

*University of Manitoba Transport Information Group
Winnipeg, Manitoba*

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EXECUTIVE SUMMARY

The motor carrier industry is a key component of the Canadian economy. Growth in truck traffic volumes in Canada and the United States (U.S.) has caused an increase in demand for truck parking spaces at both public and private rest areas. This, coupled with recent changes to the Commercial Vehicle Drivers Hours of Service Regulations, has raised concerns about the available supply of truck parking spaces and the current truck parking demand.

With growing demand for truck transportation on Canadian roads, and the potential need to develop a Canadian strategy for truck parking on Canada's National Highway System, it is important for decision-makers to understand the issues associated with inadequate truck parking, as well as current best practices regarding this issue. To assist in providing this understanding, Montufar & Associates, in association with the University of Manitoba Transport Information Group (UMTIG), were commissioned by Transport Canada to conduct a comprehensive review of relevant literature about truck parking at rest areas. Literature findings were supplemented with discussions with industry experts from Canada and the U.S. to gather information about other recent initiatives regarding truck parking issues that may not be available in the literature.

The purpose of this study is, therefore, to conduct a comprehensive literature review, supplemented with a survey of industry experts from Canada and the U.S., about the availability of truck parking at rest areas. More specifically, this research addresses the following: (1) the magnitude of the issue involving truck parking in various jurisdictions in the U.S., Canada, and Australia; (2) identification of the specific issues associated with the shortage of parking spaces for trucks at rest areas; (3) determination of how the issues have been addressed by different jurisdictions; and (4) processes used to engage stakeholders in situations where truck rest area issues have been addressed.

The project team conducted a comprehensive search of literature published in the last 10 to 12 years in Canada, the U.S., and Australia, as directed by Transport Canada. The literature search included a variety of data and information sources: (1) engineering periodicals and journals; (2) readily-available papers and texts; (3) conference proceedings; (4) special interest groups; (5) special government reports; and (6) documents on the World Wide Web. The review identified nearly 100 publications that addressed the issues being investigated. However, after further examination of these documents, 60 were found to be directly applicable to this study. The project team held interviews, either in person, or by other means, with industry experts representing the Transportation Research Board (TRB) committees on Truck and Bus Safety, Motor Vehicle Size and Weight, and Trucking Industry Research. We also communicated with the Canadian Trucking Alliance, the Canadian Private Motor Truck Council, the Owner Operator Business Association of Canada, and various provincial officials involved in truck transportation.

The following are highlights from the environmental scan:

- With respect to the magnitude of the issue, the scan reveals that there could be a shortage in commercial vehicle parking in U.S. and Canadian jurisdictions. This shortage, which is expected to increase over the next few years in both countries, is a direct result of increasing truck traffic flows and general demand in trucking operations. Furthermore, increases in truck sizes have decreased space availability since trucks may occupy multiple spaces. This is particularly important along corridors which allow trucks with multiple trailers, such as long combination vehicles (LCVs).

- Shortages in truck parking capacity contribute to truck drivers driving while fatigued and/or parking illegally, both of which can cause accidents. Drivers may choose to park at locations such as highway shoulders or off-ramps because they may not be able to find available parking spaces, yet have to park to avoid exceeding their allowable hours of work. Illegal truck parking is dangerous because of the conflicts that occur as a result of the parked trucks (e.g., visibility problems when accelerating to merge with other traffic, presence of obstacles in the clear zone, others). Illegal parking also results in problems such as shoulder damage, fuel and oil spillage, soil erosion, noise, dust, and illegal activities.
- There is a limited amount of literature which specifically identifies benefits associated with providing truck parking for commercial vehicles. In most cases, the benefits of providing parking are expected to be derived from addressing existing issues associated with limited parking availability.
- Stakeholder involvement is viewed as important to the success of alleviating truck parking issues. A wide variety of interests—from the public and private sectors—should be represented by stakeholder groups. The literature recommends the following stakeholders and methods for obtaining data and input into commercial vehicle parking studies: stakeholder focus groups, trucker surveys at private truck stops and public rest areas, interviews with trucking companies, interviews with truck stop managers, and interviews with highway patrol representatives. The stakeholders to involve would, of course, vary from jurisdiction to jurisdiction.
- Various jurisdictions have developed truck parking strategies to manage or address truck parking demand on their highway network. For the most part, these strategies involve: (1) cost-sharing opportunities such as public-private partnerships to address the truck parking shortage; (2) parking policy revisions; (3) implementation of intelligent transportation systems to provide real-time information on parking availability; and (4) use of available facilities such as weigh scales and maintenance yards for temporary parking.

This report also identifies the following issues to consider in addressing truck parking needs in Canada:

- *Supply versus demand:* Determining whether there is an adequate supply of truck parking spaces to meet current and future demands could involve:
 - Developing a nationwide inventory of existing parking facilities and their characteristics (including public rest areas, private truck stops, pullout facilities, and any other facility routinely used to accommodate parked trucks). This inventory should include remote northern areas where 2-lane undivided roads are common and where there are few areas for a driver to safely pull over.
 - Developing analytical tools to model current and future demand for truck parking, including detailed demand characteristics such as spatial and temporal distributions, and the demand for certain types of amenities.
 - Comparing truck parking supply and demand characteristics at local levels.

- Conducting surveys to supplement quantitative findings with the qualitative observations and opinions of members of the trucking industry (e.g., truck drivers, trucking company representatives, truck stop operators, shippers and receivers).
- *Evidence of issues associated with truck parking in Canada:* Although there is general agreement about the need to enhance truck parking in Canada, there is little documented evidence of the safety, infrastructure, environmental, and economic impacts of a lack of truck parking in certain jurisdictions.
- *The role of the public sector in addressing truck parking issues:* The main objective of the new HOS regulations in Canada is to reduce fatigue-related accident risk by providing drivers with additional rest opportunities.
- *Stakeholder involvement:* The scan reveals the importance of involving stakeholders in the process of identifying issues associated with inadequate truck parking and developing strategies to deal with these issues. At a minimum, stakeholder groups could include representatives from the public sector (from municipal, provincial, and possibly federal governments), truck drivers, trucking companies, trucking and automobile associations, shippers and receivers, truck stop operators, highway enforcement personnel, local chambers of commerce, and relevant special interest groups.
- *Public-private partnerships:* There is general agreement in the literature, although not explicitly quantified, that one of the most effective strategies to balance cost while increasing the number of suitable rest areas is through public-private partnerships.
- *Unique Canadian issues that may require different strategic approaches than those implemented in other countries:* Based on the literature and interviews with industry experts, the following uniquely Canadian issues are identified:
 - There is a need to accommodate the parking requirements for LCVs—particularly Turnpike doubles—which are now routinely permitted on an extensive network throughout the Canadian Prairie Region, on selected routes in the provinces of Quebec, New Brunswick, Nova Scotia, and British Columbia, and potentially on a corridor connecting to the Greater Toronto Area. Special design considerations are required to meet the geometric requirements for parking and maneuvering these vehicles at rest areas, truck stops, and highway pullouts. In addition, LCVs are subject to unique regulatory conditions—over and above HOS and other regulations that apply to commercial vehicles which operate without special permits—that require them to stop in inclement weather and to conduct periodic vehicle safety checks. From a logistical perspective, many trucking companies operate LCVs by switching trailers at specific locations. For example, a Turnpike double driver based in Winnipeg, Manitoba may haul two trailers bound for Calgary, Alberta to a specified location near the Saskatchewan-Manitoba border. At this location, another Turnpike double driver with trailers bound for Winnipeg meets the westbound driver and switches trailers. These switches require adequate space to complete safely.
 - Many Canadian highways are characterized by relatively low traffic and truck traffic volumes. Further, portions of the principal highway network do not function as freeways (which normally bypass population centres), and much of the Canadian National Highway System consists of two-lane, undivided roads. Many centres

situated on these routes rely on business resulting from traffic and truck traffic passing through their community. As such, there are potential economic impacts for these communities that depend on the types and locations of facilities developed to accommodate truck parking.

- *Short-term and long-term strategies to address truck parking issues:* The scan provides a wide range of options in dealing with truck parking demands. Best practices include:
 - the development of national-level guidelines for the spacing and design of public truck parking facilities, with appropriate consideration of private sector accommodation of truck parking needs;
 - the use of ITS technologies to provide real-time information about the location and availability of truck parking spaces;
 - the development of public-private partnerships to share or reduce facility construction and maintenance costs and enable appropriate developments to meet truckers' needs;
 - ensuring that driver security concerns at truck parking facilities are addressed;
 - seeking cost-effective options to redesign and rehabilitate existing facilities to address truck parking shortages; and
 - providing additional truck parking spaces, where needed and financially and/or commercially feasible, through the construction of new facilities.
- *Urban parking facilities:* Communication with industry experts, more so than the literature, revealed that there are also truck parking supply issues within urban areas. Although this is a different matter from that involving inter-urban rest areas, truck parking in urban centres appears to be equally deserving of attention as truck parking between urban centres. It appears that there is a lack of knowledge in this area.

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GLOSSARY OF ACRONYMS

AASHTO	American Association of State and Highway Transportation Officials
ARRB	Australian Road Research Board
Caltrans	California Department of Transportation
CMV	Commercial Motor Vehicle
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
DOT	Department of Transportation
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
GPS	Global Positioning Systems
HOS	Hours of Service
ITS	Intelligent Transportation Systems
KDOT	Kansas Department of Transportation
LCV	Longer Combination Vehicle
Mn/DOT	Minnesota Department of Transportation
NATSO	National Association of Truck Stop Operators
NCHRP	National Cooperative Highway Research Program
NHS	National Highway System
NO _x	Nitrogen Oxides
NSC	National Safety Code
NTC	National Transport Commission
NTSB	National Transportation Safety Board
NYDOT	New York Department of Transportation
OEM	Original Equipment Manufacturer
OOIDA	Owner-Operator Independent Driver Association
PM	Particulate Matter
RV	Recreational Vehicle
SAFETEA-LU	Safe Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SAIC	Science Applications International Corporation
SRA	Safety Rest Area
TEA-21	Transportation Equity Act for the 21 st Century
TRU	Trailer Refrigerated Units
TSE	Truck Stop Electrification
UMA	Underwood McLellan and Associates
UMTIG	University of Manitoba Transport Information Group
Wi-Fi	Wireless Fidelity

1. INTRODUCTION

1.1. PURPOSE AND BACKGROUND

The purpose of this study is to conduct a comprehensive literature review, supplemented with a survey of industry experts from Canada and the U.S., about the availability of truck parking at rest areas. More specifically, this research addresses the following: (1) the magnitude of the issue involving truck parking in various jurisdictions in the U.S., Canada, and Australia; (2) identification of the specific issues associated with the shortage of parking spaces for trucks at rest areas; (3) determination of how the issues have been addressed by different jurisdictions; and (4) processes used to engage stakeholders in situations where truck rest area issues have been addressed.

The motor carrier industry is a key component of the Canadian economy, with annual operating revenues of about \$50 billion (*Canada Gazette 2005). Growth in truck traffic volumes in Canada and the U.S. has caused an increase in demand for truck parking spaces at both public and private rest areas. This, coupled with recent changes to the Commercial Vehicle Drivers Hours of Service Regulations, has raised concerns about the available supply of truck parking spaces and the current truck parking demand. The impacts of possible inadequate supply of truck parking spaces on road safety, highway infrastructure, and the environment are of particular importance.

Road safety issues related to the provision of rest areas arise in two ways. First, there may be a link between supply of truck parking spaces and fatigue-related collisions. Transport Canada estimates that, on an annual basis, over 200 commercial vehicle drivers are involved in collisions where at least one of the contributing factors was fatigue. In 2005, new regulations were approved, reducing the maximum daily driving time for commercial drivers from 16 to 13 hours in a 24-hour period and increasing their minimum off-duty time by 25 percent from 8 to 10 hours. This will provide more opportunity for drivers to rest and will reduce the risk of being involved in a collision related to fatigue. However, to accommodate these longer rest times, commercial vehicle drivers require a sufficient number of highway rest areas with adequate security and amenities to serve their needs.

The second road safety issue associated with limited truck parking is the use of infrastructure which is not meant for truck parking. Having trucks parked on highway shoulders or ramps is of particular concern at night or under conditions of poor visibility, and in urban areas. This can also result in infrastructure problems, as these road elements may not be designed to accommodate the weight or performance characteristics of trucks and the presence of parked trucks may accelerate the need for shoulder and pavement maintenance.

Environmental issues result from the need for trucks to idle while parked. In addition to the provision of enough space for parking, truck drivers seek rest areas at which adequate amenities—such as food services and showers—are available. In some jurisdictions, there has been interest in electrifying truck stops and rest areas to meet electrical loads of long-haul sleeper cab tractors and reduce tractor idling. Tractor idling is common in the heavy truck sector to: (1) provide heating and cooling to the sleeper cab; (2) keep the engine warm in cold weather and alleviate engine start-up problems; and (3) provide power for auxiliary on-board devices such as microwave ovens, refrigerators, televisions, telephones, personal computers, and other small appliances. Truck stop electrification allows truckers to operate these on-board

systems and functions without idling their engines. Trucks are more likely to idle if they stop on the side of the road rather than in electrified rest areas.

With growing demand for truck transportation on Canadian roads, and the potential need to develop a Canadian strategy for truck parking on Canada's National Highway System, it is important for decision-makers to understand the issues associated with inadequate truck parking, as well as current best practices regarding this issue. To assist in providing this understanding, Montufar & Associates, in association with the University of Manitoba Transport Information Group (UMTIG), were commissioned by Transport Canada to conduct a comprehensive review of relevant literature about truck parking at rest areas. We supplemented the findings of the literature review with a survey of industry experts from Canada and the U.S. to gather information about other recent initiatives regarding truck parking issues that may not be available in the literature.

1.2. OBJECTIVES AND SCOPE

The objective of this study was to gain knowledge of the process that Canadian jurisdictions and other countries used in addressing and identifying the needs of commercial vehicle drivers at rest stops, this was accomplished by conducting a comprehensive review of literature on truck parking at rest areas and considering the following questions:

- How can the extent of the shortage of rest areas be determined?
- What specific issues (e.g., related to safety, infrastructure, the environment, and other issues) were identified as a result of this shortage?
- How were these issues addressed and what lessons were learned?
- Who were the key stakeholders in identifying and addressing these issues?

Also, selected industry experts from Canada and the U.S. were interviewed to gather information about other recent initiatives regarding truck parking issues, which were not available in the literature.

The scope of this study is limited as follows: (1) the literature review addresses literature published in Canada, the U.S., and Australia in the last 10 to 12 years; and (2) the industry survey is particularly interested in obtaining feedback from selected Canadian trucking industry experts and members of the Transportation Research Board (TRB) Truck and Bus Safety Committee, Motor Vehicle Size and Weight Committee, and Trucking Industry Research Committee.

1.3. METHODOLOGY

This study involves two components: (1) the literature review; and (2) the industry survey. The methodology used in this study—and discussed in this section—was determined in consultation with Transport Canada.

1.3.1. Literature Review

We conducted a comprehensive search of literature published in the last 10 to 12 years in Canada, the U.S., and Australia, as mandated by Transport Canada. The literature search included a variety of data and information sources: (1) engineering periodicals and journals; (2) readily-available papers and texts; (3) conference proceedings; (4) special interest groups; (5) special government reports; and (6) documents on the World Wide Web. The search included the agencies, library catalogues, and resources shown below.

Special Library Catalogues

- The Transportation Research Information System (TRIS) Online
- University of Michigan Transport Research Institute
- U.S. National Transportation Library
- U.S. Department of Transportation (DOT) Library
- U.S. Library of Congress
- University of Manitoba Bison Catalogue

Research Centres

- The Volpe National Transportation Systems Center
- University of North Carolina Transport Research Institute
- Turner Fairbank Highway Research Center
- Australian Road Research Board

Government Agencies

- Transportation Association of Canada
- Transport Canada
- U.S. Federal Motor Carrier Safety Administration
- Austroads
- British Columbia Ministry of Transportation
- Saskatchewan Highways and Infrastructure
- Manitoba Infrastructure and Transportation
- Ontario Ministry of Transportation
- Nova Scotia Department of Transportation
- Alberta Transportation

Scientific Journals and Conference Proceedings

- Canadian Journal of Civil Engineering
- Transportation Research Record
- Journal of Transportation Engineering
- Journal of Infrastructure Systems
- Transportation Research
- ITE Journal
- Public Roads

- Transportation Research Board, including conference proceedings
- International Symposia on Heavy Vehicle Weights and Dimensions proceedings
- Canadian Association of Road Safety Professionals conference proceedings
- Truck and Bus Safety Symposia proceedings

Trucking Associations

- Canadian Trucking Alliance
- American Trucking Associations
- British Columbia Trucking Association
- Saskatchewan Trucking Association
- Manitoba Trucking Association
- Ontario Trucking Association

1.3.2. Industry Survey

In January 2009, we attended three TRB committee meetings dealing with issues of direct relevance to this project: (1) Truck and Bus Safety Committee; (2) Motor Vehicle Size and Weight Committee; and (3) Trucking Industry Research Committee. At these committee meetings, participants were asked for information about truck parking at rest areas. Various attendees volunteered information and special follow-up meetings were held with them. In addition, special discussions were held with the chairs or former chairs of these committees. We also communicated with the Canadian Trucking Alliance, the Canadian Private Motor Truck Council, the Owner Operator Business Association of Canada, and various provincial officials involved in truck transportation. The purpose of these discussions, as agreed with Transport Canada, was to obtain additional information that may have not been identified in the literature.

1.4. REPORT ORGANIZATION

This report is divided into four chapters. Chapter 2 presents a summary discussion about the Commercial Vehicle Drivers Hours of Service (HOS) Regulations. This summary of information also addresses some of the differences between the current and the previous HOS regulation.

Chapter 3 presents the results from the literature review. It discusses the magnitude of the issue associated with truck parking at rest areas, the impacts of limited truck parking, as well as the benefits of implementing truck parking. This chapter also has a discussion regarding best practices involving truck parking at rest areas.

Chapter 4 provides a summary of findings from the literature review. It also contains a discussion about issues to be considered by Canada in addressing truck parking needs for the Canadian trucking industry.

2. COMMERCIAL MOTOR VEHICLE DRIVERS HOURS OF SERVICE REGULATIONS

The Commercial Vehicle Drivers Hours of Service (HOS) Regulation is based on National Safety Code (NSC) Standard 9, which is one of 16 motor vehicle safety standards contained in the NSC. The NSC resulted from the deregulation of the Canadian trucking industry in 1987, and was implemented to encourage trucking safety, promote efficiency in the motor carrier industry, and achieve consistent motor vehicle safety standards across Canada.

The *Canada Gazette (2005) states that “the main objective of the [HOS Regulation] is to reduce the risk of fatigue-related commercial vehicle collisions by providing drivers with the opportunity to obtain additional rest”. This Regulation, which went into effect on January 1, 2007, governs the maximum driving times and minimum off-duty times of commercial vehicle drivers involved in extra-provincial operations.

The following information regarding the new HOS Regulation is based on material published in the *Canada Gazette (2005). For detailed information about this Regulation, we advise that this document be consulted directly.

2.1. EXTENT OF APPLICATION

The HOS Regulation applies to all commercial vehicles (trucks and buses) involved in extra-provincial operation. However, there are some exceptions, particularly dealing with farming equipment, emergency vehicles, municipal public transit service vehicles, and commercial vehicles driven for personal use. Details of these exceptions are stated in the HOS Regulation.

The HOS Regulation divides its extent of application, geographically, into two components: (1) operations north of Latitude 60° North (Yukon, Northwest Territories, and Nunavut); and (2) operations south of Latitude 60° North. There are special provisions pertaining to operations north of Latitude 60° North, which allow greater flexibility in terms of the HOS. These special provisions have been deemed necessary due to the area’s unique geographical and climatic conditions.

2.2. CHARACTERISTICS OF APPLICATION

The following describes key issues associated with this Regulation for operations south of Latitude 60° North. Specific details can be obtained from the HOS Regulation.

- The maximum allowable driving time for any commercial vehicle driver is 13 hours in a day. This is included as part of the 14-hour maximum allowable on-duty daily time. According to the Regulation, a “day” is a 24-hour period beginning at the time designated by the carrier. Each “day” is independent, and there are certain on-duty, off-duty, and driving limits for each “day”. Furthermore, the start time of the day remains the same throughout a given cycle, and to change the start time of the day, the carrier must reset and start a new cycle.

- There are two cycles available to drivers and motor carriers for selection under the HOS Regulation. The details of operation are a function of the selected cycle as follows:
 - *Cycle 1* provides a maximum allowable on-duty time of 70 hours in a seven-day period. A driver can switch between cycles but only after completing a required off-duty period of 36 consecutive hours. This is known as “resetting the clock”.
 - *Cycle 2* provides a maximum allowable on-duty time of 120 hours in a 14-day period. However, the driver must have 24 consecutive hours of off-duty time prior to accumulating 70 hours of on-duty time during the 14 days. The off-duty requirement for cycle-switching (i.e., to reset the clock) is 72 consecutive hours off-duty.
- Regardless of which cycle is selected for operation, there is a mandatory off-duty time of 10 hours in a day (eight of these must be consecutive hours before a driver can be on-duty or can drive again). Furthermore, no driver is allowed to drive after 16 hours of time have elapsed between the conclusion of the most recent period of eight or more consecutive hours of off-duty time and the beginning of the next such period.

2.3. DIFFERENCES BETWEEN THE CURRENT REGULATION AND THE 1994 REGULATION

Transport Canada replaced the Commercial Vehicle Drivers HOS Regulations of 1994, under the Motor Vehicle Transport Act of 1987 (MVTA), with the new regulations which went into effect on January 1, 2007. As indicated in the *Canada Gazette (2005), “the central changes featured in the new Regulations include:

- introduction of a new daily requirement for a minimum of 10 hours off-duty [...];
- requiring that upon reaching the on-duty, driving or a new elapsed time limit, a minimum of 8 consecutive hours of off-duty time is taken before re-commencing driving;
- reducing the daily maximum driving time by 18.8 percent from 16 hours to 13 hours;
- reducing the daily maximum on-duty time by 12.5 percent from 16 hours to 14 hours;
- introducing a new elapsed time limit of 16 hours from the last off-duty period of 8 hours or greater;
- eliminating an option that permits a driver, on a limited basis, to reduce the minimum off-duty time from 8 hours to 4 hours;
- increasing the minimum rest period for team drivers using a vehicle equipped with sleeper berth accommodations from 2 to 4 consecutive hours;
- providing reasonable flexibility by permitting, within defined parameters, the averaging of on-duty and off-duty time over a 48-hour period;
- simplifying the Regulation by reducing the number of available work/rest cycles from three to two: a maximum 70-hour cycle over 7 days and a maximum 120-hour cycle over 14 days;

- for drivers who wish to switch or reset the cycle (cumulative time) that they are operating under, a minimum of 36 consecutive hours off-duty must be obtained for Cycle 1 (70 hours/7 days) and a minimum of 72 consecutive hours off-duty must be obtained for Cycle 2 (120 hours/14 days);
- requiring a minimum of 24 consecutive hours off-duty, at least once every 14 days for all drivers.”

3. TRUCK PARKING AT REST AREAS

This chapter presents the results from the literature review. It discusses the magnitude of the issue associated with truck parking at rest areas, the impacts of limited truck parking, and the benefits of implementing truck parking. This chapter also has a discussion regarding best practices involving truck parking at rest areas.

3.1. MAGNITUDE OF THE ISSUE

This section presents a summary of literature findings about the magnitude of the issue involving truck parking at rest areas.

3.1.1. Supply versus Demand

- Underwood McLellan and Associates *(UMA) (2008) estimates the supply and demand for truck parking on Saskatchewan's National Highway System (NHS) using a corridor-based approach. Parking demand is determined using the model produced by the Science Applications International Corporation in 2002. Estimates of truck parking supply included spaces at public rest areas, pull-offs, and private truck stops. Overall, the results of the analysis identify "a current shortage of truck parking spaces on the NHS..." (p. 2). Demand exceeded supply on four of the twelve corridors (with the supply deficit ranging from 10 to 57 spaces); supply exactly met demand on one of twelve corridors; and supply exceeded demand on the remaining seven corridors (with the surplus in supply ranging from five to 37 spaces). Three of the four corridors for which a shortage was estimated are on Highway 1 (Trans Canada Highway). The imminent development of a major private truck stop in Regina "should considerably" mitigate this shortage (p. 32). The results of the parking demand and supply are "similar" to the findings provided by regional managers with the Saskatchewan Ministry of Highways and Infrastructure (p. 32).
- Rodier and Shaheen (2007) find the following regarding truck parking supply and demand in California:
 - Truck parking demand exceeds capacity at all public rest areas.
 - Truck parking demand exceeds capacity at 88 percent of private truck stops on 34 of the highest truck volume corridors in California.
 - Nationally, shortages of public truck spaces are considered more severe than private space shortages.
 - Increases in truck size have decreased space availability since trucks may occupy multiple spaces.
 - HOS regulations and tight "just-in-time" commercial vehicle delivery schedules are a contributing factor to demand and shortage of parking facilities.

- Private truck stops are generally located nearby highway facilities and offer more parking spaces and amenities than public rest areas. Public rest areas are typically situated along major highways.
- Gaber et al. (2005) report that, according to section 4027 of the Transportation Equity Act (TEA) for the 21st century, all states are required to determine if there is a shortage of commercial vehicle parking and find the best ways to reduce the shortage. This requirement is in response to a survey of 2,000 drivers conducted by the Owner-Operator Independent Driver Association (OOIDA) that concludes that the shortage of safe places for truckers to park is causing drivers to violate HOS regulations. The authors state that there is evidence that truck drivers are increasingly parking illegally along highway shoulders and ramp exits and entrances in favour of public or private rest areas. This is supported by a survey conducted by the Trucking Research Institute where over 90 percent of commercial drivers perceive a shortage of truck-parking facilities, especially for long-term or overnight parking. Furthermore, the study states that truck drivers park illegally due to inadequate or poor designs of parking spaces at rest areas.
- Parametrix (2005), in a study for the Washington State Department of Transportation, evaluates the adequacy of truck parking along three primary freight corridors in Washington (I-5, I-90, and I-82). Based on data collected on the utilization of parking spaces at public rest areas, the extent of illegal parking, and a survey of private truck stops, the study estimates that public rest areas on these corridors are over capacity by eight percent, and private truck stops are underutilized by 13 percent. By comparison, a 2002 study by Science Applications International Corporation estimates that public rest areas and private truck stops along Washington's Interstate highways and non-Interstate portions of the National Highway System (with daily truck volumes greater than 1,000) were over capacity by 79 and two percent, respectively. Depending on the rest area, up to 15 additional truck spaces per night are needed to meet current average nighttime parking demand, and up to 24 additional spaces are needed when truck parking is at its maximum.

The authors indicate that illegally-parked trucks are most frequently observed at weigh stations and chain-up/chain-down areas, rather than on ramps or shoulders. Five reasons are provided to explain why trucks park illegally (p. ix):

- "Drivers are unfamiliar with the area.
- Drivers want to get as close as possible to their final destination.
- Drivers want to maximize their driver times within the [HOS] regulations.
- Drivers find ramps and shoulders more convenient than [public rest areas] and [private truck stops].
- Many of today's trucks are longer than the parking spaces at [public rest areas] that were designed to accommodate shorter trucks."

As a direct result of increasing truck trips, truck parking demand is expected to increase in Washington State. The study estimates a 3.5 percent annual growth rate in demand along I-5 and I-82 and a 4.0 percent annual growth rate along I-90. "Therefore, if no

additional truck parking is added, the existing truck parking shortages will continue to worsen” (p. ix).

- Smith et al. (2005) report that there is a shortage of truck parking and the continued growth of the truckload industry will increase demand for truck parking. The authors report on a survey of truck drivers to investigate truck parking issues. Reasons for drivers choosing to park on ramps or shoulders include:
 - no empty spaces at nearby truck stops or rest areas (94 percent);
 - no nearby parking facility is available (83 percent);
 - nearby parking spaces have time limits that are too short (50 percent);
 - nearby spaces are blocked by other vehicles (50 percent);
 - the ramp or shoulder is convenient for returning to the road (33 percent);
 - interruptions by strangers (including drug dealers and prostitutes) are less likely (33 percent);
 - difficult to drive around congested parking lots (18 percent); and
 - ramps or shoulders have better lighting than parking lots (4 percent).
- Garber and Wang (2004) determine the supply and demand for truck parking along Interstate corridors in Virginia. The study is the second phase of a research program in Virginia about truck parking problems. The first phase, as reported by Garber, Wang, and Charoenphol (2002), estimated the truck parking supply and demand along I-81 only. Along this route, the authors reported a maximum demand of nearly 3,000 spaces, which exceeded the supply by about 300 spaces. This shortfall was projected to increase to about 1,200 and 1,500 parking spaces in 2010 and 2020, respectively, if no actions were taken to address the problem.

The subsequent phase of the study, reported by Garber and Wang (2004), involves all Interstate highways in Virginia. Eighty percent of truck parking spaces in the state are provided by private truck stops. Factors affecting the demand for truck parking are: the number and percentage of trucks in the traffic stream, the distance between a truck stop and the mainline, the distance to the nearest truck stop or rest area, and the service facilities provided. The analysis finds that none of the public rest areas in Virginia had a demand to supply ratio greater than 1.5. Although this represents a shortage of truck parking supply, the ratio is somewhat lower than the statewide ratio of 2.16 predicted by the Science Applications International Corporation in 2002. At private truck stops, a demand to supply ratio of 1.07 is estimated (i.e., a slight shortage), which exceeds the ratio of 0.8 (i.e., a surplus) reported by the 2002 study. The authors conclude that if no action is taken, shortfalls will occur along Virginia's Interstate highways, and there will be a high probability that trucks will park on shoulders adjacent to rest areas.

- Perrot et al. (2004) quote recent U.S. DOT research stating that the national shortage of parking is almost equal to the number of existing truck parking spaces.

- NCHRP (2003) describes the extent of the truck parking problem in the U.S. by: (1) restating findings from the research reported in the 2002 study by the Science Applications International Corporation; and (2) synthesizing the results of a survey of public sector highway maintenance engineers. The survey finds that 20 of the 24 reporting states indicate that the demand for truck parking has increased in the last five years, and four of the 24 reporting states indicate a decrease in truck parking demand over this time period. Survey respondents also cite specific locations where commercial vehicle parking has been observed, as shown in Table 1.

Table 1: Locations Where Commercial Vehicle Parking has been observed

Location	States reporting
In public rest areas	20
At freeway interchange ramps	17
Along freeway shoulders	14
On conventional highway roadsides	8
On local streets near freeways	8
In local commercial areas	8
In private truck stops	7
At designated pullouts/vista points	6
At highway weigh stations	5
No significant problems	2
Other	0

Source: NCHRP 2003

- Chen et al. (2002) report on a nationwide survey of 2,000 truck drivers conducted in 2002, and sponsored by the Federal Highway Administration (FHWA). The survey revealed that:
 - 71 percent of states experience public truck parking space shortages and 16 percent experience private space shortages;
 - 90 percent of drivers park in private truck stops for long-term rest (four times per week on average);
 - 67 percent use public rest areas (two times per week on average);
 - 67 percent park illegally for long-term parking (two times per week on average);
 - 33 percent park on entrance and exit ramps;
 - 21 percent park on other parking lots;
 - 11 percent park on highway shoulders;
 - 94 percent park illegally due to unavailable parking spaces at nearby facilities and 83 percent park illegally due to the lack of nearby parking facilities; and
 - more truck parking is required during overnight hours near metropolitan areas.

Additional comments to the survey were provided by about 300 drivers. The following summarizes these comments:

- Drivers often attempt to plan their parking stops but encounter circumstances altering their plans.
- Drivers frequently experience fatigue earlier than expected, encounter delays at shipper/receiver locations, and fail to locate available parking spaces at their pre-planned destinations.
- Drivers decide where to park as their on-duty hours elapse based on how far they think they can drive during their remaining HOS.
- Drivers often park whenever a space is available rather than planning ahead.
- Pécheux et al. (2002), as part of the Science Applications International Corporation work for the FHWA, develop a model for estimating the demand for truck parking on road segments. This involves a review of current truck parking availability, including private truck stops and public rest areas. A survey of truck stops revealed that one-third had plans to expand their facilities, but there was a “concern that this additional supply may not fully satisfy the demand for public rest areas if private truck stops and public rest areas are not substitutes for each other” (p. 3). They find that private truck stops are used when truckers are seeking food or other amenities. Drivers experiencing fatigue “prefer to pull off at the nearest rest area or park wherever they can, even on the shoulders of ramps” (p. 4). The authors calibrate the model by observing field data and conclude that the model could be used to determine the locations of truck parking shortages using local data and refining the model to local conditions. The model can then be used to make “projections of parking demand for long-range planning purposes” (p. 36).
- Science Applications International Corporation (2002), in a report for the FHWA, investigates the adequacy of truck parking facilities on the U.S. National Highway System. The report: (1) estimates the demand for truck parking; (2) provides an inventory of truck parking spaces; and (3) identifies deficiencies by comparing parking supply and demand.

Peak-hour truck parking demand at public and private facilities is estimated using a model based on truck-hours of travel, the time and duration of parking stops, and consideration of HOS regulations and truck drivers' preferences. The model estimates a peak-hour demand of 287,000 truck parking spaces at public and private facilities on Interstates and other NHS routes with volumes greater than 1,000 trucks per day. Over the next twenty years, this demand is expected to increase by 2.7 percent annually. Less than one-quarter of the current demand is for parking at public rest areas. For parking stops longer than two hours, drivers prefer private rather than public facilities (78 percent to 6 percent, respectively). Public rest areas are preferred over private facilities when drivers take short rests (less than two hours).

The inventory of truck parking supply identifies 315,850 parking spaces for trucks at public rest areas and private truck stops on Interstate highways and other NHS routes with volumes greater than 1,000 trucks per day. About 90 percent of these spaces are in private truck stops; the remainder are in public rest areas. Parking supply is expected to increase at both public (about one percent annually over the next five years) and private facilities (6.5 percent annually). Because drivers perceive the services offered at public rest areas as somewhat different as those offered by private truck stops, the supply of truck parking spaces provided by these facilities cannot be viewed completely

interchangeably. Twenty-one percent of drivers report that other facilities (e.g., loading docks, company terminals, restaurants, shopping centers, motels) supply stopping opportunities needed to comply with HOS regulations.

Based on the demand and supply analyses, “a shortage of parking at public rest areas may exist in up to 35 States, and a shortage of total parking may exist in up to 12 States” (p. x). Because shortages are less common at private facilities, this excess capacity may alleviate problems at public rest areas if drivers perceive these spaces as interchangeable. Nearly one-quarter of truck parking demand is for public rest areas (which, according to 50 percent of drivers surveyed, rarely or never have spaces available), while ten percent of truck parking spaces are supplied by public facilities. Estimated supply increases at private truck stops is expected to meet growth in demand for parking at these facilities; however, increases in parking supply at public rest areas will fall short of expected growth in demand.

- Khattak et al. (2001) report on two surveys conducted in 2000 to gather information from owners of truck stops in Nebraska and truck drivers passing through Nebraska about issues relating to truck parking in the state. Eighteen truck stop owners located on Interstate, U.S., and State highways and 118 truck drivers (67 percent with more than five years of driving experience) from 29 different states and two Canadian provinces responded. The truck stop owner survey concludes the following:
 - Future increases in demand for parking spaces at specific truck stops depend on the route on which it is located.
 - The numbers of parking stalls available at each stop range from 10 to 500, and none of the owners charge a parking fee.
 - Two owners have parking restrictions for trucks carrying hazardous materials.
 - Truck stops are generally not crowded during the day and are crowded or overflowing at night, particularly at stops located on the Interstate highways.

The truck driver survey concludes the following:

- Fifty-six and 85 percent of drivers perceive insufficient parking at truck stops and public rest areas, respectively.
 - When a truck stop or public rest area is at or above capacity, 72 percent of drivers continue driving, 16 percent park on the entrance or exit ramp, and five percent park on highway shoulders. Overall, one in five drivers parks illegally.
 - Ninety-one percent of drivers feel there is a need for additional truck parking in Nebraska.
- Chatterjee and Wegmann (2000) conduct a survey of the truck parking situation on a typical night along Tennessee’s Interstate highway system. There are 767 truck parking spaces at public rest areas and truck pullouts on the Tennessee Interstate system. The survey found that the actual number of parked trucks along these highways was 1,224 (on a typical night). Thus, 457 trucks (37.3 percent of parked trucks) were parked along shoulders of ramps or mainlines, or at undesignated locations within public rest areas or pullouts. Nearly 28 percent of all parked trucks were observed at interchange ramps.

- NCHRP (2000) reports that U.S. federal guidelines developed in the early 1980s recommend rest areas to be located every 50 miles on Interstate highways. An earlier NCHRP study (NCHRP 1989) estimates that this guideline was met on a nationwide basis for Interstates and primary highways, but that the spacing of rest areas in individual states ranged between 25 and 105 miles. NCHRP (1989) also states that 42 percent of rest area users indicated a shortage of rest area facilities, 54 percent said that the supply of rest area facilities was about right, 0.5 percent indicated over supply of rest areas, and four percent had no opinion.

NCHRP (2000) cites background material on the supply of truck parking spaces in California, which was developed by a task force for improving the state's Safety Roadside Rest Area System. Between 1985 and 1999, the state built no new rest areas and closed four, despite "major deficiencies in parking capacity for commercial truckers" (p. 40). Efforts to engage private partners in the development of rest area facilities have failed. There are no details provided about the reason for this failure.

NCHRP (2000) also provides results of a survey of state and provincial department of transportation representatives regarding issues at rest areas. Concerning parking spaces for commercial vehicles, five states indicated that 100 percent of their rest areas are full at nighttime. "One-half of states indicated that 50 percent or more of their rest areas are inadequate for commercial vehicles" (p. 42). Some states are developing alternative approaches by allowing trucks to park at closed rest areas, commercial vehicle weigh stations, or on specially-constructed pullout facilities along the highway. None of the Canadian jurisdictions surveyed (Alberta, Manitoba, New Brunswick, Newfoundland, Northwest Territories, Ontario, and Saskatchewan) reported capacity problems at their rest areas.

- Taylor et al. (1999) analyze the demand for truck parking spaces in Michigan. Based on a survey conducted by state police, "the total number of [trucks] observed to be parking on the ramps or shoulder near the existing rest areas in Michigan are 164 in the midnight to 4:00 am time period and 145 in the 4:00 to 8:00 am time period" (p. 57). The authors claim this to be a "reasonable estimate" of the number of additional truck parking spaces required. This estimate is less than the shortage of 614 truck parking spaces predicted for Michigan by the Trucking Research Institute study in 1996.
- Wegmann et al. (1999) describe the Tennessee experience with nighttime truck parking along Interstate highways. A statewide survey of truck accumulation and occupancy at public rest areas and welcome centres revealed that about 39 percent of stopped trucks were parked inside public rest areas or welcome centres, about 10 percent were parked along ramps to these facilities, 21 percent were parked at pullout areas, 29 percent were parked at interchanges, and one percent were parked on the mainline shoulders. The authors analyze the demand for parking spaces at each of the state's 18 public rest areas and 14 public welcome centres along Interstate routes. The analysis shows that in all but one facility, additional truck parking spaces are required to meet demand, and the total shortfall of parking spaces is 1,407. The demand for parking spaces is a function of the volume of vehicles entering a rest area facility, but this entering volume is not correlated with the traffic volume on the mainline highway. Rather, the demand for parking spaces depends on factors such as proximity to other rest areas and urban centres.

- The Minnesota Department of Transportation (1998) identifies public rest areas where nighttime truck parking demand exceeds capacity, and documents the frequency of these occurrences. In contrast to the 1996 Trucking Research Institute report (which estimated a “severe” shortage of truck parking spaces along Minnesota’s Interstate system), the Minnesota Department of Transportation (Mn/DOT) concludes that “there may be a commercial vehicle parking problem at 26 safety rest areas in Minnesota out of the 55 full service rest areas operated by Mn/DOT” (p. 17).
- Based on a survey of rest area users, the Colorado Department of Transportation (1997) reports a shortage of overnight truck parking at its 34 public rest areas. Users also cited safety and facility maintenance as concerns.
- The Trucking Research Institute (1996), in a report prepared for the U.S. Federal Highway Administration, documents concerns about the adequacy of truck parking spaces on Interstate highways. The report: (1) summarizes the results of driver, motor carrier, and truck stop operator surveys; (2) analyzes truck parking at public rest areas; and (3) analyzes truck parking at private rest areas.

The report finds that more than 90 percent of truck drivers perceive there to be a shortage of truck parking spaces, particularly during the night. Drivers indicate a slight preference to stop at public rest areas instead of private truck stops when taking short rests (less than two hours), but prefer private facilities for longer breaks. More than 50 percent of truck drivers rate the quality of rest areas as either “fair” or “poor”. Eighty percent of rest areas are full or overflowing at night; nearly half report these conditions during the day. Overflowing is most problematic between 22:00 and midnight. Results from the motor carrier survey generally confirm the results from the truck driver survey. Nearly seven of ten private truck stop operators surveyed, however, do not believe that there is a shortage of truck parking spaces at public rest areas.

The report estimates a shortfall of 28,400 parking spaces for trucks at public rest areas and projects this shortfall to increase to 39,000 over the following decade. These estimates are based on the development of a capacity utilization model and a truck parking demand model (the Apogee Demand Model). Key demand-related factors that affect capacity utilization are: the average daily traffic (ADT) volume, truck traffic as a percentage of ADT, the distance from the previous rest area, and the proximity of the rest area to a major intersection. Supply-related factors that affect capacity utilization are: the number of truck parking spaces available, the type of parking space (parallel or diagonal), facilities, and parking rules and requirements.

The analysis of truck parking at private truck stops in the Trucking Research Institute (1996) study reveals that about one-third of truck stop operators intend to expand their facilities in the next three years, increasing the total available truck parking spaces from 185,000 to 213,000 nationwide. Although this increase may partially alleviate the public rest area shortage, additional analysis suggests that there is “no conclusive evidence that private truck stops and public rest areas are direct substitutes for each other” (p. ii). In addition, truck stop operators indicate that their facilities are frequently at or over capacity.

3.1.2. Other Issues

- Austroads, Inc. (2008) reports on an audit of Australia's rest against the National Guidelines for Provision of Rest Area Facilities. The audit examined the location, design, layout, and facilities of a sample of rest areas to determine the level of compliance with the National Guidelines. Of the 12,700 km of roads examined in the audit, none of them fully met the rest area spacing recommendations of the National Guidelines. In addition, 60 percent of the audited roads had "substantial deficiencies in the frequency or provision of rest opportunities" (p. i). Nearly three-quarters of rest areas on the audited routes did not provide the recommended access for both directions of travel. This leads drivers to take risky actions to access the rest area, such as right turns (crossing opposing traffic), U-turns, or parking the vehicle on one side and crossing on foot. Of the 147 rest areas audited in detail, there was "high compliance with the recommended minimum parking capacity requirements for different rest areas categories" (p. i). Seventy-one percent of recommended design and layout features were present and nearly two-thirds of recommended minimum site facilities were provided.
- PRR, Inc. (2008) reports on the results of two online surveys of truck drivers and trucking companies to establish their views on the adequacy and availability of truck parking and services in Washington State. Base on these surveys, the report concludes that:
 - "public and commercial truck parking and amenities are important and well used" (p. 2);
 - "truck parking is unavailable, overcrowded and too far apart" (p. 3);
 - "new truck parking is most needed in urban areas..." (p. 4);
 - "interest in amenities at new truck parking areas is strong" (p. 5); and
 - "truck drivers and trucking companies are not willing to pay for truck parking" (p. 5).
- *UMA (2008) reports the following trends, preferences, and opinions related to truck parking in Saskatchewan, as identified by trucking industry stakeholders:
 - The increased utilization of Turnpike doubles and other large trucks will require longer pullouts and more pull-in/pull-out parking spaces at existing rest areas. Turnpike double operations typically involve "switches" (when drivers for the same carrier travelling in opposite directions swap trailers). Adequate space is needed to accommodate this practice.
 - Industry stakeholders feel that no information about truck parking supply is available. Web-based maps showing truck parking facilities were suggested. In addition, a booklet or map showing the locations of private truck stops in Saskatchewan (and the rest of Canada) would be useful.
 - The need for trucking supply in Saskatchewan includes the desire for new facilities, the upgrade of existing facilities, and the provision of additional and larger pullouts.

- Wilbur Smith Associates (2008) conducted a survey of motor carriers with operations in the U.S. Midwest and Canada. The survey revealed that:
 - 70 percent of companies do not have a policy regarding where drivers should park;
 - 98 percent of companies do not provide assistance to drivers when looking for potential parking locations;
 - the most cited reasons for drivers parking at a specific location are the need for rest, fuel, or to take their 10-hour required breaks; and
 - most drivers stop at rest areas for 10 hours to comply with HOS regulations.

The authors cite a 2000 study conducted by the Minnesota DOT that finds commercial drivers arriving at rest areas before 11:00 pm are usually capable of finding available parking spaces, and typically park for most of the night.

- Australia's National Transport Commission (NTC, 2006), in its *Heavy Vehicle Driver Fatigue* study, finds that several routes exist where there are excessively large distances between rest areas and in some cases the rest areas are substandard. These rest areas are characterized by insufficient parking, poor noise protection and lack of amenities. In discussion with the trucking industry the authors found that rather than stopping at a rest stop with poor amenities drivers acknowledged breaking HOS regulations to reach a higher quality rest area.
- A *report by the Nova Scotia Department of Transportation and Public Works (2005) develops a framework for evaluating the province's two pilot highway rest areas. In addition to providing a general overview of research related to the evaluation of rest areas, the objectives of the report are to determine: (1) levels of rest area usage; (2) whether site amenities meet users' needs; (3) public opinion on the level of rest area usage and the degree of satisfaction with the rest areas; and (4) potential impact of rest areas on fatigue-related collisions. Rest area users include tourists, the general motoring public, and commercial vehicle drivers.

Approximately 300 commercial vehicle drivers were surveyed at the two pilot rest areas. Nearly all (over 95 percent) of these drivers were satisfied or very satisfied with the rest areas. Survey responses indicated that both rest areas were used by commercial vehicle drivers to break up long drives (more than 150 km already driven prior to resting, and more than 150 km to drive after resting). Specific requirements reported by commercial vehicle drivers are: (1) providing full, 24-hour restaurant services; (2) providing card lock fuel pumps; (3) providing private bathrooms, showers, and laundry facilities for truckers; and (4) reducing dust in rest areas.

- Smith et al. (2005) report that truck drivers' parking decisions are made at three time stages:
 - 12 to 24 hours in advance of needing a parking space;
 - about an hour prior to a planned rest, typically within a 100-mile radius; and
 - at the end of the day when deciding whether to pull off upon approaching a rest area.

- A report prepared by ARRB Transport Research for the Australia National Transport Commission (2004) identifies problems associated with the adequacy of rest area provision. Commercial vehicle drivers find the quality and location of rest areas in Australia compromise their ability to utilize these facilities and meet requirements of driving HOS regulations. Therefore, many commercial vehicle drivers indicate that the government can assist with fatigue management by addressing these problems. Specific concerns for truck drivers are cleanliness, provision of shade and garbage receptacles, sealed parking surfaces, access to cold water, and appropriate signage (including information about the distance to the next rest area).
- Chen et al. (2002) find that important attributes of long-term rest locations according to drivers are food, fuel, restrooms, phones, showers, proximity to the highway, well-lit parking lots, security, and lots that provide enough space to maneuver in and out.
- Wegmann and Chatterjee (2002) report on a stakeholders meeting held in Tennessee about truck parking and rest area issues. According to drivers present at the meeting, the lack of adequate truck parking at rest areas is a “critical issue” (p. 147). One specific issue raised by the drivers involved the layout of truck parking spaces at rest areas. In particular, parallel parking spaces are difficult for trucks to use, and most spaces do not accommodate the length of standard tractor semitrailers.
- The National Transportation Safety Board (2000) indicates that truck drivers do not have enough information regarding parking locations, both in advance of and during trips. Although current guides and mapping programs list private truck stops and public rest areas, they are not all-inclusive and typically do not include alternative parking locations like park-and-ride lots and weigh stations. Furthermore, parking time limits for public rest areas can result in drivers prematurely returning to the road without adequate rest or parking illegally on shoulders or ramps.
- Krammes (1999) identifies seven concerns about rest areas for commercial vehicle drivers: (1) “safety and security at public rest areas and privately owned truck stops”; (2) “privately owned trucks stops’ ability to meet the rest parking need”; (3) “availability of alternative parking sites (e.g., weigh stations, park-and-ride lots)”; (4) “location of rest areas” (i.e., adequate number and spacing along the roadway); (5) adequacy of financial support for parking facilities from all levels of government; (6) “time limits imposed by states on legal commercial vehicle parking”; and (7) “education of truck drivers about fatigue” (p. 256).
- Maze et al. (1999) review the public policies regarding commercial vehicle parking in Iowa. A task force was formed to investigate the need for the state to develop public rest areas for truck parking. In a review of the current situation, they conclude that public parking spaces are required as the “state cannot expect the private sector to meet all overnight parking demands” (p. 3). They also find that NATSO, the national trade association representing travel plaza and truck stop owners and operators, is opposed to increasing parking at public rest areas, as private truck stops are “expanding to meet the growing demand” (p. 6). Additionally, private truck stops are opposed to the expansion of public rest areas as it negatively impacts their business.
- Robin and Roberts (1999) suggest that, since exercise has been shown to combat fatigue, reduce stress, improve alertness, and enhance sleep, there is a need to implement fitness facilities at truck stops.

- Based on interviews with 593 long distance truck drivers, Schneider et al. (1999) find that 30 percent of drivers took their longest sleep while parked at public rest areas and drivers are 20 times more likely to stop at rest areas than motels or hotels.
- Wegmann et al. (1999) summarize the perspective of truck drivers on issues related to rest areas as follows:
 - Public rest areas and private truck stops provide different services and are not substitutes for each other.
 - Sleepy drivers prefer to pull over as soon as possible, and therefore sometimes choose to stop at an interchange or on the shoulder.
 - Designation of parking spaces at private truck stops is problematic and increases the risk of minor collisions while maneuvering through these facilities.
 - Security is a “major concern” for truck drivers at both public and private facilities (p. 250).
 - Limits imposed on the amount of time drivers can park at certain rest areas defeats the objective of improving safety, and occasionally contradicts HOS regulations.

3.2. IMPACTS OF LIMITED TRUCK PARKING

This section discusses the impacts of limited truck parking on safety, the environment, infrastructure, and other general trucking issues.

3.2.1. Safety

- *UMA (2008) calculates collision rates (for all vehicle types) along highway sections adjacent to rest areas on the Saskatchewan National Highway System to help identify locations which may benefit from operational or geometric improvements. The highest collision rate along each of 12 analysis corridors is identified. There does not appear to be a relationship between the ranking of these 12 corridors according to the discrepancies in truck parking supply and demand, and their ranking according to the highest observed collision rate.
- Parametrix (2005) notes that “a shortage of truck parking contributes to truck drivers driving while fatigued and/or parking illegally, both of which can cause accidents” (p. v).
- A *report by the Nova Scotia Department of Transportation and Public Works (2005) develops a framework for evaluating the province’s two pilot highway rest areas. The evaluation includes an analysis of collisions involving commercial and non-commercial vehicles on Nova Scotia’s highways that occurred due to driver fatigue or the driver falling asleep. The analysis reveals that “a direct cause and effect relationship cannot be demonstrated between the opening of new rest areas and collision rates” (p. 86). The report references literature that acknowledges rest areas as facilities to improve road safety.

- Smith et al. (2005) report negative consequences to the trucking industry resulting from the shortage of truck parking spaces include increases in crash liability due to illegal parking and driving while fatigued. The authors also suggest that increases in the demand for truck parking may result in increases in parking on shoulders and ramps.
- Morrow and Crum (2003) conduct a survey of commercial motor vehicle drivers to investigate factors that lead to fatigue-related issues while driving. They find that two underlying causes of fatigue for commercial motor vehicle drivers are: (1) irregular sleeping patterns, “inferred from difficulties in finding a safe place to rest”; and (2) the inability to attain sufficient hours of continuous sleep, resulting in “potential contributors to fatigue and crashes” (p. 60).
- NCHRP (2003) states that illegal truck parking is dangerous because: “(1) it limits the ability of parked vehicles to accelerate safely into the traffic stream from their parked position, (2) the presence of parked vehicles creates a conflict between existing and parked vehicles, and (3) errant vehicles may stray into the shoulder area and strike parked vehicles.” (p. 3)
- Williamson et al. (2001) survey 1,007 long distance heavy vehicle drivers throughout Queensland, New South Wales, South Australia, Victoria and the Northern Territory relating to driver fatigue. When asked about rest facilities, 85 percent of drivers express that “improved off-road rest facilities should be used as a government strategy to mitigate fatigue” (p. 38).
- Based on a survey of 593 truck drivers, Schneider et al. (1999) find that the frequency of not finding nighttime parking spaces is associated with falling asleep while driving and violating HOS regulations. Eighty percent of drivers surveyed indicated that they were always or often unable to find parking space at public rest areas, 25 percent said they had fallen asleep while driving in the past year, 17 percent noted that this occurred more than once, and 20 percent admitted to HOS violations.
- Taylor et al. (1999) analyze the relationship between rest areas and single vehicle truck crashes. Although it cannot be characterized as a cause-and-effect relationship, the analysis reveals “a strong correlation between rest area spacing and single vehicle crashes” (p. 42). Specifically, there is a “significant increase” in single vehicle truck collisions when the spacing between rest areas exceeds 30 miles (p. 57).
- Wegmann et al. (1999) describe two aspects of the relationship between rest areas and highway safety. First, the provision of adequate rest areas helps address driver fatigue, which is a “major cause of accidents” (p. 240). Second, the use of undesignated areas for truck parking can impact highway safety. The authors conducted an analysis of large truck collisions on Interstate highways in Tennessee. The analysis found that over a 64-month period between 1990 and 1996, 0.3 percent (39 of 12,723) of large truck collisions on Interstate highways involved parked trucks and occurred at dusk, night, or dawn. These collisions resulted in three fatalities and 16 injuries.
- The Trucking Research Institute (1996), in a report prepared for the U.S. Federal Highway Administration, recommends examination of the relationship between the inadequacy of truck parking spaces and truck collision rates.

3.2.2. Environment

- Hafiz et al. (2007) report that long-duration truck idling results from the need for heating, air conditioning, ventilation, and to operate on-board appliances. The authors state that transportation is one of the largest contributors to environmental pollution in Canada and that diesel fuel emissions include particulate matter (PM), oxides of nitrogen (NO_x), carbon dioxide (CO₂), and carbon monoxide (CO).
- Rodier and Shaheen (2007) indicate that SAFETEA-LU addresses the problem of idling emissions and truck parking shortage through the Idling Reduction Facilities on Interstate Rights-of-Way Program. The goal of the program is to provide facilities allowing truck drivers to reduce truck idling or provide alternative power supply while parked in a public rest area.
- Montufar and Regehr (2004) cite a study by Stodolsky et al. (2000), where they analyze technology options to reduce the fuel consumption of idling trucks. The report states that “a typical intercity tractor-trailer idles an estimated 1,830 [hours per year] when parked overnight at truck stops, and that “long-haul trucks idling overnight consume more than 838 million gallons (20 million barrels) of fuel annually”. The report presents truck stop electrification (TSE) as one “fuel-efficient” alternative to truck idling. Drawbacks to TSE include: (1) a limited choice of overnight TSE locations; (2) the requirement of separate sleeper air conditioner and electrically powered heater; and (3) the requirement of infrastructure at the truck stop. At the time of their study, TSE was not a commercially available option.

Montufar and Regehr (2004) also cite a study prepared for Niagara Mohawk Power Corporation by ANTARES Group Incorporated (2001), which identifies the following contributing factors to the potential need for TSE installation:

- In the U.S., current rest area, service area, and truck stop parking areas are “insufficient for today’s long-haul truck volume”. The current national shortfall (estimated at almost 100 percent) “provides opportunity to put TSE into new as well as expanded truck parking and commercial truck stop facilities”.
- As of December 2000, 15 states and the District of Columbia had enacted new anti-idling legislation that places limits on the amount of time a truck or bus can idle. “These laws, if enforced, would compel sleeper cab trucks on layover to use either on-board power, which doesn’t necessarily reduce noise or emissions, or shore power/TSE to serve on-board loads”. The states with anti-idling laws according to this report are: California, Colorado, Connecticut, District of Columbia, Hawaii, Illinois, Maryland, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, Texas (pending), and Virginia.
- Federal (U.S.) drivers HOS regulations “increase required length and frequency of driver rest periods.” This change “will potentially increase truck idling and, in turn, the potential market for shore power and TSE service”.
- Engine idling releases exhaust emissions to the air. Diesel emissions are primarily composed of: (1) carbon dioxide (CO₂), a “significant” greenhouse gas; (2) carbon monoxide (CO), a criteria pollutant with “serious” health impacts; (3) particulate matter (PM₁₀), a respiratory irritant; and (4) nitrogen oxides (NO_x), which are ozone

precursor pollutants. The report quotes estimates that a single long-haul truck idling for 1,890 hours per year emits 21,000 pounds of carbon dioxide, 390 pounds of carbon monoxide, and 225 pounds of nitrogen oxides.

- “Truck engine idling has safety impacts in the sleep lost by truck drivers due to noise and high localized levels of CO”.
- “If present operating trends continue, even with in-place anti-idling laws, sleeper cab truck idling will increase, not decrease, as heavy truck vehicle-miles-of-travel increase”.
- “All Class 8 sleeper cab [original equipment manufacturers–OEM] now offer shore power as an option,” and customized retrofitting kits are available.
- Costlow (2004) cites a study by Argonne National Laboratory reporting that a typical heavy-duty freight-hauling truck idles an average of six hours per day or about 1,818 hours per year. The author refers to studies conducted by the Edison Electric Institute and the Argonne National Laboratory which show that idling a truck engine for 2,500 hours annually is the equivalent of 200,000 extra miles of engine wear, burning 3,750 gallons of diesel fuel, and increasing operating costs between US\$4,000 and US\$7,000 per truck per year.
- Perrot et al. (2004) report that “the average heavy-duty tractor consumes approximately one gallon of diesel fuel for each hour spent idling”, and that the total cost of idling (including service, maintenance, repairs, and fuel) is over \$2.50 per hour of idling.
- The United States Environmental Protection Agency (2003) issued a technical bulletin that lists some benefits of using truck stop electrification. The bulletin states that the “use of truck stop electrification can reduce emissions by 90 percent and save 100 percent of the diesel fuel for the time spent idling.” It also indicates that the “fuel savings per year will amount to \$3,240 per truck parking space.”

3.2.3. Infrastructure

- NCHRP (2003) synthesizes the results of a survey of public sector highway maintenance engineers asked to identify problems observed because of unauthorized truck parking. Specific problems related to highway infrastructure are: “shoulder damage, restriction of sight distance, the presence of obstacles in the clear zone, and litter and sanitation problems in public rest areas” (p. 21).
- The Trucking Research Institute (1996), in a report prepared for the U.S. Federal Highway Administration, recommends examination of the relationship between maintenance expenses related to shoulder damage and the inadequacy of truck parking spaces, since a consequence of a shortfall of truck parking spaces may be illegal parking of trucks on shoulders.

3.2.4. Other Issues

- Knipling (2009) discusses truck parking issues in his recently-released book *Safety for the Long Haul; Large Truck Crash Risk, Causation, & Prevention*. The book cites a study by the OOIDA Foundation (1999), where three-quarters of drivers surveyed about truck parking issues reported that “they had been awakened by officials and told to leave public spaces, even though their driving would violate Federal HOS rules” (p. 8-3). The author also states that in some locations, drivers are caught between HOS requirements to stop and rest area time limits requiring them to move. “An even higher percentage (85%) of the OOIDA survey drivers expressed concerns about rest area thefts, assaults, prostitution, or other crimes” (p. 8-3).
- Smith et al. (2005) report that negative consequences to the trucking industry resulting from the shortage of truck parking spaces include increases in job dissatisfaction experienced by drivers resulting from poor parking choices provided to them, and decreases in driver productivity due to time and money spent searching for parking.
- NCHRP (2003) synthesizes the results of a survey of public sector highway maintenance engineers asked to identify problems observed because of unauthorized truck parking. Specific problems unrelated to highway infrastructure are: fuel and oil spillage, soil erosion, noise, dust, and illegal activities.

3.3. BENEFITS OF IMPLEMENTING TRUCK PARKING AT REST AREAS

There is a limited amount of literature that specifically identifies benefits associated with providing truck parking for commercial vehicles. In most cases, the benefits of providing parking are expected to be derived from addressing existing problems associated with limited parking availability. This section summarizes literature findings about benefits of implementing truck parking at rest areas.

- Austroads, Inc. (2008) review literature regarding the safety and economic benefits of rest areas, but find that there are “very few reports on the benefits of providing regular rest areas” (p. 23). This is because it is difficult to determine the types of collisions that rest areas mitigate and by extension the resulting economic benefits. The report identifies the benefits associated with the implementation of rest areas, which include:
 - “safety (minimizing shoulder or verge parking)
 - comfort and convenience (availability of rest areas and other facilities)
 - reduction in excess travel (if no rest areas available en route, vehicles may choose to divert off the route to reach the next rest area)
 - refuge from adverse driving conditions
 - a safe place to check loads and/or the vehicle
 - compliance with transport regulations” (p. 23).
- Aldinger (2004) cites the economic benefits associated with the planned development of a 200-acre truck stop on I-40 in Arkansas—reportedly the largest truck stop in the country. The facility employs a minimum of 400 people, and possibly as many as 1,000 people after all the services are fully deployed.

- Pommen and Associates (2004) indicates that in addition to improving highway safety, rest areas are required in Alberta: for driver safety and fatigue management, load checking for the logging industry, load inspections of heavy hauls and wide loads, as refuge during adverse weather conditions, to satisfy general travel needs, and because of growth in economic development.
- AASHTO (2001) indicates that the primary function of rest areas is to reduce accidents, and they are an “important instrument” for improving highway safety (p. iii). Safety benefits of rest areas are achieved by providing safe off-road locations for motorists to stop and rest. AASHTO (2001) also lists three secondary benefits of rest areas (beyond their primary safety benefits): (1) they offer a break from long travel periods; (2) they enhance driver comfort and convenience; and (3) they provide venues for public agencies to communicate with travelers.
- NCHRP (2000) states that “there is general agreement that rest areas have a beneficial effect on highway safety; however, there is little empirical data to support this claim” (p. 36).
- The Minnesota Department of Transportation (1998) states that adequate facilities for commercial vehicle parking mitigate two specific safety issues: driver fatigue, and unsafe truck parking on highway shoulders and interchange ramps.

3.4. BEST PRACTICES REGARDING TRUCK PARKING AT REST AREAS

This section discusses literature findings about best practices regarding truck parking at rest areas. The discussion addresses the following topics of interest: (1) determining truck parking supply and demand; (2) involving stakeholders; (3) addressing shortages in truck parking at rest areas; and (4) using advanced technologies at truck parking facilities.

3.4.1. Determining Truck Parking Supply and Demand

- Wilbur Smith Associates (2008) report that a model to evaluate the utilization of Michigan’s rest areas shows that average daily truck traffic determines the amount of available parking between 12:00 am and 2:00 am. However, the distance to the nearest city determines parking space utilization between 4:00 am and 8:00 am. This reflects the delivery schedules of trucks that are required to make early morning deliveries to metropolitan destinations.
- Gaber et al. (2005) discuss a traditional supply and demand model developed by Science Applications International Corporation in 2002 to assess the availability of truck parking. In this model, truck parking demand is calculated for a highway segment using total hours of truck-travel and the time and duration of stops. Truck parking supply is calculated as the number and location of public and private truck spaces. The model requires four steps: (1) identify relevant trucking corridors, select analysis segments, and estimate parking demand, (2) develop an inventory of public and private parking spaces for each analysis segment, (3) compare truck parking demand to supply to identify deficiencies, and (4) analyze the results. A shortcoming of this model is that it

incorrectly assumes that drivers methodically park their trucks according to designated parking spaces.

Science Applications International Corporation acquired additional data through direct observations of truck drivers at parking facilities to supplement the model results. The observations capture driver behaviour and add a level of complexity not addressed in the model. For example, observations reveal dangerous parking practices by truck drivers at the entrances and exits of parking facilities. In some instances the model results diverge from observational data. However, the authors do not necessarily view this divergence as a negative aspect; rather, they claim that it allows more complex understanding of the adequacy of parking spaces beyond “surplus”, “sufficient”, and “shortage”.

The authors suggest that researchers studying the adequacy of parking spaces should use direct observations of truck driver behaviour at parking facilities to assist with understanding the issue and use the observations to differentiate between the reliability of the model and the validity of the observations it produces.

- Khattak et al. (2001) state that it is important to estimate the proportion of truck drivers that cannot find parking on different routes and determine the travel time or distance drivers find acceptable to search for legal parking before resorting to parking illegally. This can assist with the placement of new parking facilities and with HOS policy decisions.
- The Trucking Research Institute (1996) presents findings of a modeling exercise of a driver survey and rest stop operators survey. From this model, they conclude that the following have a positive influence on truck parking utilization: one-way average daily traffic, ease of accessibility to the truck stop, ability of the truck stop to accommodate oversized trucks or triples, and security measures. Furthermore, the distance of the truck stop from the Interstate, the number of available truck parking spaces, and the number of facilities offered at the truck stop have a negative influence on truck parking space utilization. Proximity of the truck stop to a major intersection and the truck stop's ability to accommodate trucks carrying hazardous materials do not have an effect on capacity utilization.

3.4.2. Involving Stakeholders

- As part of its *Truck Rest Stop Strategy for Saskatchewan, UMA (2008) recommends a plan to communicate information about truck parking availability to stakeholders, specifically the trucking industry and associated businesses.
- *EBA Engineering (2008) conducted a survey of representatives of Alberta trucking industry regarding improvements in the planning, design, pavement management, safety and operation of highways and urban roads in Alberta. The survey was in the form of a focus group of ten representatives of this industry. The following are observations raised during the focus group:
 - More frequent, better designed rest areas with more facilities should be provided on Alberta highways. Furthermore, more rest stops/staging areas should be provided

near large urban areas, to facilitate the movements of over-dimensional commercial vehicles and long combination vehicles.

- There should be rest areas for the public before or after brake check stops for trucks. The reason for this is that it is common for non-commercial vehicle drivers to rest in a brake check stop area, which makes it difficult for truckers to do their required brake checks.
- Gaber et al. (2005) suggest the following stakeholders and methods for obtaining data and input into commercial vehicle parking studies: stakeholder focus groups, trucker surveys at private truck stops and public rest areas, interviews with trucking companies, interviews with truck stop managers, and interviews with highway patrol representatives.
- *Pommen and Associates (2005) reports on an evaluation of 16 sites in Alberta that were considered as potential Safety Rest Areas (SRAs). This study follows *Pommen and Associates (2004), which develops a policy framework and implementation strategy for safety rest areas in Alberta. *Pommen and Associates (2005) reports that various stakeholders were involved and consulted in the development of the strategies for rest areas in Alberta. These are:
 - Alberta Motor Association;
 - Alberta municipal districts and counties;
 - Alberta Transportation Association;
 - Alberta Infrastructure and Transportation Safety and Inspections;
 - Alberta Urban Municipalities Association;
 - American states and safety associations;
 - American Association of State and Highway Transportation Officials (AASHTO)
 - forestry industry representatives;
 - Heavy Haul and Commercial Transportation District Advisory Committees; and
 - other Canadian provinces.

The report states that stakeholders identified the need for additional stopping opportunities along transportation corridors in the province. This need identification was further supported by North American practices and studies that discuss the benefits of rest areas.

- Kelley (2003) discusses the truck parking shortage in the United States. The author compares commercial truck stops to public rest areas, stating that truckers prefer truck stops due to their convenience and amenities, and use rest areas for shorter stops involving a quick nap or bathroom break. The author also examines the U.S. government plans to commercialize state rest areas, a plan which both the American Trucking Association and the National Association of Truck Stop Operators (NATSO) oppose. In particular, NATSO states that this commercialization may have “contributed

to the parking shortage in the northeast. (p. 24). Many people, however, maintain that the “government needs to be a part of the solution” (p. 24).

- Berthelsen (2002) discusses the Rest Area System Master Plan developed by the California Department of Transportation (Caltrans) in 2000. In this plan, the state prioritizes the improvement of the 88 existing rest areas, and develops a plan for adding new or auxiliary facilities. The plan recommends 80 new rest areas to be built either through partnership with private agencies or, in the absence of partners, with public funds. Part of the plan calls for the accommodation of Highway Patrol workspaces at selected rest areas to improve safety for motorists.
- Wegmann and Chatterjee (2002) identify stakeholders represented in groups in the 10 southeastern states (Tennessee, North Carolina, Virginia, Kentucky, Arkansas, Mississippi, Alabama, Georgia, South Carolina, and Florida) involved in truck parking issues. Table 2 lists the stakeholders and the number of states in the region that involve each entity. The authors state that shippers and receivers are “noticeably absent” from this list (p. 150).

Table 2: Truck Parking Stakeholders Identified in the Ten Southeastern States

Stakeholder	Number of states that involve the stakeholder
State trucking associations	10
Trucking company owners	10
State departments of transportation	10
Federal Highway Administration	9
Federal Motor Carrier Safety Administration	8
State Highway Patrol	8
Private truck stop operators	7
American Automobile Association	3
State Department of Motor Vehicles	3
Independent truck drivers	2
Good Roads Association	1
Citizens	1
Insurance groups	1
Tourism representatives	1
Special interest groups	1
Oil product marketer	1

Source: Wegmann and Chatterjee 2002

- NCHRP (2000) identifies effective collaboration as important to implementing any type of countermeasure for driver sleepiness. “These collaborations extend beyond public awareness and education activities to the full range of countermeasures being pursued—new technologies, roadway improvements, rest area management, and regulatory/judicial actions” (p. 51). Collaborative partners include federal agencies, trucking associations, road safety special interest groups, intelligent transportation systems experts, and others.
- The Caltrans Safety Roadside Rest Area System Improvement Team (1999)—as reported in NCHRP 2000—discusses efforts to revitalize rest areas for all drivers in

California by seeking new ways to partner with the private sector and other key stakeholders. Table 3 lists the stakeholders involved in this initiative.

Table 3: Caltrans Safety Roadside Rest Area Improvement Team

External representatives	Caltrans representatives
American Association of Retired Persons	Rest Area Coordinators (all districts)
Automobile Club of Southern California	Office of State Landscape Architecture
California Department of Mental Health	Maintenance
California Department of Rehabilitation	Engineering Service Center
California Commission on Aging	Traffic Operations
California Division of Tourism	Traffic Planning
California Highway Patrol	Traffic Information
California Roundtable on Parks, Recreation and Tourism	Former District Director
California State Automobile Association	Team Leader, Office of State Landscape Architecture
Collier Interpretative Information Center Agency	
Federal Highway Administration	
Parents Against Tired Truckers	
Traveler Center Services	

Source: Caltrans Safety Roadside Rest Area System Improvement Team 1999

3.4.3. Addressing Shortages

- Knipling (2009) states that “the national deficiency of rest parking creates roadway hazards, undermines commercial motor vehicle (CMV) driver quality-of-life, and contributes to CMV driver fatigue.” The author summarizes recommendations found in the literature about possible approaches to improve truck parking issues:
 - Expand and improve public rest areas as well as private truck stops and travel plazas.
 - Create public-private partnerships to support truck parking projects.
 - Use alternative parking sites such as weigh stations, stadium parking lots, and shipper/receiver lots.
 - Improve parking area layout to facilitate parking.
 - Improve amenities, lighting, safety, and security.
 - Use technology to provide real-time information on available spaces to drivers, such as FMCSA’s “Smart Park” program.
 - Extend public parking time limits to be compatible with HOS rules.
 - Continue to increase government and public awareness of truck parking problems.
- Ritchie (2008) reports that Ontario is planning a major re-development of its existing 23 service centres located along Highways 400 and 401. This will be done through an

agreement where a single corporation will build, finance, maintain, and operate the facilities. The main objective is to upgrade these service centres into 24/7 “world-class” travel centres providing travellers and tourists with safe places to rest, eat, and refuel.

- *UMA (2008) develops a Truck Rest Stop Strategy to manage truck parking demand on Saskatchewan's National Highway System. The strategy includes a short term (within two years) and long term (beyond two years) action plan. The short term action plan has three components:
 - The first component recommends the establishment of a database of existing truck parking supply, the assessment of deficiencies, and the dissemination of truck parking supply information to the trucking industry. Specific action items within this component are: (1) the development of a map of truck rest locations on the NHS; (2) an assessment of the truck parking facility signage, parking supply, and the potential location of new facilities; (3) a detailed assessment of future truck parking facilities; and (4) the provision of information to truck drivers on the distance to the next parking facility.
 - The second component recommends the exploration of cost-sharing opportunities. Specific action items are: (1) the development of policies regarding public-public and public-private partnerships for developing future truck parking facilities; and (2) the identification of potential partnerships.
 - The third component encourages private industry involvement in addressing truck parking deficiencies.

The long term strategy has five components:

- The first component recommends continued provision of information about truck parking supply by: (1) implementing variable message signs for disseminating real-time parking information to drivers; and (2) updating a map of truck parking facilities in Saskatchewan.
 - The second component recommends the development of truck parking facilities with public-public and public-private partnership programs.
 - The third component continues to encourage and monitor private sector involvement with the truck parking issue.
 - The fourth component recommends that future highway development projects include truck parking facilities.
 - The fifth component recommends the construction of more public rest areas where financially feasible and private sector interest is limited.
- Wilbur Smith Associates (2008) identifies the following options for solving truck parking supply problems: public-private partnerships, parking capacity additions, parking policy revisions, and information technology systems.

The authors summarize the strategies of several states to solve truck parking issues:

- New York increased the number of truck parking spaces by about 300 in 1997. Furthermore, the New York Department of Transportation (NYDOT) prepared plans to convert closed rest areas into truck parking and construction of new rest areas on heavily traveled corridors. NYDOT provided a framework for a system of rest areas with the following recommendations: (1) introduce additional truck registration fees to be used solely for initiatives to address truck parking issues; (2) shift rest area funding from locations that are well-served by private businesses to areas where additional development is necessary; and (3) encourage the formation of public-private partnerships.
- California proposed the creation of a public-private partnership to develop fenced, lighted parking lots adjacent to commercial developments near overcrowded rest areas. The lots would be free to all motorists and would require the State to lease or purchase the land and the private sector to provide restrooms, clean up services, and security.
- Maryland implemented a strategy to educate truck drivers about available legal parking space, added signage along Interstates to advise drivers of overnight parking facilities, and published and distributed a truckers' map that located public and private parking locations.
- Kentucky introduced a "safe haven" concept that allows trucks to park at weigh stations overnight with the condition that enforcement officials will not disturb drivers. This concept increased available parking by about 225 spaces.
- Connecticut studied truck parking shortages and found that reconfiguring, expanding, or building new truck parking facilities is a viable option to address parking deficiencies. The study produced by the State, and referenced in the Wilbur Smith (2008) report also examines alternative sites for truck parking but was unable to identify any locations that met the design requirements for a truck parking facility.
- Iowa identifies several strategies and goals to address truck parking issues, including: (1) evaluate existing facilities to determine how to accommodate more truck parking; (2) use ITS to inform truck drivers of available parking spaces; and (3) upgrade existing rest areas to meet the parking demand based on a 20-year plan.
- Austroads, Inc. (2008) make the following recommendations about the provision of rest areas:
 - "Until road safety benefits and economic value of heavy vehicle rest areas are determined, funding should continue to be prioritized to the initiatives with demonstrated safety and economic benefits" (p. 29).
 - "Methodological research into the relationship between the provision of rest areas and crash reduction needs to be undertaken, particularly in relation to heavy vehicles" (p. 29). These safety benefits need to be evaluated in terms of benefit/cost ratios.
 - Australian jurisdictions should maintain records of the assets associated with their rest areas.

- Clarifications are needed for the future development of the National Guidelines for Provision of Rest Area Facilities to enable jurisdictions to apply them.
- Rodier and Shaheen (2007) discuss recommendations from Congress to the FMCSA to develop a guide to inform truck drivers of the locations of parking and parking availability in the U.S. Specifications in the TEA-21 and SAFETEA-LU transportation bills emphasize the importance of investigating the availability of truck parking and introduce the Interstate Oasis Program to address the problem of truck parking shortage. This program is a public-private partnership to improve truck rest stops in response to the closure of public rest areas. The Secretary of Transportation designates facilities as part of the Interstate Oasis Program based on the following criteria: (1) it must offer products and services to the public; (2) it must provide 24-hour access to restrooms; and (3) it must have parking for heavy trucks and automobiles. The proximity to the Interstate system is also considered.

The authors also explain that SAFETEA-LU established the Truck Parking Facilities Pilot Program to fund projects that both improve facility access and reconfigure parking spaces to accommodate truck maneuvers at currently operational facilities. The program also funds projects aimed at increasing the number of facilities.

- Parametrix (2005), in a study for the Washington State Department of Transportation, identifies and evaluates five strategies to increase the supply of truck parking along three freight corridors in Washington State (I-5, I-90, and I-82):
 - The first strategy is to construct new public rest areas, reconfigure existing public rest areas, or create new truck-only facilities to create additional truck parking spaces. Cost estimates per truck parking space range from \$30,000 to \$75,000. The conversion of a closed public rest area into a limited-feature truck-only parking facility in Ohio is cited as an example implementation of this strategy. Also, many states have reconfigured public rest areas to create additional truck parking capacity.
 - The second strategy involves legalizing truck parking at non-port of entry weigh stations, and modifying these facilities to accommodate truck parking needs. The cost estimate per truck parking space for this strategy is about \$67,000. Several states have successfully implemented this strategy.
 - The third strategy implements public-private partnerships to encourage private sector truck stop developments in locations where public rest areas are known to be over capacity. The “Interstate Oasis” programs in Vermont and Utah are cited as examples of successful public-private partnerships.
 - The fourth strategy implements public-private partnerships that provide financial assistance for private truck stops to expand their capacity. The “Interstate Oasis” programs in Vermont and Utah are the basis for this strategy.
 - The fifth strategy develops shared-use agreements with existing parking lot owners.

In addition to these strategies that focus on creating new truck parking spaces, Parametrix recommends: (1) the implementation of a program to communicate information about parking availability to truck drivers; (2) clear designation of truck parking from recreational vehicle parking spaces; and (3) increasing enforcement of truck parking laws.

- Gaber et al. (2005) reveal that truck stop operators view public rest areas as strong and unfair competition, however, truck drivers prefer the ability to choose between truck stop and rest stop parking. The authors state that if public agencies believe additional truck parking is necessary, they should consider increasing public rest area parking at locations that are not in direct competition with private truck stops. Based on a survey conducted for this study, the authors find that the majority of drivers prefer public rest areas for short-term parking.
- Smith et al. (2005) suggest three approaches to solving truck parking shortages: (1) enhance attractiveness of underutilized spaces (e.g., by improving lighting to reduce crime and modifying parking layouts); (2) increase the supply of spaces (e.g., by constructing new spaces, using weigh stations and park-and-ride lots, and relaxing parking time limits); and (3) better match supply and demand of truck parking spaces (e.g., by using technologies to provide real-time information on parking availability).

The authors consult state officials to obtain the following feasible and effective options to address issues with commercial vehicle parking:

- Use ITS to expand the amount of information available to truckers.
- Expand existing rest areas for truck parking by providing more spaces.
- Permit the use of weigh stations for parking.
- Establish a Federal Assistance Program targeted at truck parking.
- Encourage the development of public-private partnerships.
- Build new rest areas for autos, trucks, and RVs.
- Eliminate parking time enforcement.

The authors also cite results of an FHWA truck driver survey that lists the following popular parking-related improvements:

- Build more truck stop parking spaces (79 percent).
 - Build more rest area parking spaces (66 percent).
 - Stop enforcement officers from waking drivers (57 percent).
 - Eliminate parking time limits (49 percent).
 - Improve parking layout and configuration (46 percent).
 - Separate truck, car, and RV parking (42 percent).
 - Improve signs and roadway information for parking facilities (28 percent).
 - Provide real-time information on parking availability (18 percent).
- A report prepared by ARRB Transport Research for the Australia National Transport Commission (2004) provides guidelines to promote consistency in the frequency,

location, and provision of facilities for rest areas used by commercial vehicle drivers. The guidelines are intended to reflect Australia's fatigue management guidelines. Recommendations are given in the following categories:

- *Planning for rest areas:* A strategic plan should be developed for the provision of rest areas and the upgrade of existing facilities on major highways and freight corridors.
 - *Categories of rest areas:* Three rest area categories should be included in these strategic plans: (1) major rest areas, designed for long rests and providing a full range of services for trucks and cars; (2) minor rest areas, designed for shorter rests for trucks and cars; and (3) truck parking bays, designed to allow truck drivers to conduct short stops for checking loads, completing log books, and conducting other operational duties.
 - *Locating rest areas:* As a general rule, major rest areas should be located every 100 km, minor rest areas every 50 km, and truck parking bays every 30 km. Rest areas should be provided for both directions of travel on undivided roads, or where this is not possible, be staggered on either side of the highway to discourage cross-traffic movements. Mid-block locations sufficiently removed from interchange locations are recommended for rest area sites. The proximity to urban centres and towns and the environmental quality of the site should also be considered.
 - *Design:* Major rest areas should accommodate at least 20 vehicles, minor rest areas at least 10 vehicles, and truck parking bays about four or five trucks. Other design issues to be considered are personal security, pedestrian accommodation, lighting, design speed, and access and egress.
 - *Signage:* Signage (based on Australian standards) should provide travelers information about upcoming rest areas, directions to access these areas, and the distance to the next nearest rest area.
 - *Facilities and services:* Minimum facilities that should be provided at major and minor rest areas are: all-weather pavements, shade, garbage receptacles, separate parking for trucks and cars, shelter, and tables or benches. Truck parking bays should at least provide all-weather pavements, shade, and garbage receptacles. Facilities should accommodate people with disabilities. Drinking water and toilets should be provided at facilities where expected use justifies these additional capital and maintenance costs.
- Based on a study of truck parking supply and demand in Virginia, Garber and Wang (2004) make five recommendations to address Virginia's truck parking issues:
 - Investigate the feasibility of establishing public-private partnerships to construct new truck parking facilities along Interstate highways.
 - Study the appropriateness of changing the two-hour parking limit at rest areas.
 - Collect data on factors that influence truck parking demand, such as commodity flow patterns and the distribution of terminals.
 - Study technologies for disseminating real-time parking information to truckers.

- Investigate the feasibility of permitting trucks to park on some interchange ramps.
- NCHRP (2004) provides details on two strategies related to truck parking aimed at fatigue-related truck crashes: (1) increasing the efficiency of use of existing parking spaces by implementing message signs showing real-time parking information (based on experiences in North Carolina); and (2) creating additional parking spaces by creating “Rest Havens” at existing weigh station facilities (based on experiences in Kentucky). Table 4 and Table 5 summarize these strategies.

Table 4: Strategy Attributes for Implementing a Truck Parking Information System

Attribute	Description
Technical attributes	
Target	<ul style="list-style-type: none"> • Truck drivers seeking a place to stop and rest.
Expected effectiveness	<ul style="list-style-type: none"> • In North Carolina, the implementation of a message sign showing real-time parking information at a rest area reduced the number of trucks parked on ramps at 07:00 from an average of 34 per day during the two-weeks prior to implementation to an average of about 20 trucks per day in the year following implementation. • North Carolina claims that some crashes have resulted from truck parking issues around rest areas, and that providing spaces for these trucks to park contributes to highway safety.
Keys to success	<ul style="list-style-type: none"> • Provision of timely information is important, particularly in “corridor” states (i.e., states that trucks travel through to reach their final destination). • Ideally, truck parking information would be updated automatically when a truck fills a spot; otherwise, custodial staff may be required to update parking information.
Potential difficulties	<ul style="list-style-type: none"> • Power outages would eliminate the ability for signs to convey parking information. • It is advisable to monitor parking availability at truck stops off the Interstate system, however, this information may be difficult to obtain. • If illegal parking persists, there should be coordination with law enforcement officials to ticket illegally parked vehicles.
Appropriate measures and data	<ul style="list-style-type: none"> • The extent to which the truck parking information system is successfully operated (presumably by custodial staff) should be measured and monitored. • The number of locations at which the system is implemented should be tracked. • Although the link between the implementation of a message sign and safety impacts is difficult to establish, the following safety indicators should be measured: total crashes involving trucks, night crashes, and crashes in which drowsy driving is involved.
Associated needs	<ul style="list-style-type: none"> • Coordination between states is necessary to provide advanced information about truck parking in adjacent jurisdictions. • An information campaign targeted at truckers may help introduce this change.
Organizational and institutional attributes	
Organizational, institutional, and policy issues	<ul style="list-style-type: none"> • Agreements will be needed to coordinate information sharing between states. • Public-private partnerships will be needed to provide truckers with real-time information about parking in public rest areas and private truck stops.
Issues affecting implementation time	<ul style="list-style-type: none"> • Initial implementation of a message sign in a particular jurisdiction may take more than a year, but can be fully deployed in as little as four months.
Costs involved	<ul style="list-style-type: none"> • The cost of purchasing a variable message sign is between \$25,000 and \$30,000. Associated costs are minimal.
Training and personnel	<ul style="list-style-type: none"> • If custodial staff is required for updating the sign, time should be allotted for training.

Source: NCHRP 2004

Table 5: Strategy Attributes for Creating Additional Parking Spaces at “Rest Havens”

Attribute	Description
Technical attributes	
Target	<ul style="list-style-type: none"> Truck drivers seeking a place to stop and rest.
Expected effectiveness	<ul style="list-style-type: none"> Additional parking spaces should allow for more truck drivers to obtain rest and reduce fatigue-related crashes. Although no research establishes a direct link between increasing truck parking supply and crash reductions, it is expected that creating additional supply will contribute to driver wellness and highway safety.
Keys to success	<ul style="list-style-type: none"> Truck drivers should be informed about availability in time to make decisions. Truck drivers need to feel secure in the available parking space. Truck drivers need assurance that enforcement will not require them to move. Adequate publicity about Rest Haven availability is important. Amenities such as rest rooms and food services are not essential, but increase the attractiveness of a Rest Haven. The creation of Rest Havens relies on support from high-level administrators.
Potential difficulties	<ul style="list-style-type: none"> Costs to modify weigh stations for truck parking may be problematic. Enforcement personnel working at Rest Havens should not be permitted to inspect trucks using parking spaces. A lack of personal security, food services, and restrooms will discourage truckers' use of Rest Havens. Private truck stop facilities may consider Rest Havens as undue competition from the public sector.
Appropriate measures and data	<ul style="list-style-type: none"> The change in the parking space availability should be monitored. Although the link between the implementation of a message sign and safety impacts is difficult to establish, the following safety indicators should be measured: total crashes involving trucks, night crashes, and crashes in which drowsy driving is involved. Feedback from suggestion boxes is helpful.
Associated needs	<ul style="list-style-type: none"> There will be a need to provide information to truckers about parking availability at Rest Havens and to assure truckers that they will not be subject to inspection. An information campaign targeted at truckers may help introduce this change. Arrangements with custodial staff will be required.
Organizational and institutional attributes	
Organizational, institutional, and policy issues	<ul style="list-style-type: none"> Support from high-level administration, motor carrier enforcement personnel, and the trucking industry will be needed. It is likely that private truck stop owners will suggest that truckers are responsible for finding legal parking spaces in accordance with HOS regulations.
Issues affecting implementation time	<ul style="list-style-type: none"> In Kentucky, it took three years between the identification of the truck parking shortage and the implementation of the first Rest Haven. Funding and land availability will affect implementation time.
Costs involved	<ul style="list-style-type: none"> Kentucky estimates a cost of \$10,000 per parking space at its Rest Havens.
Training and personnel	<ul style="list-style-type: none"> No special training is required for this strategy. Arrangements with custodial staff will be required.
Other key attributes	
	<ul style="list-style-type: none"> It is argued that truckers know where to find a place to park, and that if the severity of penalties was increased, trucks would stop parking in illegal spaces. Larger trucking companies typically arrange for places for their trucks to park. Drivers working for smaller trucking companies may not benefit from these arrangements, and yet face potential truck parking shortages that are not entirely within their control. Thus, requiring drivers to move may be a detriment to safety.

Source: NCHRP 2004

- *Pommen and Associates (2004) discusses the development of a policy framework and implementation strategy for safety rest areas in Alberta. The purpose of the framework is “to provide a context and strategy for prioritizing and ranking of Rural Safety Rest areas along highways in Alberta.” (p. 5). The report presents a five-step procedure to follow in the implementation of responsibilities to deploy this strategy: (1) policy and strategic implementation; (2) site evaluation stage; (3) implementation stage; (4) construction stage; and (5) monitoring and maintenance stage.

According to the authors, the implementation strategy must plan, coordinate, budget for, and complete the construction of safety rest areas “based on a three-point (A, B, C) priority scale as follows:

- A – High priority sites: Construction should be planned, coordinated and completed within a three-year window . . .
- B – Medium priority sites: Construction should be planned, coordinated and completed within three to six years . . .
- C – Low priority sites: Construction should be planned and coordinated for completion after A and B priority safety rest areas are constructed.” (p.7)

According to *Pommen and Associates (2004), the location and spacing of rest areas must be based on functional factors such as: travel times, load check requirements, trucking industry regulations, special needs regarding poor weather conditions at specific areas, and roadside functional design standards. Furthermore, the location selection must be based on traffic characteristics and log haul routes, proximity to urban and commercial services, proximity to other highways and geometric and geotechnical conditions of the proposed sites.

The report summarizes results found in the literature, as well as current practices in other jurisdictions, regarding spacing of rest areas. The authors indicate that the average spacing between rest areas in the U.S. is about 70 km, and the recommended spacing is about 60 minutes or 80 km. The following are practices in other jurisdictions:

- Ontario Ministry of Transportation: 80 km intervals on controlled access roads.
- British Columbia Department of Highways: 80 km intervals or 60-minute driving time on four-lane routes; 60 km intervals or 60-minute driving time on two-lane routes.
- Alberta Transportation: 90 km intervals or 60-minute driving time; Class III safety rest areas every 30 to 40 km.
- Washington Department of Transportation: 100 km or 60-minute intervals with restroom equipped facilities

*Pommen and Associates (2004) also identifies that the design of highway safety rest areas in Alberta (p. 42):

- “should maintain or improve traffic safety;
- should address safe access/egress to a highway (i.e., proper deceleration/acceleration and parking requirements;

- must be conveniently located and highly visible to encourage high usage;
 - should provide the opportunity to reduce and minimize driver fatigue, while minimizing interruptions to safe traffic flow;
 - should address log haul, heavy haul, and long haul trucking industry needs, combined with regular traffic stream;
 - should provide a basic level of service including toilets, while being an integral part of overall Safety Rest Area spacing; [and]
 - should take into account future highway upgrading plans”.
- NCHRP (2003) synthesizes successful and innovative strategies used to manage increasing demand for truck parking and identify potential approaches yet to be deployed. Based on a survey of public sector highway maintenance engineers, the report ranks twenty strategies according to their combined levels of effectiveness and feasibility (Table 6). The study also summarizes strategies developed through the work by the Science Applications International Corporation in 2002. Based on the survey and synthesis of recommended strategies, the report concludes that a multi-pronged approach is required to deal with truck parking demands. Aspects of this approach include the expansion and improvement of public rest areas, the establishment of a federal assistance program targeted at truck parking issues, education and information dissemination—via the implementation of ITS—about truck parking supply, and the development of public-private partnerships to improve existing facility utilization.
 - Chen et al. (2002) survey drivers regarding their preferences in receiving truck parking information and find that:
 - 73 percent would like to receive information by radio in their vehicle;
 - 40 percent would like to receive information using their vehicles electronic visual display; and
 - 12 percent prefer information over the internet.

The survey also reveals that the types of real-time information drivers wish to receive include:

- location of truck parking facilities along the road being traveled (84 percent);
- features available at upcoming facilities, such as showers and hot meals (77 percent);
- number of parking spaces available at upcoming parking facilities (68 percent); and
- length of time limits for upcoming truck parking spaces (46 percent).

Additional comments to the survey indicate that drivers are interested in receiving real-time information about the layout and size of parking spaces at upcoming facilities and whether a parking facility can accommodate trucks that are oversized, transporting hazardous materials, or multi-trailer loads.

Table 6: Improvement Strategy Effectiveness, Feasibility, and Combined Ratings

Improvement strategy	Effectiveness score ^a	Feasibility score ^a	Combined score ^b
Use ITS to expand amount of information available to truckers	2.04	1.96	4.00
Expand existing rest areas for truck parking by providing more truck spaces	2.00	1.79	3.58
Permit the use of weigh stations for parking	1.71	1.92	3.27
Establish federal assistance program targeted at truck parking	2.08	1.50	3.13
Encourage the development of public-private partnerships	2.08	1.48	3.08
Build new rest areas for autos, trucks, and RVs	1.79	1.54	2.76
Allow use of federal-aid funds to maintain public rest areas	1.63	1.33	2.17
Build new rest areas for trucks only	1.92	1.04	2.00
Redesign parking configuration at existing rest areas to provide more spaces	1.46	1.33	1.94
Install security systems, cameras, and effective lighting	1.33	1.42	1.89
Reopen closed rest areas	1.38	1.31	1.81
Locate law enforcement office substations at rest areas	1.21	1.46	1.76
Build pull-offs to provide parking	1.54	1.13	1.73
Expand existing rest areas for truck parking by permitting use of auto spaces at certain times	1.29	1.29	1.67
Construct multi-use rest area facilities that also address tourism and truck inspection (e.g., safety, size and weight, and diesel emissions testing) needs	1.29	1.25	1.61
Conduct education campaign to encourage drivers to better plan trips	1.38	1.17	1.60
Use park-and-ride lots	1.17	1.18	1.38
Establish a rating system for commercial truck stops	1.21	1.13	1.36
Improve access to commercial truck stops (e.g., driveway design and curbing)	1.25	1.08	1.35
Eliminate parking time enforcement	1.15	1.00	1.15

Source: NCHRP 2003

Notes: ^a The effectiveness and feasibility scores are weighted average scores developed from a three-point scale in which a value of 3 is assigned to a rating of “high”, a value of 2 is assigned to a rating of “medium”, and a value of 1 is assigned to a rating of “low”.

^b The combined score combines the effectiveness and feasibility scores but is not the sum of these scores.

- Science Applications International Corporation (2002), in a report for the U.S. Federal Highway Administration, recommends improvements to mitigate truck parking shortages at truck parking facilities on the U.S. National Highway System. Specific actions recommended are to:
 - expand and improve public rest areas by providing additional parking spaces and redesigning existing facilities to better accommodate commercial vehicles;

- expand and improve private truck stops by directing a portion of truck registration fees to address parking shortages, closing public facilities in areas well-served by the private sector and shifting these funds elsewhere, and removing certain requirements for developers of new facilities;
 - encourage public-private partnerships to allow private truck stop operators access to low-interest loans for capacity expansion and engage in lease agreements to maintain nearby publicly owned parking lots;
 - educate or inform truck drivers about available spaces through deployment of Intelligent Transportation Systems, information mail-outs, and the publication and distribution of a map of public and private truck parking facilities;
 - modify parking enforcement rules to discourage parking on shoulders and interchange ramps and increase the amount of time trucks can park at public rest areas; and
 - conduct additional research about the adequacy of truck parking facilities.
- Wegmann and Chatterjee (2002) list actions taken by 10 southeastern states (Tennessee, North Carolina, Virginia, Kentucky, Arkansas, Mississippi, Alabama, Georgia, South Carolina, and Florida) to address the shortage of truck parking spaces in that region (p. 148):
 - “Close inadequate rest areas and/or improve existing rest areas by increasing truck parking spaces [and] renovate/redesign existing facilities and spaces to provide additional parking for trucks and better services to drivers...”
 - “Add totally new rest areas where needed...”
 - Use available space at weigh stations to provide additional parking...”
 - “Improve safety and security at public rest areas by providing special parking for police, and enhance security related facilities and services (e.g., landscaping, lighting, surveillance, etc.).”
 - “Use ITS to provide better traveler information on road conditions...”
 - “Provide timely public rest area information through the use of the web, distribute maps, [and] use kiosks to identify the location and facilities available in rest areas to truckers...”
 - “Use real time information on the availability of truck parking spaces at public rest areas...”
 - “Explore opportunities, and identify barriers, to form private/public partnerships for enhancing public rest areas...”
 - “Provide a uniform logo and signage system for displaying the location of privately owned truck parking facilities...”
 - “Develop an anti-fatigue educational program for truckers...”

- “Provide educational information to truckers regarding legal requirements, the best use of public truck parking spaces and the benefits of good route planning...”
- “Enhance the enforcement of unsafe truck parking...”
- “Improve the design and operation of freeway interchanges (e.g., turning radius, width of ramps, traffic signals, turning lanes, etc.) and upgrade access roads to private truck stops near Interstate highways...”
- AASHTO (2001) provides guidelines for the development of rest areas on arterials and freeways and the implementation of a state-wide rest area program. The Guide proposes a three-phase development process: planning, determining site location, and design.

In the planning phase, the Guide recommends a systems analysis approach, which requires information about existing and projected traffic (and truck traffic) volumes, annual-usage, and recommended spacing between rest areas (which currently suggests that rest areas should be located every 100 km). Separate formulae are proposed for determining the number of parking spaces for cars and trucks. Special consideration for truck parking requirements relies on information about the number of trucks stopping at rest areas (which typically peaks during the day), and the length of stay at rest areas (which typically increases during the night and represents peak conditions). Time limit restrictions for trucks at rest areas may cause enforcement problems and may not be desirable for alleviating truck driver fatigue. If inadequate truck parking spaces are supplied, drivers may choose alternative, less desirable places to park such as along highway shoulders.

If upgrades to existing rest area facilities are not sufficient to meet parking demands, the Guide proposes the following criteria for selecting a site for a new rest area:

- scenic value and access to shade and water;
- availability of utilities;
- ability to meet recommended spacing intervals;
- geometric design considerations such as horizontal and vertical alignment, sight distances, and merging and diverging requirements; and
- environmental considerations.

The third phase involves site design. In general, site design issues to be considered are: aesthetic quality, separation of parking spaces for cars and trucks, provision of basic services and shelter, provision of advance warning signs and traveler information, all-weather parking facilities, security features such as lighting and emergency phones, geometric requirements, pedestrian facilities, and ease of maintenance.

- Khattak et al. (2001) conduct two surveys to gather information from owners of truck stops in Nebraska and truck drivers passing through Nebraska. Eighteen truck stop owners located on Interstate, U.S., and State highways and 118 truck drivers (67 percent with more than five years of driving experience) from 29 different states and two Canadian provinces responded. The truck driver survey concludes that 39 percent of

drivers are willing to pay \$3 for better parking facilities, while 61 percent are unwilling to pay any amount. The authors also suggest investigating diagonal pull-through parking stalls, real-time parking stall availability information, and the ability to reserve a parking stall in advance on busy routes.

- The National Transportation Safety Board (2000), in a report on truck parking-related problems, makes the following recommendations:
 - Create both a paper and electronic comprehensive guide for truck drivers that indicates the location of all parking areas, both private and public, and space availability. Additionally, develop a plan for its distribution and maintenance.
 - Eliminate or modify parking time limits at public rest areas or redirect drivers to nearby parking facilities where they can obtain adequate rest.

The NTSB also finds that Global Positioning Systems (GPS), in conjunction with electronic guidance, may enable dispatchers to inform truck drivers about the nearest parking facility.

- NCHRP (2000) cites the following security-related recommendations for rest areas made by a New York State task force on drowsy driving:
 - establishing State Police or satellite offices at key rest area locations;
 - installing security lighting;
 - providing direct telephone access to the police;
 - investigating the feasibility of security cameras where appropriate;
 - employing uniformed DOT maintenance personnel at each rest area, with 24-hour staffing at selected rest areas; and
 - implementing design improvements, such as improved lighting and visibility from the roadway, to enhance rest area safety, security, and appearance.
- Hamilton (1999) provides a summary of proceedings of the Rest Area Forum in 1999, attended by the Federal and State departments of transportation, the motor carrier industry, the private truck stop industry, commercial vehicle drivers, and safety advocates. The following recommendations arose from the forum:
 - Provide safety and security in public rest areas and privately owned truck stops by locating law enforcement office substations at public rest area facilities, establishing a safety rating system for private facilities, increasing crime prevention services, staffing public rest areas, installing security systems (cameras and lighting), providing signs with crime reporting contact information, designing landscaping with safety in mind, and eliminating commercial vehicle inspections in public rest areas to avoid disturbing sleeping drivers.
 - Support private truck stops' ability to meet the parking need by providing low-interest loans, partnering in construction, developing and posting general guidelines and ratings of private truck stops, and identifying solutions for hindrances to rest stop

- expansion and modernization (e.g., diesel emissions, noise control issues, environmental concerns, and citizen opposition).
- Provide alternative parking sites such as park-and-ride lots and weigh stations.
 - Improve provision and location of public rest areas and private truck stops by adopting uniform spacing standards for public rest areas (approximately one hour apart), providing additional parking at existing public rest areas, re-opening closed public rest areas, encouraging shippers and receivers to accept responsibility for providing parking spaces, and encouraging public-private partnerships to meet needs in areas with parking shortages.
 - Improve federal, state, and local financial support of parking.
 - Eliminate time limits imposed by states on legal commercial vehicle parking.
 - Increase driver education and information through fatigue-related information campaigns, stopping alternatives and planning ahead strategies, better signage on corridors, use of ITS to deliver real-time parking information, and development and distribution of private and public rest area maps.
- Schneider et al. (1999) list lessons learned from a program to expand New York State's rest areas for motorists and commercial vehicle drivers (p. 236):
 - "Public rest areas serve a critical public safety need."
 - "The public expects first class rest area facilities and services."
 - "Inadequate attention has been paid to the needs of commercial vehicle drivers, especially with respect to parking and resting places."
 - "A high level of commitment is necessary to ensure that rest areas receive proper attention."
 - "Input from many officials and interest groups are desired in planning rest areas."
 - "The public sector probably cannot satisfy all rest area needs in the future, as costs are substantial."
 - "Increased federal flexibility appears desirable for (1) appropriate commercialization of public rest areas, especially where such services are not readily available and (2) encouraging development of more private truck stops."
 - The Trucking Research Institute (1996), in a report prepared for the U.S. Federal Highway Administration, presents four measures to increase truck parking at rest areas: (1) enforcement of time limits; (2) modification of existing facilities; (3) renovation of existing facilities; and (4) construction of new facilities. Because of the potential safety consequences of increasing enforcement of time limits, this option was discarded. Specific options within the remaining three measures are provided in Table 7, including advantages and disadvantages. Total nationwide cost estimates to meet the demand for truck parking at public rest areas range between \$489 and \$629 million, and involve a combination of modification, renovation, and construction options. "The issue of

inadequate truck parking can only be met by creative strategies to help facilitate future rest area spending decisions over ten years” (p. ii).

Table 7: Measures and Options to Increase Truck Parking at Rest Areas

Options	Advantages	Disadvantages
Measure – Modification		
Option A: use some car parking area for trucks at night	<ul style="list-style-type: none"> • Low cost • Increases truck parking during peak usage time 	<ul style="list-style-type: none"> • Provides only a few parallel spaces for trucks during the night-time • Trucks may still tend to park on shoulders and ramps
Option B: use existing park-and-ride facilities for night overflow parking	<ul style="list-style-type: none"> • Low costs for signing and publicity to drivers only • Provides parking for periods of high parking volumes • Space for pull-through type parking 	<ul style="list-style-type: none"> • Does not provide normal rest area facilities • May require some enforcement to ensure that trucks leave before normal daytime use of lot begins • May only be feasible in select urban areas
Measure – Renovation		
Option A: minor renovation of rest area parking lot with pull-through type spaces	<ul style="list-style-type: none"> • Maximum use of existing land • Provides parking for an additional number of trucks • Truck parking is pull-through type, allowing better utilization 	<ul style="list-style-type: none"> • Moderate capital expense • Requires rest area to be temporarily closed • May not provide adequate additional parking for all trucks
Option B: major renovation, convert/redesign existing parking lot to add additional truck parking spaces that are pull-through type	<ul style="list-style-type: none"> • Maximum use of existing land • Provides potentially substantial additional parking for trucks • Truck parking is pull-through type, which has higher parking utilization than parallel 	<ul style="list-style-type: none"> • May require extensive capital expense • Requires rest area to be temporarily closed • Extra land may be required • May not be feasible at all rest areas
Measure – New Construction		
Option A: build pull-off areas within the existing right-of-way with no additional facilities	<ul style="list-style-type: none"> • Supplies additional parking for trucks without cost of a complete rest area • Can provide daytime picnic area for cars 	<ul style="list-style-type: none"> • Moderate capital cost • If not visible from the Interstate, drivers may perceive that it is not safe for parking • May be rejected as a safety hazard • May lack public support
Option B: build new rest areas	<ul style="list-style-type: none"> • Supplies maximum truck parking • Supplies security and service 	<ul style="list-style-type: none"> • May require large capital expense • May require new land • Requires acceleration lane for re-entry • May lack public support

Source: Trucking Research Institute 1996

3.4.4. Using Advanced Technologies

- Secrist (2008) presents information about an initiative by the U.S. Federal Motor Carrier Safety Administration called Smart Park. The purpose of this initiative is to apply technology for conveying real-time information on parking availability to truckers on the road. Phase 1 of the project demonstrates technologies for accurately and reliably determining the number of spaces available for truck parking at a truck stop or rest area. This phase selects one technology for Phase 2 of the work, which runs from January 2009 to January 2010. Phase 2 involves:
 - calibration of sensors;
 - implementation of parking information dissemination to truckers (e.g., variable message signs);
 - installation of parking space monitors in adjacent truck stops and rest areas;
 - implementation of the capability for tracking historical usage of a truck stop or rest area;
 - implementation of a system for assigning truck parking spaces at a paved, striped area;
 - implementation of a system for making truck parking reservations; and
 - creation of a business plan for sustaining operation.
- Wilbur Smith Associates (2008) cite a truck parking study conducted by Connecticut in 2001 that concludes that providing real-time information to drivers with electronic display boards does not appear to be beneficial based on the inability to continuously update changes in parking availability.
- Stanford et al. (2008) suggest that the reasons drivers stop at truck stops have changed over the last 20 years. In-cab technologies (such as TVs, DVD players, and microwave ovens) allow drivers stay within their cabs rather than make use of restaurants, entertainment options, and other amenities at typically provided by truck stops. Truck stops seeking to raise revenues provide truck drivers with shore power and wireless internet access.
- Young and Blue (2007) discuss the task of creating Wi-Fi access by the Kansas Department of Transportation (KDOT) at public rest areas. The objectives of KDOT were to provide free access to travel information, while allowing the option for general Internet usage by way of subscription service. This was achieved through a public-private partnership where the private sector would generate revenue through advertising while providing the service for the state.
- Zietsman et al. (2007) review the strategy for deploying truck stop electrification in the United States. Previously, locations for TSE were decided by economic factors; they suggest this may not provide the most efficient locations. An efficient location is defined as one which reduces emissions and fuel consumption through the following (p. 11):

- “A *network* of TSE facilities providing more than 500,000 long-haul trucks adequate opportunity to hookup stationary idle reduction technologies during their trip.
- Selecting locations that would have the *greatest potential* of reducing idling, and therefore, emissions and fuel consumption.
- Selecting locations where the reduction in emissions and fuel consumption would have the *greatest benefit*”.

The authors discuss the spacing of these locations with truck drivers and others in the trucking industry to optimize the effect on the network. Through additional discussions, they conclude that truck stop locations with more than 75 parking spaces prove to be the most effective candidates for TSE implementation. They use a “multi-criteria decision making method” (p. 8) in order to rank the chosen corridors, and then divide these corridors into zones before finally prioritizing the zones. An Internet tool is being developed from this methodology to assist the public and private sectors in choosing TSE locations.

- Smith et al. (2005) state that the effectiveness of real-time parking availability information depends on the answers to four questions:
 - What is the fundamental issue? Is better matching of drivers to available spaces the issue or is there a shortage of spaces in the corridor?
 - How accurately can entering and exiting trucks be detected?
 - How can raw data on space occupancy be converted to useable information for approaching drivers?
 - How effectively can information be communicated to drivers?

There are two automated approaches to calculate available parking spaces at a parking facility:

- *Vehicle presence detection at each parking space*: Technologies for this method include inductive loop detectors placed beneath the surface of the lot, and break-beam (ultrasonic) presence detectors placed on poles or overhead structures.
- *Count in and count out*: Technologies for this method include inductive loops, magnetometers, infrared or ultrasonic sensors. To distinguish trucks, pole-mounted break-beams similar to those used to warn vehicles of over-height situations, or weigh-in-motion devices can be used. This method may also warrant re-organization and channelization of the parking facility to accurately determine in-and-out vehicle counts, and benefits from overhead video imagery as backup.

Technological approaches to inform drivers whether spaces will be available when they arrive at a truck stop or rest area include:

- providing information to drivers immediately prior to entering the parking facility;
- notifying drivers about how many spaces are available and how many are occupied;
- providing a forecast of space availability based on historical information; and

- allowing drivers to submit a request for parking to a parking management system.

The authors state that a real-time parking information system must include a parking data collection process, conversion of raw data to useable information, and a method to disseminate the information to drivers. The authors identify the following methods to deliver information to drivers: (1) variable message signs; (2) traveler information radio; (3) citizen's band radio; (4) cellular telephone; (5) 511 trucker information; and (6) on-board computers.

- Perrot et al. (2004) state that truck stop electrification is an anti-idling option that addresses many of the concerns of truck operators, governments, and citizens. TSE allows truck drivers to operate on-board systems including sleeper cab heating and cooling, microwave ovens, refrigerators, televisions, telephones, personal computers, and other small appliances without idling. TSE can supply power to trailer refrigeration units (TRUs) at a significant cost premium; however, since few TRUs are compatible with TSE architecture, this option is not cost-effective. The authors reason that TSE is best suited for facilities with over one hundred parking spaces due to high initial investment and infrastructure costs.
- Bronzini et al. (2002) discuss the use of remote sensing technologies to monitor rest area parking space availability and utilization. The authors outline proposed research to use remotely obtained images to (p. 103):
 - "locate and identify rest areas;
 - identify the number of vehicles parked in rest areas
 - classify the vehicles parked
 - identify vehicles parked on ramps and shoulders; and
 - characterize rest area physical conditions".

There may also be opportunity to develop real-time parking information systems based on remote sensing data rather than data obtained from other types of vehicle sensors. Limitations associated with remote sensing technologies are the timely availability of images and the sophisticated image processing requirements.

4. SUMMARY OF FINDINGS

This chapter provides a summary of findings from the environmental scan. It also contains a discussion about issues to be considered by Canada in addressing truck parking needs for the Canadian trucking industry.

4.1. ENVIRONMENTAL SCAN

4.1.1. Magnitude of the Issue

The scan reveals the following:

- There could be a shortage in commercial vehicle parking in U.S. and Canadian jurisdictions. This shortage, which is expected to increase over the next few years in both countries, is a direct result of increasing truck traffic flows and general demand in trucking operations. In some jurisdictions, there is an estimated truck traffic annual growth rate of four percent.
- Factors affecting the demand for truck parking are: the number and percentage of trucks in the traffic stream, the distance between a truck stop and the mainline, the distance to the nearest truck stop or rest area, and the service facilities provide.
- Factors affecting the use of truck parking facilities are: the number of truck parking spaces available, the type of parking space (parallel or diagonal), quality of facilities, and parking rules and requirements.
- Public rest areas and private truck stops provide different services and are not substitutes for each other. Public rest areas are preferred by drivers for short-term parking (say less than two hours). However, for parking stops longer than two hours, drivers tend to look for private rather than public facilities. This is because private truck stops are generally located nearby highway facilities and offer more parking spaces and amenities than public rest areas.
- Increases in truck sizes have decreased space availability since trucks may occupy multiple spaces. This is particularly important along corridors which allow trucks with multiple trailers, such as long combination vehicles (LCVs).

4.1.2. Impacts of Limited Truck Parking at Rest Areas

The scan reveals the following:

- The primary function of rest areas is to reduce collisions, and they are perceived as an important instrument for improving highway safety. Safety benefits of rest areas are achieved by providing safe off-road locations for motorists to stop and rest. Although

there is general agreement that rest areas have a beneficial effect on highway safety, there is little empirical data to support this claim.

- There may be a correlation between rest area spacing and single vehicle collisions. However, there is a need to conduct further research on this topic to confirm this is true.
- Shortages in truck parking capacity contribute to truck drivers driving while fatigued and/or parking illegally, both of which can cause accidents. Drivers may choose to park at locations such as highway shoulders or off-ramps because they may not be able to find available parking spaces, yet have to park to avoid exceeding their allowable hours of work. Illegal truck parking is dangerous because of the conflicts that occur as a result of the parked trucks (e.g., visibility problems when accelerating to merge with other traffic, presence of obstacles in the clear zone, others). Illegal parking also results in problems such as shoulder damage, fuel and oil spillage, soil erosion, noise, dust, and illegal activities.
- There are limits imposed on the amount of time drivers can park at certain rest areas. These limits may defeat the objective of improving safety, and may sometimes contradict HOS regulations.
- One fuel-efficient alternative to truck idling is truck stop electrification. As of December 2000, 15 states and the District of Columbia have enacted new anti-idling legislation that places limits on the amount of time a truck or bus can idle. Part of the reason for this is that truck engine idling has safety impacts in the sleep lost by truck drivers due to noise and high localized levels of CO.
- Security is a “major concern” for truck drivers at both public and private facilities.

4.1.3. Benefits of Implementing Truck Parking at Rest Areas

There is a limited amount of literature which specifically identifies benefits associated with providing truck parking for commercial vehicles. In most cases, the benefits of providing parking are expected to be derived from addressing existing problems associated with limited parking availability. The scan reveals the following:

- The benefits of rest areas include: (1) offering a break from long travel periods; (2) enhancing driver comfort and convenience; and (3) providing venues for public agencies to communicate with travelers.
- Adequate facilities for commercial vehicle parking mitigate two specific safety issues: driver fatigue, and unsafe truck parking on highway shoulders and interchange ramps.

4.1.4. Best Practices Regarding Truck Parking at Rest Areas

The scan reveals the following:

- Efforts to determine truck parking supply and demand involve a combination of empirical evidence and industry intelligence. Truck parking supply is generally estimated through

inventories of available parking spaces at the various parking facilities (i.e., public rest areas, private truck stops, welcome centres/travel stops, and pullouts). Demand estimation involves complex modelling and careful selection of relevant demand variables. The literature reveals the use of a variety of variables in the demand modelling process, for example, total hours of truck-travel, duration of stops, traffic and truck traffic volume, the distance from the previous rest area, and the proximity of the rest area to an urban centre or intersection. Much of the literature supports supplementing empirical evidence about the supply and demand of truck parking spaces with surveys of truck drivers, trucking companies, and/or truck stop owners. Findings from these surveys generally, but do not always, confirm modelled results.

- Stakeholder involvement is viewed as important to the success of alleviating truck parking issues. A wide variety of interests—from the public and private sectors—should be represented by stakeholder groups. The literature recommends the following stakeholders and methods for obtaining data and input into commercial vehicle parking studies: stakeholder focus groups, trucker surveys at private truck stops and public rest areas, interviews with trucking companies, interviews with truck stop managers, and interviews with highway patrol representatives. The stakeholders to involve would vary from jurisdiction to jurisdiction.
- Because public and private rest areas serve different functions and meet different needs for truck operations, it is possible that some of the shortfall at public rest areas could be addressed by private truck stops.
- Various jurisdictions have developed truck parking strategies to manage or address truck parking demand on their highway network. For the most part, these strategies involve: (1) cost-sharing opportunities such as public-private partnerships to address the truck parking shortage; (2) parking policy revisions; (3) implementation of intelligent transportation systems to provide real-time information on parking availability; and (4) use of available facilities such as weigh scales and maintenance yards for temporary parking.
 - The multi-faceted nature of the truck parking problem prompts much of the research to recommend the long-term involvement of both public and private sectors in developing solutions to parking shortages. Public-private partnerships provide opportunities to share or reduce facility construction and maintenance costs, enable appropriate commercial development to meet truckers needs, allow truckers to comply with publicly-mandated HOS regulations, and invest in real-time parking information technologies. Some literature also recommends the construction of new public rest areas and pull-off areas for truck parking, providing the availability of public funds. Where public funding is not available, the public sector may encourage private developments in certain locations where truck parking shortages are evident.
 - Implementing truck parking information systems is regarded as one of the most effective ways of addressing truck parking shortages. In most cases, this implies the deployment of ITS technologies to provide real-time information (via the internet or some other media) to truckers about the availability of parking spaces in public and private facilities. There may be a need for driver education efforts as a corollary to ITS deployment. However, alternative information dissemination approaches such as paper maps are also cited as a viable tool.

- Certain states restrict the amount of time that trucks are allowed to park at public rest areas. Although these time limits are not uniformly enforced, some studies suggest the elimination of these limits to encourage drivers to comply with HOS regulations and take rest when they feel fatigued. Simultaneously, some studies suggest that enforcement be increased to eliminate trucks parked at illegal or unsafe locations (such as along interchange ramps).
- The literature suggests several strategies that address truck parking shortages by rehabilitating or reconfiguring existing facilities. Examples of these types of efforts include: reopening previously closed rest areas; converting car parking spaces to spaces for trucks during the nighttime; developing park-and-ride facilities; reconfiguring truck parking spaces to allow pull-through access; renovating existing public rest areas; and utilizing weigh station facilities for truck parking.
- There is a need to improve the short-term and long-range planning for truck parking in many jurisdictions. This involves ongoing analysis of truck parking supply and demand, securing necessary funding, and the establishment of regional strategies to address potential shortages, and— particularly in the U.S. — appropriate legislative agreements between state and federal governments.
- Security is a concern for truck drivers, and it impacts truck parking shortages because it may discourage them from parking in designated spaces (particularly at public rest areas). Efforts to enhance security (e.g., through improved lighting, enforcement, installation of security cameras) can thus help alleviate truck parking shortages.
- Because truck stop operators view public rest areas as strong and unfair competition, public agencies should consider increasing public rest area parking at locations that are not in direct competition with private truck stops.

4.2. GENERAL OBSERVATIONS

In the U.S., much of the literature and work on the truck parking issue stems from the 1996 *Making Space for Safety* report, conducted by the Trucking Research Institute under commission from the Federal Highway Administration. This report developed national-level estimates of truck parking supply and demand, and predicted a nationwide shortfall in truck parking along the Interstate system. In response to this report, several states (e.g., Minnesota, Colorado, Michigan, Iowa, New York, Nebraska, California, and Tennessee) undertook their own truck parking studies. In some cases, the results of these more local analyses confirmed that truck parking shortages exist, although they typically estimated that the magnitude of the shortage was less severe than claimed by the 1996 report. A second federally-initiated effort pursuant to the TEA-21 legislation culminated in a series of reports by the Science Applications International Corporation in 2002. Again, these reports predicted widespread shortages in truck parking, particularly at public rest areas. State-driven efforts (e.g., California, Virginia, Washington State, and Nebraska) were again commenced following the SAIC reports to determine local conditions and develop strategies to deal with observed problems. The National Cooperative Highway Research Program has addressed truck parking issues in several of its reports, namely: *Report 324* in 1989, *Synthesis 287* in 2000, *Synthesis 317* in 2003, and *Report 500* in 2004. *Synthesis 317* contains specific information about strategies to deal with truck parking demands. In addition, AASHTO released design guidelines for the construction of rest area facilities in 2001.

In Australia, a major research program on truck driver fatigue led to revisions in drivers HOS regulations. To accommodate the stopping needs of drivers mandated by the HOS regulations, national-level guidelines on rest area design were developed by the National Transport Commission in 2004. These guidelines are analogous to the AASHTO guidelines developed in the U.S.

In contrast to the U.S. and Australia experiences, the scan suggests that truck parking issues in Canada have generally been dealt with at a provincial level. Recent reports commissioned for Alberta and Saskatchewan find a need to develop strategies for enhancing truck parking in those provinces. Efforts to address truck parking shortages have also occurred in Quebec, British Columbia, Ontario, and the Maritime provinces. In Manitoba, a study was conducted on the feasibility of truck stop electrification.

Based on the experiences in the U.S. and Australia that are reported in the literature and supplemented with knowledge gained through interviews with selected industry experts, we identify the following issues to consider in addressing truck parking needs in Canada:

- *Supply versus demand:* Determining whether there is an adequate supply of truck parking spaces to meet current and future demands could involve:
 - Developing a nationwide inventory of existing parking facilities and their characteristics (including public rest areas, private truck stops, pullout facilities, and any other facility routinely used to accommodate parked trucks). This inventory should include remote northern areas where 2-lane undivided roads are common and where there are few areas for a driver to safely pull over.
 - Developing analytical tools to model current and future demand for truck parking, including detailed demand characteristics such as spatial and temporal distributions, and the demand for certain types of amenities.
 - Comparing truck parking supply and demand characteristics at local levels.
 - Conducting surveys to supplement quantitative findings with the qualitative observations and opinions of members of the trucking industry (e.g., truck drivers, trucking company representatives, truck stop operators, shippers and receivers).
- *Evidence of issues associated with truck parking in Canada:* Although there is general agreement about the need to enhance truck parking in Canada, there is little documented evidence of the safety, infrastructure, environmental, and economic impacts of a lack of truck parking in certain jurisdictions.
- *The role of the public sector in addressing truck parking issues:* The U.S. experience is characterized by a combination of federal and state-level involvement in truck parking issues. It is well-known that the main objective of the new HOS regulations in Canada is to reduce fatigue-related accident risk by providing drivers with additional rest opportunities. However, while national-level research efforts are important in stimulating interest in and clarifying general issues associated with a lack of truck parking, there is a need to conduct more refined, local studies about truck parking supply and demand. Corridor-level approaches, such as the one used in the Saskatchewan study *(UMA 2008), provide this level of detail.

- *Stakeholder involvement:* The scan reveals the importance of involving stakeholders in the process of identifying problems associated with inadequate truck parking and developing strategies to deal with these problems. At a minimum, stakeholder groups could include representatives from the public sector (from municipal, provincial, and possibly federal governments), truck drivers, trucking companies, trucking and automobile associations, shippers and receivers, truck stop operators, highway enforcement personnel, local chambers of commerce, and relevant special interest groups.
- *Public-private partnerships:* There is general agreement in the literature, although not explicitly quantified, that one of the most effective strategies to balance cost while increasing the number of suitable rest areas is through public-private partnerships.
- *Unique Canadian issues that may require different strategic approaches than those implemented in other countries:* Based on the literature and interviews with industry experts, the following uniquely Canadian issues are identified:
 - There is a need to accommodate the parking requirements for longer combination vehicles—particularly Turnpike doubles—which are now routinely permitted on an extensive network throughout the Canadian Prairie Region, on selected routes in the provinces of Quebec, New Brunswick, Nova Scotia, and British Columbia, and potentially on a corridor connecting to the Greater Toronto Area. Special design considerations are required to meet the geometric requirements for parking and maneuvering these vehicles at rest areas, truck stops, and highway pullouts. In addition, LCVs are subject to unique regulatory conditions—over and above HOS and other regulations that apply to commercial vehicles which operate without special permits—that require them to stop in inclement weather and to conduct periodic vehicle safety checks. From a logistical perspective, many trucking companies operate LCVs by switching trailers at specific locations. For example, a Turnpike double driver based in Winnipeg, Manitoba may haul two trailers bound for Calgary, Alberta to a specified location near the Saskatchewan-Manitoba border. At this location, another Turnpike double driver with trailers bound for Winnipeg meets the westbound driver and switches trailers. These switches require adequate space to complete safely.
 - Many Canadian highways are characterized by relatively low traffic and truck traffic volumes. Further, portions of the principal highway network do not function as freeways (which normally bypass population centres), and much of the Canadian National Highway System consists of two-lane, undivided roads. Many centres situated on these routes rely on business resulting from traffic and truck traffic passing through their community. As such, there are potential economic impacts for these communities that depend on the types and locations of facilities developed to accommodate truck parking.
- *Short-term and long-term strategies to address truck parking issues:* The scan provides a wide range of options in dealing with truck parking demands. Best practices include:
 - the development of national-level guidelines for the spacing and design of public truck parking facilities, with appropriate consideration of private sector accommodation of truck parking needs;

- the use of ITS technologies to provide real-time information about the location and availability of truck parking spaces;
 - the development of public-private partnerships to share or reduce facility construction and maintenance costs and enable appropriate developments to meet truckers' needs;
 - ensuring that driver security concerns at truck parking facilities are addressed;
 - seeking cost-effective options to redesign and rehabilitate existing facilities to address truck parking shortages; and
 - providing additional truck parking spaces, where needed and financially and/or commercially feasible, through the construction of new facilities.
- *Urban parking facilities:* Communication with industry experts, more so than the literature, revealed that there are also trucks parking supply issues within urban areas. Although this is a different matter from that involving inter-urban rest areas, truck parking in urban centres appears to be equally deserving of attention as truck parking between urban centres. It appears that there is a lack of knowledge in this area, which warrants investigation.

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