LIGHT RAIL TRANSIT SOCIAL COSTS AND BENEFITS

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This paper identifies the social aspects of light rail transit and categorizes them according to the viewpoints of the rider, those on the wayside, the community, and the contributor of capital funds. The physical characteristics and service qualities of light rail transit accumulate to benefits that are judged to outweigh the social costs. Highlighted is the light rail transit attribute of serving a greater number of persons' travel needs through extensive distance covered for a given investment, frequent stations, easy access, and short door-to-door travel time. The ability of light rail transit to condense the amount of time between ground breaking and operation of service is stressed. This is credited to simpler construction enabled by need for narrower rights-of-way, use of sharper curves and steeper gradients, and tolerance of grade crossings. The ability of light rail transit to evolve at a later date, through additional investment, into conventional rapid transit is acknowledged. The paper draws conclusions from a 1960 study in Frankfurt, Germany, that served as the springboard for the now extensive development of light rail transit networks throughout Europe. Instances of specific social aspects are cited.

Social aspects cover a community's welfare and quality of life. The social aspects of transportation facilities and services to which costs or benefits can be attributed encompass a wide range of changes to the economy, the environment, and the ecology. Social aspects include, for example, impacts on employment, such as decreasing the level of unemployment by creation of short-term jobs for construction of facilities and manufacture of equipment and long-range jobs for operation and maintenance. Social aspects also cover technical topics such as air quality, acoustics, visual aesthetics, water quality, and ecological impact resulting from construction, consumption of resources, and emission of wastes. Social aspects extend to the commitment (or recovery) of financial resources. These are, of course, features of all public works projects. Unique to transportation is the social aspect of urban mobility; transportation connects workers to job opportunities, students to education opportunities, shoppers to stores, and everyone to municipal and health services, cultural institutions, and recreation activities. Expressed another way, social aspects encompass concern for the conservation or judicious expenditure of material, resources, energy, time, and human endeavor.

Benefits are not free. To gain a social benefit, one must make a social investment (cost). For example, to transport an individual to employment (this has a positive connotation), it is necessary to commit time, land, materials, and funds, which, once committed, cannot be recovered (this has a negative connotation), and make certain irrevocable sacrifices in air quality, sound, and visual aesthetics (this has a negative connotation). The items that have negative connotations are costs; those with positive

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connotations are benefits. Urban transportation facilities must be planned so that the benefits outweigh the costs.

The social aspects I have mentioned apply generally to all modes of urban transportation. The costs and benefits among different modes vary relatively as a function of technological (land requirements, power consumption), service (speed, frequency, route layout, passenger appeal), and financial (construction, maintenance, operation, revenues) characteristics and according to the numbers of persons who can avail themselves of the transportation service or be attracted to it. In cost-benefit analyses, the costs and benefits are tallied, compared mathematically, and expressed as a cost-benefit ratio. The ratios for alternative modes or projects can be compared. (Such an endeavor involves setting values. It is difficult—indeed, it is often impossible—to assign a dollar value to certain social costs and benefits.) In modal choice, according to local circumstances, one mode, in social terms, can be either more beneficial or less costly than another.

This paper explores briefly the topic of social costs and benefits of light-volume rapid transit (light rail transit). It treats the subject narratively rather than quantitatively because of the difficulty of placing dollar values on some of the costs or benefits without exploring in detail a specific instance of applying the light rail transit concept.

SOCIAL ASPECTS OF LIGHT RAIL RAPID TRANSIT

For convenience, the social aspects of light rail rapid transit are categorized according to 4 different viewpoints: those of the rider, the person on the wayside, the community, and the contributor of capital funds. These are not mutually exclusive viewpoints; there is considerable overlap.

Viewpoint of the Rider

From numerous studies and considerable debate on the value of a traveler's time, there is at least agreement that a traveler's time does have value that can be expressed in terms of dollars and weighted into modal-split analyses and cost-benefit calculations. So, if one mode will save more time than another mode, it is economically superior in that respect.

In what proved to be a milestone in transit planning, the city of Frankfurt in the Federal Republic of Germany conducted a study in 1960 in which it examined 3 alternative systems: supported monorailway (Alweg), light-volume rapid transit (light rail transit), and heavy-volume (conventional) rapid transit predominantly in subway (29). Table 1 gives a summary of some of the comparative findings. Notice in particular that the total peak passenger travel time is somewhat less for the light rail transit alternative.

The light rail transit system serves, in effect, as its own feeder, requiring fewer miles (kilometers) of bus routes. This is because of its ability to have branches, to extend for longer distances at low investment, and to have more frequent stations (3). These characteristics are reflected in total route length of railway, length of bus routes, and average distance between stations. Therefore, the lower average speed for rail systems for light rail transit, which is due to its making more stops, is more than compensated for by the considerably lower amount of transferring and the resultant lower amount of time lost in transferring.

Frankfurt pursued the light rail transit alternative and now has an exemplary public transport network (20, 24, 27, 39, 40, 54, 55, 56, 71, 72, 73, 74, 75). The Frankfurt experience spurred light rail transit development throughout Europe.

The shorter door-to-door travel time by light rail transit is not only a valuable saving for each individual rider but also a major factor in attracting more riders. Transferring is known to be a deterrent to transit use (7). In light rail transit networks, there is less need for transferring, and the chore of traveling can be made more convenient.

Table 1. Comparison of monorailway, light rail transit, and conventional rapid transit systems designed for Frankfurt.

Item	Monorailway	Light Rail Transit	Conventional Rapid Transit
Route length of railway, miles			
In tunnels	2.83[a]	13.15	23.76
On elevated way	36.30[b]	4.42	15.42
On separate roadbed	—	46.48	—
Total	39.18	64.03	39.18
Length of bus routes, miles	99.30	71.91	90.73
Year of completion	1968	1974	1981
Number of rail stations	82	192	91
Average distance between stations, ft	2,387	1,686	2,099
Total number of stations and stops	307	349	316
Average speed for rail systems, mph	17.76	16.02	17.53
Number of peak-hour passengers	95,600	95,600	95,600
Percentage of peak-hour passengers			
Not transferring	21.0	36.7	24.6
Making 1 transfer	44.3	47.8	45.3
Making 2 transfers	29.3	14.1	24.3
Making 3 transfers	5.4	1.4	5.6
Total peak transfer movements	113,500	76,519	106,812
Total peak passenger travel time, h	52,200	49,300	50,300
Adjusted annual cost of system for first 10 years (no interest), dollars	22,900,000	16,100,000	22,700,000
Annual cost as percentage of present street railway costs	95	47	93

Note: 1 mile = 1.6 km. 1 ft = 0.305 m.

[a]With alternate plan: 4.30 miles (6.9 km). [b]With alternate plan: 34.88 miles (55.8 km).

The rider viewpoint is often overlooked by the transit planner. In Image of the City, which I regard as required reading for transit planners, Kevin Lynch cautions that the urban dweller has a psychological need to be constantly aware of his or her location (34). Express buses on freeways that bypass development and conventional rapid transit in subways violate that need. Light rail transit, which characteristically is a surface operation, suits that need. Also personal contact of the passenger with the operator gives some sense of security. That is a lesson learned from the Lindenwold Line [a rail rapid transit line operated by the Delaware River Port Authority subsidiary, Port Authority Transit Corporation (PATCO), in the southern New Jersey suburbs of Philadelphia] where the operator is not walled off from the passengers. An appreciation of the scene is gained by the light rail transit passenger. The view is generally more relaxing than along freeways or in subways. Rai Okamoto's work for Seattle's rapid transit project is significant in its seeking to enhance the panorama seen by the rider (43). Associated is the high visibility of service; light rail transit cars are mobile billboards boasting of availability, speed, and dependability.

Dependability (regularity, adherence to schedules, and freedom from in-service equipment failures) is a major factor, but most difficult to quantify for modal-split models, in the ability of rail transit to attract greater numbers of riders than buses. Particularly when it operates on an exclusive right-of-way, light rail transit exhibits this characteristic. The all-weather dependability of rail transit deserves mention. In addition, light rail transit has the flexibility to absorb sudden increases in ridership, such as those "foul-weather friends" who descend on the transit system when ice, snow, or heavy rain immobilizes their automobiles.

The viewpoint of the rider also is covered by Jessiman and Kocur (79).

Viewpoint of Persons on the Wayside

The viewpoint of persons on the wayside includes the viewpoints of those who might not be users of the transit service.

In league with electric commuter railways and conventional rapid transit, light rail transit is an efficient user of energy and produces no air pollution at the wayside. Although a central power plant, in generating the electricity, emits some air pollution, it is lower in quantity and toxicity than that produced by automobiles or buses carrying the same number of persons. The Skokie Swift, Chicago's hybrid light rail transit line operated by the Chicago Transit Authority, was heralded soon after its opening in an analysis by the Northeastern Illinois Planning Commission as having effected a 40 percent reduction in hydrocarbons in the 40-mile^2 (104-km^2) area served by the rail line (10). Light rail transit generally produces less pollution, even at the power plant, because it consumes less energy than conventional rapid transit (2, 60, 62). If the conventional rapid transit alternative employs rubber tires instead of steel wheels or if it is predominantly underground, more energy is consumed for overcoming rolling resistance, for overcoming air drag on restrictive subway walls, for tunnel lighting and ventilation, for station lighting and air conditioning, and for escalator operation—features that are usually not associated with light rail transit projects. Streamlining of light rail transit cars as is done in Europe and Canada and was done formerly in the United States significantly reduces power consumption (5, 15, 37). Based on wind-tunnel tests, Pawlowski found that 70 percent of the energy used to propel a conventional electric railway car was consumed in overcoming wind resistance. His later tests for the Philadelphia and Western Railway in 1931 found that the streamlining for the railway's Bullet cars saved the amounts of power given in Table 2, which are significant at rapid transit operating speeds. The Bullet cars operated through much of their careers on the Philadelphia and Western Railway in express service at 85 to 90 mph (136 to 144 km/h). They continue to be run by the Red Arrow Division of the Southeastern Pennsylvania Transportation Authority between Sixty-ninth Street in Philadelphia and Norristown in regular service at speeds up to 70 mph (112 km/h). This 13.4-mile (21.6-km) line with 23 stations is a hybrid light rail transit line: Its main variations are power collection from a third rail, loading from high-platform stations, and full grade separation.

A light rail transit line introduces less noise into a neighborhood (60). Because light rail transit lines generally run on the surface, the noise that is produced is not projected as far from the right-of-way. It is typical for light rail transit to follow a freight-railroad or be in a highway median. In these cases, trains and motor vehicles already have made the sound invasion and light rail transit cars will not add significantly to ambient noise. An accumulation of features (resilient wheels, skirting covering underbody components, general operation at a lower top speed, and use of catenary instead of third rail for power collection) make the light rail transit car inherently quieter than its conventional rapid transit counterparts, and both of these are quieter than motor buses. This quality of quietness can be exploited by placing light rail transit operation in closer proximity to occupied buildings, thus enabling economies in line location and right-of-way acquisition.

There is less community disruption in the construction and operation of light rail transit. By using existing rights-of-way, grades, and roadbeds (such as little-used or abandoned railways, dismantled interurban or suburban trolley lines, electric power

Table 2. Power savings resulting from streamlining (5).

Speed (mph)	Power Saved (percent)	Speed (mph)	Power Saved (percent)
10	5.5	60	39.5
20	17	70	41.5
30	26.5	80	42.5
40	32.25	90	43.5
50	37		

Note: 1 mile = 1.6 km.

transmission lines, former canals, and highway and boulevard medians), one can save in costs and elapsed time in bringing a project from concept to service. Because light rail transit can surmount steep gradients and tolerate sharper curvature in line location, it is possible to provide the way for the transit facility at less cost and without the heavy construction generally associated with conventional rapid transit. This minimizes disruption to established neighborhoods. Light rail transit can slip past delicate situations, such as those involving historical buildings where no right-of-way is available, by reverting to paved streets. However, it must be acknowledged that such a practice might interfere with dependability. In some instances, adherence to schedules can be enhanced by separating the light rail transit tracks from automobile traffic by curbs or simply by painted stripes accompanied by prohibitions and enforcement. Where street space is limited but is sufficient to segregate the tracks, it would be useful to revert to left-hand operation to minimize the amount of space taken from the pavement and still provide for stations (36). In some cases, this may obviate cutting trees to widen street pavement.

An important concern is visual intrusion into a neighborhood. Light rail transit intrudes less than other modes do. It blends in better and can operate successfully in close proximity to the natural environment. Shaker Heights, Ohio, Rapid Transit runs in the grassy median of attractive Shaker Boulevard and Van Aken Boulevard, which are fronted by expensive homes. In Mexico City, the Servicio de Transportes Electricos del Distrito Federal's 53-Tlalpan and 54-Xochimilco light rail transit lines in Calzada de Tlalpan blend in far better than the Sistema de Transporte Collectivo's heavy-volume rapid transit Linea 2, which replaces it for part of the way. Transport of New Jersey's 7-City Subway line forms a suitable perimeter for Newark's Branchbrook Park. Similarly, Massachusetts Bay Transportation Authority's Highland Branch (Green Line—Riverside) blends in alongside Back Bay Fens and through Hammond Pond Park; San Francisco Municipal Railway's J-Church line blends in alongside Mission Park; and Southeastern Pennsylvania Transportation Authority's 101-Media line blends in through Smedley Park. The former D.C. Transit System 20-Cabin John car line followed a narrow way along the palisades overlooking the Potomac River. The George Washington Memorial Parkway had to rearrange the topography and remove thousands of mature trees to make space for a safe highway in the same area.

Light rail transit is compatible with people, too. Safety is inherent in the smooth contour of most light rail transit cars and the practice of shrouding underbody components. Consequently, people and light rail transit cars mix successfully in pedestrian malls in Geneva and Zurich, Switzerland, and in Bremen, Frankfurt, Kassel, and Magdeburg, Germany (52, 69).

In the development of light rail transit lines, the urban environment can be enhanced through the use of textured pavements, plantings, and plazas. At light rail transit stations, where on-board payment of fares usually prevails, there is no need for unsightly fences to separate the fare-paid areas. A by-product of this feature is that stations are more easily approached by riders. Aesthetics are covered more thoroughly by Rogers (80).

The collection of electric power from overhead wires can be a visual problem. Most U.S. examples of light rail transit inherited their overhead wires from an era when wood and labor were so cheap that they warranted forests of guy poles (instead of more costly catenary for longer spans). Little care was displayed for the visual aspects of public transit during this era. But modern applications of electric railroading in Europe and Japan have led to overhead systems that are both economical and sensitive to appearance. Weight-tensioning of the overhead wire (Bremen, Germany, and Göteborg, Sweden) is a successful way to keep the overhead as delicate as possible (57). Where overhead wires are absolutely prohibited, light rail transit cars can collect power from a third rail, but the right-of-way must be fenced. Deserving of attention in such circumstances is the conduit system formerly employed for aesthetic reasons in New York City, Washington, D.C., London, Berlin, Paris, Lille, Nice, and Brussels. The power rails in the conduit cannot be reached; therefore, the transit line need not be fenced or specially protected. Chandler recommends a modern, economical design of conduit track (8).

Viewpoint of the Community

The viewpoint of the community is that of the entire population (residents, taxpayers, and voters).

As shown by Beetle (81), light rail transit enjoys an inherently lower cost of construction. This allows a given investment to be spread more widely over the urban area. Notice in Table 1 that the total route length of railway for the light rail transit alternative is $1^2/_3$ greater than either monorailway or conventional rapid transit, yet the cost of the light rail transit facilities (given in the table on an annualized basis) is only 70 percent of the cost of the other 2 alternatives (29). Therefore, a community decision in favor of light rail transit can mean that the investment will be lower or that the money that might have been spent on a conventional rapid transit line can instead be used to provide light rail transit service over a wider area. For example, the Pennsylvania Department of Transportation estimates the funds that would have to be spent to produce the 10.6-mile (17-km) Skybus line in Pittsburgh's South Hills Corridor will more than cover development of 25.5 miles (41 km) of light rail transit line in the same area; obviously, this will reach more potential riders (45).

Because for light rail transit projects there is a shorter period of time between ground breaking and commencement of service, the community benefits earlier from its investment. In 1959, the 10-mile (16-km) Highland Branch of the Massachusetts Bay Transportation Authority was put into service in exactly 1 year (13, 21). The diminutive light rail transit line operated by Leonards Department Store in Fort Worth (Leonards M&O Subway) took only 10 months from ground breaking to opening of service in 1963; and this included construction of a 0.25-mile (0.4-km) subway section (33). The Chicago Transit Authority 5-mile (8-km) Skokie Swift moved from application for federal funds to public use in only 4 months (9, 26). It can be seen that light rail transit can offer prompt relief from traffic congestion. (Today, using federal-grant funds, these cited projects would take longer. More intensive feasibility studies are demanded as justification and bureaucratic processing of paperwork take as long as or longer than implementation. Nevertheless, once a grant is approved, implementing light rail transit would consume less time than a busway or conventional rapid transit would in a typical corridor.)

It is possible to use short segments of light rail transit lines even before completion of an entire line. This is often not possible or is uneconomical with conventional rapid transit lines. Inexpensive alternate routings also can be employed while permanent routes are being designed and built. For example, Shaker Heights, Ohio, Rapid Transit opened service with street running from East Thirty-fourth Street to Cleveland's Public Square until Union Terminal was completed 10 years later (6). In the meantime, people were able to use the service, and new residents established their travel habits. Göteborg, Sweden, extends its several light rail transit lines station by station as urbanization grows outward (18).

Because light rail transit is more of an operating concept than a mode, it can evolve into conventional rapid transit if necessary. Meanwhile, an area can enjoy the benefits of rapid transit service well before conventional rapid transit might be warranted. In Europe, some cities design their light rail transit systems with no expectation that their evolving into conventional rapid transit will ever be necessary. [Light rail transit has sufficient capacity to carry the loads of most conventional rapid transit lines (47).] Other cities, such as Brussels (11, 12, 48, 53, 65), Vienna (30, 31, 41), and Oslo (22, 67), design specifically for later conversion, and much of the cost of the later conventional rapid transit (costs for long stations) is incorporated into the original project. Other cities, such as Cologne (17, 24), design feeling that later conversion may be required but do not make advance investment. This art of "evolution" was used in the United States in the past. Conventional rapid transit lines in North America that began their existence as light-volume rapid transit or its early-era equivalents include: Massachusetts Bay Transportation Authority's Blue Line between Bowdoin in downtown Boston and Revere Beach; Chicago Transit Authority's Congress Route between Laramie and Des Plaines; Sistema de Transporte Collectivo's Linea 2 from Chabacano to Tasquena; and New York City Transit Authority's "Franklin Avenue Shuttle" and "Brighton

Line" from Franklin Avenue via Prospect Park to Stillwell Avenue, "Sea Beach Line" between Ninth Avenue and Stillwell Avenue, "Rockaway Park Line" from Hammels to Rockaway Park, "Culver Line" between Ditmar Avenue and Stillwell Avenue, "Dyre Avenue Line" from 180th Street to Dyre Avenue, and "Flushing Line" between Grand Central and Hunters Point Boulevard. Operating light rail transit lines that were designed for later conversion to conventional rapid transit are Shaker Heights, Ohio, Rapid Transit at Cleveland (6), Philadelphia's 100-Norristown High-Speed Line (operated by Southeastern Pennsylvania Transportation Authority's Red Arrow Division) (15), and Transport of New Jersey's 7-City Subway line in Newark. The demand for conversion never arrived, but in the intervening years, millions of passengers have been carried.

A little-used freight railroad need not be completely abandoned before rapid transit on it can be considered. Light rail transit and continued freight service are compatible on light-density branch lines. Careful scheduling can obviate interference, or freight can be relegated to night hours. Thus a community need not suffer employment loss by shippers to gain rapid transit. In fact, joint use with light rail transit can serve to secure the permanent availability of freight service for industries not on main lines.

Light rail transit has several safety advantages. Its general use of overhead catenary instead of third rail makes the right-of-way less hazardous. Over the years, people have come to respect a railway facility. This is not the case with a busway, which becomes an attractive nuisance and is trespassed on rather casually unless it has difficult access (such as the busway in the median of Shirley Highway and I-95 in the Northern Virginia suburbs of Washington, D.C.). Philadelphia's R-Ardmore busway (operated by Southeastern Pennsylvania Transportation Authority's Red Arrow Division) has become a neighborhood hiking and biking trail. Runcorn, a new town in the vicinity of Liverpool, England, has difficulty warning strolling mothers with perambulators off its busway. Intermittent use of busways by buses compared with their frequent use of city streets is deceptive. Morris (82) has covered this more thoroughly.

Perhaps, at first thought, the tendency to tolerate grade crossings for light rail transit would seem hazardous. Even if the motorman feels inclined to slow for crossings, the high rate of acceleration of the light rail transit car allows the car to rapidly reachieve top speed with almost no discernible loss of time. Most light rail transit stations are situated at intersecting streets so that the instances of cars speeding through grade crossings are minimized. Although full grade separation would be useful to remove a capacity constraint, it is not really necessary from a safety standpoint (76). Adequate protection can (and should) be provided with automatic gates and flashing lights (35, 63) or traffic signals actuated by the passage of light rail transit cars (23). Tippetts-Abbett-McCarthy-Stratton (TAMS) has designed such a system to expedite the movement of Green Line Light Rail Transit cars on Commonwealth Avenue in Boston. (As part of a computer-controlled traffic signal system, TAMS designed a priority system for light rail transit cars along Commonwealth Avenue where the Green Line is located in a broad median; it is to be provided where the light rail transit movement can be accommodated without any conflict and where far-side platforms can be situated.) Otherwise, grade crossings provide the ideal way for passengers to approach the station—on ground level.

Viewpoint of the Contributor of Funds

Fourth is the viewpoint of the contributor of funds. In these times, transit improvement projects cost so much that federal grants (and, in many places, state grants) and local-government contributions are needed. In addition to providing technically sound justifications and weighing cost effectiveness, one must persuade elected government officials that financial participation is in their best interest. This is difficult to do with a project such as a typical conventional rapid transit project that will consume 7 to 10 years from adoption to public service. The shorter time span for constructing a light rail transit line is more in harmony with the short tenure of political terms of

office. In a more positive sense, measurable value from the grant or investment is gained earlier.

The value of light rail transit is not so much that it is more quickly built or that its facilities are less costly; it is that light rail transit can extract full value from earlier investments. An abandoned railroad grade, for example, represents right-of-way assembly, grading and drainage, and construction that already has been amortized. In a light rail transit project, the only cost representing this earlier work would be the acquisition of the property. To convert the abandoned railroad into a conventional rapid transit line might require the high cost of full grade separation. To develop the abandoned railroad as a busway generally would obviate the advantages of the earlier investment. Light rail transit is more likely to use the abandoned facilities as they are with a minimum of expenditure for modification. Developing a light rail transit line to use Cincinnati's subway is an extreme example of the capability of light rail transit to exploit past investment. The city's taxpayers have fully paid the bonded indebtedness incurred to build the subway. Owned by the public, the facility would be "free" for use in a new project.

With light rail transit, there is greater flexibility in areas where traffic might increase later. Increased patronage can be accommodated by purchasing additional rolling stock, by double-tracking initial single-track sections, and by effecting full grade separation in place of initial street-running sections while still remaining within the light rail transit concept. The initial lower investment takes some of the risk out of commitment of funds by government officials. Should the light rail transit project not achieve the predicted level of patronage, the people are left with an operating transit facility rather than a "white elephant." In the meantime, the citizens have enjoyed a useful transit service instead of having a pie-in-the-sky volume of recommendations gathering dust on the library shelf.

Net Benefits

The social costs of light rail rapid transit include

1. Committing land space for right-of-way and stations;
2. Allocating public funds;
3. Tolerating noise, dust, and some disruption during construction;
4. Tolerating some visual intrusion;
5. Committing energy resources;
6. Accepting a slight addition to ambient noise; and
7. Accepting protected grade crossings instead of grade separation in some localities.

These social costs are more than offset by the benefits of light rail rapid transit, which include

1. Less obtrusive construction on a narrower right-of-way,
2. Blending in with the urban and natural environment,
3. Conservation of energy and relatively small contribution to air pollution,
4. Rendering useful service sooner,
5. Serving more people's travel needs more directly,
6. Providing a quicker door-to-door trip,
7. Safety, and
8. Flexibility of evolving to conventional rapid transit if necessary.

CONCLUSION

Social costs and benefits are probably more variable from city to city and project to project than are construction costs, operating costs, and revenue forecasts. Therefore,

firm dollar values cannot be assigned nor rules of thumb coined. Light rail transit, compared to an urban busway, could mean increased benefits at no increase in costs. Or, compared to conventional rapid transit, it could mean a decrease in investment at no loss of benefits. And, compared to an electric commuter railway, costs and benefits could come out even, depending on population location and density, length of line, and related factors. Any comparison should be made on an area basis rather than a line-by-line basis because it might be possible for 2 light rail transit lines to serve more people yet be less expensive to build and operate than a single conventional rapid transit line.

No single mode can serve all situations. However, I would conclude generally that, wherever busways, rapid transit, or commuter trains are being considered, it would be well to measure the costs and benefits of versatile light rail transit as an alternative.

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