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The Future of Passenger Trains and Buses in North America

*by J. Lukasiewicz**

SUMMARY

SINCE THE MAJORITY of the present rail services is already duplicated or could be replaced by faster, more frequent, cheaper, more energy efficient and commercially viable, unsubsidized and profitable buses, it is suggested that the majority of passenger rail routes should be discontinued with the buses and airlines providing all public transportation. Subsidization of a small number of new bus routes, where traffic is small but the service socially desirable, would have to be attended to. The remainder of rail routes, on which roads are not available, would have to be studied in detail to determine how each should be rationalized and subsidized.

In the long-term, passenger rail policy in North America must be concerned with the potential of modern, fast trains, capable of competing with the car, the bus, and—on short trips—with the airplane.

A start in this direction has been already made in the United States, with the upgrading of the North-East corridor for 120 mph operations. Estimates of traffic which would be available in the Quebec-Windsor corridor (where traffic is largest) indicate, as noted already, only a limited potential for modern rail in Canada; capital investment and operation would entail losses (and thus subsidies) comparable to the losses now sustained in the operation of obsolete passenger rail throughout the country. Nevertheless, public funds would be used more productively on gradual development of fast rail links in the corridor than on support of obsolete and deteriorating services. As traffic levels and oil prices augment, the potential of fast rail will continue to grow. In the long-term, also in the Canadian corridor, fast rail would be chosen as a socially desirable and technically superior mode of passenger travel.

The past two decades have witnessed a renaissance of passenger rail in W. Europe and Japan. In terms of service, this has meant a steady increase in speed over continually expanding mileage. Start-to-stop runs at over 100 mph are operated in Japan, Great Britain and France. The **minimum** speed on the new Paris-Lyon line, to be opened in the early 1980's, will be 135 mph. A maximum speed of 160 mph is planned (RGI, 1979).

Unlike in Europe, in the United States and Canada passenger rail has been an unresolved transportation dilemma since the end of World War II. The North American society, the most modern of all, has been unable to cope with the modernization of the oldest mode of mechanical land transport.

DECAY THROUGH OBSOLESCENCE—The obsolescence of the traditional, slow North American trains has been accelerated in the 1960's and 1970's. As affluence increased and car ownership became universal, as roads were continually improved and super-highways built and as fuel costs stayed relatively low (even after the 1973 oil crisis), local and intermediate range traffic was virtually monopolized by the automobile, and—where traffic was large enough—by the bus, to the exclusion of the railway. As average speeds of cars and buses reached 60 to 70 mph, and as inter-city jet travel developed, the railway, operating—excepting a few runs—at much lower speeds, became totally uncompetitive.[1] To-day, only a negligible fraction of inter-city traffic is by rail (one per cent in Canada, 0.3 per cent in the U.S.). The ocean liners met the same fate, for similar reasons, and have all but disappeared.

As public deserted the obsolete trains, rail deficits mounted and train services deteriorated. The quality of service, as measured by punctuality, frequency and comfort of trains, quality of rolling stock and station—downtown access, has been declining and further eroding rail patronage.[2]

Since AMTRAK took over passenger trains in the U.S. in 1971, system on-time performance and scheduled speeds have generally decreased. In 1978-1979, only two-thirds of AMTRAK trains achieved scheduled times; in February, 1979, the performance dropped to 52 per cent. In the best month, the figure rose to 69.5 per cent. The punctuality attained on the North-East Corridor route was no better than the above system averages.

In Canada, on the Toronto-Montreal prime passenger run, in 1972 only 72 per cent of trains arrived "on time"; this figure dropped to 24 per cent in the month of February. The punctuality of long distance trains was much

****Professor, Department of Mechanical and Aeronautical Engineering, Faculty of Engineering, Carleton University, Ottawa, Kls 5J7, Canada.***

worse. For seven months in 1972, less than 32 per cent of CN's Super Continental trains made the schedule. (Lukasiewicz, 1976; 1976b)

THE MOUNTING LOSSES AND SUBSIDIES

The Canadian Scene—The lack of recognition of obsolescence as the basic cause of the demise of passenger rail in Canada and the U.S. has led to maintenance of obsolete services at a truly exorbitant cost to the taxpayer.

Since 1967, passenger rail has been maintained in Canada through government order and subsidy (to the extent of 80 per cent of audited losses). Subsidy payments have risen from $66 million for 1971 to $265 million for 1979 at an average rate of 20 per cent per year (C.T.C., 1967R).

It should be noted that such numbers, no matter how impressive, are not meaningful unless related to the volume of the transportation that is subsidized. In fact, in 1974–75 the federal airport subsidies amounted to $442.6 million, whereas the unrecovered road costs—to $1,495 million, sums much larger than spent on passenger rail (C.T.C., 1977). But when subsidies (in mid-1970s) are expressed in terms of revenues per passenger mile, they are much higher for railways than for the other modes: 150 per cent compared to 38 per cent for air and none for the bus. The rail subsidy per passenger-mile is about 4 times larger than the air subsidy, and 8 times larger than the car subsidy (C.T.C., 1976; T.C., 1976). The deficits on transcontinental trains are particularly large. A $100 Montreal-Vancouver coach fare is only possible because the taxpayer pays an additional $340.

In an attempt to arrest the climb of passenger rail deficits, VIA-Rail Canada Inc. organization was set up by the Canadian Government in 1977 (Lang, 1977). But, without sufficient capital needed to improve roadbed and signalling, VIA's schedules cannot be significantly shortened and rail's competitive position can't be bettered. New rolling stock (VIA Rail has on order 22 LRC[3] locomotives and 50 coaches, for a total of $90 million) will not be able to operate at design speed of 120 mph. Even the Montreal-Quebec "Demonstration" (C.P.C.S., 1977; Lukasiewicz et al., 1978b), which is to cost $28 million for improvements to the line and for new LRC trains (consisting of a locomotive and just two coaches), will not provide a faster service than the bus (2 hr. 30 min. to Quebec suburbs, at an average speed of 70 mph, compared to 2 hr. 40 min. to downtown by bus), at an estimated operating loss of $1.9 million annually (excluding the cost of capital). Clearly, a marginal improvement of the railway mode, while exceedingly costly, cannot attract enough traffic to render the operation economically reasonable.

The expectation of "revitalization" through VIA-Rail has not been supported by estimates of traffic, costs and revenues. In the light of the information summarized above, the creation of VIA-Rail will be seen as a political move which lacks a sound economic and technical basis.

The United States Scene—VIA-Rail reflects the experience of the U.S. National Passenger Railroad Corporation (AMTRAK) established six years earlier. Just as in the case of VIA-Rail, the purpose of AMTRAK was to consolidate and rationalize passenger rail services, and make passenger rail pay its own way eventually. It is now conceded that these objectives are not attainable. By 1977, AMTRAK accumulated an operating deficit of $1.8 billion; the subsidy in the 1978 fiscal year reached $779 million, or about 200 per cent of the revenue. The U.S. Department of Transport estimated that AMTRAK will need over $12 billion in subsidies through 1989, or more than $1 billion per year. In January, 1979, the D.O.T. published its plan for cutting down AMTRAK services and costs: eliminating 43 per cent of the 27,700 route miles now operated would save $1.4 billion (or a mere 23 per cent of cost) between 1980 and 1984, and reduce the deficit for the 5-year period to $4.6 billion. Protests from areas that would lose train service pressured congressmen to oppose this proposal. Legislation passed in the summer of 1979 authorized elimination of only about 16 per cent of AMTRACK's route mileage and expenditure of $985 million for the 1981 fiscal year.

It is apparent that in spite of such measures the operation of traditional rail services cannot be rendered economically reasonable. A system whose average speed is 46 mph (in 1979; 91 per cent of routes are operated at average scheduled speeds below 55 mph) and which includes many long distance trains (runs in excess of 500 mi. account for 90 per cent of route mileage; 54 per cent are over 1000 mi; 23 per cent—over 2000 mi.) cannot possibly compete with the faster and newer modes.

Summing up, it is evident that the lack of recognition of obsolescence as the cause of passenger rail failure in Canada and the United States had led to initiatives which, while supposed to "revitalize" rail services and cut losses, are more likely to cut services, incur new capital expenditures and maintain large subsidies.

ENERGY EFFICIENCY—In recent years, the energy economy of trains has been advanced as an argument in favour of maintenance of traditional passenger rail services in North America. However, contrary to uninformed but popular views, the traditional Canadian and American trains consume more fuel than the buses.

In 1977 in Canada, for each passenger on board (16 per car on average), 4.8 tons of train had to be hauled. The energy efficiency of Canadian trains, expressed in seat-miles per gallon (US) of fuel, has been estimated as follows (Ganton et al., 1975):

Average of all trains:	165
Turbotrains:	130
Transcontinental:	140
Rapido (intercity):	190

The data for AMTRAK (D.O.T., 1974) shows a range from 5 to 350 seat-miles/gallon (US), with the majority of trains (powered by 2250 hp, not—super-charged locomotives) in the 140 to 300 bracket. The 5 seat-miles/gallon (US) refers to cross-country sleeper trains. The highest efficiency of 350 seat-miles/gallon (US) is attained by trains consisting of 9 coaches per locomotive, hauled by 3000 hp turbo super-charged locomotives. The performance of rail diesel cars ranges from 140 to 230 seat-miles/gallon (US). The turbine trains (French RTGs) attain 120 seat-miles/gallon (US).

These figures have to be compared with the average economy of intercity buses which produce 280 seat-miles/gallon (US).

Evidently, buses are more energy efficient than the great majority of trains now operating in North America. Canadian trains consume on the average 70 per cent more energy per seat mile than buses. In practice, because North American trains run less full than buses, they are even less efficient, relatively. The modern (electric and diesel-electric) trains, which produce 400 to 470 seat-miles/gallon (US) can match and surpass the energy economy of diesel buses. Clearly, if the North American train traffic were taken over by buses, energy and oil would be saved.

THE AVENUES TO MODERNIZATION

It is pertinent to note that the prospects of passenger rail in Canada (and in North America in general) have been correctly assessed already in 1961 by MacPherson's Royal Commission on Transportation (Canada, 1961).

MacPherson's study emphasized the change from a monopolistic to a new, competitive transportation environment. In the passenger sector this spelled obsolescence of the railway which could not compete with the auto, the bus and the airplane. Passenger rail, which already in the 1950s had run up large deficits, was bound to produce even larger operating losses in future, "a burden which at present must be borne by the users of rail freight services." There was "little social justification and less economic, for the permanent provision of railway passenger services as we know them today . . . The public, by and large, has already indicated its preference for the other modes of travel . . ."

Recognizing this situation, the 1961 plan called for phasing out of all uneconomic passenger services within a period of five years, except where alternate surface transportation is not available. MacPherson's advice on passenger rail in Canada (also applicable to the U.S.), ignored by politicians and society, has been fully substantiated by developments since 1961, reviewed above. All evidence points to the bus as the appropriate successor to the traditional North American rail. The bus is not only capable of profitable, unsubsidized operation, but, as shown below, also offers a higher quality service than the obsolete railway.

The major potential for **modern** passenger rail is in the high traffic corridors, such as Boston-Washington and Quebec-Windsor, where distances between serveral **large** cities are **small** so that 100 to 125 mph rail would offer a highly competitive service.

BUS TRANSPORTATION IN PLACE OF OBSOLETE TRAINS—A detailed study was made of the feasibility of bus substitution on routes now served by rail in Canada (Lukasiewicz et al., 1978b). In general, the results of this study are also applicable to the situation in the United States.

In 1977, 71 per cent of route miles served by rail in Canada were also served by buses; of the remaining 29 per cent, roads were available on 14 per cent. Thus bus services were available, or could be offered on 85 per cent (17,700 of 20,800 miles) of routes served by trains.

Trip frequency and scheduled speed were employed as measures of service quality for the rail and bus modes. It was found that on the routes served by rail, the frequency of bus services exceeded the train frequency by a factor of 3.1 on the average. The average speed of the two modes was compared in terms of daily distance covered within specific speed brackets. Taking all bus and rail services, the bus daily mileage was found to exceed the train mileage by a factor of 1.9; over 90 per cent of the bus mileage was travelled at speeds in excess of 36 mph, compared to 71 per cent for rail. Even in the Quebec-Windsor corridor, where—relative to the other routes—trains are faster, the bus mileage at speeds above 46 mph exceeded by 51 per cent the rail mileage.

Speed, frequency and direct cost to the passenger are recognized as the major attributes which govern the competitiveness of public passenger transportation. As regards rail versus bus, rail's superiority in terms of space and on-board service is sometimes advocated. However, it should be recognized that, as already noted, such superior amenities of traditional rail cannot be provided today at a reasonable, competitive price. The same has been true of the ocean liners which have now all but disappeared.

With buses, there may be even more scope for providing economically the comfort associated with the traditional rail. In recent years spacious premium-fare "executive" buses with food, drink, telephone and hostess service on board have appeared on a few routes.[4] In Europe, sleeper-buses are increasingly popular for cheap, overnight travel.

Based on 1974 data (T.C., 1976), substituting buses for trains on 85 per cent of train routes would result in elimination of about 80 per cent of passenger rail losses.[5] As already noted, it would also lead to energy and oil savings.

It should be noted that the inability to perceive obsolescence is not the monopoly of the public sector. Not only the Canadian and American governments, but also the bus carriers have so far failed to recognize—and exploit to their advantage—the obsolescence of the traditional passenger rail. Instead of advocating the take-over of the obsolete rail services, a move which would lead to a significant expansion of their business, the bus companies have taken a defensive stand, protesting unfair competition by highly subsidized VIA-Rail Inc. and AMTRAK (Loving, 1978; CMCA, 1979).

THE POTENTIAL OF FAST PASSENGER RAIL—As already noted, the feasibility of fast passenger rail is governed by: (i) competitiveness vis-a-vis other modes; and (ii) availability of large enough volume of traffic. With the maximum scheduled speed in the 90 to 160 mph range, the first criterion limits the application of modern trains to journeys not exceeding about 300 miles. As for the adequacy of traffic volume, this can be judged in general terms from data (here given for 1976) on modern passenger train operations. In Europe, average traffic densities range from 1.5 to 3 million passengers per year. In Japan, the average for the system is 10 million, with 7.75 million on the narrow gauge lines and 50 million on Shinkansen. The average densities in Canada and the U.S. are 100,000 and 325,000, numbers which clearly indicate that the traditional trains are not a viable mode.[6] However, in the densely populated corridors, even the uncompetitive, slow trains have attracted reasonable patronage. On the New York-Washington route, in 1975, the density on different segments varied between a minimum of 1.9 million to a maximum of 5.5 million passengers per year. Today, the North-East Corridor alone serves approximately 9.5 million passengers each year, about 50 percent of AMTRAK's total. In the Canadian corridor, 0.83 million was recorded between Montreal and Toronto in 1974.

The potential of fast rail was recognized in the United States in 1976, when $1.75 billion was authorized for electrification and upgrading of the North-East Corridor line (Washington-New York-Boston) to speeds up to 120 mph; legislation providing the final $750 million was signed in May, 1980. When the improvement project is completed, the average speeds will be increased to 84 mph (2 hr 40 min trip time) on the Washington-New York run, and to 63 mph (3 hr 40 min) on the New York-Boston run. This is a performance which falls short of the modern passenger rail practice, but nevertheless constitutes a significant improvement over the present service. The practicality of diverting freight traffic from the North-East Corridor will be studied and could lead to further, substantial increases in passenger train speeds.

There are indications that the original concept of AMTRAK as a network of traditional, long distance train services is being re-considered in favor of shorter—range, corridor services, where modern passenger trains can compete with the other modes. The May, 1980 bill authorizes $38 million to analyze potential of high-speed passenger trains in high density traffic corridors. Thirteen such corridors have been identified by AMTRAK and the Department of Transportation, including Chicago-Detroit, Chicago-Cleveland, Seattle-Portland; the results of the study are to be reported back to Congress by February 15, 1981. The bill also permits AMTRAK to complete final design work on the Los Angeles-San Diego link.

No such initiatives have been as yet undertaken in Canada. Studies (Lukasiewicz, 1977; 1978b) of the traffic which 100 mph trains could attract in the Canadian corridor indicate that train frequencies comparable to the current bus frequencies could be offered at a load factor of 50 per cent.

The cost of such high speed train operations was estimated from data on (i) costs of upgrading rail lines for high speed; and (ii) costs of operations. The estimates for the line upgrading range from $200,000 to $750,000 per route mile for single track lines (in 1975 dollars) (C.T.C., 1975; Hamzawi, 1977). At 10 per cent interest, the capital cost of up-grading of the corridor lines would range from $25 to $90 million/year. As regards operations, based on unit costs and forecasts of rail traffic (P.C.S., 1977; Alberta, 1976), financial performance of 100 mph passenger rail was estimated.[7] It was found that the annual losses ranged from $65 million to over $200 million (1974-75 dollars). For example, a loss of $186 million was computed for the maximum estimated capital and operating costs, and for a revenue based on a fare 30 per cent higher than the 1974 average. Thus the losses which would be experienced through operation of a 100 mph rail in the Canadian corridor appear to be comparable to the losses now sustained in the operation of obsolete passenger rail throughout Canada.

THE ROLE OF STOL—In view of the continuing promotion of STOL (short take-off and landing aircraft) for travel in the Canadian corridor by the federal government and industry, it is pertinent to comment[8] on the significance of this mode.

The most recent study of Transport Canada (T.C., 1978) clearly shows that, in the Canadian corridor, the hoped-for gains cannot be realized by STOL: the time savings on the ground (due to proximity of STOLports to downtown Toronto and Montreal; existing airports would be used in other corridor cities) are offset by flight times longer than with conventional jets. Marginally shorter trip times would be only possible if processing of STOL passengers in Toronto and Montreal were streamlined, a measure which need not be related to the use of STOL. Indeed, if a significant improvement in terminal processing could be realized, it should be instituted at Malton and Dorval for the benefit of all air carriers and passengers.

Also, the operation of STOL would have to be heavily subsidized and would serve only very few passengers; no more than 5 to 10 per cent of those who start or finish their trips in Toronto.

Evidently, in the Canadian and similar corridors, measures other than STOL are needed to speed up the air travel. In addition to faster terminal processing, fast rail links to conventional airports could further shorten trip times. Since 1970, this solution was adopted in five major European airports; construction is underway in three others (Rimrott, 1977).

RESTRUCTURING OF TRAIN AND BUS TRANSPORTATION—Substitution of buses for the obsolete rail in Canada and the U.S. emerges from the present analysis as the major short-term policy recommendation.[9] In the long-term, passenger rail policy in North America must be concerned with the potential of modern, fast trains, capable of competing with the car, the bus, and—on short trips—with the airplane.

A start in this direction has been already made in the United States, with the upgrading of the North-East corridor for 120 mph operations. In the long term, also in the Canadian corridor, fast rail would be chosen as a socially desirable and technically superior mode of passenger travel.

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SC Statistics Canada, Ottawa
TC Transport Canada, Ottawa

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FOOTNOTES

1 In 1972, the average scheduled speed of Canada's fastest trains was 56 mph; CN's "Super Continental" attained 43 mph in the 1960s but, by 1976, its speed slipped back to 34 mph, a level first attained some 40 years before. (Lukasiewicz, 1976, 1976b) The average scheduled speed of AMTRAK trains was 46 mph in 1979.

2 It has been often held that these factors were the major cause of rail traffic decline, and that "service improvements" would bring passengers back to traditional rail. The competitiveness of traditional rail would not be substantially increased through such measures; the traffic decline started when trains were punctual, frequent and comfortable. The deterioration of the service quality has been the consequence and not the cause of passenger rail decline.

3 For Light, Rapid and Comfortable, a diesel-electric train developed by a Canadian consortium, with a federal subsidy of $2.5 million. Just as in the case of STOL (see below), the government support of development, production and application of LRC appears to be motivated by a desire to help the industry, rather than to improve transportation.

4 **Le Grand Express** 24-seat executive bus service was operated by Voyageur Colonial Limited in 1978 and 1979 between Montreal and Quebec.

5 This was also the outcome of a recent study of intercity passenger transportation in the Atlantic region (Atlantic, 1977). The losses ($34 million in 1974) would be virtually eliminated through replacement of all rail services by buses; improvements in bus and air services would offer a higher level of service throughout the Atlantic region in Canada.

6 A density of 116,800 passenger/year corresponds to a frequency of two 320-seat (4 cars) trains per day at a 50 per cent load factor.

7 No attempt was made to account for costs which could result from interference with freight operations, or for savings which could be realized through electrification. Recent studies (Cornell et al., 1976; Fisher, 1971; Lukasiewicz, 1976, 1978a) indicate that electrification of high density traffic (freight) lines is economically justified.

8 See Lukasiewicz, 1979, for detailed analysis.

9 It is encouraging to note that the potential of large "jumbo" buses for intercity transportation in the Canadian Corridor is being investigated; initial results show significant productivity gains. (Taylor, 1979).