

**Analysis of Traffic Operations
for
the Movement of Very Large Vehicles
on the
Edmonton–Fort McMurray High-Wide Load Corridor**

by

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Abstract

Alberta Transportation and Utilities, Alberta Power Ltd. and Trans Alta Utilities Ltd. in conjunction with Syncrude Canada Ltd. and other contractors have developed a high-wide corridor from Edmonton to Mildred Lake (north of Fort McMurray). The corridor allows the transport of very large vehicles up to 8 m wide, 8 m high and 27 m long. The transport weights allowed on the high-wide corridor ranges from 122 tonnes in the summer months to 177 tonnes in the winter months. The very large vehicles allowed on the high-wide corridor transport process modules, dressed equipment and major pre-assemblies for the oil sands extraction plants in the Fort McMurray area.

The purpose of this paper is to discuss the results of a recently completed analysis of the impact of very large vehicles on rural highway traffic operations.

The problem of determining the impact of very large, slow-moving vehicles on two-lane highway level of service cannot be solved using conventional highway capacity analysis procedures. Thus traffic simulation models were utilized to determine the impact of 1600 very large slow-moving vehicles and up to 20 % heavy trucks on the traffic stream.

Also discussed in the paper is how the findings of the simulation studies were used to demonstrate the importance of strategically located passing lanes and turn-outs in helping to maintain an acceptable level of service on the high-wide corridor during periods of heavy truck movements.

1 Introduction

Alberta Transportation and Utilities, Alberta Power Ltd. and Trans Alta Utilities Ltd. in conjunction with Syncrude Canada Ltd. and other contractors have developed what is known as High-Wide Load (HWL) transportation corridors from Edmonton to Mildred Lake. These corridors, depicted in Figure 1, allow the transport of modules and pre-assemblies of various sizes up to the following maximum dimensions: width 9.1 m (30 ft.); height 9.1 m (30 ft.); and length 60.6 m (200 ft.). Typical module weights on these routes range from 122 tonnes in the summer months to 177 tonnes in the winter months. However, weights as high as 380 tonnes may be conveyed provided size and spacing requirements of undercarriage wheel assemblies are met for critical bridge structures.

2 Problem Definition

Although the HWL corridors have been selected to permit the shipment of large modules, two traffic problems are still created by the over dimension modules and the large volume of

freight and equipment required for any plant expansion. The traffic operational problems are:

1. the slow moving vehicle problem (module transport); and;
2. the high volume of heavy trucks in the traffic stream.

In addition to the above, there is a range of variable road conditions (road widths and traffic) prevalent along various segments of the HWL corridors. Therefore, each problem requires a separate non-conventional technical analysis and solution. These are discussed separately.

2.1 The Slow Moving Vehicle Problem

The slow moving vehicle (SMV) problem involves the shipment of various size modules including convoys of up to three modules at speeds up to 50 km/h. Figure 2 shows the maximum dimensions of a module and Figure 3 the configuration and space requirements of a typical three module convoy. Passing of modules is controlled by pilot trucks at locations where adequate pavement width exists. The HWL corridor has road sections of width ranging from 8 to 13 m (26.5 ft. to 42.5 ft.) and, depending on module width, passing may or may not be permitted. Table 1 shows the cases where passing may be accommodated. Where passing along the road cannot be accommodated, then truck turnouts have to be utilized—if available. Thus traffic delays are a function of SMV speed, traffic flow, the number of modules transported, and the number of opportunities for overtaking which in turn is a function of module and road widths.

The number of modules and pre-assemblies for the proposed OSLO plant expansion is estimated at approximately 1600 of varying sizes. During the peak period there could be in the range of 5 to 7 modules arriving daily at the plant site. In order to estimate the impact of module shipment on free moving traffic, a simplified slow moving vehicle model was developed to estimate delay. The engineering solution to reducing delay is to widen the road, or alternatively, develop a system of strategically located turnouts to allow modules to stop temporarily and permit both opposing and following vehicles to clear the module. Figure 4 shows typical truck turnouts that have been designed for incorporation into Highway 63.

2.2 The Heavy Truck Problem

The OSLO expansion will also require substantial tonnages of construction equipment and material most of which will be shipped by truck. It is estimated that during construction the total weight exclusive of modules, pre-assemblies and local materials of bulk and other materials is estimated at 155,400 to 171,600 tonnes. During peak shipping periods this could result in 18 to 22 truck loads per day of bulk and other materials. The heavy truck problem is essentially one of impacting the level of service in terms of increasing the percent time spent following by free flowing higher speed traffic and increasing the

demand for overtaking while at the same time reducing the opportunity for overtaking caused by oncoming traffic. In order to determine the impact of a substantial increase in the number of heavy trucks on Highway 63, a two-lane highway simulation model was utilized to compliment conventional analysis procedures.

3 Alberta Slow Moving Vehicle (SMV) Model

The engineering solution for a narrow alignment (worst condition) to the slow moving vehicle problem is to widen the road or develop a system of strategically placed turnouts or passing bays. The cost of a typical single turnout is \$50,000. Delay also has an associated cost and, depending on traffic volumes, there is an optimum number of turnouts desired to reduce delay costs. The SMV model was developed to determine the impact of alternative turnout spacing on traffic delay.

3.1 Derivation of the SMV Model

Models relating effects of slow moving vehicles to operational aspects of two-lane highways utilize a variety of technical parameters. Field measurements are necessary for such parameters to be estimated for a particular application. Since most of these parameters are site-specific, models based on these parameters are not usually transferable except within the same technological and operational settings. Examples of parameters which are required by such models are those included in the fundamental flow-speed diagram (e.g. capacity of the highway section, jam density).

A simple, yet reliable, model was desired for the analysis of the effect of slow moving vehicles on free flowing traffic on a two-lane highway. The model was not to be based on any data that required field measurements or experiments. The development of this simplified model was made possible by the fact that no overtakings in the direction of the SMV is permitted. The model is based on the following assumptions:

1. Traffic arriving at the study section is Poisson distributed with the mean number of vehicles expected to arrive in time t is $m = Q \cdot t$, where Q is the flow rate (veh/h). This assumption involves all the implicit assumptions for the applicability of the Poisson distribution such as the randomness of arrivals. This assumption is particularly reasonable to this application since the Poisson distribution is inappropriate over 600 veh/h (Lay, 1985, p. 346).
2. Slow moving vehicles travel at a constant speed, V_s , and free traffic travel at a constant speed, V_f , such that $V_s \leq V_f$.
3. Traffic flow rate is sustainable over the entire journey time.

Using the above assumptions, the model was derived as follows:

The number of vehicles crossing an arbitrary point on the highway¹ in a given time interval, t , may be obtained, at any probability level, using the Poisson distribution:

$$P_t(x) = \frac{\sum_{x=1}^X e^{-m} \cdot m^x}{x!} = \frac{\sum_{x=1}^X e^{Q \cdot t} \cdot (Q \cdot t)^x}{x!} \quad (1)$$

where,

$P_t(x)$ = probability that x vehicles will arrive at any point in a given time interval, t , at the specified arrival rate, and

Q = flow rate, veh/h.

The above equation contains four variables: $P_t(x)$, Q , t , and x . Given any three variables, equation (1) can be solved for the unknown variable. $P_t(x)$ was set at 0.95 in the calculations of the expected number of vehicles. Since the Poisson distribution is discrete, i. e. , $x = 0, 1, 2, \dots$, it is not possible to solve equation (1) analytically for x or t . Instead, a numerical method was used whereby a computer program was written to solve for the desired variable given the values of the other three. For any section of the highway, it is then possible to calculate, at a given probability level, the arrival time of all vehicles expected to enter that section while the SMV is still travelling along the same section. At the same time, any vehicle entering the section at time t will not be affected by the SMV until it catches up with the SMV after time, t_c , where:

$$t_c \cdot V_f = V_s(t + t_c) - (n - 1)L \quad (2)$$

where,

n = the number of vehicle under consideration (the first vehicle entering the section is assigned number 1, the next is number 2, and so on),

and

L = average length of vehicles, m .

Solving equation (2) for t_c :

$$t_c = t \cdot \frac{V_s}{V_f - V_s} - \frac{(n - 1) \cdot L}{V_f - V_s} \quad (3)$$

Note that the second term of the right hand side of equation (3) can be neglected without loss of accuracy; it only accounts for the difference in the catch-up times when no vehicles are following the SMV versus that when there is n vehicles following the SMV at the same speed, V_s .

The delay experienced by any vehicle travelling along any section is simply the difference between two travel times. The first one, t_w , is the travel time spent by a free moving

¹This point may be set, for convenience, at any truck turnout from which the SMV starts its journey.

vehicle following a SMV at a speed V_s . The second travel time, t_{wo} , is the time spent by the same free moving vehicle without following a SMV. That is,

$$\text{Delay} = D_t(x) = t_w - t_{wo} \quad (4)$$

where,

$D_t(x)$ = delay experienced by vehicle x , arriving at time t ,

t_w = travel time *with* SMV being in the section,

t_{wo} = travel time *without* SMV being in the section.

For a section of length, d , and using assumption (2) above, the values t_w and t_{wo} can be written as:

$$t_w = \frac{d - t \cdot V_s}{V_s} \quad t_{wo} = \frac{d - t \cdot V_s}{V_f} \quad (5)$$

Substituting equation (5) into (4) and simplifying, yields:

$$D_t(x) = C \left(\frac{d}{V_s} - t \right) \quad (6)$$

where C = speed reduction ratio = $\frac{V_f - V_s}{V_f}$.

Inspection of equation (6) shows that the delay experienced by vehicle x arriving at time t is equal to zero if and only if it arrives at time $t = d/V_s$ which is equal to the time required by the SMV to travel a section of length d . However, this is not the case, since vehicles can arrive at an earlier time than the time required by the SMV to travel the entire length of d , and still do not experience any delay. This is because of the catch-up time required by a free moving vehicle to start experiencing delay. Then, modifying equation (6) to include the catch-up time, yields:

$$D_t(x) = C \left(\frac{d}{V_s} - t - t_c \right) \quad (7)$$

Substituting the value of t_c from equation (3) into equation (7), yields:

$$D_t(x) = C \frac{d}{V_s} - t + \frac{(n-1)L}{V_f} \quad (8)$$

Finally, the total delay resulting from the SMV trip along a section of length d is:

$$\text{TD} = \sum_{x,t} D_t(x) = \sum_t x_t \left(\frac{C \cdot d}{V_s} - t + \frac{(n-1)L}{V_f} \right) \quad (9)$$

where, x_t is the number of vehicles arriving in time interval t .

The value of t can be adjusted in the computer program until the step size (the value of x_t) is at the desired level. However, the smaller the step size, the more computer time will be required to solve equation (1), and the more accurate the results will be. The most accurate estimate of the total delay, however, can be calculated by selecting the minimum increment of x_t (i. e. $x_t = 1$). The calculations then proceed as follows:

- First, the arrival time, (t , in equation (9)) is calculated for *every* vehicle, $x = 1, 2, 3, \dots N_a$, where N_a is the number of affected vehicles in a particular section.
- Second, x_t is set equal to a vector of ones of a length equal to N_a , and n is used as a counter: $n = 1, 2, 3, \dots N_a$.
- Finally, the total delay (TD) can be calculated as:

$$TD = \sum_{i=1}^{N_a} t_i^* \quad (10)$$

where,

$$t_i^* = \frac{C \cdot d}{V_s} + \frac{(n_i - 1)L}{V_f} - t_i$$

n_i = index of the i^{th} vehicle (equal 1 for the first vehicle, 2 for the second, and so), and,

t_i = arrival time of the i^{th} vehicle.

3.2 Application of the SMV Model

The SMV model developed in this paper (the ALBERTA Simplified model) was applied to analyze the operational effects of slow moving vehicles on two-lane highway traffic. The scope of the model was considered satisfactory for the application in hand, since geometrics of the highway and the dimensions of the SMV did not allow for passing (i. e. testing of narrow highway sections) of the SMV except on the specified truck turnouts along the highway. These turnouts were located along the highway at spacings of 10–30 km. The spacing of two successive turnouts represents the length of the highway section over which no passing is allowed (i. e. length of a study section).

The ALBERTA Simplified model utilizes a variety of input data, as described in the previous section, and generates two major outputs: total delay (in hours), and the number of affected vehicles. Before presenting the empirical results, the performance of the model in predicting these two measures is compared with that of another “similar” model developed by DELFT University in the Netherlands (Botma, 1988). The two models share the same objective of “analyzing the effects on traffic operation of a slow moving vehicle on two-lane rural roads”. While the ALBERTA model has been developed for the specific purpose of “estimating the delay experienced by motorists following a SMV on a two-lane

highway with no passing opportunity”, the DELFT model contains more sophisticated treatment of the effects of a SMV on two-lane highway traffic *with* and *without* passing opportunity. Therefore, the DELFT model was adjusted for its “No-Overtaking” module so that results from the two models could be compared.

Table 2 shows total delay in hours for the set of truck turnout spacings used in this study as calculated by the two models for two values of flow, 100 and 200 veh/h. Another output from the simplified ALBERTA model, number of affected vehicles, is shown in Table 3. Also shown in Table 3 is the average delay per vehicle as estimated by the two models for a flow rate of 200 veh/h. This value was calculated by dividing the total delay (in hours) for each section, from Table 2, by the number of affected vehicles, and multiplying the result by 60 min/h. Figures 5, 6 and 7 are graphical representations of the comparisons held in Tables 2 and 3 for selected flow rates.

The following notes may be made on the comparison of the two models:

1. The two models differ in the values implemented for some of the operational parameters. These parameters include speed at capacity, jam density, and the capacity of the highway section.
2. The range of distance over which the output from the two models are compared (13–25 km) is rather arbitrary. The DELFT model was developed for use with much shorter distances (up to 5 km) which are more common in the case of farm tractor trips along rural roads in the Netherlands (Botma, 1988).

In spite of the above, and other minor differences in the assumptions and values of parameters utilized in both models, the results show a good “fit” between the predictions of the two models.

4 Simulation of Heavy Trucks on Highway 63

The heavy truck problem is also essentially one of delays incurred by faster following traffic and is exacerbated where trucks are heavily laden, and are climbing moderate to steep grades. In addition, increasing opposing traffic reduces the number of gaps for overtaking to occur. Poor road geometry (no passing zones) also aggravates the problem.

Conventional highway capacity analysis (1985 HCM) does not incorporate procedures for analysing road sections with a third lane. Therefore, a simulation model was used to help solve this particular deficiency.

4.1 Traffic Volume and Composition

The base year (1985) average annual daily traffic (AADT) on Highway 63 is approximately 1000 between the junction with Highway 55 and Fort McMurray. The AADT for the design year of 1993 is estimated at 1350 based on a 3.8 % growth rate.

The base year traffic composition shown in Table 4 indicates a high percentage of heavy trucks (approximately 20 %) compared to the provincial average which is normally in the 5-12 % range. For the horizon year of 1993, traffic composition was taken similar to the base year plus an additional 20 heavy trucks per day. The directional split for analysis purposes was taken as 50/50.

4.2 Highway 63 Simulation Model

4.2.1 The Simulation Model

The TRARR (TRaffic on Rural Roads) two-lane highway simulation model developed by Robinson (1980) at the Australian Road Research Board (ARRB) was used to determine the impact of heavy trucks on traffic flow. The TRARR model was selected for simulation purposes because of its flexibility and the fact it is particularly user friendly and well documented (Hoban, Fawcett, and Robinson, 1985).

The TRARR model can be used to simulate traffic operations on a road in detail and to investigate the effects of changes in road traffic characteristics. By changing the traffic characteristics, the user can investigate the effects of increased volumes, more heavy trucks, or changes in vehicle size and power. Auxiliary lanes may be added on one or both sides, so that climbing lanes, passing lanes, and three or four-lane roads may be modelled. TRARR allows passing restrictions, auxiliary lanes, horizontal and vertical curves, and variable sight distances to be studied. Vehicles may vary in performance, and drivers may vary in their behavior when unimpeded, following other vehicles, overtaking or merging.

The simulation process used in TRARR has the following five main components:

1. read in data on the road, traffic vehicle and driver description, and observing points along the road;
2. generate a traffic stream with volume, composition, and directional split as specified in the input files;
3. simulate the movement of each vehicle along the road;
4. record details of traffic characteristics passing certain points or over certain intervals of roads; and
5. print, plot, or summarize the observed traffic behavior.

Traffic generation with TRARR is based on random (or Monte Carlo) selection of values from specified distribution of arrival times, speeds, and vehicle types. This is the only Monte Carlo aspect of the TRARR model since vehicle behavior along the simulated road is completely determined by vehicle/driver characteristics, and is not subject to any probabilistic decision-making. Within TRARR, a new vehicle is generated as the preceding vehicle enters the simulated road segment. Alternatively, it is possible to bypass the traffic generation routines and read in a file of traffic from outside the program such as a real

traffic data or a separate traffic generation program. The progress of each vehicle along the road is reviewed at frequent intervals and changes made according to the current state of the vehicle. Decision rules for overtaking, merging, catching up, and other maneuvers are determined by the vehicle/driver characteristics supplied as input. The simulation cycle also includes a number of book-keeping tasks to maintain and update lists of vehicle positions and relative order in each lane and between lanes.

4.2.2 Input Data

A major feature of TRARR is its extensive use of input data files, allowing the user to vary many aspects of the simulation without altering the computer program. The four main files are as follows:

1. **The Road File** — this file gives details of barrier lines, sight distance, curves, and auxiliary lanes for every 100 m interval in both directions. The road file was created from data taken from videologs and as-built plans of two sub-sections of Highway 63. Passing sight distance and barrier line information was obtained during field trips.
2. **The Vehicle File** — contains approximately 60 vehicle/driver characteristics for 18 vehicle types. For purposes of this project, a modified Vehicle File was assembled for 6 vehicle categories to emulate the vehicle/driver profile characteristics of traffic on Highway 63.
3. **The Traffic File** — traffic composition is described as a mix of 6 vehicle categories. Volumes, speeds, and directional splits are specified for each category for existing and future conditions.
4. **The Observation File** — this file allows the user to specify at what points along the simulated road segment the model should output traffic performance indicators. The standard observation routine outputs data at a spacing of 1000 m. This spacing was decreased to 100 m at the start and end of proposed passing lanes in order to provide detailed information on the diverging and merging processes.

4.2.3 Special Consideration for Loaded and Unloaded Trucks

Unlike traffic composition on rural highways under normal circumstances, the traffic and vehicle files for Highway 63 had to be further modified in order to reflect the fact that heavy trucks are loaded in northbound direction and, almost always, unloaded in the southbound direction. This modification has been achieved by splitting the heavy truck volumes into north and southbound and assigning 100 % of the northbound trucks to “loaded truck” category while 0 % of the southbound trucks were assigned to this category. On the other hand, 100 % of the southbound trucks were assigned to “unloaded truck” category while 0 % of the northbound trucks were assigned to this category.

4.3 The Output File

The following outputs are given for each direction of travel and each observation point: overtakings commenced, mean speed and standard deviation, percent vehicles following, and mean speed by category of vehicle. A summary is also provided for each direction including, for each vehicle type: mean and standard deviation of travel time, journey desired and unimpeded speed, percent time spent following, overtakings of and by each vehicle type, and fuel consumption.

4.4 Simulation Results

Table 5 provides a summary of simulation model runs for two-way volumes ranging from 50 veh/h to 300 veh/h in increments of 50 veh/h. The road files used for the runs were two sections of the existing highway. The table shows the percentage of time spent following and the number of overtakings, by direction and total two-way. Percent time spent following is shown for section 4 in the northbound and southbound directions in Figures 8 and 9 respectively.

In the northbound direction percent following reaches a maximum of approximately 30 % at the 6 km position as shown in Figure 8. The impact of climbing lanes on percent following at the 6 km and 13 km position of section 4 is clearly evident. For example, at a volume of 300 veh/h percent following is reduced approximately 15 percent at the 6 km position.

Figure 9 shows that percent following reaches a maximum value of approximately 35 % in the southbound direction. The impact of climbing lanes at the 3 km and 11 km position is approximately 15 % reduction in percent following.

4.5 Discussion of Simulation Results

Percent time spent following at a volume of 300 veh/h corresponds to level of service B as determined by the 1985 Highway Capacity Manual (HCM). For purposes of determining level of service using the 1985 HCM procedures, the terrain was classified as rolling and 22 % no passing zones were used.

Percent time spent following is not the only measure of level of service of a highway. Other performance indicators such as: number of overtakings, percent time delayed, capacity utilization, and speed should be used in conjunction with percent following. Morrall and Werner (1988) have suggested a new measure— Overtaking Ratio, defined as the ratio of overtakings on an existing two-lane highway to that on a four-lane highway. For the highway, terrain, and traffic conditions, the achieved to desired overtaking ratio was determined to be 0.70. The ratio has been defined by Morrall and Werner (1988) as follows:

$$\text{Achieved/Desired Overtaking ratio} = \frac{AO}{DO} \quad (11)$$

where,

- AO = Achieved Overtakings: the total number of overtakings for a given two-lane highway;
- DO = Desired Overtakings: the total number of overtakings for a four-lane highway with vertical and horizontal geometry similar to the given two-lane highway.

In other words, the overtakings achieved on Highway 63 for the conditions stated are approximately 70 percent of those possible if Highway 63 were a four-lane highway. If the volume of traffic were doubled to 600 veh/h, the overtaking ratio would drop by approximately 50 percent to 0.35. It is noted that the achieved/desired overtaking ratio decreases at a much faster rate than percent time delay increases through the ranges of level of service which are most critical for a two-lane highway, namely, the mid-range of B to the mid-range of C.

In summary, heavy trucks will not have an adverse impact on level of service at a volume of 300 veh/h. Level of service for this project has been evaluated by three independent measures, namely, simulation, achieved/desired overtaking ratio, and the 1985 Highway Capacity Manual.

5 Conclusions

The application of the Alberta SMV model and the TRARR simulation has assisted in confirming the initially proposed location of passing/climbing lanes and truck turnouts as the most appropriate engineering solution(s) to enhance traffic operation. The models have also provided the means to evaluate appropriate engineering solutions for other segments of the HWL corridor.

References

- [1] Botma, H. (1988) "Effects on Traffic Operation of a Slow Moving Vehicle on Two-lane Rural Roads", a paper presented at the 1988 TRB meeting.
- [2] Hoban, C.J., Fawcett, G.J. and Robinson, G.K. (1985) "A Model for Simulating Traffic on Two-Lane Roads: User Guide and Manual for TRARR Version 3.0", Australian Road Research Board, Technical Manual ATM No. 10A.
- [3] Lay, M.G. (1985) "Source Book for Australian Roads", Second Edition. Australian Road Research Board.
- [4] Morrall J.F. (1989) "Highway 63 Traffic Operation Analysis During Periods of Expansion of Oil Sands Extraction Plants", Alberta Transportation and Utilities, Draft Report.

- [5] Morrall, J.F. and Werner, A. (1988) "Measuring Two-Lane Level of Service by Overtakings". Institute of Transportation Engineers Proceedings.
- [6] Transportation Research Board (1985) "Highway Capacity Manual— 1985", Special Report 209, National Research Council, Washington, D.C.

TABLE 1
Passing for Various Module and Road Widths

Module Width m (ft)	Road Standard			
	RAU 208	RAU 209	RAU 211	RAU 213
9.1 (30)	No	No	No	Yes
7.3 (24)	No	No	Yes	Yes
5.2 (17)	No	Yes	Yes	Yes

TABLE 2
Total Delay (Hours), TD

Truck Turnout Spacing (Km)	ALBERTA Model		DELFT Model	
	Q=100	Q=200	Q=100	Q=200
	13.50	0.74	1.39	0.72
14.20	0.82	1.52	0.78	1.63
14.60	0.88	1.63	0.83	1.73
16.10	1.08	1.95	1.02	2.12
16.60	1.14	2.07	1.07	2.25
21.70	1.94	3.51	1.80	3.83
22.90	2.14	3.90	2.05	4.26

Directional Split = 50 %

TABLE 3
Affected Vehicles and Average Delay Per Vehicle (min)†

Truck Turnout Spacing (Km)	ALBERTA Model		DELFT Model	
	Aff. Veh	Delay/Veh	Aff. Veh	Delay/Veh
13.50	20	4.17	18	4.93
14.20	20	4.56	19	5.15
14.60	20	4.89	19	5.46
16.10	20	5.85	19	6.69
16.60	24	5.18	22	6.14
21.70	27	7.80	29	7.92
22.90	31	7.55	30	8.52

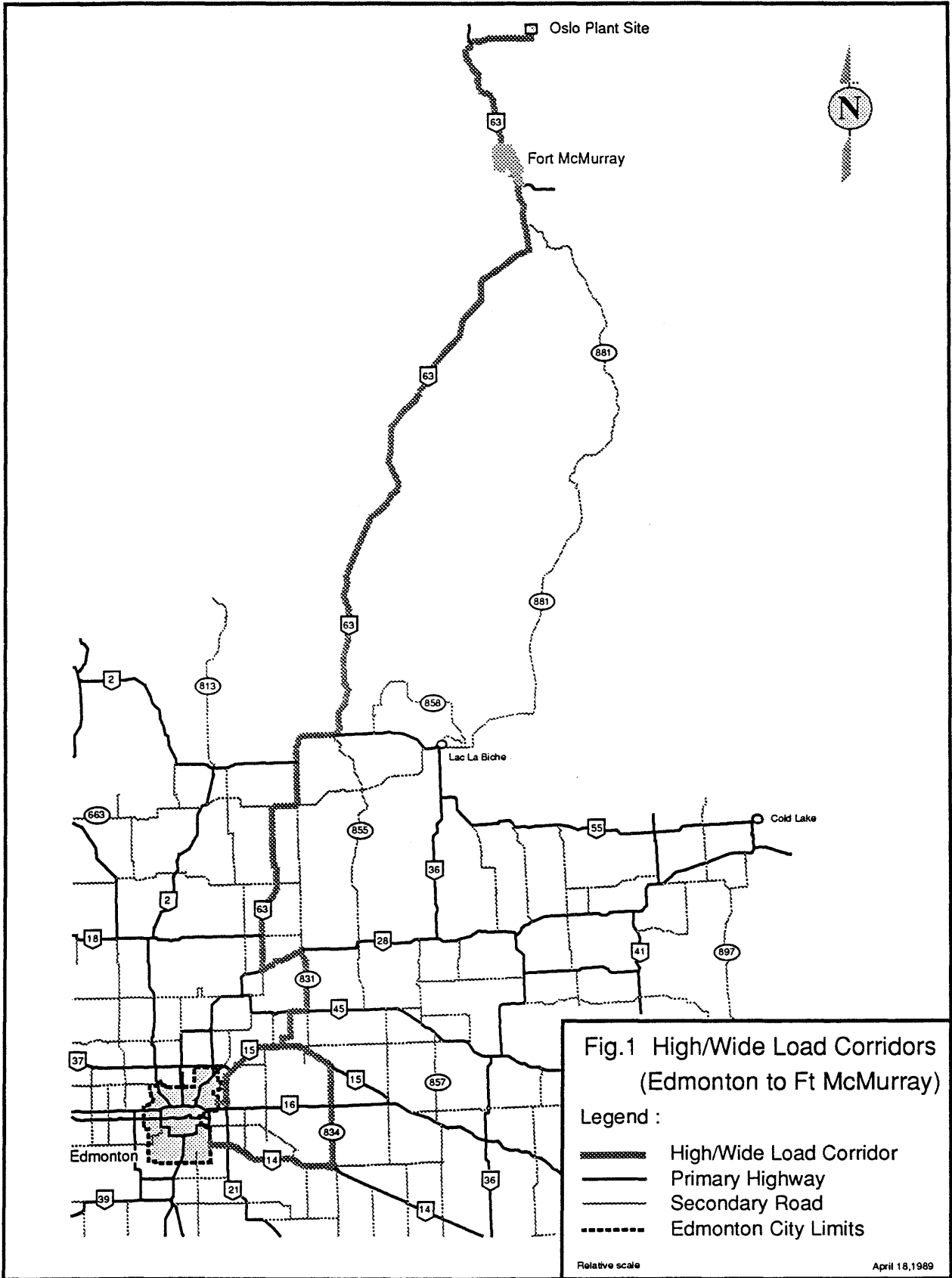
† Flow = 200 Veh/h, Directional Split = 50 %

TABLE 4
Traffic Composition: Highway 63

Vehicle Type	Percent
Passenger Cars	74%
Recreational Vehicles	4%
Buses	1%
Heavy Trucks	19%
Single Unit Trucks	2%
Total	100%

TABLE 5
Simulation Results—Existing Highway

Highway Section	2-Way Volume (Veh/h)	Percent Following			Overtakings		
		NB	SB	2-WAY	NB	SB	2-WAY
Section 4 (63:04)	50	4.0	7.5	5.7	5	5	10
	100	7.3	7.9	7.6	28	29	57
	150	11.9	12.2	12.1	70	73	143
	200	14.2	17.0	15.7	126	140	266
	250	17.4	23.2	20.1	231	197	428
	300	20.5	28.2	24.3	288	284	572
Section 5A (63:05A)	50	4.5	5.9	5.2	6	3	9
	100	8.4	7.8	8.2	23	26	49
	150	12.7	10.5	11.6	55	53	108
	200	13.2	11.7	12.4	88	101	189
	250	21.4	19.0	20.3	165	132	297
	300	24.7	25.3	25.0	201	213	414



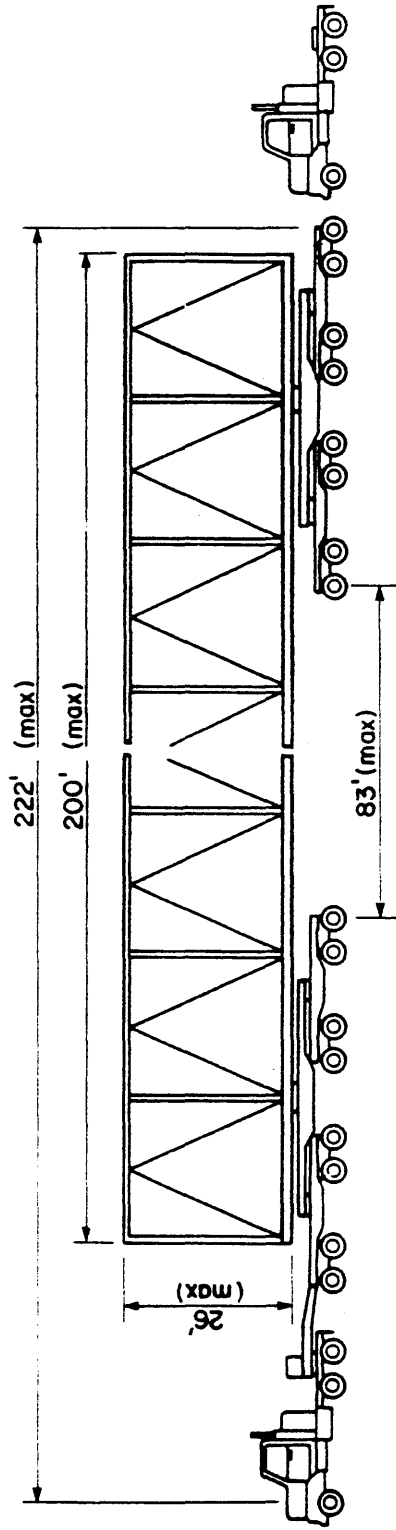
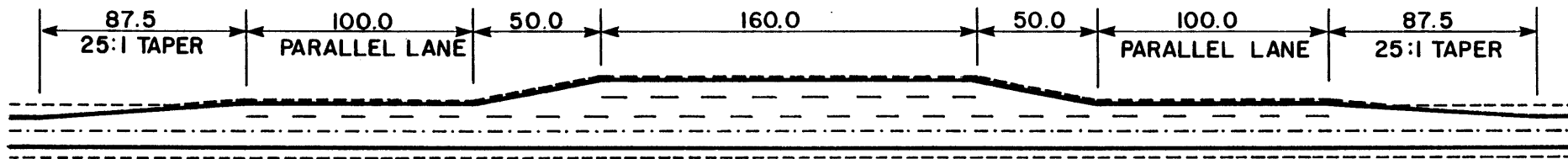


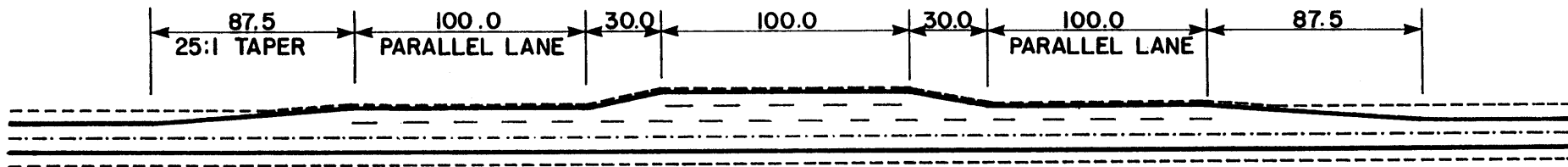
Figure 2. Maximum Module Dimensions



Figure 3. Three Module Convoy



TRUCK TURNOUT FOR NORTH BOUND LANES



TRUCK TURNOUT FOR SOUTH BOUND LANES

Figure 4. Truck Turnout Dimensions

Figure 5. Comparison of the Simplified ALBERTA & DELFT Slow Moving Vehicle Models
Flow = 200 Veh/h (50/50 Split)

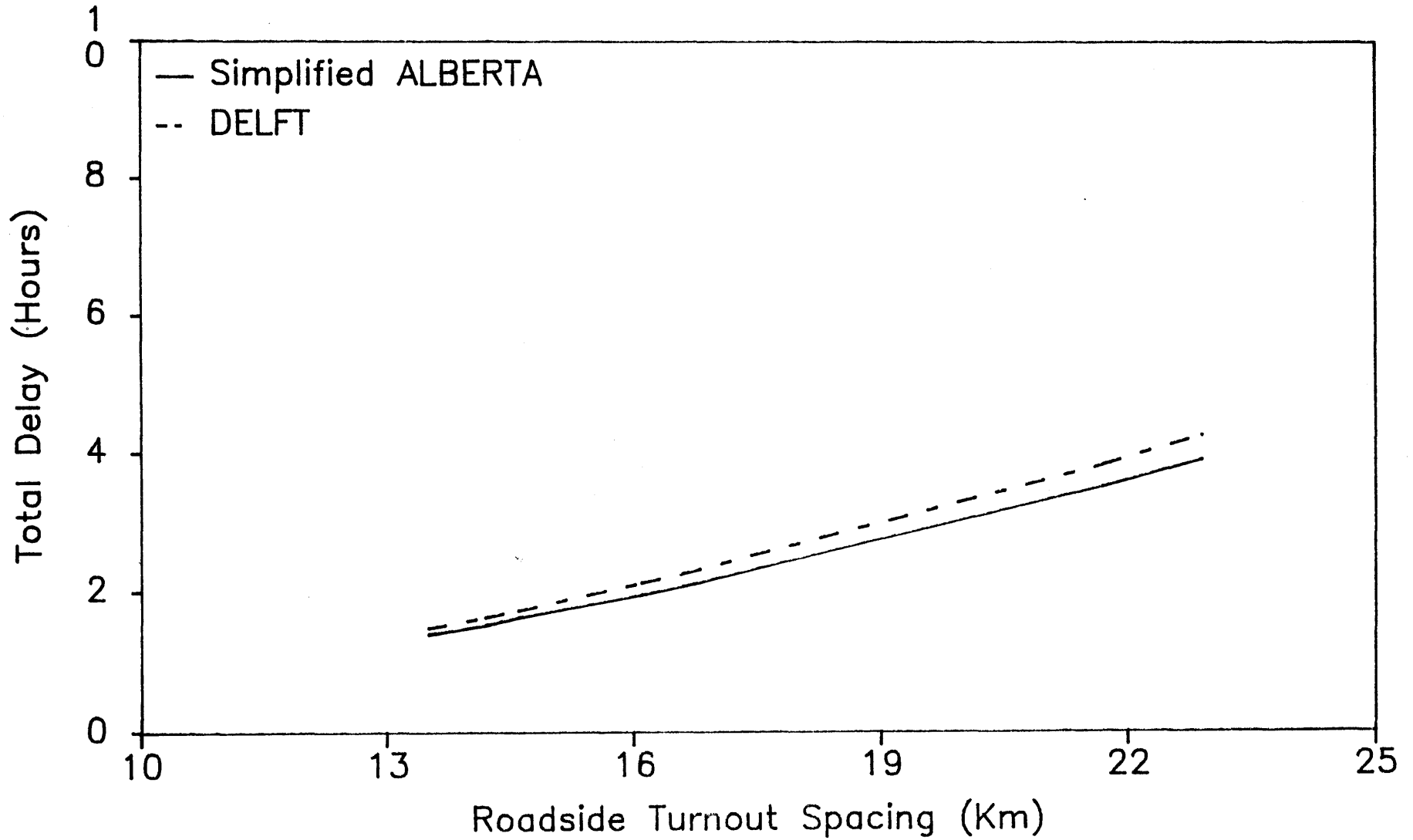


Figure 6. Comparison of the Simplified ALBERTA & DELFT Slow Moving Vehicle Models
Flow = 200 Veh/h (50/50 Split)

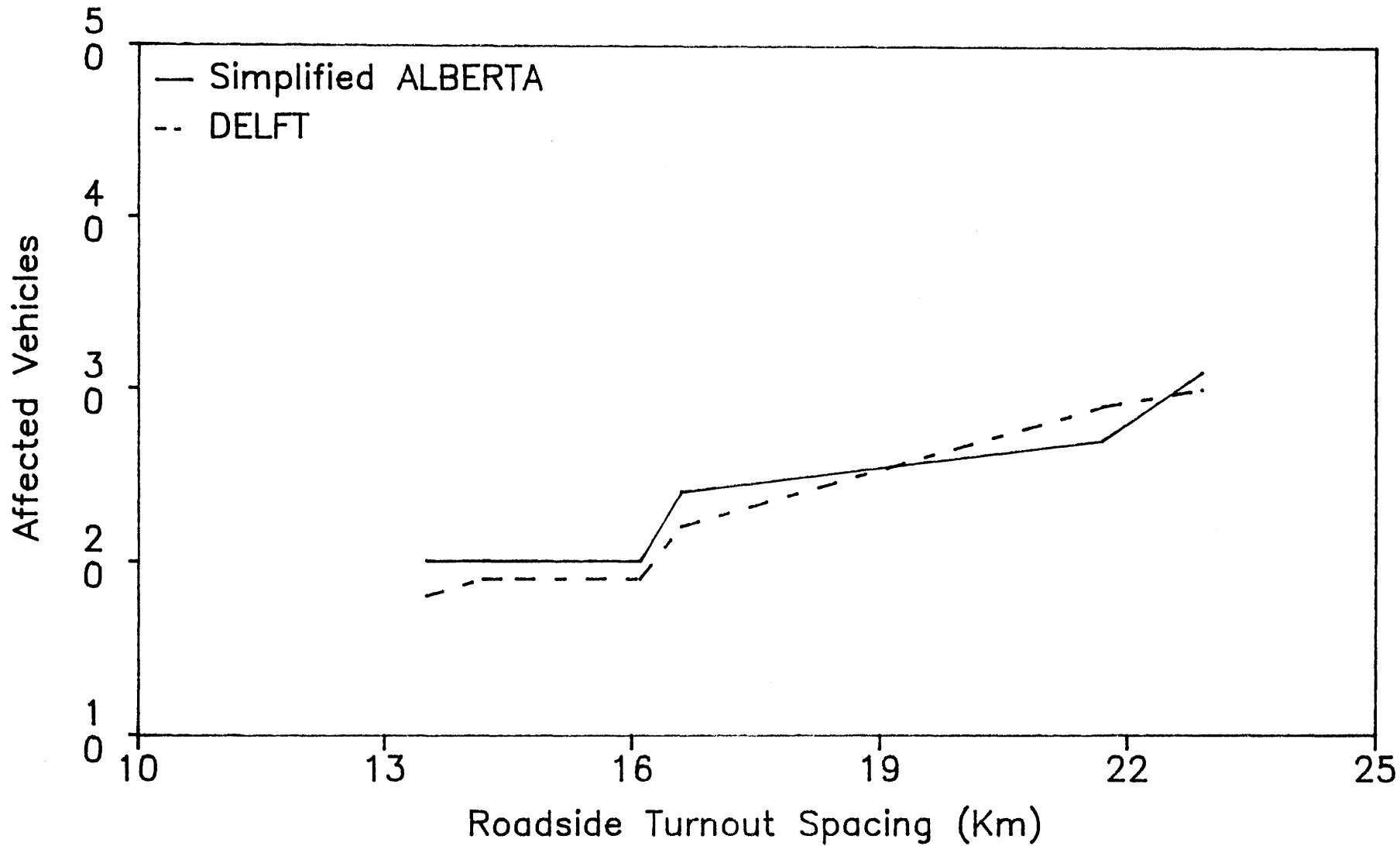
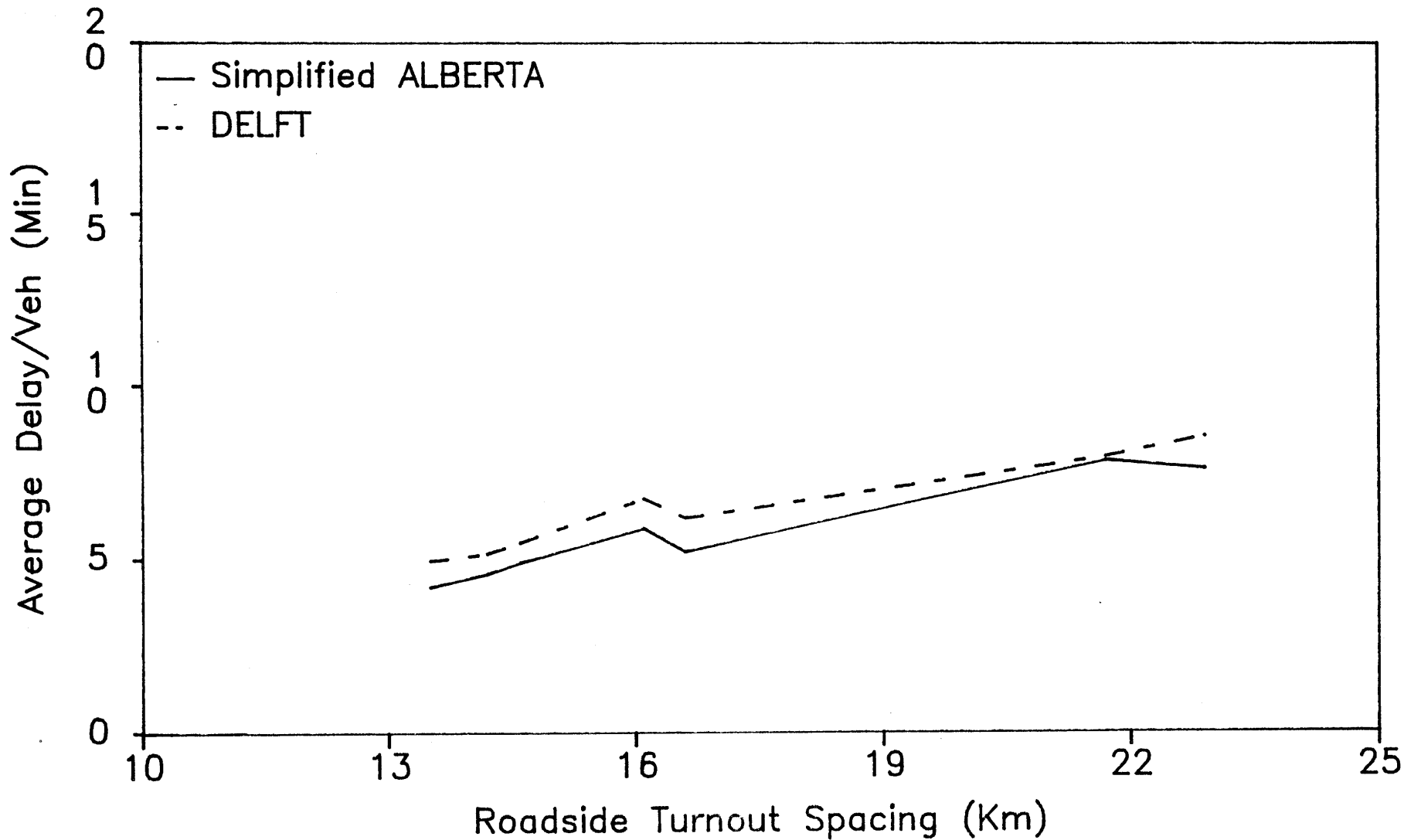


Figure 7. Comparison of the Simplified ALBERTA & DELFT Slow Moving Vehicle Models
Flow = 200 Veh/h (50/50 Split)



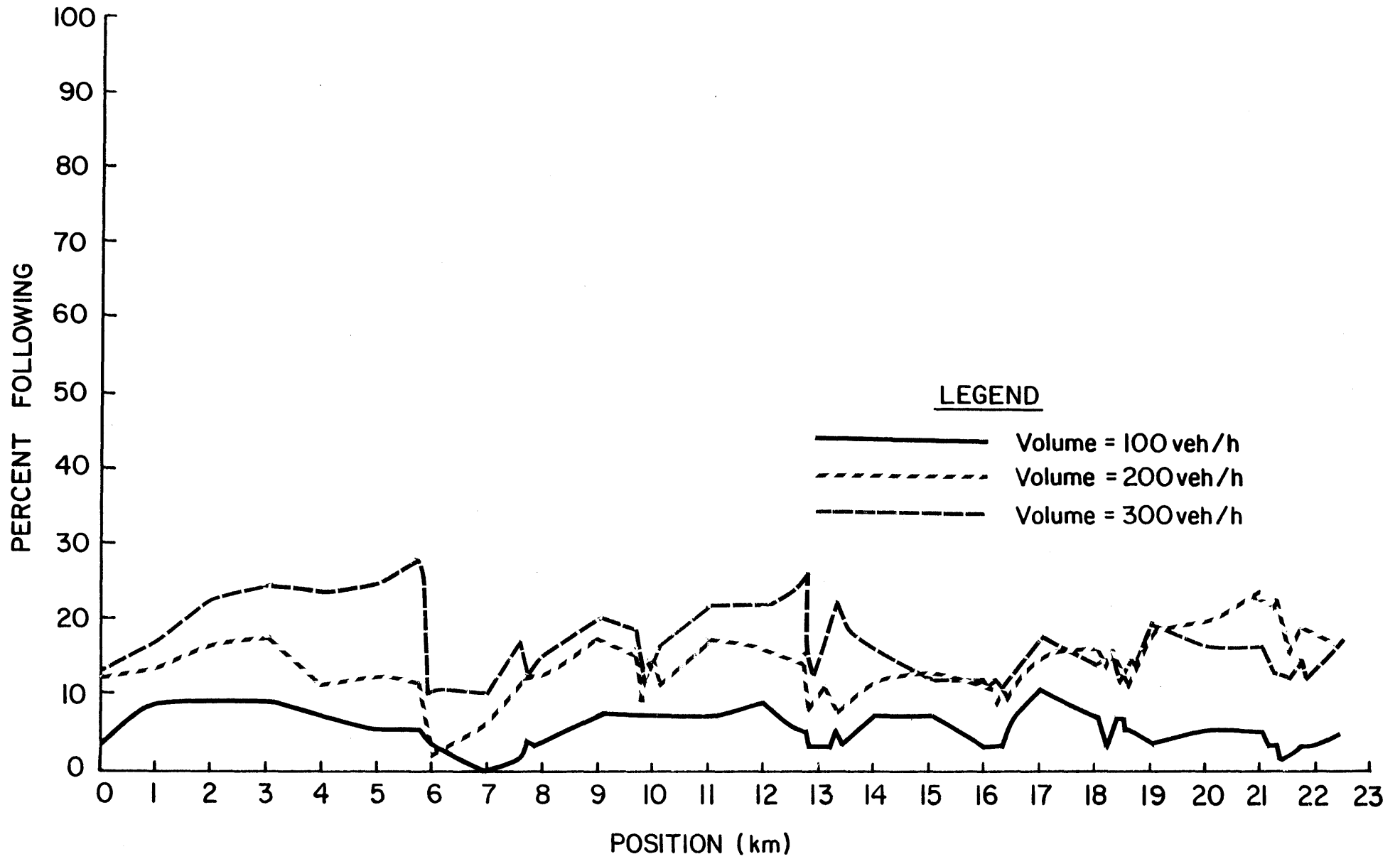


Figure 8. Percent Following vs. Position in the Northbound Direction (Highway Section No. 4)

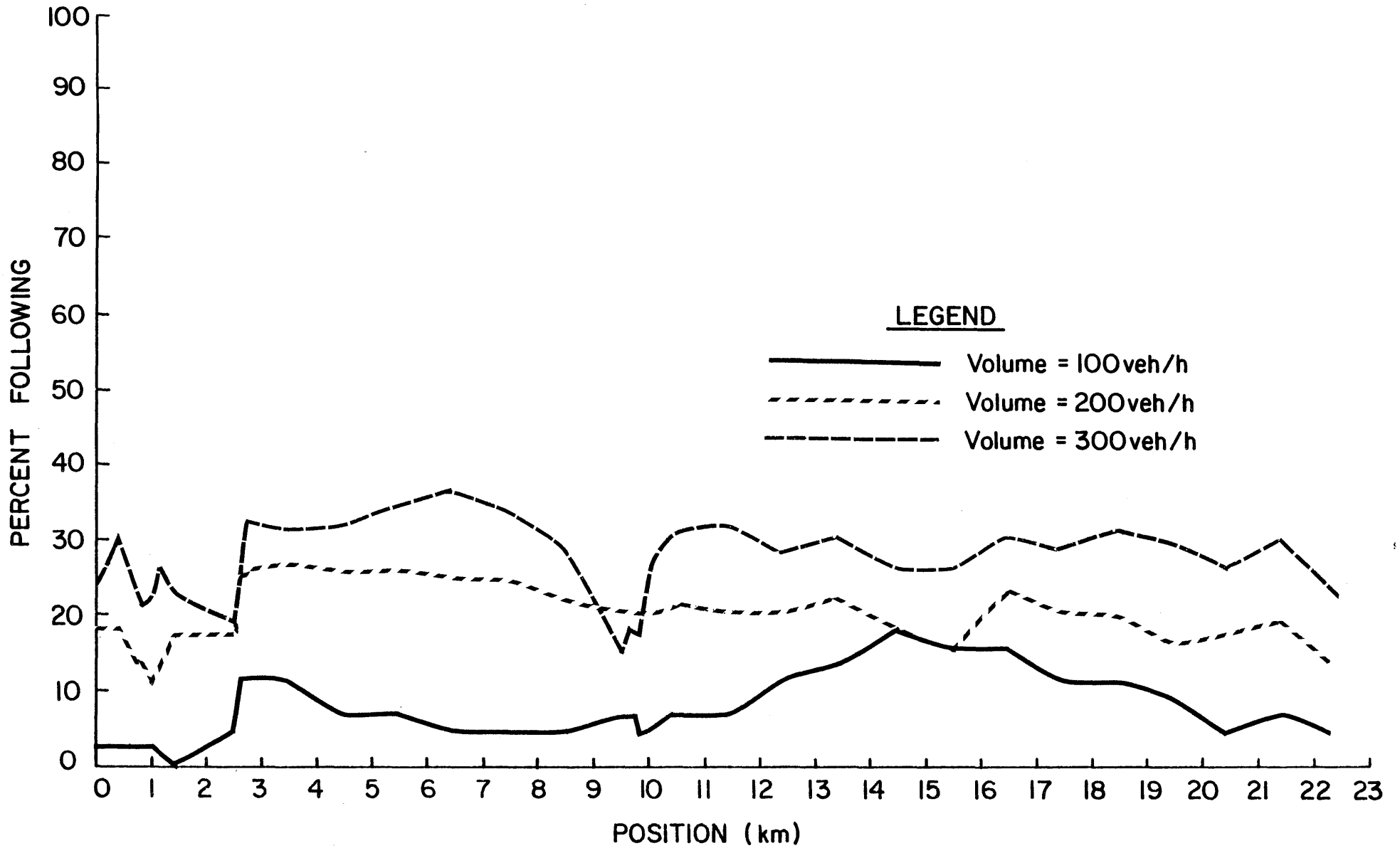


Figure 9. Percent Following vs. Position in the Southbound Direction (Highway Section No. 4)

SESSION 9 – WEIGHTS, DIMENSIONS AND PRODUCTIVITY

Chairman: Keith Walker, Interjurisdictional Committee on Vehicle Weights and Dimensions

Speakers

1. **Economics of Vehicle Weights and Dimensions in Canada**
L. Sims, N.A. Irwin, IBI Ltd., Toronto
2. **The Benefits of 62.5 tonne, 25 m B Trains in Alberta**
T. Fredericks, Economy Carriers, Alberta
3. **The Economic Benefits of Long Combination Vehicle Operations**
M. Rice, Transystems, Black Eagle, Montana
4. **The Economics of Road Train Operations in Australia**
J. Parnell, Parnell Transport, Australia

