8. ANALYSIS OF TRUCK AND RAIL RISK PERCEPTION

8.1 Introduction

The perception of risk can play an important part in influencing policies on risk management. The fact that people perceive certain risks as either higher or lower than the actual risk is well known (Van Aerde and Lind, 1986), and the reasons for these differences include factors of dread of the unknown, the magnitude of the worst case, the degree of control, the type of hazard, etc.

The perceived risk can also be impacted by the attention of the media (Siddall, 1981), as well as deep seated feelings of importance, such as the concern for the environment, for children, and for historical objects such as railways. These factors can also lead to the expectation that rail risks would have a higher perception relative to actual risks.

The role of the media is considered to be an amplification factor rather than a biasing factor in its impact on risk perception. That is, a risk that is perceived to be higher will receive more media attention, and as a result of this attention the public perception of risk will be exaggerated.

The objective of this part of the study is to develop and test a methodology for comparing the perception of risk associated with the rail and road transport of dangerous goods. Perceived risk is considered important since policies designed to enhance safety require the consideration of perceived risk as well as objective risk to be fully effective and acceptable.

The approach taken in this study is to assume that the coverage of incidents in the printed media (i.e., the daily newspapers) is an accurate reflection of general media coverage and that the amount of coverage is a reflection of the perceived risk. The use of the printed media was chosen because of the availability of historical records. The actual risk was classified by several dimensions in an attempt to compare equal levels of incident hazard. The concept was to develop a number of pairs of equally hazardous events, one on rail and one on road, and then to examine the coverage in the daily newspapers on the basis of the number of words or column inches.

In searching the newspapers for incidents, it was expected that not all incidents would be reported. The selection of incidents that were reported or not reported was also considered a factor in the perception of risks. Surprisingly, a number of observations from the newspaper files were found to be absent from the Transport Canada file.

8.2 Data Sources and Sampling Procedures

The initial sample of incidents involving dangerous goods was taken from Transport Canada data for the period January 1986 to August 1987 (Transport Canada, 1987). For this period both road and rail incidents were required by law to be reported.

The listing of road and rail accidents involving a release of dangerous goods was obtained from the Transport Dangerous Goods Directorate, Transport Canada. Regulations require that a Dangerous Occurrence Report be filed following an incident involving dangerous goods as specified by the Transportation of Dangerous Goods Act. Accidents were broken down into the following fields: commodity by Product Identification Number (PIN) and Class; type of occurrence; date and time; location by city and province; mode of transport; vehicle type involved; number of injuries and fatalities; evacuation and number of people involved; total mass of dangerous goods carried; percent loss; and cause of release. The data include both road and rail accidents during transit or at terminals.

The dangerous goods were grouped by class according to the nine classes shown in Table 8.1. Figure 8.1 shows the number of samples in each class. Class 3 (Flammable Liquids) and Class 8 (Corrosives) were the most common and were chosen for further analysis.

For incidents of Class 3 or 8 the amount of commodity spilled in the accident is shown in Figures 8.2 and 8.3. Spills were classified as low (<80 kg or litres), medium (80-800 kg or litres), or high (>800 kg or litres). Spill data were given either in kilograms or litres. For this analysis, it was assumed that 1 kg is equivalent to 1 litre.

The data were further limited to the province of Ontario for the preliminary study since it was intended to use the Globe and Mail and the Toronto Star as representative newspapers. For the 215 incidents in the Transport Canada data base for Class 3 and 8 spills the population density for the area near the incident was determined. Three levels were considered: low (<100 persons per square kilometer), medium (100-1000 persons per sq. km.), and high (>1000 persons per sq. km.). Figure 8.4 indicates the distribution of population densities for Class 3 and 8 incidents in Ontario for the Transport Canada data.

The determination of equal hazard for a road and rail incident was treated by pairing events using equal levels of factors considered most important. Three factors were selected as being of importance in estimating the actual severity of an incident. These are: type of commodity, amount of commodity spilled, and the population potentially at risk. In order to maximize the number of matched pairs of data, the classification of factors was limited to two types of commodities and to three levels of quantity spilled and population density.

TABLE 8.1

DANGEROUS GOODS CLASSES AND SUBDIVISIONS

Class 1 - Explosives

Class 2 - Gases (Compressed)

Class 3 - Flammable Liquids

Class 4 - Flammable Solids; Spontaneous Combustibles; Substances when Wet Emit Flammable Gases

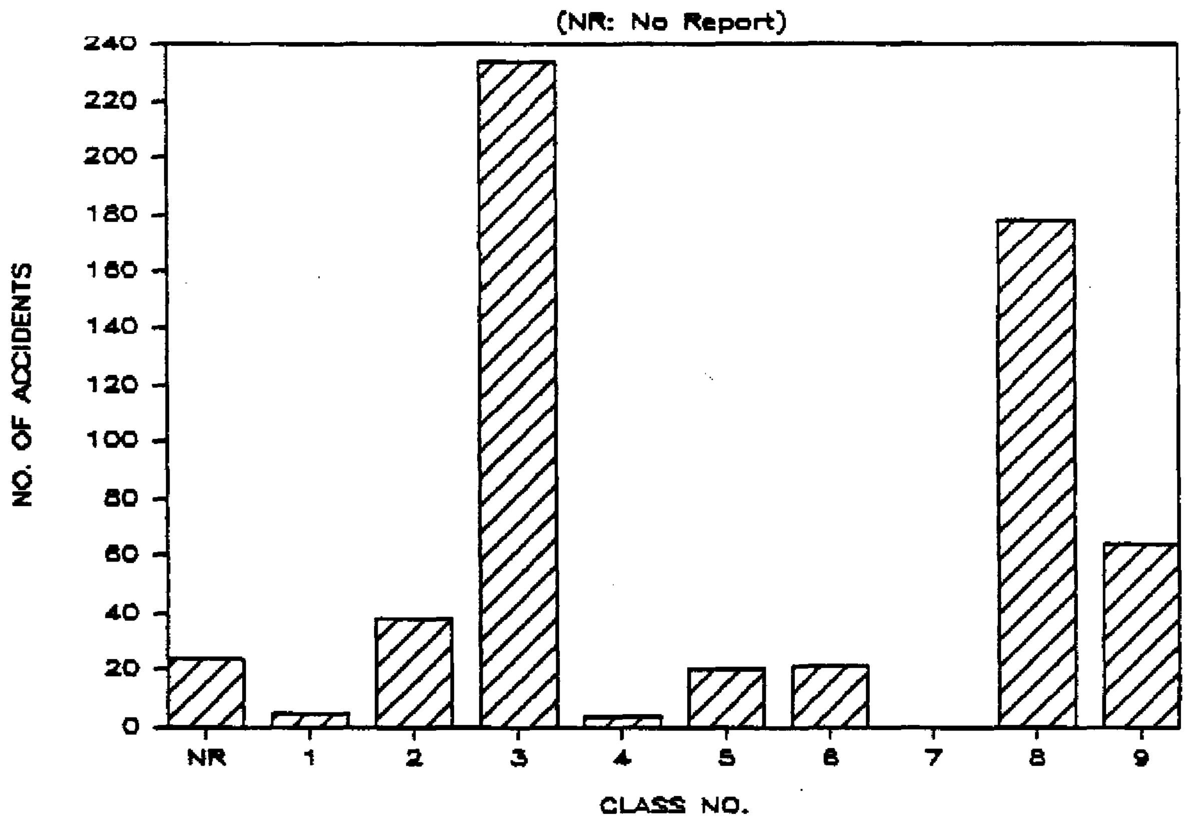
Class 5 - Oxidizing Substances and Organic Peroxides

Class 6 - Poisonous Substances and Infectious Substances

Class 7 - Radioactive Materials

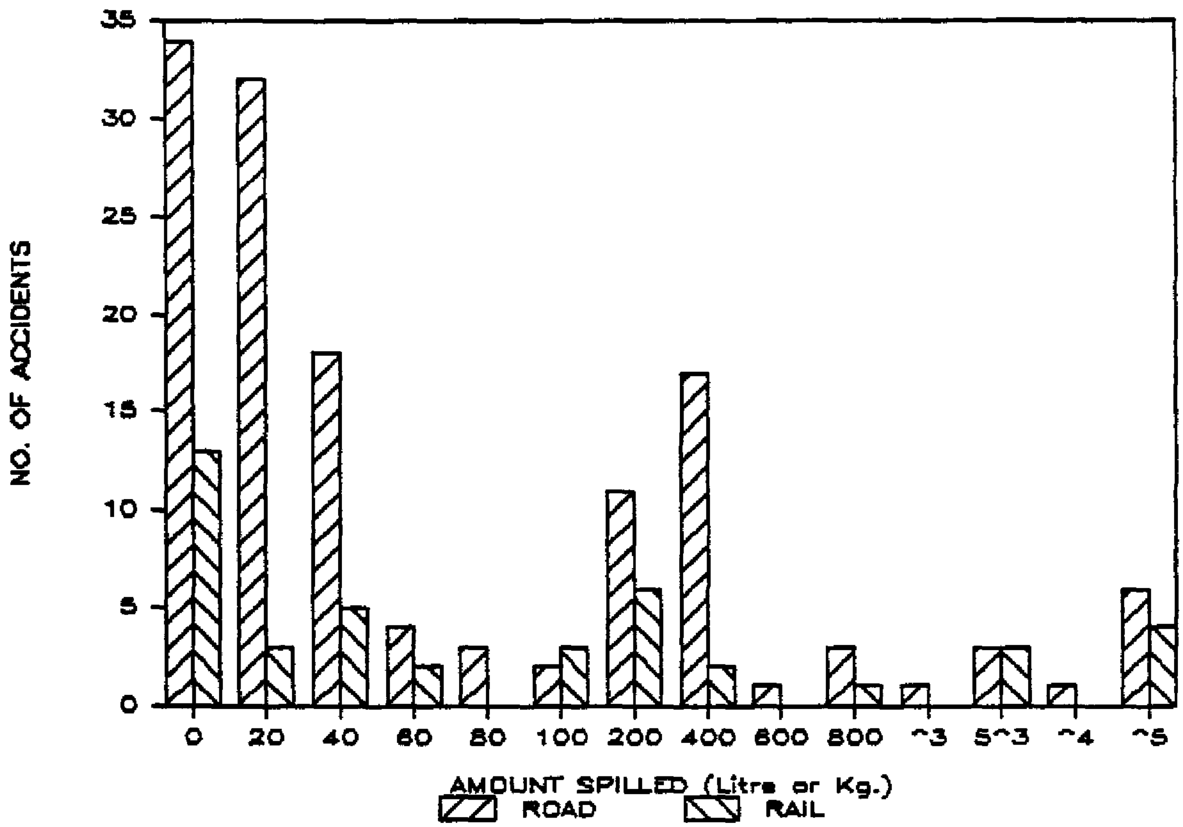
Class 8 - Corrosive Substances

Class 9 - Miscellaneous Dangerous Goods



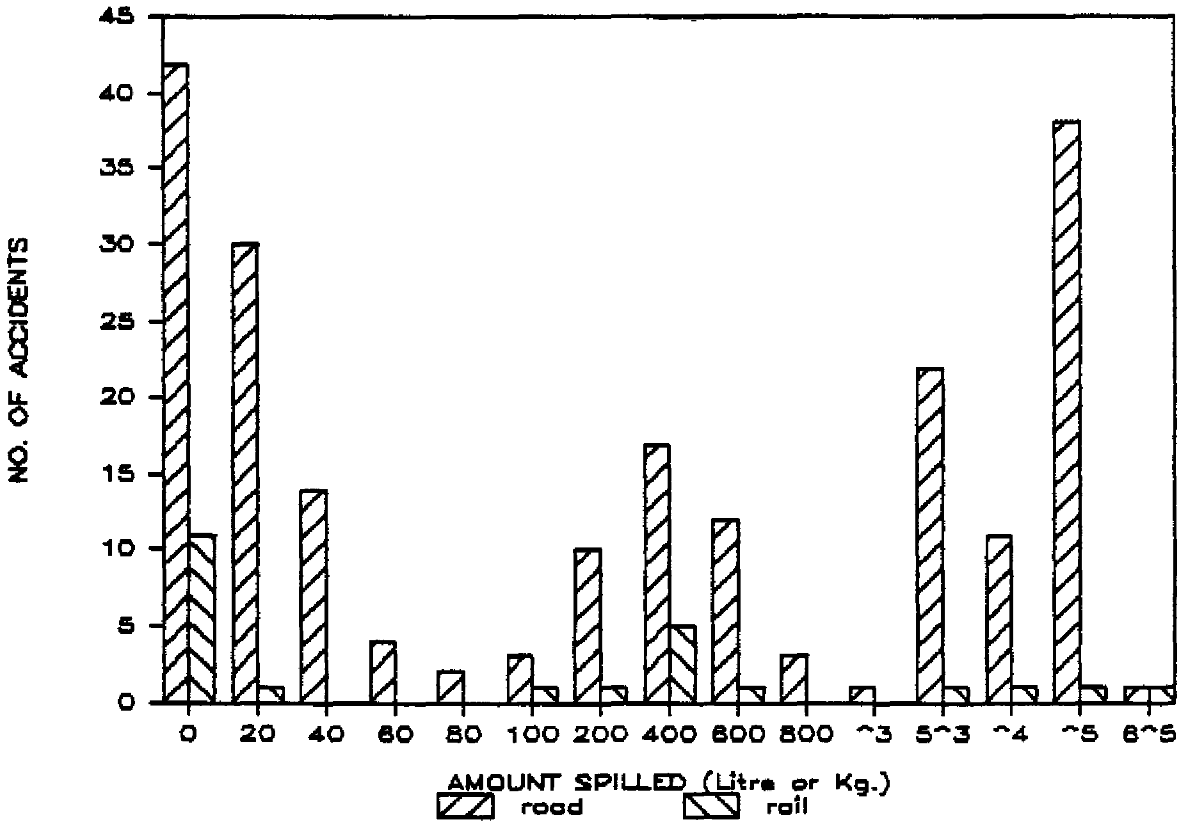
Note: Data from Transport Canada for January 1986 to August 1987

Figure 8.1 DG Class Distribution.



Note: Data from Transport Canada for January 1986 to August 1987

Figure 8.2 Histogram for Amount Spilled (Class 8 DGs: Corrosives).



Note: Data from Transport Canada for January 1986 to August 1987

Figure 8.3 Histogram for Amount Spilled (Class 3 DGs: Flammable Liquids).

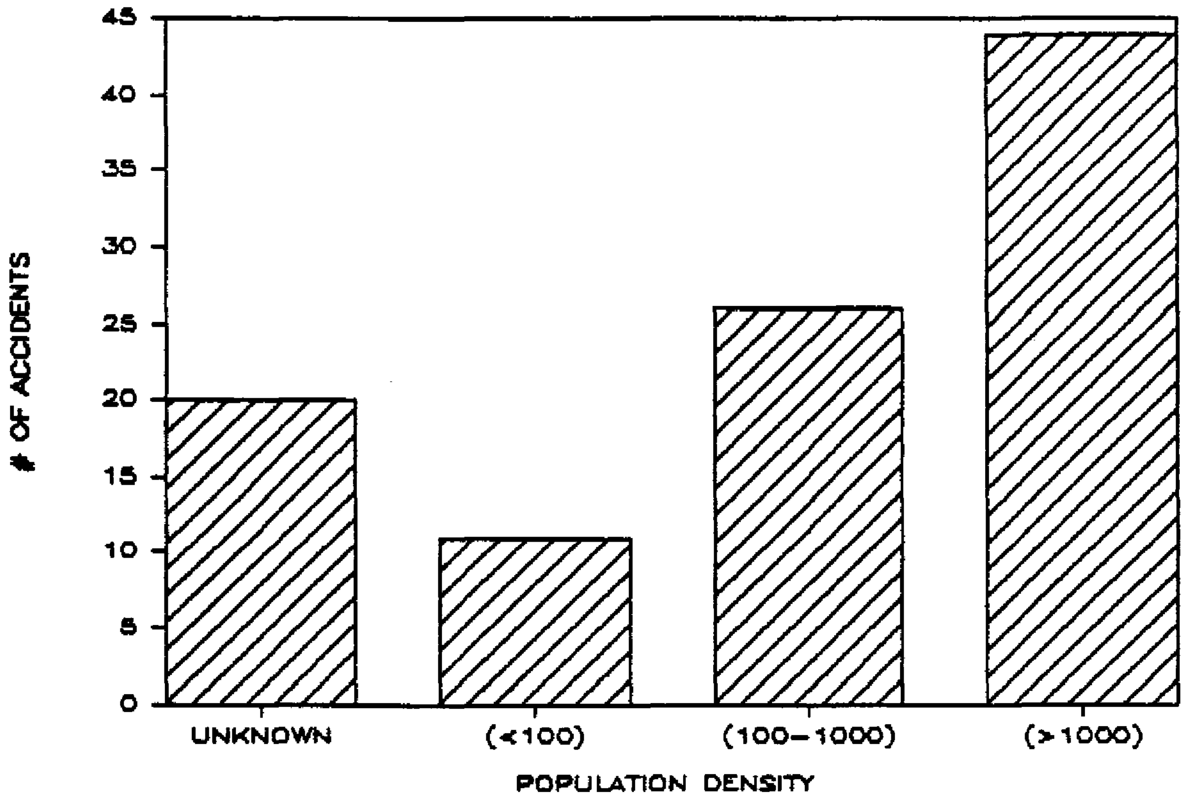


Figure 8.4

POPULATION DENSITY DISTRIBUTION
ONTARIO, CLASS: 3 & 8

Figure 8.5 shows the number of Ontario incidents for road and rail contained in the Transport Canada data base. Only data for Class 3 and Class 8 were analyzed since these are the most numerous incidents. There were 14 rail incidents and 90 road incidents in the Transport Canada file. Only five out of a possible 9 classes in this figure represent both road and rail incidents for each commodity. Where there was more than one possible match of a road and rail incident, the spill quantities and the population densities were examined and the pair of incidents selected which reflected the best match in terms of potential hazard..

Table 8.2 lists the 10 matched pairs of incidents which were selected from the 101 incidents in the Transport Canada data base for Class 3 and 8 commodities. The next step was to search the newspapers and find the incidents. The first attempt was a visual search of the Globe and Mail. It was quickly found that this was too time comsuming and that incidents could be easily missed.

The next procedure was to use a computer search of the data files for the Globe and Mail and the Toronto Star. The data files used were INFOGLOBE for the Globe and Mail, which covered the whole of the period from January 1986 to August 1987, and INFOMART for the Toronto Star, which only covered the period from April 1986 to August 1987.

The key words used in the search were: (road or rail or highway* or truck* or train*) and (spill* or leakage* or discharge*) and (dangerous or hazardous or fuel or gas or gasoline or corrosive or acid or chemical*) and (accident or collision or crash* or derail* or overturn*). (Note: * is any extension of the word).

8.3 Results of Computer Search for Incidents

The maximum number of Transport Canada incidents was 215, and of these 7 incidents were found in the INFOGLOBE computer search. None of these were in the matched pairs selected in Table 8.2. For the shorter time period involved with the INFOMART search, there were 184 Transport Canada incidents, with only 7 of these showing up in the Toronto Star. None of these are in Table 8.2. In addition, the computer searches turned up 5 incidents in the Globe and Mail and 4 incidents in the Toronto Star which should have been but were not included in the Transport Canada data.

The computer search was not comprehensive as a review of an ad hoc file of clippings in the IRR office found two incidents that were in the Transport Canada data base but not in the computer search. One involved the June 1987 fatality of a truck driver who was loading chemicals when a fire started. Thus, further refinements for the computer search are required. In addition, one incident was found in the clipping file that was not in the Transport Canada data base but in the computer search.

Table 8.3 shows the characteristics of the incidents found in the computer searches. It is noted that in terms of the severity classes in Table 8.2 there is a tendency for the newspapers to cover incidents that are more severe. Figure 8.6

CLASS 3

		POPULATION DENSITY		
		LOW	MEDIUM	HIGH
	LOW	3/1 (1)	4/0 (2)	11/0 (3)
SPILL	MED	6/2 (4)	4/1 (5)	5/1 (6)
	HIGH	5/0 (7)	1/0 (8)	5/1 (9)

CLASS 8

		LOW	MEDIUM	HIGH
	LOW	5/2 (1)	7/0 (2)	12/0 (3)
SPILL	MED	3/2 (4)	7/1 (5)	5/1 (6)
	HIGH	2/0 (7)	1/0 (8)	2/1 (9)

LEGEND 7/1 (5) — road / rail (severity class)

FIGURE 8.5

ONTARIO TRANSPORT CANADA DATA CLASS 3 AND 8 FOR
JANUARY 1986 - AUGUST 1987

TABLE 8.2

MATCHED PAIRS OF ROAD/RAIL INCIDENTS OF EQUAL SEVERITY

SELECTED PAIRS OF EQUIVALENT RISK

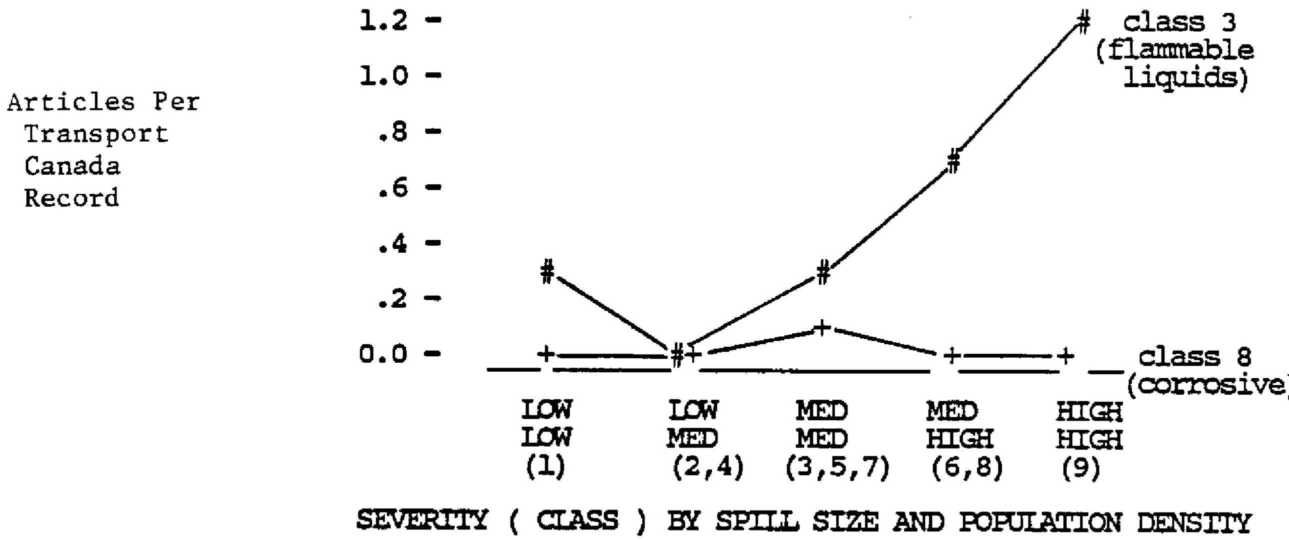
	Date	Location	Pr	DGPIN1	DG Class	Mode	% Spilled	Cause	Spilled (1)	Pop. Density	Cell #
CLASS 3 (FLAMMABLE LIQUIDS)											
1	5 25 86	Shabaqua	ON	1866	33	21	6	Weld Fail	12	?	1
2	5 24 87	Hornepayne	ON	1263	32	22	30	Pkg Failu	14	?	1
3	3 14 86	White River	ON	1263	33	1	98	Unknown	402	9.6	4
4	4 28 86	Timmins	ON	1203	31	22	1	Overflow	385	15.3	4
5	1 8 87	Sudbury	ON	1105	32	1	1	Valve Fai	200	349.5	5
6	3 15 86	Sudbury	ON	1866	33	2	2	Imp Braci	486	349.5	5
7	10 6 86	Etobicoke	ON	1263	32	1	43	Load Shif	344	2410.3	6
8	5 6 87	Mimico	ON	1203	31	22	1	Fitting F	393	2410.3	6
9	10 23 86	Sarnia	ON	1142	32	2	1	Fitting F	7027	1553.5	9
10	4 22 87	Sarnia	ON	1208	31	21	1	Negligenc	909	1553.5	9
CLASS 8 (CORROSIVES)											
11	3 9 87	Bloomington-Aurora	ON	2014	80	1	98	Imp Braci	37	?	1
12	9 14 86	Hornepayne	ON	1760	80	22	1	Pkg Damag	21	?	1
13	3 4 86	Milton	ON	1824	80	1	46	Imp Braci	104	76.4	4
14	7 18 87	Milton (Milbase)	ON	1814	80	22	1	Puncture	146	76.4	4
15	3 27 87	Oakville	ON	1903	80	1	13	Imp Braci	213	548.5	5
16	4 26 86	Halton	ON	1760	80	22	1	Load Shif	209	127.6	5
17	1 7 87	Hamilton	ON	1840	80	1	9		202	2495	6
18	7 5 86	Toronto	ON	1791	80	22	1	Pkg Failu	155	6168	6
19	1 8 86	Scarborough	ON	1824	80	1	98	Valve Fai	22707	2362	9
20	1 23 86	Etobicoke	ON	1821	80	22	98	Water Dam	20090	2410.3	9

Modes 1 and 21 are road
Modes 2 and 22 are rail

TABLE 8.3

INCIDENTS FOUND BY COMPUTER SEARCH

G & M # articles	G & M tot words	T S # articles	T S tot words	CANUTEC Rec #	DATE	TIME	LOCATION		DG CLASS	MODE	# INJURIES	# DEATH	EVACUATE	# EVACUATE	CAUSENOTE	AMOUNT SPILLED (lt)	POPULATION DENSITY (/km^2)	CELL
ROAD																		
1	83	1	427	559	7 8 87	1200	HUNTSVILLE	ON	31	1			Y	300	OVERTURN	20435	16	7
2	633	3	1002	586	8 12 87	200	HAMILTON	ON	31	1	2	1	Y	300	COLLISION/OT	22000	2495	9
1	193	1	157	576	8 3 87	1830	STILL RIVER	ON	31	1	3				COLLISION	9820	?	7
1	1402	0	0	58	2 15 86	1046	BERNIERES	PQ	31	2	42				COLLISION	0	0	1
1	64	2	533	446	3 26 87	525	PRESCOTT	ON	32	1		1	Y		COLLISION/OT	517	1156	6
1	53	0	0	455	4 15 87	1800	TOPPING	ON	51	1	1				OVERTURN	11299	?	7
1	121	1	178	255	8 11 86	1015	NORTH YORK	ON	61	21					FL/PUNCTURE	2	3164	1
0	0	2	459	540	7 14 87	1300	ABERFOYLE	ON	80	1					TANK FAILURE	667	675	5
1	66	0	0	420	2 21 87	2000	BARRIE	ON	80	1					PKG FAILURE	0	1327	3
0	0	1	63	213	7 22 86		TORONTO	ON	92	21	2				IMP LOADING	20	6168	3
RAIL																		
		1	118		5 23 87		SMITH FALLS (resin sol)		3	2					DERAILMENT	0	1037	3
		2	556		4 6 87		ORILLIA (ethylene oxide)		2	2					DERAILMENT	9000	1045	9
		1	292		10 19 86		TORONTO (6 trucks - flammable/corrosive		3/8	21					SABOTAGE	4541	6468	9
		1	76		8 5 86		ETOBICOKE		8	22					DRUM LEAKAGE	4.5	2410	3



(See Class Definitions in Figure 3.5)

FIGURE 8.6

ARTICLES IN TWO NEWSPAPERS PER INCIDENTS
RECORDED BY TRANSPORT CANADA

shows the ratio of number of articles in both the Globe and Mail and the Toronto Star as a ratio of the number of incidents recorded by Transport Canada for Classes 3 and 8. It is clear that the coverage in the media is related to the severity of the incident. In addition, it is clear that the perception is that Class 3 incidents are more severe than Class 8 incidents.

A review of the words per article indicated that for a newspaper article to contain more than 200 words the incident involved a death, an evacuation or more than 3 injuries (based on a sample of 6 articles with > 200 words). For example, in Figure 8.6, severity level 1, there was one article for an incident which involved 42 injuries. It appears that the severity must also include a measure of the consequences of the incident in addition to the other three factors selected.

Data were not sufficient to compare the perception of incidents involving trucks versus those involving rail.

8.4 Discussion and Conclusions

The observed level of reporting of incidents in the Transport Canada data bank precluded the approach proposed, which was to sample incidents from the Transport Canada file and then observe the words reported as a measure of the perceived severity. Only about 4% of all incidents in the Transport Canada file were reported in either the Globe and Mail or the Toronto Star.

In addition, there were almost as many incidents reported in the newspapers that were not in the Transport Canada data base. It would appear that the assumption that the Transport Canada file could be used as a sampling frame is not correct.

The results indicate that the severity of incidents can be measured by population density, type of commodity, size of spill and consequences of the incident. The newspaper coverage in terms of the number of articles and the number of words of coverage appear to be related to the severity of the incident.

It is concluded that the use of computer search techniques could provide a basis for sampling incidents, noting that this sample is biased towards the more severe incidents. It is proposed to use the Transport Canada data in conjunction with the actual news articles to develop the characteristics of incidents and their severity. It will be necessary to sample more newspapers over a longer period of time in order to obtain sufficient information to compare the reporting of rail versus road incidents and account for the severity of the incident.