THE ELECTRIFICATION OF PUBLIC TRANSPORT

The case for electrified transport, particularly of the railways, is often justified on the basis of the continuously rising costs of oil imports and the availability of exploitable hydro-electric energy resources in this country. It is very clear that every endeavour must be made to minimize the use of oil. Such endeavours however should not impede the development efforts in all sectors which are vital for the betterment of the country. We should therefore have effective substitution of the bulk energy consumption presently derived from oil. In the foreseeable future, this can only be achieved through the rapid development of our hydraulic energy resources. These developments although highly capital-intensive are absolutely essential. Such heavy financial inputs however will not only raise the price of the electrical energy provided, but also enhance the importance of its most beneficial utilization. In this context, the electrification of transport should be given the highest priority.

The railways have indicated the absolute necessity of more than doubling their currently serviceable motive power units by the end of this decade in order to provide an acceptable standard of service. In view of the general case for railway electrification, such a major development must consider the feasibility of electric traction to supplement or replace diesel traction in suitable areas. Such considerations must obviously take into account technical aspects such as the types of traction available, their operation and maintenance, loading and service frequency, and the economic aspects such as capital costs, operating costs, expected life etc. In fact, a feasibility study of the proposal to modernize the suburban train services of Colombo by electrification was undertaken by SOFRERAIL of France, and its report submitted in August 1974. The proposal was recommended as being technically feasible and economically viable, and that, therefore, the railway sections from Negombo, Veyangoda and Kalutara-South to Colombo be electrified bothways. Subsequently, the Institution of Engineers, Sri Lanka studied the engineering and economic aspects of the Colombo suburban electrification and also the SOFRERAIL report. The Institution however, felt that a more cautious approach by a phased electrification of the Colombo suburban railway network was important, and recommended that in an initial phase, only the Panadura-Colombo-Veyangoda section should be electrified bothways.

Both AC and DC systems are adopted for railway electrification along with an overhead line or a conductor rail system for power collection by a pantograph or brush. Recent developments in solid state control devices, particularly thyristors, give greater technical and economical advantages to AC single phase supply systems. The DC series motor however, is well known to possess characteristics ideally suited for traction purposes and has been employed with DC supply systems, typically around 600 volts, or with AC supply system together with suitable transformation and rectification. The characteristic advantages of the DC series motor are also available to a fair degree in the AC series motor, and there are efficient railway traction systems fed from 25 kv. AC employing such motors controlled through tap changing transformers. Variation of applied voltage provides the most efficient means of controlling AC or DC traction motors. The success of the AC series motor, although disadvantageous in certain respects, can be attributed to this fact. A typical modern 25kv AC supplied railway traction system would however, employ DC series motors fed through a multi-circuit transformer and individual thyristor bridge groups which can operate both in rectifier and inverter modes to provide well-controlled traction and energy saving regeneration. The method of electricity supply must necessarily be mentioned before considering the other aspects. The proposed suburban railway electrification is expected to demand around 60 MVA at peak times. As suggested by the Institution Committee and the sub-committee appointed by the GMR, this can be provided at two of the 132 kv grid stations through Scott connected transformers. This arrangement at perhaps Ratmalana and Ragama, would provide four independent single-phase supplies at the required voltage of say 25 kv, for four sections of the track to be electrified.

Once the actual mode of electrified railway traction has been decided, considerable thought must be given to the civil engineering aspects of the changeover and also to its effect on the existing communication system. AC electrification will interfere with the communication circuits and adequate steps such as screening, re-routing and even re-designing them, will have to be taken to overcome the problems. The Civil engineering aspects are mainly concerned with the design and construction of the overhead power supply line equipment and the provision of adequate clearance above the rails. The former aspect would form an integral part of the actual electrification and would be the responsibility of whoever undertakes the contract for the same. The latter aspect deals with the raising of existing pedestrian bridges, station platform roof-overhangings and overhead bridge bracings. As suggested in the Institution Report priority must be given to raising existing bridges and the construction of new ones to avoid delaying the changeover. Finally track strengthening and re-profiling too would have to be undertaken.

With the move towards an electrified suburban railway transport system, constructive thought must be given to a form of electrified road passenger transport. The trolley bus can be considered to be the most appropriate form for this purpose, since it provides quicker runs, and faster turnovers at low operation and maintenance costs. Trolley transport is best commenced through a pilot project covering a busy section such as from Colombo Fort to Mount Lavinia. A service every 10 minutes can be provided at an average speed of 15 mph with about 15 nos. 150 hp trolleys. Such a trolley could be constructed around a standard bus chassis with the engine, clutch and gearbox removed. The traction unit could be either a DC series motor or a squirrel cage induction motor with suitable thyristor control fed from a 600 volt DC overhead supply derived from a group of rectifier stations. The comprehensive details and capital costs of such a scheme need further investigation but the project would most certainly be feasible. Once the socio-economic and technical advantages are established through a pilot trolley transport project, the scheme can be extended, not only to cover other areas around Colombo but also to suitable outstation areas as well.

A team of Sri Lanka engineers should be provided immediately with the necessary facilities for study both locally and abroad of all aspects of railways and road transport electrification.

The time has been reached in this country when electrification of transport is imperative. It provides yet another opportunity for our engineers to make a useful contribution towards national development.