THE MANITOBA FOOD SUPPLY UNDER A PANDEMIC STUDY: SUPPLY AND DISTRIBUTION

Dave Wolters and Stephen Wright
University of Manitoba Transport Institute

Introduction

Some researchers suggest that a global pandemic is not a matter of "IF" but rather a matter of "WHEN". As part of preparing for a potential pandemic, (such as from H5N1 Bird Influenza), the University of Manitoba Transport Institute has developed a plan for the continuation and distribution of the Manitoban food supply.

As stated above, the principle goal of the pandemic plan is to ensure the continuation and distribution of the Manitoba food supply. To achieve this, the pandemic plan focused on several different topics including nutritional needs of the population, overall food production capacity, nutritional surpluses and deficits, and potential scenarios. This paper will focus solely on the supply and distribution side of providing nutrition to the Manitoban population. Areas that will be addressed include transportation equipment requirements and availability, driver requirements and availability, and other considerations such as fuel supplies, support staff, the likely high demand for refrigerated equipment, and security.

Transportation Equipment

During an emergency situation, proactive transportation planning could be the difference between life and death. Maintaining an adequate food supply in Manitoba is dependent on the availability of transportation equipment to route food throughout the province.

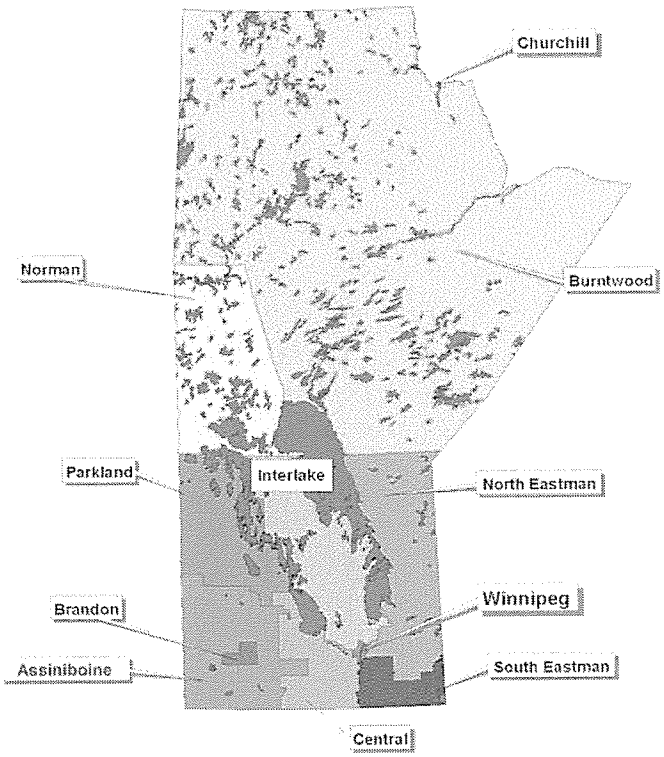
To gauge the present transportation capabilities in Manitoba, surveys were created and distributed throughout key food supply industries (food processors, abattoirs, wholesaler/distributors, retailers, and logistics). The data gathered by the logistics survey focused on several areas:

- The number of each equipment type that is owned/operated (trucks, trailers, cube vans, etc.).
- The size and type of storage facilities (including trailer yards).
- The number of drivers, and more importantly, the number located in Manitoba.
- The size of fuel depot(s), if operated by the company itself.

Data was also collected from the other key industries (food processors, abattoirs, wholesaler/distributors, and retailers) as to their equipment availability, equipment needs, average shipment sizes, and number of shipments per week. The results were then used to estimate the requirements and availability of transportation equipment in the province. Transportation equipment requirements for Manitoba were then compared with availability to determine areas of surplus and shortfall.

For this project, the province was separated into eleven regions based on the currently established Regional Health Authorities (RHA's). The map on the following page shows the RHA's in Manitoba.

Figure 1: Map of Manitoba's Regional Health Authorities (RHA)[1]



The majority of food supplies are routed through Winnipeg and redistributed to their final destinations, be that in Winnipeg or any of the other RHA's. Several different types of transportation equipment are available for use. The common equipment types used are cube vans (refrigerated and non-refrigerated) and tractors (semi) hauling both dry van and refrigerated trailers (typically 53 feet).

[1] Manitoba Health. "Map of Manitoba's Regional Health Authorities." (December 2007) <http://www.gov.mb.ca/health/rha/rhamap.html>

Transportation Equipment Requirements

When calculating the daily transportation requirements for the province in terms of supply of nutrition, several assumptions were made. The first assumption was that pallets would be used to package and secure loads. Based on accounts from several processors and distributors, a standard (40" x 48") pallet holds between 2000-2500 pounds (909-1136 kilograms). This information was used along with the pallet weights of some "special" cases of products to calculate the total number of pallets used by Manitoba processors. The second assumption made was that pallets would not be stacked during travel. The number of pallets used was multiplied by the area occupied by each type of pallet (e.g. a bakery tray is much smaller than a standard pallet). This was used to determine the number of 53-foot trailers and cube vans (refrigerated and non-refrigerated) needed in each RHA to move a day's worth of production.

Supplying nutrition for the province with strictly 53-foot trailers, we find similar requirements for both 53-foot dry van and 53-foot refrigerated (reefer) trailers. Approximately 227 dry van trailers are needed to distribute food amongst and within the various Manitoba RHA's (and shipments outside of Manitoba, primarily to Saskatchewan and western Ontario). Of these 227 dry van trailers, the bulk are needed in the Winnipeg RHA (approximately 166). Of the 166 trailers needed in the Winnipeg RHA, 134 of them will be used for redistribution. Redistribution represents shipments that originate in other RHA's but are shipped to Winnipeg to be redistributed throughout the province and surrounding areas. With the greatest amount of food production in terms of nutrition occurring in the Central and Assiniboine RHA's, Winnipeg acts as a focal point for distribution.

Determining the estimated daily requirements for 53-foot refrigerated trailers yields similar results to that of dry van trailers. The total quantities are slightly larger at 248 refrigerated trailers required for food distribution in Manitoba. The nature of moving perishable food is the primary reason for the need for more refrigerated trailers compared to dry van trailers.

Assuming all movements were made using cube vans, without the availability of 53-foot trailers, we see a similar trend in which the number of reefer cube vans slightly outnumbers the number of dry cube vans (620-reefer compared to 578-dry van).

The following table provides a summary of requirements for transportation equipment throughout the province assuming 53-foot trailers and cube vans are used in conjunction with each other.

Table 1: Manitoba Daily Transportation Equipment Requirements

Pandemic Planning Area/Destination	53-foot Dry-Van Trailer	53-foot Refrigerated Trailer	Cube Van (Dry)	Cube Van (Refrigerated)
From Northern[2]	*0*	*1*	*0*	*1*
Within Northern	*2*	*2*	*2*	*2*
From Western[3]	*10*	*28*	*25*	*70*
Within Western	*4*	*5*	*9*	*9*
From Capital[4]	*36*	*39*	*80*	*86*
Within Capital	*108*	*109*	*281*	*280*
Province	***160***	***184***	***397***	***448***

As the majority of the population of Manitoba is based in the Capital region (over 80%), it becomes clear why the majority of equipment is required to operate within the Capital region.

When other operating assumptions are taken into consideration, such as 16 hours of service per day (accounting for load and unload time and other downtime), 10% time for maintenance, and pallets stacked 3 high (on average), we obtain the following requirements.

[2] Northern includes Churchill, Norman, and Burntwood RHA's.
[3] Western includes Parkland, Brandon, and Assiniboine RHA's.
[4] Capital includes Interlake, Winnipeg, Central, South Eastman, and North Eastman RHA's.

Table 2: Manitoba Daily Transportation Equipment Requirements: Operating Assumptions

Pandemic Planning Area/Destination	53-foot Dry-Van Trailer	53-foot Refrigerated Trailer	Cube Van (Dry)	Cube Van (Refrigerated)
From Northern	0	*2*	*0*	*2*
Within Northern	*1*	*0*	*1*	*1*
From Western	*6*	*16*	*41*	*38*
Within Western	*2*	*3*	*5*	*5*
From Capital	*20*	*22*	*44*	*47*
Within Capital	*59*[5]	*60*	*154*	*153*
Province	***88***	***103***	***245***	***246***

The greatest needs for equipment are found in the Capital region (operating both "Within" and traveling "From"). From the Capital region represents primarily redistribution. The Western region maintains the next highest requirements, with equipment traveling "From" this area. This is due to the large amount of food production in the Assiniboine RHA, which will then be routed elsewhere for consumption or processing. Despite taking into account time for maintenance, downtime, and loading/unloading time, equipment requirements still drop dramatically. This is due to the assumption which allows pallets to be stacked 3 high.

For movements between pandemic planning areas, it is suggested that 53-foot trailers be used. For movements within pandemic planning areas (where shipment sizes will most likely be smaller), it is advised that cube vans be used. As there is a likely shortage of reefer cube vans as compared to reefer 53-foot trailers, the Capital region will use reefer 53-foot trailers in substitution for reefer cube vans. The revised equipment requirements are shown in the following table. The only change is the substitution of some 53-foot reefer trailers for reefer cube vans in the Capital region.

[5] As an example of the calculation. From Table 1, 108 53-foot dry van trailers are needed. Stacked 3 high = 36. Only operable 2/3 of a day means that 54 are needed (36/.67). Maintenance is 10%, so the total is 54x1.10 = 59.

Table 3: Manitoba Daily Transportation Equipment Requirements: Operating Assumptions- Fewer Refrigerated Cube Vans in Capital Pandemic Planning Area

Pandemic Planning Area/Destination	53-foot Dry- Van Trailer	53-foot Refrigerated Trailer	Cube Van (Dry)	Cube Van (Refrigerated)
From Northern	0	*2*	*0*	*2*
Within Northern	*1*	*0*	*1*	*1*
From Western	*6*	*16*	*41*	*38*
Within Western	*2*	*3*	*5*	*5*
From Capital	*20*	*22*	*44*	*47*
Within Capital	59	98	*154*	76
Province	**88**	**141**	***245***	**169**

To facilitate the movement of all 53-foot trailers, 229 tractor units will be required.

Transportation Equipment Availability

Transportation companies were asked the number of each equipment type they operate. Other members of the food supply chain, such as processors and distributors, were also asked about the types of transportation equipment they own. Since some of the firms surveyed were national carriers, their numbers included fleets that operate across Canada and in the United States. Taking that into account, firms were also asked what percentage of each equipment type is typically located in Manitoba. This number included equipment that was either based in Manitoba, passing through Manitoba, or resting in Manitoba. Due to the mobile nature of large transportation fleets, it can prove difficult to determine the exact amount of equipment located in the province at any given time. However using the data provided by the respondents, a rough estimation of the transportation equipment available daily in Manitoba was produced. The data presented is based on responses from medium (50-100 drivers) and large (100 or more drivers) transportation firms.

Table 4: Transportation Equipment Operated by Logistic Firms (Survey Results)

Equipment Type	# Operated	Average # Located in MB
Cube Van (Non-Refrigerated)	775	97
Cube Van (Refrigerated)	48	17
Tractor	4,674	1,394
Dry Van 53' (Trailer)	5,270	1,302
53' Refrigerated Trailer	1,177	440

Approximately 14% of the cube vans operated by transportation companies in Manitoba were located within the province at any given time. There were a higher proportion of non-refrigerated cube vans compared to refrigerated cube vans as the non-refrigerated cube vans located in Manitoba outnumbered the refrigerated cube vans located in Manitoba almost five to one. Approximately 27% of the 53-foot trailers owned by transportation companies in Manitoba were located in the province at a given time. Similar to the cube vans, the dry van 53-foot trailers far outnumbered the reefer 53-foot trailers. An average of 440 53-foot refrigerated trailers were located within the province at any time.

Several other types of firms were also surveyed as to the amount of equipment they operate. The following table displays the types of equipment operated by the non-logistics firms surveyed.

Table 5: Transportation Equipment Operated by Non-Logistics Firms (Survey Results)

Industry	Cube Van (Non-Refrigerated)	Cube Van (Refrigerated)	Tractor	Dry Van 53' (Trailer)	Refrigerated 53' Trailer
Processor	15	5	32	12	20
Abattoir	0	6	14	0	2
Wholesale (Processing)	1	2	0	0	3
Wholesale (Non-Processing)	10	21	38	7	111
Province	**26**	**34**	**84**	**19**	**136**

A large portion of the equipment operated by the non-logistics firms is refrigerated, due to the need for refrigeration when transporting perishable food products. These numbers add significantly to the total equipment already operated within the province, especially in terms of refrigerated 53-foot trailers.

The total number of units operated in the province at any given time is presented below.

Table 6: Total Transportation Equipment by Type (Survey Results)

Industry	Cube Van (Non-Refrigerated)	Cube Van (Refrigerated)	Tractor	Dry Van 53' (Trailer)	Refrigerated 53' Trailer
Transportation Firms	97	17	1,394	1,302	440
Processors etc.	26	34	84	19	136
Province	**123**	**51**	**1,478**	**1,321**	**576**

Looking at the requirements and availability of transportation equipment in Manitoba (based on the survey results), it is evident that we do in fact maintain an overall surplus of equipment. The results are shown in the following table.

Table 7: Daily Equipment Requirements vs. Availability

	Cube Van (Non-Refrigerated)	Cube Van (Refrigerated)	Tractor	Dry Van 53' (Trailer)	Refrigerated 53' Trailer
Requirements	245	169	229	88	141
Availability	123	51	1,478	1,321	576
Surplus/ Deficit	**-122**	**-118**	**+1,249**	**+1,233**	**+435**

There is a clear shortage of cube vans, both refrigerated and non-refrigerated, however the surplus of 53-foot trailers can help to offset this shortage. As stated earlier, it would be ideal to use cube vans for shorter trips within pandemic planning areas, but if faced with a shortfall in this area, 53-foot trailers would be able to fill in and would be able to carry a substantially larger load than that of the cube vans.

While tractors and 53-foot trailers show a large surplus, we need to acknowledge the fact that other sectors will be in need of transportation during an emergency situation. The distribution of health and medical supplies will be of vital importance during a pandemic and will undoubtedly use some of the transportation equipment available in Manitoba.

In order to estimate the total population of transportation equipment in Manitoba, the provincial registrar of vehicles (Manitoba Public Insurance) provided data regarding the total number of vehicle types registered in the province. Although registrations classified the type of equipment (cube van, tractor, trailer, etc.) it did not describe if it was refrigerated or not. Based on the survey results of the logistics and processing firms, the total registrations were split into refrigerated and non-refrigerated categories, and the likely availability was determined. From a planning perspective, this is likely the maximum equipment capacity. The results are listed in the following table.

Table 8: Available Transportation Equipment - Estimate of Total Population

	Cube Van (Non-Refrigerated)	Cube Van (Refrigerated)	Tractor	Dry Van 53' (Trailer)	Refrigerated 53' Trailer
Registered	2,112		8,888	33,381	
Total Manitoba	1,916	196	8,888	26,742	6,639
Available Manitoba	1,916[6]	196	2,761	6,679	2,912

After taking into consideration the needs of other industries, it is still believed that Manitoba will have adequate transportation equipment to maintain the continuation and distribution of the Manitoba food supply.

[6] It is assumed that many of the cube vans registered in Manitoba will be owned by private businesses and will operate exclusively in Manitoba.

Driver Availability

Although the availability of transport equipment is vital to the distribution of supplies, it is virtually useless without skilled personnel to operate it. Those firms that were surveyed regarding their logistics capabilities were also questioned regarding the drivers they employed. In addition to asking the total number of drivers employed, companies were also surveyed as to how many of their drivers were residents of Manitoba and the average number of drivers that were located in the province on a given day. This data was used to help determine how many drivers may be available in the province if sufficient warning were issued and drivers were able to return home before borders were closed and how many drivers may be available if the borders were closed immediately (with no warning). The results of the surveyed firms are displayed in Table 8.

Table 9: Drivers Employed by Logistics Firms (Survey Results)

Total # of Drivers	Manitoba Residents	Avg. # of Drivers Located in Manitoba
6,513	3,197	1,316

Based on these figures, nearly half of all the drivers in the surveyed firms were from Manitoba[7] and on any given day, approximately 20% of the company drivers would be located in Manitoba[8].

These figures were then applied to the total number of "Class 1" licenses (Manitoba class for semi-trailer truck operators) issued throughout the province[9].

[7] Many major national trucking firms have home offices located in Manitoba resulting in the large number of driver's living outside of the province.
[8] These drivers would either be working within the province or resting.
[9] These licenses do not necessarily mean that the holders are currently working as truck drivers. Rather, they may have previously worked in the industry and maintained their licensed status.

Table 10: Potential Number of Class 1 Drivers

	# of Drivers
Total # of Drivers	33,977
Average # of Available Drivers	14,498

Based on these figures, it was determined that the population of Class 1 license holders found in the province on any given day was roughly over 10 times the number of surveyed drivers. Overall, the number of drivers appears to be far greater than the available number of logistics vehicles (tractors and cube vans). Even when factoring in a 30% absentee rate (due to illness, family commitment, or fear of illness), the ratio of license holders to (semi) tractors is approximately 3:1.

Even in a worst-case scenario where outbound shipments continue, but inbound shipments decline, a sufficient number of license holders would remain available for some time.

Other Considerations

In addition to the direct logistics considerations (vehicles and drivers) there are other key factors that should be considered[10].

Fuel

A major consideration is the continuation of fuel supplies. Without fuel, a vehicle is useless. During the survey, only 20% of the companies involved owned their own fuel depots. The majority of these depots were located in Winnipeg, requiring alternate fuel sources for Northern operations. In the event of a pandemic, it is vital that the fuel supply continues. During this period, transport companies will also be competing with the various fuel needs of other groups including municipalities, health care facilities, private businesses, and government and non-government agencies. Ultimately, further study is needed to determine both the provincial fuel needs and distribution capabilities and ultimately to create a system to ensure continued supply.

[10] Many of these considerations were beyond the scope of this project. Though some initial study was done, additional research may be required.

Alternative Transportation Needs

During the course of this study, the only the transportation needs considered were those involving food production and distribution. However, many departments, agencies, and businesses will seek transportation equipment. In particular, it is believed that refrigerated equipment (both cube vans and trailers) will be in high demand. Most likely, it would be health agencies requiring this equipment to transport and house medications and vaccines. In addition, there have been suggestions of using refrigerated trailers as temporary morgues to hold pandemic fatalities. This has been suggested (in-part) to reduce the negative associations of a pandemic (e.g. death) with public infrastructure. For example, if bodies were housed in a community arena, would the public refuse to use the facility given what had happened there? While this measure would be implemented to ultimately save infrastructure and taxpayer funding, the immediate needs (food supply) must be weighed against these future considerations. A possible consideration is the possibility of converting 53-foot dry van trailers to reefer trailers to increase the number of available units. The ease of adding refrigeration units to current dry van trailers could be an important factor based on the variety of needs. Ideally, alternative arrangements can be implemented to keep refrigerated equipment for transportation and distribution purposes (rather than storage and warehousing).

Security

Although we would like to believe that the population would remain calm and rational during a crisis, it is impossible to know for sure how it will react. Many disasters have shown people to do what they feel is needed to survive regardless of the legality. Will citizens continue to use the grocery stores or will mobs over-run factories and delivery shipments? Although it is impossible to know how the population will react, contingencies must be in place to ensure food distribution, should the situation turn "ugly". This area of planning is well outside the scope and expertise of this project, but should be considered by the appropriate agencies.

Support Personnel

In addition to drivers, additional personnel are required to ensure the movement and operation of transport equipment. A major need may be for mechanics. Without mechanics, equipment may sit idle despite an availability of drivers, trailers, and fuel. The "required" number of mechanics is difficult to determine, largely because of the unknowns of the potential situation (e.g. what season, how constant is equipment running, etc.). While it is beyond the parameters of this project, agencies may strongly consider exploring the issue further. This may involve examining the current wait-times truckers experience both when their equipment is taken into a shop for maintenance and when they wait for mobile service. Other personnel to consider may include dispatchers, planners, and "lumpers" (staff to load and unload trailers). Although many firms operate without these positions, they may contribute to the efficient operation and continuation of the food distribution system. It's possible that firms may need to consolidate these roles based on the available number of staff.

Alternative Applications

Ultimately, the information gathered through this study is beneficial for all disaster planning and management (not exclusive to pandemics). In addition, the results are useful to many different areas (e.g. health/medical, fuel supply, etc.) and not limited to food distribution.

Conclusion

In recent years, the importance of disaster planning and management has been thrust into the limelight. The public has witnessed a variety of incidents where governing agencies could have been more effective at rising to the challenge at hand (e.g. the aftermath of Hurricane Katrina or the Asia tsunami disaster). The nature and scope of this study can be modified for a variety of conditions and scenarios. Ultimately, this project and others like it may be used by governments and agencies in the development of contingencies for a variety of scenarios.

A full copy of the Pandemic Planning report along with the executive summary and appendices is available to view in the research publications section of the University of Manitoba Transport Institute website (www.umti.ca).