LIGHT RAIL TRANSIT: A MODERN RENAISSANCE

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Transit development decisions in U. S. cities have as their source the all too familiar litany of ills visited on our cities by the automobile: air pollution, congestion, thoughtless land use patterns, restricted mobility for the handicapped, the elderly, and the poor as well as constrained pedestrian movement and many other conditions affecting the quality of urban life. These have been joined by other frightening specters—a diminishing petroleum resource and an unsettled national economy.

It is now obvious that those in public transit must consider the mobility needs of a population larger than that of the daily commuter. Jitneys, car pools, buses, and light and heavy rail transit are all forms of public transit. Each mode is desirable under specific conditions. Together they can form a transit system that will meet a variety of different service needs.

Defining public transit in broad terms provides the public with numerous transit options; each has its own service characteristics and cost structure. In this regard, the light rail concept is attractive because it expands the available deployment options for rail transit.

Before discussing the attractive features of light rail transit, it would be useful to review its technological evolution in the United States.

Before the development of the electric motor, urban mass transit was provided by horse-drawn streetcars. Horse-drawn rail cars were used first in Baltimore in 1828. The first real system, the New York and Harlem Railroad, was constructed in New York City in 1832. The line was 1.5 miles (2.4 km) long; vehicle capacity was 30 persons; headways were 15 min; and the fare was 12.5 cents. This system did not stagnate. In 1833, it was extended to 4 miles (6.4 km), and cars were added. By 1940, headways on the system were down to 6 min. New Orleans built its system shortly after the New York system. But it was more than 20 years later before Brooklyn, Boston, Cincinnati, Baltimore, Chicago, and Pittsburgh developed horse-drawn rail service. It was 1858 before Philadelphia inaugurated horse-drawn service.

Horses were hardly a satisfactory means of motive power. Five to 10 horses were needed for each car. Each horse cost about $125, which was expensive in those times. Their service life was short (3 to 5 years) because the work was punishing. Average speed was 5 to 6 mph (8 to 9.6 km/h); therefore, the area that they could serve was limited. The horse's susceptibility to disease placed the reliability of horse-powered street railways in a precarious position. This shortcoming became apparent during the Great Epizootic Epidemic in 1872. Thousands of horses died and street railway operations were curtailed or discontinued. In some instances, companies maintained service by hiring gangs of unemployed workers to pull the cars through the streets.

One would expect that the next logical development in transit technology would have been the substitution of the steam engine for horses. Steam engines were used in the London Underground, which began service in the 1860s, and steam was serving well on

intercity railroads. However, years before environmental impact statements, the American public knew what it did and did not want in urban transportation. The system should be silent, emit no smoke, and have no exposed parts to endanger pedestrians and horses. Even though Philadelphia, in 1860, had a half dozen steam-propelled streetcars, steam never became an attractive technology for street rail systems.

An interesting technological response to certain topographic conditions was Andrew Halladie's cable car, which incidentally met some of the environmental constraints of the day. Although cable cars had high initial cost, they were less expensive to operate and could carry heavier loads than horse-drawn cars could. Two dozen cities, including Chicago and San Francisco, of course, installed cable cars. Cable car systems, however, were hampered by equipment failure and low speeds.

By 1880, it was obvious that the electric motor was going to be the primary source of traction. During the 1880s, the overhead trolley and the electric collector (the "plow") were invented. The street railway of Montgomery, Alabama, was completely electrified and began service in 1886. It was a 15-mile (24-km) system, but it was plagued with trouble continuously. In 1887, there were 9 electric streetcar systems in Europe and 10 in the United States involving 60 miles (97 km) of track and 100 motors and cars.

Unreliability was nowhere better demonstrated than in San Diego, where an electric line was added to a local system that included cable cars and horse cars. There were 2 trolley wires for positive and negative, and a small 4-wheeled cart ran overhead on wires connected to the car with a trailing wire. This cart often jumped the tracks and landed in passengers' laps or on their heads, which discouraged ridership. Obviously, improvements were needed.

Because of its unreliability, advancement in the adoption of the electric motor had been limited. F. J. Sprague, a U. S. midshipman, changed the situation. Sprague first developed his interest in electricity at the U. S. Naval Academy, and, while serving aboard ship, he produced 60 inventions. In 1881, he built a novel dynamo that led to his selection as secretary of a jury testing dynamos and gas engines at the 1882 British Electrical Exhibition. Sprague's frequent rides on the steam-driven underground in London fostered his idea of an electric railway system. Sprague left the Navy and served as Thomas Edison's assistant for a year before striking out on his own. Richmond, Virginia, let a contract with Sprague for 12 miles (19 km) of track and 80 motors on 40 cars to be completed in 90 days. As Sprague observed later, it was a contract "a prudent businessman would not ordinarily assume." However, Sprague had faith in his ideas and confidence in his ability to carry them out. As is the case with many contracts based on new systems, things did not go well.

He was delayed first by outbreaks of typhoid fever, then by shoddy workmanship and cheap materials, and finally by an "insuperable" combination of grades and curves. Even Sprague's confidence wavered. Could a self-propelled vehicle merely maintain adhesion on grades of up to 10 percent? Late one November evening the car was put to the test. It negotiated curves and grades to arrive finally at the top of the long Franklin Street Hill to the cheers of an enthusiastic after-theater crowd. The crowd did not realize that the motors had overheated and were disabled and that the streetcar that had arrived at the top of the hill so triumphantly would have to be towed home by a team of mules in the dead of night. Sprague now knew his ideas were feasible, and he went back to the drawing board with renewed enthusiasm.

On February 2, 1888, the Richmond system opened for regular service. It is now recognized as the first system in which a large railway was equipped and operated under service conditions by electricity. It was the pioneer of commercial electric traction. More than 1,260 miles (2030 km) of electric streetcar track were installed nationwide by 1890, and 22,000 miles (35 000 km) of electric streetcar track were installed by 1902.

Between 1902 and 1910, streetcar lines expanded and the interurban light rail network developed. The interurban light rail systems were different. They had heavier, faster, and usually more comfortable cars. They were developed in a more sophisticated fashion; they often used reserved rights-of-way in rural areas and continued on city streets in built-up areas. They carried some freight but they predominately were passenger carriers.

Land values soared along the new rail lines and speculators did not overlook their opportunities. Many lines were built not to fill a transportation need but to fill the promoters' pockets. Expansion of track reached its peak in 1916 with 15,580 miles (24 928 km) of interurban railway. From 1910 to 1922, one could have traveled from eastern Wisconsin to central New York [more than 1,000 miles (1600 km)] completely by interurban railway. Southern California's Pacific Electric Railway, centered in Los Angeles, operated nearly 1,000 route miles (1600 route km) and reached 125 cities and communities. However, by 1939, only 2,700 miles (4300 km) of interurban line remained in the United States.

Before World War I, jitneys had penetrated the street railway market, but, by 1917, most of these had been forced out of business. In that year, more than 1,000 street railway companies were carrying about 11 billion passengers/year. Eight thousand electric streetcars covered 45,000 miles (72 000 km) of track, but the companies had problems. The high cost of labor and materials, financial mismanagement, and inadequate fare systems eventually would prove to be their downfall. After World War II, because of lack of maintenance, the street railways became prey to buses and the burgeoning of America's love affair with the private automobile. They did not fall without a struggle. In 1930, leading street railway operators formed the Electric Railway Presidents' Conference Committee to develop a modern vehicle. After 5 years and about $750,000 in research, the PCC car was born. It far surpassed its predecessors in both performance and comfort, and, to this day, it remains the best urban transit vehicle designed and built in this country.

Between the demise of the interurban and electric streetcar systems and the resurgence in urban rail transit best epitomized by the Bay Area Rapid Transit system, the concept of light rail transit was lost. Until very recently, urban mass transit was considered to be buses or heavy rail transit. As a society, we had placed ourselves in a corner. Public officials were faced with an "either-or" situation. This limited rail transit to a very few cities. Buses, in spite of their usefulness, have disadvantages in long-run costs, speed, capacity, and acceptance by the public, but the majority of urban centers in this country were left with no real transit alternative.

Rapidly increasing costs in heavy rail development and uncertainty regarding new transit technology served as an incentive to search for a different rail technology. The search led to Europe and especially West Germany, where the use of intermediate capacity systems variously deployed was widespread. Cologne, Bonn, Bielefeld, and Frankfurt provide a few examples of how light rail transit can be integrated into existing urban environments and multimodal transportation systems. The search led also to Boston, San Francisco, and Philadelphia where the remnants of urban and interurban electric lines continue to provide service and are looked on as useful elements of the transportation system. The search culminated in the renaissance of interest in light rail transit.

The rediscovery of light rail transit was not motivated by sentimentality and nostalgia for a bygone era. It was simply the result of judgments founded on a realistic assessment of growing transit needs and diminishing financial resources. Light rail transit was reborn. The reason for this rebirth is the inherent advantages of the technology. Light rail transit can be run on streets in mixed traffic, in reserved street lanes and highway medians, in activity center malls and rights-of-way shared with other rail transit modes, and in subways. It offers public officials the opportunity to initiate rail transit development at a rather modest cost by using existing rights-of-way. Later, as additional funds become available, the system can be extended or the degree of right-of-way exclusivity improved or both. The flexibility of the technology allows transit service, system capacity, and available resources to be traded off in a variety of ways so that the most ideal transit system for a community can evolve over time.

The benefits of light rail transit are beginning to prove themselves politically. Rochester, New York, and Dayton, Ohio, have committed themselves to light rail technology. Edmonton and Vancouver are 2 Canadian cities that decided light rail was the appropriate rail technology for their fast-developing communities, and Toronto is looking to light rail as the best choice for new interurban service. San Francisco, of

course, is well on its way to upgrading new transit technologies. We can be certain many of these technologies will have a role to play in providing transit services.

All of us must examine critically the claims made for light rail transit. The rôle of light rail transit and its relationship to existing and emerging transit technologies must be defined carefully. This will ensure that light rail will stand the test of technical and public scrutiny.

I am confident that light rail will become a more familiar mode of transportation in the United States. The interest in light rail expressed by the Urban Mass Transportation Administration and the commitment being made to it across the country deserve commendation because urban transit decisions require a degree of pragmatism that has often been lacking in recent years.