LIGHT RAIL TRANSIT: ITS NATURE AND ROLE

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Cost overruns, construction delays, and operating and maintenance problems with conventional rapid transit (CRT) systems are stimulating transit planners to examine alternative approaches to rapid transit systems. European successes with light rail transit (LRT) have reawakened U.S. interest in LRT with the hope of reducing the massive construction costs and the delays that have characterized the Washington, D.C., Metro and of avoiding the maintenance and operations problems that have plagued the San Francisco Bay Area Rapid Transit (BART) system. The stated policy of the U.S. Department of Transportation is to "regard the present types of fixed rail systems as appropriate only in a few highly populated metropolitan areas" and to "support efforts to develop a type of rail system which is much less costly to build, operate, and maintain."

Nature of LRT

This renewed interest in LRT has raised the question of where the line should be drawn between LRT and CRT. The fact is that in practice the distinction between LRT and CRT is not hard and fast, but rather somewhat vague and arbitrary. It is a case of shades of grey rather than black and white.

A review of North American rail transit systems, both operating and under construction, reveals an almost continual spectrum of construction and operating practices from streetcars, through LRT, into CRT, and ultimately to commuter service on main-line freight railroads. No clear line of distinction can be drawn between LRT and CRT either on the basis of system construction and operation or on the basis of passenger volume, although it is generally recognized that LRT costs less to construct and carries lower passenger volumes than CRT. Principal characteristics of selected systems are given in Table 1. The acronyms used in Table 1 are for the following agencies:

MBTA	Massachusetts Bay Transportation Authority
CTS	Cleveland Transit System
CTA	Chicago Transit Authority (Table 1 excludes the Skokie Swift)
PATCO	Port Authority Transit Corporation
PATH	Port Authority Trans-Hudson
NYCTA	New York City Transit Authority
BART	Bay Area Rapid Transit
SEPTA	Southeastern Pennsylvania Transportation Authority
ICG	Illinois Central Gulf Railroad

The key feature of LRT is its flexibility to operate in full subway, on conventional elevated structure, on private right-of-way, on a median strip, at the side of the road, and where necessary on city streets or pedestrian malls and over roadway grade crossings; to handle passengers at facilities that range in size from full subway high-level platform stations down to safety lines painted on city streets; and to be adapted to local conditions and thus less costly to construct than CRT. The flexibility of LRT is derived essentially from two characteristics: the overhead power collection (as opposed to third rail) and the ability to handle passengers at either high or low platform stations. The

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Table 1 Principal characteristics of selected systems.

	System	Subway	Elevated	Median	Private Right-of-Way	Mall	Street	Multiple-Unit Trains	Power Collection	Station Platforms
Streetcar	Toronto, streetcars			x			x	Yes	Overhead wire	Low
	Philadelphia, streetcars						x	No	Overhead wire	Low
	Pittsburgh				x		x	No	Overhead wire	Low
	New Orleans			x			x	No	Overhead wire	Low
	Newark	x			x			No	Overhead wire	Low
LRT	Philadelphia, Red Arrow–Media				x		x	Yes	Overhead wire	Low
	Philadelphia, Red Arrow–Norris		x		x			Yes	Third rail	High
	Philadelphia, subway and surface lines	x					x	No	Overhead wire	Low
	San Francisco, Muni Metro	x		x			x	Yes	Overhead wire	Both
	Boston, MBTA–Green Line	x		x	x		x	Yes	Overhead wire	Low
	Cleveland, Shaker Heights lines			x	x			Yes	Overhead wire	Low
CRT	Cleveland, CTS				x			Yes	Overhead wire	High
	Boston, MBTA–Blue Line	x			x			Yes	Both	High
	Chicago, CTA	x	x	x	x			Yes	Both	High
	Philadelphia, PATCO	x			x			Yes	Third rail	High
	New York City-New Jersey, PATH	x			x			Yes	Third rail	High
	Philadelphia, subways	x	x					Yes	Third rail	High
	Washington, D.C., METRO	x	x	x	x			Yes	Third rail	High
	New York City, NYCTA	x	x		x			Yes	Third rail	High
Commuter railroad	San Francisco, BART	x	x		x			Yes	Third rail	High
	Chicago, ICG			x	x			Yes	Overhead wire	High
	New York City, commuter rail to Connecticut and New Jersey	x			x			Yes	Overhead wire	Both
	Philadelphia, commuter rail				x			Yes	Overhead wire	Both
	New York City, Long Island Rail	x			x			Yes	Third rail	High

flexibility of LRT is enhanced, particularly for mall and street operation, by the fact that LRT cars are generally smaller and lighter than CRT cars.

This flexibility is further enhanced by the simplicity and proven design of light rail vehicles (LRVs), from the old American PCC car (commonly known as the streamlined streetcar) to the new European articulated cars, and is further enhanced by the control options for LRVs, which can range from simple manual operation to computerized fully automatic train control. Operation of multiple-unit trains is possible with LRT when passenger volume exceeds the capacity of a single car.

Several features of the systems given in Table 1 are worthy of note:

1. In Cleveland, the Shaker Heights rapid transit (an LRT system) operates to and from the downtown terminal on the same tracks as the Cleveland rapid transit (a CRT system) and also uses the same overhead power collection system. Stations serving both systems have high platforms for the CRT and low platforms for the LRT; and left-handed running places the doors of the single-ended LRVs on the inside for the center platforms.

2. In Boston, the MBTA Blue Line (a CRT system) uses third-rail power collection in the downtown subway and overhead power collection on the private right-of-way beyond. High platforms are used throughout the Blue Line.

3. The San Francisco Muni Metro, now under construction, will have LRVs equipped with adjustable steps to permit high platform loading and unloading in the downtown subway and street-level loading and unloading on city streets in the residential area. Automatic train control is to be used in the subway, and full manual operation is to be used on the city streets. Overhead power collection will be used throughout.

As general practice, systems with extensive subway operation have used third-rail power collection because it reduces overhead clearance requirements and thus reduces construction costs; systems with extensive surface operation that is accessible to the general public have used overhead power collection because it reduces the electrical hazard. There are, of course, exceptions to general practice: SEPTA's Red Arrow Line to Norristown in suburban Philadelphia and CTA both use third-rail power collection, yet the Norristown line runs through a suburban residential area on an unfenced right-of-way and the CTA has at least one crossing of a city street at grade.

Interestingly, the overhead power collection and the high-low station capability that give LRT its flexibility are commonly used in commuter railroad service, which is considered to be rather less flexible than LRT. Perhaps the size and weight of the equipment as well as railroad operating practices reduce the flexibility of commuter railroad service.

Role of LRT

What, then, is to be the role of LRT in the United States in the future? This is a significant question facing transit authorities, government agencies, and equipment suppliers. It has been suggested that LRT is appropriate for·

1. Medium-sized cities,
2. Medium density corridors in large cities, and
3. Large spread-out metropolitan areas that have no dominant high-density core.

European practice is to use LRT in all of the above situations and also to use LRT as an intermediate stage in the development of CRT systems. European LRT systems achieve a high-capacity, high-productivity status by operating three- and four-unit articulated LRV's, sometimes in trains, with a single operator.

Although LRT works well when used as a feeder to a CRT line, such as at Sixty-ninth Street in Philadelphia, where three LRT routes connect with the CRT system, it is most effective from a service viewpoint when the LRV's can go all the way to the central business district or to some other strategic location, as is done on the Philadelphia subway and surface lines via subway, in Cleveland via private right-of-way, and in Pittsburgh via city streets. Avoiding the necessity for a transfer adds to the convenience of the transit patron.

Many factors will influence, or even control, the future development of transit systems in the United States. The need to hold down construction costs and the desire to get systems into service with minimum delay will work against fixed-guideway systems in general and against CRT in particular; the need to hold down operating costs, the need to reduce air pollution, the need to conserve petroleum, and the desire to revitalize major cities will work in favor of fixed-guideway systems.

For the next decade, cost factors may be the controlling factors, and this would mean that LRT would be favored over CRT for higher capacity systems while buses would be favored over LRT for lower capacity systems. Thus, LRT development would be pushed toward the higher end of its band in the total rail transit spectrum.

Conclusions

1. LRT is not so much a radically different form of rail transit as it is a band in the total rail transit spectrum that ranges from the simple streetcar line to the high capacity CRT and the heavy main-line commuter rail service.
2. The key feature of LRT is flexibility that permits LRT to be operated almost anywhere that tracks and overhead wire can be constructed.
3. The flexibility of LRT is derived essentially from two characteristics: the overhead power collection and the ability to handle passengers at either high or low platform stations. It is enhanced by the small size and light weight of the LRV's, by their simplicity and proven design, and by the wide range of operational control that is available.
4. LRT offers significant construction cost savings and operating flexibility due to its ability to run on "open" surface lines as well as in subways and due to its simplicity and possible full manual operation.
5. With cost factors expected to be controlling, LRT development will be in the higher capacity end of the LRT band of the rail transit spectrum, essentially becoming a lower cost alternate for CRT.
6. Any metropolitan area planning a new transit system or an unconstrained addition to an old system should consider LRT as an alternative. Further, any metropolitan area contemplating transit system construction where LRT may be a valid option should (a) preserve immediately any old railroad or streetcar rights-of-way that may be available and (b) give due consideration in any CBD subway planning to overhead power collection to permit future LRT operation in the suburban area with direct LRV service to the CBD via the subway.