TDRI Quarterly Review
Published in *TDRI Quarterly Review*
Vol. 8 No. 3 September 1993, pp. 28-32
Editor: Anne Johnson

Strengths and Weaknesses of Railway Transport*

Human Resources and Social Development Program

FUEL EFFICIENCY

In an economy-wide context, the fuel efficiency of Thailand's transport system is an issue of some significance. As transport is an essential supporting sector for the whole economy, gains in transport fuel efficiency will lower production and distribution costs, household transport-related consumption, and also help improve the country's external trade position.

The Thai transport sector's fuel consumption has been growing by more than 10 percent annually since 1984 (Table 1). This has contributed to the high growth in fuel import after 1986, when there was a sharp downward adjustment in world oil prices (Table 2).

In fuel efficiency, rail transport is much superior to road transport. Recently, a study sponsored by the U.S. Federal Railroad Administration into the relative fuel efficiency of truck versus railway freight operations was concluded.[1] The study's objective was to identify the circumstances in which rail freight service offers a fuel efficiency advantage over alternative truckload options, and to estimate the fuel savings associated with using rail service. The findings were based on computer simulations of rail and truck freight movements between the same origins and destinations. The simulation input assumptions and data were based on actual rail and truck operations. Input data were provided by U.S. regional and Class I railroads and by large truck fleet operators.

The study noted that design improvements have been incorporated into successive series of locomotives, with each new model containing greater levels of fuel economy improvement. These design changes are made on an evolutionary basis and work in concert to improve overall locomotive fuel efficiency. Locomotive fuel economy improvements have been added in the areas of the engine, auxiliary systems and rail lubrication.

Because of the many variables involved with the simulations, and the resultant "best/worse case scenarios," the study shows a wide range of savings in rail transport over road transport (Table 3). On average, however, the study shows that, in ton-miles per gallon of fuel, railways are about 4.5 times as fuel efficient when compared to trucks. If we assume the same efficiency for passenger operations, then the fuel expenditure by the State Railway of Thailand (SRT) in 1990 of 724 million baht would have cost the Thai economy an additional fuel cost of approximately 2,500 million baht had all rail transport services been carried out by road transport. It is interesting to note that this amount is greater than the current annual loss of SRT.

ENVIRONMENTAL CONSIDERATIONS

Environmental considerations also favor rail over road transport. Given the superior fuel efficiency of rail transport, emissions of harmful gases from fuel usage will obviously be less per unit of output for rail compared to road transport. Some numbers from Sweden, which has integrated environmental concerns into its transport pricing policy through environmental charges, illustrate the difference.[2]

In 1990, the Swedish Commission on Economic Instruments in Environmental Policy proposed the following pollution charges:

Sulfur (SO_2)	$ 5.25/kg
Nitrogen Oxides (NO_x)	$ 7.00/kg
Hydrocarbon (HC)	$ 3.50/kg
Carbon Dioxide (CO_2)	$ 0.04/kg

Using these "price tags" as weights, 45 percent of total SO_2, NO_x, HC, and CO_2 emissions in Sweden originate from the transport sector. Taking the traffic level in 1990, and the above proposed charges, the cost responsibilities for the Swedish transport sector's various subsectors are as follows:

Road	$ 16,300 Million
Maritime	$ 2,600 Million
Aviation	$ 900 Million
Rail	$ 60 Million

Thus the emission costs for road are more than 270 times that for rail, even though road passenger traffic is only 16 times higher than that for rail (96,400 million passenger kilometers for road compared to 6,120 million passenger kilometers for rail), and freight traffic is only 1/3 higher for road (25,000 ton kilometers for road versus 19,100 ton kilometers for rail). Thus, the unit pollution cost for road is much higher than that for rail.

These figures give a rough guide to the advantage of rail service in containing environmental pollution. In Thailand, however, the advantage will probably not be as great as in the Swedish case, as most of the Swedish rail network is electrified, while Thailand still relies on diesel locomotives.

ROAD CONGESTION

That traffic congestion is a serious problem for the Bangkok Metropolitan Region (BMR) is more than clear. The problem does not just occur inside Bangkok, but also along routes leading from the city in all directions. For major cities in other parts of the country, such as Chiang Mai or Hat Yai, the traffic situations are also becoming severe.

Table 4 shows the rapid growth of traffic on the Bangkok expressway. From this, it is easy to understand why, at times, the expressway becomes more of a car park than an expressway. Nationwide, average road density has also increased rapidly. Table 5 shows transport flows by various types of vehicles for 1984 and 1990 on national and provincial highways, and also the length of the road stocks. It can be seen that the average density on national highways has increased by over four times between 1984 and 1990.

With continuing high growth of transport demand, the present traffic situation on the roads has every prospect of getting worse and worse. More intensive use of rail transport in the future may help to alleviate this worsening trend.

SAFETY

In terms of safety, rail transport also has advantages over road transport. Table 6 shows accidents by mode of transport in Thailand for 1990. It can be seen that road accounts for about 94.5-97.5 percent of all the country's accidents, deaths and injuries, while rail accounts for about 2.5-4.8 percent. If this is compared to the 16.6 percent share of rail in inter-provincial land person trips, then the safety rate for rail can be seen to be far superior to that for road. While this comparison is not strictly accurate, as for proper comparison one needs to look at intra-provincial travel as well and also include freight traffic in the analysis, it seems fairly clear that rail transport should be much safer than road transport. Nevertheless, this does not mean that SRT should not put continued efforts into trying to make rail travel even safer. This is particularly so in view of indications of past deferred maintenance, and increasing age of rolling stock.

COMPETITIVE CONSIDERATIONS

In spite of all the advantages of rail transport, the railway remains a relatively minor player in the Thai transport picture compared to road transport. The railway accounts for not more than 16.6 percent of all inter-provincial passenger movement and only 2.5 percent of all inter-provincial freight movement. To a large extent, this is due to the relatively poor competitive position in Thailand of rail versus road (and also air and waterway) transport, which in turns depends on many factors; such as the country's geography, human settlement and urbanization patterns, overall government policy concerning the transport sector through infrastructure investment, pricing, fare controls etc., and also the operational efficiencies of the various Thai transport providers.

As far as the operational efficiency of SRT is concerned, analyses indicate that it has been fairly satisfactory, in that it has been able to provide increased services for both passengers and freight, while, at the same time, reducing the number of employees and improving the average train speed.[3] The principal disadvantage of rail transport, however, is its inefficiency in door-to-door operations. This is especially true for freight services where SRT does not connect directly with the origin or destination organizations. In such cases, the overall transport costs may involve trucking at either end of the route, with high handling costs for transferring from truck to train and train to truck. For short distances, this additional cost is greater than any savings gained by rail transport. This explains why the railway has not been that competitive with road transport, even though analyses show that the unit cost for rail transport (ignoring multiple handling costs) is much less than that for road transport for comparable commodities.[4] The long-term variable cost for rail transport of petroleum trainloads, for example, is about 0.35 baht per ton/kilometer (1991 prices), while the full cost less annual capital cost of road transport of petroleum comes to about 1.00 baht per ton/kilometer (at a distance of about 200 kilometers). Similarly, for passengers, heavy bus operations at optimum operating speeds cost about 0.28 baht per passenger kilometer, versus express train services which cost 0.18 baht per passenger kilometer, or rapid train services which cost 0.12 baht per passenger kilometer.

For the future, however, with ever more congestion on the roads, and the rapid growth of provincial cities—which may generate large distribution centers near to the rail network that can take advantage of scale economies to reduce multiple handling costs—the railway may be able to compete better with medium- to long-range road transport. Intensive marketing efforts will be needed, however.

Another consideration is government transport policy. It is often suggested that, in the competition between rail and road, the playing field is tilted toward road transport. While the railway has to invest in its own infrastructure and take care of the debt payments, road users are subsidized in that the charges they have to pay do not cover the full cost or even the marginal cost of using the roads. This is certainly the case. Based on previous studies, it is clear that the road user charges on 6-wheel and 10-wheel trucks (which do the most damage to the roads) do not cover even the marginal road cost. This obviously gives an edge to road transport of freight compared to rail. On the other hand, light vehicles generally pay more road user charges than the marginal road cost.

While present road user charges are biased in favor of road freight transport, however, this is not a major reason behind the competitive edge that road has over rail, i.e., that even if heavy trucks were to pay the full cost of road use (not just the marginal cost) the competitive edge of road over rail would not be affected in a major way. Basically, it is estimated that if 6- and 10-wheel trucks were charged the marginal road cost, then the vehicle operating cost would increase by about 2.5-5.0 percent, while if the full road cost were charged, then the vehicle operating cost would increase by about 5-10 percent. Against this, it has to be borne in mind that transport rates are often very different from vehicle operating costs, and are often two to three times the calculated vehicle operating costs. Thus, an increase in vehicle operating costs by about 5-10 percent is unlikely to have any major impact on the relative competitive position between road and rail transport.

Government policy also applies to rail fares, particularly from passengers. SRT earns over 70 percent of its passenger revenue from Third Class passengers. Political considerations have made fares on this class of

passengers extremely hard to increase. This, of course, encourages more rail use than otherwise. The low fare policy is, however, a two-edged sword. It leads to the continued financial loss position of SRT. This leads to deferred maintenance, difficulty in getting investment funds, and a general lack of morale in the staff. The problem is compounded if it is difficult to ascertain the detailed operations that account for the total loss, or if policy-makers are not interested in such details. In this case, if the organization feels that no matter how much effort it tries to put into improving performance, the loss position will not go away and the organization will continue to be looked upon unfavorably by outsiders as being inefficient and loss-making, then there will no incentive for improved performance or improved competitive position. This is the kind of situation that SRT finds itself in today, and urgently needs to change.

CONCLUSIONS

From the above, one can conclude that rail transport does have many advantages. The key ones relate to the relatively high **negative externalities** generated by road transport-relative fuel inefficiency, pollution, congestion, and safety considerations. These externalities have not been taken into account in the nation's overall transport policy. Without such considerations, the railway is likely to continue to play a relatively minor role in the nation's future transport needs. The railway's share in passenger transport has been on the decline over the last decade. Without a change in the approach to transport policy, this trend is likely to continue.

In examining the railway's likely future role, a **strategic** approach is recommended. Analyses based on past trends implicitly assume that the current transport policy will continue. This is likely to lead, as expected, to the railway's declining role over time. Such an approach is unlikely to be helpful when looking at the long horizon necessary for transport planning.

Assuming that the negative externalities associated with road transport are considered **important**, and need to be corrected over time, it is suggested that, as a minimum, the rail shares in future transport **should not be allowed to** decline below the share in the base period (1990). While this will mean that the negative externalities associated with road transport will continue to increase, along with increases in the country's overall transport sector, the target still will not be easily achieved without effort and new investment. If more effective government action to alleviate the harmful externalities associated with road transport is taken, then the railway may even be able to increase its share in the nation's future transport system.

REFERENCES

Bevis, Alan. 1992. *Transport Costs,* Working Paper No. 2. SRT Master Development Plan Study, May.

Hansson, Lars. 1991. The Pricing of Air Pollution in the Swedish Transport Policy. Transport Research Board's 70th Annual Meeting, January 13-17, Washington, D.C.

U.S. Federal Railroad Administration. 1991. *Rail vs. Truck Fuel Efficiency: The Relative Fuel Efficiency of Truck Competitive Rail Freight and Truck Operators Compared in a Range of Corridors.* Final Report. Abacus Technology Corporation, April.