The Streetcar Renaissance

ITS BACKGROUND AND BENEFITS

A research report for the St. Clair Avenue
Transit Improvements Environmental Assessment Study
by Greg Gormick

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FRONT AND BACK COVER MAIN PHOTO
St. Clair Avenue West looking east at Dufferin Street, September 12, 1928.
TTC Collection, City of Toronto Archives, Series 71, Item 6240

Acknowledgements

The author gratefully acknowledges the generous and thoughtful assistance of the following individuals:

Toni Bates, Division Director, Transportation Planning,
San Diego Association of Governments, San Diego California

Mike Bergman, Project Manager, Regional Express, Sound Transit, Seattle, Washington

Ron Bouwhuis, Principal, Nework Creative, Toronto, Ontario

Suany Chough, Transit Planner, San Francisco Municipal Railway, San Francisco, California

Darrell Clarke, Friends 4 Expo Transit, Los Angeles, California

Al Fazio, President, 21st Century Rail, Newark, New Jersey

Mary Fetsch, Communications Director, Tri-Met, Portland, Oregon

Christopher Gallagher, Graphic Specialist/Marketing Services, Washington Group International,
Princeton, New Jersey

Peter Harris, Director of Public Transport, State of Victoria Department of Infrastructure,
Melbourne, Victoria

Michael Hopkins, Senior Project Manager, Business Development, Public Transport Division,
State of Victoria Department of Infrastructure, Melbourne, Victoria

John Huzil, Archivist, City of Toronto Archives, Toronto, Ontario

Allan Jacobs, Oakland, California

Christopher W. Jenks, Manager, Transit Cooperative Research Program,
Transportation Research Board, Washington, D.C.

Miriam Kirschner, Senior Planner, San Diego Association of Governments, San Diego, California

Charles Kromer, Project Designer, New Vehicle Program, Southeastern Pennsylvania Transportation
Authority, Philadelphia, Pennsylvania

Rick Laubscher, President, Market Street Railway, San Francisco, California

Howard Levine, President, HJL Consulting, Toronto, Ontario

William Lieberman, Transit Planning Consultant, San Diego, California

Morgan Lyons, Manager, Media Relations, Dallas Area Rapid Transit, Dallas, Texas

David MacDonald, Business Analyst and Chief Statistician, Business Strategies, Calgary Transit, Calgary, Alberta

Tom Matoff, Director, Transportation Planning, LTK Engineering Services, Portland, Oregon

William D. Middleton, Contributing Editor, Railway Age, Charlottesville, Virginia

Steve Munro, Toronto, Ontario

Xanthi Pinkerton, Manager, Corporate Communications, Siemens Transportation Systems, Sacramento, California

David Pirmann, Webmaster, www.nycsubway.org

Benjamin Redd, Vice-President, Project Development, Washington Group International, Princeton, New Jersey

Michael Roschlau, President and CEO, Canadian Urban Transit Association, Toronto, Ontario

Gareth Rosenau, Senior Attorney, Office of Chief Counsel, U.S. Department of Transportation, Federal Railroad Administration, Washington, D.C.

John Schumann, Senior Transportation Consultant, LTK Engineering Services, Portland, Oregon

John Stanley, Executive Director, Bus Association Victoria, Port Melbourne, Victoria

Jeffrey Tumlin, Partner, Nelson Nygaard Consulting Associates, San Francisco, California

John Turner, Melbourne, Victoria

Tony Turrittin, Director, Transport 2000 Ontario, Toronto, Ontario

William Vantuono, Editor, Railway Age, New York, New York

Executive Summary

1.0 Introduction

This report reviews the historical background of North American streetcar service, the European experience in advancing the technology and techniques in the post-war era, and the application of that experience in the North America renaissance since the 1970s. Particular emphasis is given to the issue of streetcar priority, especially in terms of right-of-way separation from motor vehicle traffic. A review of the economic benefits of second-generation streetcar service in four major urban centres is highlighted.

2.0 The Streetcar Revolution

The development and perfection of the electric streetcar changed the face of urban life beginning in the early 1890s. Until the rise of the automobile in the post-First World War era, it shaped the size and form of urban centres more than any other invention, allowing cities to spread out on contiguous corridors along which mixed-use development occurred. In Toronto, many of the stable and vibrant neighbourhoods of today were created by the expanding electric streetcar system built between 1892 and the late 1920s, including The Beaches, Bloor West Village, Moore Park, The Danforth, Long Branch and St. Clair Avenue West.

The dominance of the streetcar in urban transportation was eroded by the rise of the all-weather automobile, which not only drew ridership away from transit, but also encouraged outer suburban development and created traffic congestion and conflicts along the streetcar routes. Some cities dealt with this congestion by modifying their streetcar systems with dedicated rights-of-way, tunnels, elevated structures and even all-new routings independent of the street grid. These infrastructure upgrades helped streetcar systems in many large cities compete with the private automobile on the basis of speed, travel time and passenger convenience.

The economic depression of the 1930s brought further pressure on North American streetcar systems. Newly-perfected diesel and electric trolley buses offered a lower cost alternative to capital intensive modernization. Smaller systems often opted for bus conversion rather than modernization with the fast, efficient and comfortable Presidents' Conference Committee (PCC) streamlined streetcars developed cooperatively by the transit industry in the 1930s. Larger cities such as Toronto, with heavy traffic volumes best suited to streetcar operation, invested heavily in such equipment and ridership rebounded by 1939, when the Second World War commenced.

Wartime gasoline and tire rationing, a prohibition against automobile production and massive ridership increases due to war production employment left many urban streetcar systems severely deteriorated after the Second World War. Rising post-war disposable income and decreased production costs greatly increased automobile ownership. This spurred outer suburban development and decreased transit

ridership in many cities. These and other factors contributed to the abandonment of streetcars in many North American cities from the late 1940s through to the early 1960s, leaving only buses and a limited number of heavy rail operations (subways, elevated railways, commuter trains) to cater to transit riders in many jurisdictions.

But in nine North American cities, including Toronto, streetcars were retained because they were well suited to the provision of an intermediate-capacity service that efficiently bridged the gap between buses and heavy rail services. In most cases, the key factor in favour of retention was the percentage of the systems operated on private rights-of-way, where the streetcars were free of automotive congestion and could compete effectively with motor vehicles.

As transit ridership fell dramatically across North America in the period 1945-1975, some transit advocates and planners urged a re-evaluation of the streetcar. They promoted it as an intermediate-capacity technology that could help reverse the downward trend in ridership, lure commuters out of their automobiles and play a role in re-orienting development around transit. In this, they were influenced by the experience with modernized streetcar operations in Europe.

3.0 The Post-War European Experience

The majority of European cities rebuilt, modernized and expanded their streetcar systems in the period following the Second World War. Although some countries followed the North American abandonment trend – notably England, France and Spain – most others embarked on evolutionary programs to upgrade their systems, even as they converted their most heavily-trafficked lines to subways or metros. Streetcar modernization and expansion was justified by lower automobile ownership, a lack of domestic petroleum resources, plentiful electricity and a desire to not allow automobile usage to disturb the traditional economic and social patterns of these centuries-old cities.

The European approach was evolutionary, incrementally building on the streetcar's strengthen as a cost-effective, intermediate-capacity transit technology filling the gap between high-capacity, heavy rail systems and lower-capacity buses.

The result was a series of technological and operational advances, including:

- faster, larger and lighter weight rolling stock to increase speed, capacity and productivity;
- better trackwork that provided a smoother and quieter ride;
- lighter, less obtrusive overhead wiring and more efficient distribution systems;
- pre-emptive transit-priority signaling at intersections; and
- progressive conversion of mixed-traffic street running to reserved rights-of-way.

European planners and transit operators were quick to embrace the concept of transit-oriented land use development, using fast, frequent and convenient transit services as a means of controlling outer suburban development. They also used the upgrading of streetcar lines with dedicated rights-of-way

as an opportunity to totally re-engineer and improve their streets for all users under a concept known as lateral segregation. Each user – transit rider, motorist, cyclist and pedestrian – is assigned a portion of a street and each is segregated from the other in order to accommodate their varying requirements.

Separation is often accomplished through physical segregation with curbs and integrated signaling at intersections. Every element of the street is re-engineered accordingly: traffic lanes, parking, taxi stands, traffic management systems, cycling lanes, sidewalks, street lighting and all aspects of the "street furniture." The total effect is one of calming the street while also invigorating it economically and socially.

As components of multi-modal urban transit systems, streetcars play major roles in both large and medium-sized European cities today. More than 30 European cities that abandoned their systems – including Paris, London and Barcelona – have built new, second-generation systems since the late 1970s. Rolling programs of expansion and modernization have been undertaken in the cities that retained them.

In each case, the conversion from open, mixed-traffic running to dedicated right-of-way operation has been prominent. Milan, for example, is in the midst of its Metrotramvia project, upgrading and expanding four routes within the massive streetcar system to these new standards. As well, increased use of dedicated rights-of-way and pre-emptive signaling will increase streetcar speed, convenience and effectiveness throughout Milan.

Europe's lengthy, positive experience with innovative streetcar operation has shaped the renaissance that has occurred in North America since the late 1970s.

4.0 The Streetcar's Second Generation

In many North American cities in the post-war era, transit use and inner city vitality declined, while automobile use and outer suburban sprawl increased. By 1975, only nine North American cities – including Toronto – had not abandoned their streetcar systems. What was eventually discovered, based largely on European experience, was that a combination of heavy rail transit and buses was inadequate to provide transit that was completely cost-effective, attractive to riders and competitive with the automobile. Each mode has a particular capacity range to which it is best suited:

- 10,000-40,000 persons/hour: subways and metros;
- 2,000-20,000 persons/hour: streetcars; and
- less than 5,000 persons/hour: buses.

Second-generation streetcar systems, operating in dedicated rights-of-way, also exhibit many other intermediate characteristics. With their ability to operate without expensive tunneling and station facilities, modern streetcar systems cost about one-fifth of subways of similar length. With higher acceleration and braking abilities, they also operate at average speeds competitive with or even in excess of other transit modes.

Eliminating streetcars had wiped out the capability to capture and retain traffic in the intermediate-capacity range. Toronto never lost this capability. The successful 1972 campaign by an ad hoc citizens' coalition, supported by two north end Toronto alderman, convinced the TTC to retain, modernize and expand the large streetcar system that remained at that time. This program has since included:

- purchase of 196 Canadian Light Rail Vehicles (CLRV) and 52 higher-capacity Articulated Light Rail Vehicles (ALRV), which TTC staff helped design;
- progressive rebuilding of the track, overhead and power distribution systems;
- construction of the Harbourfront and Spadina lines, along with a connecting link between the Harbourfront and Bathurst lines, all on private rights-of-way; and
- planning and design of additional reserved right-of-way lines, including Waterfront East and West, and conversion of St. Clair to these standards.

The growing interest in streetcars as a solution to many North American planning and transportation problems came into focus with the first National Conference on Light Rail Transit in Philadelphia, in 1975, sponsored by the Transportation Research Board, a body of the U.S. National Academies. Shortly after, Edmonton, Calgary and San Diego became the first North American cities to inaugurate all-new, second-generation streetcar systems, largely using service-proven German equipment and designs. These three "no frills" systems started a renaissance that has seen new systems introduced in 26 North American cities, totalling nearly 1,000 route-kms and more than $20 billion (U.S.) in capital investment. All nine of the existing, first-generation systems have been upgraded and/or expanded, and more than 30 additional new systems are now under construction or study and planning.

4.1 Rights-of-Way and the Renaissance

One of the key factors in the success of these European-influenced, second-generation streetcar systems has been the provision of dedicated rights-of-way that are free of automotive congestion. This type of infrastructure and operation gives streetcars the speed, safety and time advantage necessary to compete effectively with the automobile and shift commuters to transit. A 1994 study for the U.S. Transit Cooperative Research Program examined 10 North American streetcar systems and developed guidelines for right-of-way construction that include:

- separating streetcars from motor vehicles by a more substantial element than striping;
- designing the line to run in the median – *not outside curb lanes* – of the street;
- coordinating traffic signal phasing and timing near streetcar crossings to preclude motor vehicles from stopping on and blocking the tracks;
- controlling motor vehicle turns that conflict with streetcar operations;
- maximizing the visual impact of streetcars in motion.

Attempts in Toronto and elsewhere to implement peak-hour, streetcar-only lanes with traffic regulations, striping and signage have been largely unsuccessful. Motorists routinely ignore the restrictions and constant enforcement is difficult. Beginning with The Queensway reconstruction/extension project of 1957, the TTC has built its new lines on dedicated rights-of-way. However, the TTC currently operates

only 11% of its streetcar services on dedicated rights-of-way, the lowest percentage of any North American system. The continent-wide average in 2003 was 88.8%; most new-build, second-generation systems use 100% dedicated rights-of-way.

4.2 The Melbourne Tram Priority Response

Melbourne operates the fourth largest streetcar system in the world, totalling more than 240 route-kms and operating more than 34,000 trips per week. The streetcars – known as trams – serve all of the city's major downtown and inner suburban residential, office and retail districts. As in Toronto and other streetcar cities, Melbourne has attempted to improve the speed, efficiency and safety of its trams with peak-hour automotive restrictions, known as the Fairway concept. However, the regulations, road stripes and signage have not been effective; motorists violate the rules regularly.

Melbourne's trams are currently under study as part of a comprehensive review of all transportation infrastructure and services by the State of Victoria's Department of Infrastructure. Four investment options have been studied: "do-nothing, do-minimum, do-something and do-everything." The first two options have been rejected. The two preferred options include extensive measures to give trams greater priority, including increased private right-of-way operation. Also included are:

- greater enforcement of the automotive prohibitions on the tram Fairways;
- expansion of the tram priority traffic control and signaling; and
- reconstruction of the most congested portions of the lines, referred to as "redspots."

On July 16, 2004, the State of Victoria unveiled a first-phase, $30-million (Australian) Tram Priority Program for all the major retail areas and other strategic, congestion-prone approaches to the inner areas of Melbourne. To be implemented over the next two years, the program will use advanced traffic control technology and infrastructure to separate trams and motor vehicles to the maximum extent possible and improve speed and safety for transit riders, motorists, cyclists and pedestrians.

5.0 The Economic Benefits of Modern Streetcar Service

A study presented to the International Union of Public Transport determined that North American cities with modern streetcar service experience:

- 41% lower energy use per passenger-km. than cities with all-bus transit;
- 18% the level of energy use per passenger-km. of buses in bus-only cities;
- 14% lower automobile passenger kms. per capita;
- 22% less private transport energy use per capita;
- 23% lower total transport emissions per capita; and
- 38% fewer transport deaths per million people.

The economic spin-off of modern streetcar service upgrading with dedicated rights-of-way is less well known. Gathering data to equate these transit improvements with retail activity is a difficult task, often complicated by the fact that merchants are reluctant to provide detailed sales information for fear of weakening their competitive positions.

However, significant anecdotal evidence exists in cities that have inaugurated second-generation streetcar systems to suggest the impact has been anywhere from neutral to positive. Merchants – many of whom originally opposed the construction of these lines – have subsequently told reporters and researchers that business has increased since the introduction of streetcar service. As well, customers show a preference for streetcar service over the buses they have replaced.

5.1 San Diego Trolley

San Diego introduced the first all-new, second-generation streetcar system in the U.S. in 1981. It followed the same German designs employed in Edmonton and Calgary. Known as the San Diego Trolley, the system was intended to not only shift commuters out of their automobiles, but also lead to the adoption of transit-oriented land use principles and regulations. All of this has subsequently occurred in San Diego.

The San Diego Association of Governments (SANDAG), which is responsible for planning within the urban region, has several times studied the economic benefits of the streetcar system. The four studies conducted by and for SANDAG revealed:

- the San Diego Trolley caused a positive 10% benefit to hotel occupancy within one-half mile of stations (1992 study);
- the region received about $300 million in benefits from the local sales tax investment of $143 million in the construction of the streetcar system (1996 study);
- congestion relief related to transit saved $37.1 million annually, while air quality benefits provided by transit would cost $18 million per year to meet federally-mandated air quality standards (1996 study);
- the influx of $92 million of federal and state transit investment in FY 1993-1995 increased regional output by more than $101 million annually and supported 156 transit jobs and more than 1,400 private sector jobs (1996 study);
- the approximately 7,000 transit-dependent workers in the region contribute $140 million annually to the local economy (1996 study);
- about 80% of streetcar riders at the Fashion Valley and Mission Valley stations also shop at these malls as part of their trip (1997 survey);
- 57% of these riders said they would not have shopped at the malls without this transit service (1997 survey); and
- the average amount spent by these streetcar riders was $75 (1997 survey).

The San Diego Trolley system currently totals 73.6 route-km. and carries between 80,000 and 100,000 weekday riders. Of San Diego Trolley's total existing and planned mileage, 100% is or will be operated on dedicated rights-of-way.

5.2 Portland MAX

Where San Diego used its starter streetcar line as a means of introducing comprehensive, transit-oriented land use policies, Portland built its Metropolitan Area eXpress (MAX) to implement similar policies and regulations it had introduced from the 1970s onward.

The 24-km. starter line (Eastside MAX) opened in 1986, linking the city's downtown core with the adjacent Lloyd District and the eastside communities of Banfield, Burnside and Gresham. One of the key elements was its use of private rights-of-way, including roadway medians and off-street alignments that reclaimed portions of an old interurban electric railway line.

A 1996 study determined that the original Eastside MAX line had been responsible for $1.3 billion of development immediately adjacent to the starter line and had positively influenced property values along the route.

PORTLAND PROPERTY VALUES: 1980-1991

AREA	INCREASE
Countywide	67.5%
MAX Lloyd Center	134.0%
MAX 162nd Avenue	112.0%
MAX 181st Avenue	491.0%

MAX has also had a measurable effect on retail businesses adjacent to the line. In a 1987 survey of 54 businesses, "66% of business owners said that their businesses had been helped by being located near MAX. More specifically, 54% said they saw increased sales volume as a result of being located near MAX."

The MAX system now consists of three lines, with more planned. The system totals 71 route-km. and carries about 80,000 weekday riders. Dedicated right-of-way accounts for 99% of the MAX operation. A Portland Streetcar operation provides a trolley-style circulator service in conjunction with MAX, operating in mixed traffic in a brownfield redevelopment area. Although successful, it has experienced the motor vehicle conflicts and safety problems inherent in mixed-traffic, street running operation.

5.3 Dallas DART

The first Dallas Area Rapid Transit (DART) second-generation streetcar line was inaugurated on a 30-km., dedicated right-of-way in 1996. The eventual hub-and-spoke system was designed to work in concert with an all-new commuter rail line, increased bus service and land use planning reform to combat the high automobile usage and sprawl that was threatening the city's economic, social and environmental sustainability.

In 1999, University of North Texas researchers collected appraisal data for the period 1994-1998 on nearly 700 commercial and residential properties within a quarter-mile of 15 DART streetcar stations. A comparison with a control group of 160 properties in eight comparable areas not served by the DART streetcar line (but otherwise exhibiting similar neighbourhood characteristics) revealed:

- the increase in total valuations around DART stations was about 25% greater;
- the average appreciation of land values around DART stations was double;
- proximity to DART stations helped increase occupancy and rent levels for Class A and Class C office buildings and strip malls;
- retail sales growth in the DART-served central business district was higher than citywide growth;
- DART-served community retail properties (those with at least one major retail anchor) experienced a slight decrease in occupancy, but rental rates increased 29%;
- on-line neighbourhood establishments (convenience stores, personal services and supermarkets) saw a 3.3% increase in occupancy rates and 6.2% for rental rates; and
- adjacent strip retailers saw increases of 4.2% in occupancy rates and 18.4% in rental rates.

A 2003 University of North Texas study examined the economic impact of the DART streetcar service for the period 1997-2001, but using a slightly different methodology. The study determined that median values of residential and office properties increased more rapidly near the DART stations than they did in the control group (32.1% versus 19.5% in the case of residential and 24.7% versus 11.5% in the case of offices).

However, retail properties now showed no meaningful difference between those served or not served by DART. The researchers attributed this variance from the previous study to "the fact that retail growth during the boom years 1997 to 2001 was fairly evenly dispersed across Dallas County. Still, retail properties within one-quarter mile of DART stations are quite competitive and should fare well in the future as the LRT expansion improves access to these venues."

DART's second-generation streetcar system has more than doubled in size since the study periods; additional lines are under construction. There are now more than 50,000 weekday boardings on the 71.3 route-km. system, all operated on dedicated rights-of-way.

5.4 NJ Transit Hudson-Bergen Line

The Hudson-Bergen Light Rail Transit (HBLRT) Line is a light, rapid transit system built to remedy serious mobility and congestion problems created by explosive growth along the once-depressed west shore of the Hudson River, across from Manhattan. The HBLRT system, at full build-out, will stretch from Bayonne to Jersey City, Hoboken, Weehawken, Union City, West New York and North Bergen.

In 1996, NJ Transit awarded the contract to 21st Century Rail Corporation for the first segment of the planned 32.8-km. system. Washington Group International is the majority owner of 21st Century Rail (70%) and the prime contractor. Kinkisharyo International is the minority owner (30%) and responsible for the low-floor, second-generation streetcar fleet. Washington Group will operate and maintain the system through 2015.

Since the inauguration of the first 12-km. section of the HBLRT in 2000, it has had a significant economic impact all along its route. In Jersey City, the increase in property development since the opening of the line's first phase in 2000 has been dramatic:

TIME PERIOD	DEVELOPMENT (SQUARE FEET)
1974-2001 (without HBLRT)	8,703,000 (actual)
2001-2003 (with HBLRT)	6,660,000 (actual)
2003-2005 (with HBLRT)	10,376,000 (approved)

As well, a study by New Jersey City University predicts a wide variety of commercial, residential and institutional investment in Jersey City along the HBLRT, including:

- Liberty Tower observation deck and media transmitter;
- expanded Liberty Science Center;
- 400-unit Liberty Harbor North residential development;
- 900-unit "transit village," including affordable housing; and
- three new high schools.

Since HBLRT's construction, Bayonne has experienced:

- in general, property valuation increases of 40%;
- rental residential rate increases of 60%;
- a 500% increase in building permits for substantial rehabs;
- residential property sales increases from an average $130 per square foot in 2000 to the $200-300 per square foot range in 2002; and
- almost every building is in redevelopment along the HBLRT corridor on Prospect Avenue, once the most depressed economic area in Bayonne.

Consultation with city councils and the public ranked high in the planning and construction of HBLRT. When the City of Hoboken disputed the alignment along the waterfront, business leaders to the west lobbied the Governor and elected officials to relocate it to support their ethnic businesses and small property owners. Although a Hoboken planner stated initially there was little effect on development as a result of the HBLRT, real estate professionals disagreed. Lower cost properties in the western section now have quick access to downtown businesses, as well as to intermodal transfer centres. New mixed-use buildings, artists' studios and apartments are popular, starting at $375,000 for sale and $1,850 - $3,550 per month for rentals.

The HBLRT currently serves an average of 15,700 weekday riders and is expected to increase to more than 100,000 daily when completed in 2010. The system will be at completion 88% in reserved rights-of-way.

6.0 Summary and Conclusions

The streetcar has made a remarkable comeback in North America in the last quarter-century. Prior to Toronto's 1972 reversal of its earlier decision to abandon its streetcars, many transit professionals saw little future for this technology. Now, it is being touted as the preferred transit mode for tomorrow.

Using tried-and-true principles developed on this continent before the Second World War – and improved in Europe afterward – the streetcar has evolved into a modern, efficient and cost-effective transit mode. It is increasingly filling the intermediate-capacity niche between buses and heavy rail technologies. This renaissance has yielded a wide variety of technical design responses to address local travel patterns and urban conditions. One size does not fit all. Advocates have made the point that this is one of the key attributes of modern streetcars: they are easily adaptable and applicable to specialized conditions.

However, common threads have emerged from the experience of all modern streetcar system operators. These include:

- the adoption of transit-oriented land use policies and guidelines in order to justify the investment in new streetcar capital and operating costs, generate ridership to make them cost effective and realize a full range of economic, social and environmental benefits;
- the necessity of streetcar priority to give them the speed and freedom from congestion to make them competitive with motor vehicles, through both pre-emptive signaling and physical segregation along their routes, as proposed in the reconstruction and upgrading of the TTC's St. Clair line;
- the re-design and re-engineering of the streets served by these transit lines in order to improve their utility for all users and, in many cases, reinvigorate deteriorated or declining corridors and neighbourhoods; and
- the adoption of a wide range of complementary street improvements, including tree planting, landscaping and installation of street art and furniture.

Every North American city that has followed this pattern has faced some opposition from residents and merchants fearful of the changes. Both quantitative and qualitative analysis has confirmed that new streetcar systems operating on dedicated rights-of-way have been beneficial to residents and businesses, including here on Toronto's Spadina Avenue.

Once on the brink of extinction, modern streetcar service is now thriving. With at least 30 additional North American cities building, planning or studying new lines, the streetcar renaissance shows no signs of letting up. Indeed, it is accelerating.

1.0 **Introduction**

> *"… the best course of action for Toronto's transit riders is upgrading the present streetcar system. We urge the Public Works Committee to recommend this course of action to City Council and that City Council request that the [TTC] adopt a streetcar improvement policy…"*
>
> Streetcars for Toronto Committee, Oct. 23, 1972

When the members of the City of Toronto Public Works Committee accepted and endorsed that recommendation 32 years ago, it helped set in motion a revolution in North American transit, reversing the earlier decision to scrap Toronto's remaining streetcars by the early 1980s. That reversal was reached as the result of the campaign by an ad hoc transit users' group and two municipal politicians, all of whom felt the streetcar should play a larger role in the transportation mix required by this city.

This decision to permanently maintain the streetcars as vital components of the city's multi-modal transit system helped influence the handful of other North American cities that had retained portions of their systems. The TTC was already seen throughout the transit world as a modern and progressive system that provided one of the most efficient and effective services on the continent. With this reputation, the TTC's acceptance of the recommendations by the Public Works Committee and City Council to retain and improve the largest remaining streetcar system on the continent was viewed with respect. It confirmed that streetcars did still have a role to play in the provision of modern transit service. Toronto's decision became a touchstone for citizens, planners and politicians in other cities in their campaigns to modernize or even build their own all-new systems.

Shortly after that decision was made unanimously by the TTC commissioners, a streetcar renaissance began in North America, reversing a 25-year trend of streetcar abandonment. Today, this renewed interest in and application of modern streetcars is accelerating. Since 1978, 26 new systems have been built in cities that had abandoned their streetcars decades before. Most of these "new build" systems have been expanded, some several times. More than 30 additional North American cities are building, planning or proposing new, second-generation streetcar systems.

This report reviews the historical background of North American streetcar service, the European experience in advancing the technology and techniques in the post-war era, and the application of that experience in the North America renaissance since the 1970s. Particular emphasis is given to the issue of streetcar priority, especially in terms of right-of-way separation from motor vehicle traffic. A review of the resultant economic benefits in four major urban centres that have followed this course is highlighted.

2.0 **The Streetcar Revolution**

> *"It was the electric streetcar that proved to be the most potent force of all in determining the shape, quality and direction of American city growth."*
>
> *The Streetcar: Shaper of American Cities*, George M. Smerk in Traffic Quarterly, 1967

With the possible exception of the elevator, no urban transportation device had as great an impact on the shape and size of North American cities during the first half of the 20th century as the electric streetcar. One of the first demonstrations of this city-changing machine was given by Belgian inventor Charles Van Depoele at the 1883 Toronto Industrial Exhibition (now the Canadian National Exhibition).

Perfected and implemented in Richmond, Virginia, in 1888 by U.S. inventor Frank J. Sprague, the streetcar enabled cities to grow outward in linear form along city streets and on private rights-of-way, pushing cities far beyond their 19th century limits. They offered the first form of mass transportation over greater distances, at higher speeds, in greater comfort and at lower cost than the horse cars that preceded them. Electric streetcars brought freedom and mobility to a population that rarely could afford horse-drawn carriages in the era before mass-produced automobiles.

Toronto began electrifying and expanding its network of horse car lines in 1892 and completed the job in 1894. And with this conversion there came expansion. As in every major North American city, the development of whole new "streetcar suburbs" occurred in Toronto in the first three decades of the 20th century. Prime examples include:

- Moore Park;
- Upper and Lower Beaches;
- The Danforth;
- Bloor West Village;
- Long Branch; and
- St. Clair Avenue West.

Most of the established, stable residential and retail districts of today's Toronto developed because of the expanding streetcar network in the early 20th century. Streetcars provided fast, frequent and convenient travel to jobs, shopping, schools, medical services and entertainment that made these areas viable and attractive.

DEVELOPMENT FOLLOWS THE STREETCAR
The intersection of St. Clair Avenue West and Spadina Road demonstrates the impact of the streetcars, which transformed the area from an undeveloped rural tract in 1911 to a thriving, transit-oriented community by 1913.

Both photos: James V. Salmon Collection, City of Toronto Archives, Fonds 1231, Items 1772 and 1786

Only the largest and most densely populated North American cities – such as New York, Boston, Philadelphia and Chicago – could justify the construction of subways or elevated rapid transit lines in this period. With little interference from horse-drawn vehicles and the limited number of automobiles, streetcars could travel on city streets at speeds close to those provided by these heavier and more costly forms of rail transit.

However, some cities extended the benefits of streetcar service by constructing sections of dedicated rights-of-way, elevated track, tunnels or completely private, railway-like rights-of-way separate from the street grid to circumvent local street congestion without the high cost of conversion to heavy rail technologies.

Toronto had a prime example of this higher-order infrastructure in its St. Clair Avenue West line. When it opened in 1913, the St. Clair line was separated from the roadway from Yonge Street to Caledonia Road, then the western end of the line.

The original St. Clair streetcar reservation was taken away from the TTC between 1928 and 1935, when it was paved over to create more automotive capacity and, later, as a make-work project for unemployed Torontonians suffering through the Great Depression. The loss of the right-of-way was not serious at that time because automotive traffic was still not heavy enough to cause major delays to the streetcars. This situation changed when traffic volumes grew, creating conflicts between streetcars and motor vehicles.

PRIORITY REVOKED
Reconstruction of St. Clair between 1928 and 1935 eliminated the original dedicated right-of-way in favour of increased automotive capacity. The loss has since become an impediment to the provision of fast and reliable transit service.

Left photo: TTC Collection, City of Toronto Archives, Series 71, Item 6240; lower photo by Greg Gormick

Increasing income, the declining cost of mass-produced automobiles in the late 1920s and an inability to fully modernize and improve many streetcar systems began to threaten their dominance in urban transport. As costs climbed and the impact of the automobile increased, modernization could be justified only on the busiest lines.

On a national basis, streetcar mileage in Canada peaked in 1920, but ridership didn't reach its zenith until 1946. This dichotomy reflected the fact that large systems, such as Toronto and Montreal, were experiencing increased patronage on their streetcar routes, but many smaller communities were abandoning them because they were excessive for their low-density needs, especially in the face of rising private automobile usage.

Automotive advances resulted in comparable improvements in bus technology. Buses, with lower initial cost, were used increasingly in smaller cities as streetcar substitutes on routes with low traffic demand. Some small transit systems converted to all-bus operation to avoid the higher capital costs of renewing or expanding their streetcar lines.

The TTC and many other large urban transit systems took a different course, using the new buses – with their lower per-vehicle and route capacity – to feed traffic from low-density routes to the primary, high-capacity streetcar lines.

The depression of 1929-1939 halted any further expansion of the TTC's streetcar system, just as it did in other North American cities. Ridership and revenues fell sharply due to massive unemployment. Government-funded road construction, as a means of providing relief employment, further undermined transit's supremacy in the urban market by making more automotive infrastructure available at no direct cost to users. New streetcar routes were postponed pending an economic upswing.

Nonetheless, the transit industry took steps to increase the efficiency and attractiveness of their existing streetcar systems, even in the face of the decline. Twenty-eight North American transit systems and 26 suppliers banded together to form the Electric Railway Presidents' Conference Committee (PCC) to co-operatively design an advanced streetcar that could be applied with little modification to all systems throughout the continent.

The result was the introduction of the PCC car in 1936. Smooth, fast and lighter than the older rolling stock then in use, the PCC modernized the image of rail-based transit, attracted new riders, improved operating speeds and reduced costs. Toronto received its first PCC in 1938 and ultimately acquired the world's largest fleet of 744 "streamliners."

The PCC had a positive effect on streetcar operation in many major cities, but it wasn't a panacea. As the Great Depression wore on and transit ridership continued to decline, additional small and medium-sized transit systems converted streetcar routes or entire systems to bus operation to match capacity and costs with decreased transit demand.

STREAMLINED SAVIOURS
The Presidents Conference Committee (PCC) car improved the quality, performance and attractiveness of streetcar service in the face of increased automotive competition in large cities in the 1930s and '40s. The TTC received its first in 1938 and ultimately had the world's largest fleet of 744.
Photo by Greg Gormick

This trend of streetcar-to-bus conversion stopped with the declaration of war in Canada in 1939 and in the U.S. in 1941. Government-ordered tire and gasoline rationing, and a prohibition against new automobile production, followed the outbreak of the Second World War. These factors, plus the surge in war-related industrial employment, stimulated massive transit ridership increases. Ironically, this traffic surge left streetcar systems with deferred maintenance and the need for high capital investment in their overworked infrastructure and rolling stock.

When the Second World War ended in 1945, many transit systems chose to reduce or eliminate their streetcar systems. The reasons varied from city to city, but included:

- the high cost of physically renewing systems mechanically exhausted by heavy wartime use;
- the lower, up-front capital cost of diesel buses and electric trolley buses, which also enabled transit systems to eliminate track and related road paving costs;
- technical improvements in bus design and construction resulting from government-funded, production-driven wartime industrial research and development;
- decreased transit demand due to increased income, automobile sales and use;
- new, low-density suburban development beyond the limits of the old city streetcar systems, generating transit ridership that could, at best, support only bus services;
- decreased residential and commercial activity in the older "inner city" areas served by streetcar lines, resulting in a significant drop in ridership in many cities;
- union staffing agreements that required some systems to operate streetcars with two-man crews, but allowed for bus operation with one employee; and
- traffic engineering schemes that converted streets to one-way flow to increase automotive speeds, but rendered unusable the bi-directional, double-track streetcar plant.

Under all these negative influences, streetcar research and development ceased as many cities replaced their systems with buses and, in a few cases, heavy rail subway lines. Many cities that retained their streetcars planned for gradual, long-term replacement with subways on the highest-demand routes and diesel or electric trolley buses on the others.

In the 1950s, the TTC followed this course, too. The streetcar system met the traffic demands of many major routes, remained popular with Torontonians and represented an investment that could not be prudently abandoned and replaced with other modes. The plan was for slow abandonment over a 25-year span, as it came due for physical renewal.

Some routes were abandoned – notably as part of service realignments coincident with the opening of the Yonge, University and Bloor-Danforth subways – but a large system remained at the end of the 1960s. In 1972, the TTC set a definite timetable for the elimination of the remaining routes by the early 1980s, when new rolling stock and major track rebuilding would have been required. Citizen and political opposition resulted in the decision to retain, expand and modernize the system.

By 1975, the only municipal transit systems in North American cities still operating streetcars were:

- Toronto
- Newark
- Pittsburgh
- New Orleans
- Mexico City
- Boston
- Philadelphia
- Cleveland
- San Francisco

In almost all of these cases, one factor primarily accounted for the retention of the streetcars: physical separation and freedom from automotive interference. In his 1987 article, *From streetcars to light rail: A centennial perspective*, published in the trade magazine, Railway Age, author William D. Middleton observed:

"Perhaps the best early example was afforded by Cleveland's Shaker Heights line, completed in 1920. The inner portion of the 24-km. line was built in private rights-of-way, while two outer branches were laid in broad boulevard medians.… Trolley car subways, tunnels, private rights-of-way or extensive centre median operation gave surviving streetcar systems many of the same congestion-free advantages. Only Toronto continued to operate a significant system of conventional streetcar lines in urban streets."

RIGHT-OF-WAY, CREOLE STYLE
New Orleans' St. Charles line links downtown and an outer residential area with a dedicated and landscaped right-of-way, known as "neutral ground." This design has also been used for the new Canal Street line and will be applied to further system expansion in the near future.
Photos by Greg Gormick

This separation of transit from automotive traffic was applied extensively in Europe, where streetcar abandonment had not duplicated the North American experience. It was from Europe that some North American transit planners, managers and politicians – dismayed by the overall decline of transit's market share in the post-war era – would draw their inspiration for a new approach to transit in the 1970s and '80s.

3.0 **The Post-War European Experience**

> *"… increasing numbers of North Americans were traveling to northern Europe, including some who were interested in transit revival. The difference between what they were experiencing at home and what they saw in northern Europe was stunning and galvanizing."*
>
> *Defining an Alternative* by Gregory L. Thompson, 2003

The electric streetcar revolutionized urban transport in Europe in the late 19th century, just as it did in North America. However, the rapid growth of automobile ownership after the First World War did not occur in Europe. The continent remained much more dependent on mass public transportation than North America. Subways or metros were constructed in some major European cities and replaced some of the most heavily-trafficked streetcar lines, but the remaining routes were vital components of these multi-modal urban transit systems.

As well, buses were generally added to these systems only as feeders, not replacements for the streetcars, similar to the approach employed by the TTC from the 1920s to the 1940s.

As in North America, European streetcar systems did yeoman work during the Second World War. Many were not just deteriorated from heavy use at the cessation of hostilities in 1945, but also physically damaged from Allied bombing. In the rebuilding of Europe after the war, the production of private automobiles and road infrastructure ranked well behind the need to reconstruct the tramways, railways and other forms of mass transportation to support economic and physical renewal.

With little or no domestic oil, plentiful electricity from hydro and fossil fuel thermal generating stations, and limited space in which to build within centuries-old cities, Europeans remained more committed to public transit than North Americans – even after reconstruction and economic rejuvenation. In combination with expanded commuter rail, subway and bus service, the streetcar still had a major role to play as an intermediate-capacity technology that "fit" the European model.

The result was a series of technological and operational advancements, including:

- faster, larger and lighter weight rolling stock to increase speed, capacity and productivity (many using updated North American PCC design elements);
- better trackwork that provided a smoother and quieter ride;
- lighter, less obtrusive overhead wiring and more efficient distribution systems;
- pre-emptive transit-priority signaling at intersections; and
- progressive conversion of mixed-traffic street running to reserved rights-of-way.

While it declined in North America and elsewhere, streetcar development and usage surged in Europe. An initial period of doubt in the 1950s in cities such as Amsterdam was quickly replaced by enthusiasm that resulted from detailed studies of the potential benefits of investment and, in particular, increased

separation of streetcar rights-of-way from adjacent roadways. Germany was first and foremost in this renewed interest and development of the streetcar.

What emerged in Europe was not so much a second streetcar revolution as an evolution. It had become apparent to many European transit planners and system operators that not all transit services could be provided by either buses or heavy rail transit systems, such as subways and commuter trains. There existed a legitimate need for the type of flexible, intermediate capacity service that could be provided by streetcars, which had the additional benefit of being expandable and upgradable on an incremental basis.

GOING DUTCH
Amsterdam's large tram system typifies the European approach with extensive use of dedicated rights-of-way designed to blend with their surroundings, as demonstrated by this grass-paved line in a residential district.
Photo by Gareth Rosenau, Federal Railroad Administration

In addition to upgrading of the rights-of-way through modal segregation, there came such elements as bicycle lanes, pre-emptive transit priority signaling at intersections, high-tech schedule information systems and advanced fare collection equipment. In combination, these various advances made transit even more attractive in these progressive European cities. All this was accomplished without disturbing the social and economic activities on these "tram streets." The European approach is to not just re-engineer the streetcar line, but every element of the street: traffic lanes, parking, taxi stands, traffic management systems, cycling lanes, sidewalks, lighting and all aspects of "street furniture."

This total re-engineering of streets is based on a European concept known as lateral segregation. It assumes streets are multi-purpose corridors that must accommodate a wide variety of travel by various modes and at various speeds. The means of integrating these various and seemingly conflicting flows is to segregate them into their own areas of the street, but preventing conflict at the points where they meet, namely intersections. A portion of the street is clearly assigned to each mode with lanes for exclusive transit, bicycle and motor vehicle use and broad sidewalks for pedestrians. Each is usually physically segregated from the other, often with curbs and landscaping.

Conflict at intersections is eliminated with phased or prioritized signaling, which favours the more efficient modes. This lateral segregation improves the speed, safety and capacity of the street as a whole. With road space frequently limited in European cities – particularly in the historic, protected downtown cores and older neighbourhoods – lateral segregation calms a street while it also energizes and wrings the maximum utility from it.

NOT JUST ABOUT STREETCARS
In Amsterdam and other European cities, modern streetcar lines include transit-preemptive signaling (left), real time arrival information displays (right) and sharing of some rights-of-way with taxis, buses and emergency vehicles (far right).
Photos by Gareth Rosenau, Federal Railroad Administration

As well, the connection between transportation and land use planning was made more decisively at an earlier date in Europe. Planners understood the potency of transit as a growth management tool and how, in transit-dependent cities, growth could be sculpted and even encouraged without ripping apart or discarding the existing urban form and its social and economic patterns.

Modernized, expanded streetcar systems were viewed more positively in European cities because they could be inserted into an urban environment more easily than other forms of public or private transport. And at lower cost in the long term.

Not every European city embraced the streetcar in the post-war era. By the early 1970s, all but a handful of cities in Great Britain, France and Spain had eliminated their urban streetcar systems. But, as traffic congestion mounted in the major cities of these nations, and the positive experience with modern streetcars could be observed in the nearby cities of other countries, a second wave of streetcar building began.

Since 1975, modern streetcar systems have been inaugurated in more than 30 diverse European cities, including:

- Essen (1977)
- Grenoble (1987)
- Manchester (1992)
- Strasbourg (1994)
- London/Croydon (2000)
- Nottingham (2004)
- Newcastle (1980)
- Genoa (1990)
- Paris (1992)
- Barcelona (1997)
- Lyon (2001)
- Dublin (2004)
- Utrecht (1983)
- Lausanne (1991)
- Sheffield (1994)
- Birmingham (1998)
- Bordeaux (2003)
- Athens (2004)

SHOPPING DAY
In the retail and business districts of many European cities, high-capacity streetcars on dedicated rights-of-way comfortably share the thoroughfares with pedestrians, cyclists and motor vehicles. Both median alignments on bi-directional streets and side-of-the-road configurations on one-way boulevards are used, as shown here in Budapest (left) and Milan (right).
Left: photo by John Turner; Right: photo by Yves-Laurent Hansart, courtesy of the Light Rail Transit Association

All of these systems have been built to service-proven standards that include reserved rights-of-way, usually in street medians in the often cramped and economically vibrant central business districts. Many of them link well-established downtown business and retail districts with inner and outer residential neighbourhoods, as well as leisure and tourist attractions. In European cities where the streetcars have long been part of urban fabric, the conversion of mixed-traffic, open street running routes and the construction of new lines in reserved rights-of-way is underway, too.

Milan, for example, has embarked on a program of expansion and upgrading, using portions of many existing lines as its basis. This new, four-route system-within-a-system is called Metrotramvia and will make extensive use of new, reserved right-of-way operation through and beyond the well-established heart of the city. As with many other Milan routes already operated on private rights-of-way, the new ones will be extensively landscaped and accessorized to harmonize with their surroundings.

The Milan transit authority, Azienda Transporti Milanesi, has also adopted a program for "the protection of the main tramway lines by either creating reserved lanes or changing the routing of private traffic so that the routes private cars follow are different from those followed by public transport."

Experience in European cities that have built new streetcar systems – and those, such as Milan, that have historically relied on theirs – has proved that streets with this form of rail-based priority transit tastefully integrated into them become more vibrant, appealing and productive. One of the most prestigious and attractive shopping streets in Europe is Zurich's Bahnhofstrasse, which is filled with high-end retail establishments. It is a main route for many of Zurich's modern trams. It is also an automobile-free thoroughfare.

These European experiences and influences began migrating to North America in the 1970s. They have helped shape what has been a revolution in transit and transit-oriented development in many cities that found buses, subways and commuter trains were insufficient to attract motorists and halt automotive-dependent urban sprawl.

WORLD'S LARGEST STREETCAR SYSTEMS: 1998

CITY	ROUTE KM
St. Petersburg, Russia	344.0
Budapest, Hungary	332.0
Katowice, Poland	245.0
Melbourne, Australia	238.0
Moscow, Russia	220.0
Sofia, Bulgaria	220.0
Milan, Italy	205.5
Cologne, Germany	188.5
Vienna, Austria	188.0
Berlin, Germany	178.0
Bucharest, Romania	155.0
Leipzig, Germany	152.6
Warsaw, Poland	148.0
Kiev, Ukraine	139.9
Amsterdam, Holland	138.0
Brussels, Belgium	134.0
Tashkent, Uzbekistan	133.8
Kharkiv, Ukraine	132.2
Dresden, Germany	129.6
The Hague, Holland	128.1
Oslo, Norway	128.0
Prague, Czech Republic	125.0
Turin, Italy	123.0
Toronto, Ontario	**79.6**

Source: Light Rail Transit Association

4.0 **The Streetcar's Second Generation**

> *"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."*
>
> James R. Mills, California State Senator, 1975

By the early 1970s, both transit and mobility in many North American cities were at their nadir. The social, economic and environmental ramifications of allowing the automobile to become the principal means of urban transit were increasingly identified. A means of dramatically and economically improving transit as an alternative was required.

The streetcar was seen as an intermediate-capacity solution. Planners now realized it was, in modern form, capable of drawing commuters out of their automobiles and sparking the social and economic renewal of inner-city areas – many of which had deteriorated badly in the U.S. – and reform land use in outer suburban areas.

What had been discovered through the post-war era of streetcar abandonment was that a transit capacity and technology gap had been created. European studies, in particular, revealed there were peak-hour capacity ranges for each transit technology. Based on cost, speed and passenger preference, these generally accepted ranges are:

- 10,000-40,000 persons/hour: subways and metros;
- 2,000-20,000 persons/hour: streetcars; and
- less than 5,000 persons/hour: buses.

Second-generation streetcar systems, operating in dedicated rights-of-way, also exhibit many other intermediate characteristics. With their ability to operate without expensive tunneling and station facilities, modern streetcar systems cost about one-fifth of subways of similar length. With higher acceleration and braking abilities, they also operate at average speeds competitive with or even in excess of other transit modes. On an eight-km. route with stops at 450-metre intervals and a five-minute layover at each end, second-generation streetcars can provide a round trip time of 47.2 minutes, compared with 54.8 minutes for buses and 42.6 minutes for subways.

Consequently, by abandoning their streetcars, many North American cities put themselves in an "either/or" transit situation. They had left themselves with either heavy rail systems for the busiest routes or buses, suitable for those with much lower ridership. This modal capacity/technology/cost gap partially accounted for transit's falling share.

One reason the TTC had not experienced this loss of ridership in this period was its maintenance of a mixed-technology system, where each mode did what it does best. Long viewed within the industry as a model of pro-transit planning and operation, Toronto solidified its reputation in this regard when, as previously discussed, it voted to retain, modernize and expand its streetcar system in 1972. Since that decision was made, the TTC has undertaken a series of improvements to its streetcar system, including:

- purchase of 196 Canadian Light Rail Vehicles (CLRV) and 52 higher-capacity Articulated Light Rail Vehicles (ALRV), which TTC staff helped design;
- progressive rebuilding of the track, overhead and power distribution systems;
- construction of the Harbourfront and Spadina lines, along with a connecting link between the Harbourfront and Bathurst lines, all on private rights-of-way; and
- planning and design of additional reserved right-of-way lines, including Waterfront East and West, and conversion of St. Clair to these standards.

A similar re-evaluation and renewed commitment to the streetcar as a flexible, intermediate-capacity transit technology occurred in seven U.S. cities that had retained but reduced their once-massive systems. Following Toronto's lead, these cities reversed their previous phase-out decisions. One major contributor to the decisions to retain and expand streetcar operation in all these U.S. cities was the percentage of these systems operated with transit-only infrastructure.

COAST-TO-COAST RENAISSANCE
Following the TTC's 1972 decision to retain, modernize and expand its streetcar system, all the other remaining North American systems followed. From Boston's Massachusetts Bay Transportation Authority (left) to San Francisco's Municipal Railway (right), successive fleets of European-inspired rolling stock have been purchased.
Photos by Edward Finglas, courtesy of the Light Rail Transit Association (left) and Jon Bell, courtesy of Light Rail Central (right)

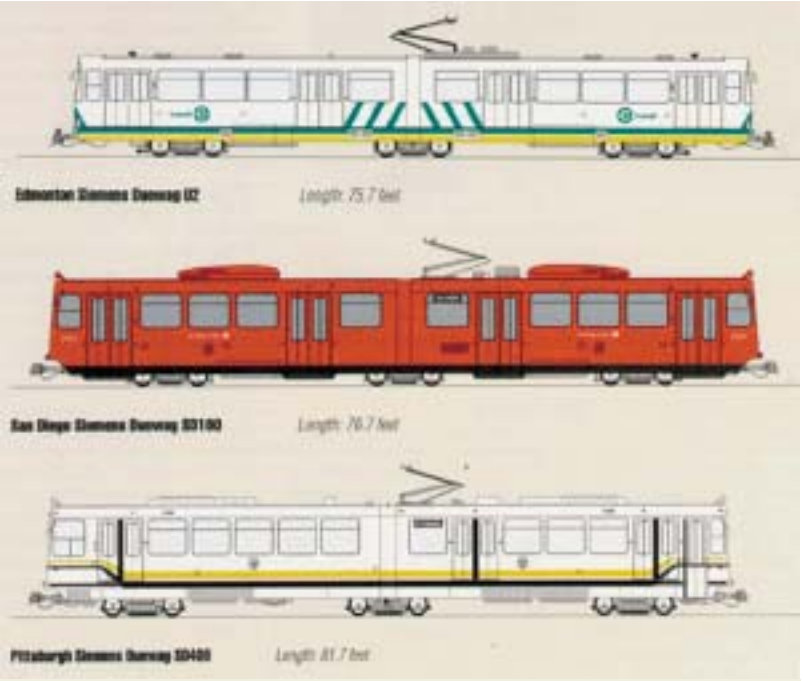
But cities that had abandoned their streetcar systems began looking seriously at reintroducing them, too. The experience in Europe and the North American cities that had retained their streetcar systems offered compelling proof that, in modernized form, streetcar service could lure riders out of their cars and

contribute significantly to residential and commercial renewal plans. These would not be exact replications of the abandoned lines, but second-generation systems employing the best of European design and operating techniques, built on alignments giving them priority over motor vehicles.

The turning point in the reawakened professional interest in streetcars was the first National Conference on Light Rail Transit, held in Philadelphia in 1975 and sponsored by the Transportation Research Board (TRB), a body of the U.S. National Academies. This renewed interest resulted in the adoption of a phrase not commonly used in Toronto: light rail transit (LRT). It became standard terminology in the U.S. partially because planners and operators wanted to differentiate modern streetcars from the often neglected and deteriorated systems that existed in many cities at the end of the first streetcar era.

TRB defines LRT as "a metropolitan electric railway system characterized by its ability to operate single cars or short trains along exclusive rights-of-way at ground level, on aerial structures, in subways or, occasionally, in streets, and to board and discharge passengers at track or car floor level."

Because this phrase has never come into common usage in Toronto – indeed, many European cities continue to refer to their systems as tramways – the term LRT is used in this report only when it occurs within the titles or text of reports being quoted.



NIMBLE AND VERSATILE
Service-proven European designs, such as the Siemens-Düwag U-2 series rolling stock, were easily adapted to local North American requirements and demonstrated the flexibility of the technology early in the streetcar renaissance.
Drawings courtesy of Siemens Transportation Systems

But no matter which name is used, by the mid-1970s, North American urban and transit planners began to take note of the advantages Europeans enjoyed because they had advanced – not destroyed – their streetcar systems. Edmonton was the first to adopt light rail as the transit route to the future, opening its first European-style line in 1978. Calgary followed in 1981, duplicating Edmonton's European-style infrastructure and using the same Siemens-Düwag U-2 cars, originally built for Frankfurt. In cookie cutter fashion, San Diego inaugurated an identical system that same year. The North American streetcar revolution and renaissance had begun.

Since 1978, second generation systems have been introduced in 26 North American cities, totaling nearly 1,000 route-kms and more than $20 billion (U.S.) in capital investment. All nine of the first-generation systems have been substantially upgraded and/or expanded. Additionally, the American Public Transportation Association reports more than 30 second-generation systems under construction or study and planning, including:

- Montreal
- Quebec City
- Nashville
- Milwaukee
- Seattle
- Ottawa
- Norfolk
- Louisville
- Austin
- Honolulu
- Kitchener-Waterloo
- Raleigh/Durham/Chapel Hill
- Columbus
- Phoenix
- Washington, D.C.

THE RENAISSANCE ROLLS ON
Since 1978, 26 North American cities have built all-new streetcar systems. The most recent is Minneapolis, which opened its Hiawatha Line on June 26, 2004, shown here on its dedicated right-of-way in the downtown. More than 30 other cities are building or planning similar new systems.
Photo by Gary Ulmer and courtesy of www.nycsubway.org

The acceptance of the modern streetcars in cities that abandoned their systems decades ago is the result of many factors, some difficult to quantify. One of the most overlooked factors is passenger preference. At the International Union of Public Transport (UITP) Fifth Light Rail Conference in Melbourne, Australia, in October, 2000, Jeff Kenworthy and Felix Laube, of Murdoch University, Perth, Australia, reported:

"Some of the issues that have been raised, particularly in comparing the relative merits of light rail transit versus buses are:

- comfort and convenience factors…;
- schedule reliability;
- the issue of transfers between modes;
- inherent passenger appeal, including width of aisles, smoothness, odour/engine noise, all-weather reliability and other environmental factors;
- "The Sparks Effect" – increased passenger appeal of an electric system over diesel system observed in all new rail electric systems; and
- route understandability of light rail transit versus buses."

NORTH AMERICAN STREETCAR/LRT CONSTRUCTION: 1978-2005

CITY	YEAR	ADDITIONS	ROUTE KM	INVESTMENT (US $ MILLIONS)
Edmonton	1978	1981/1983/1989/1992/2005	13.1	288
Calgary	1981	1985/1987/1990/2001/2003/2004	35.7	477
San Diego	1981	1986/1989/1990/1992/1995/1997/2005	82.5	1,380
San Francisco	1982	1991/1995/1998/2000/ 2005	28.9	1,078
Buffalo	1985	1986	10.3	650
Pittsburgh	1984-87	2004	40.0	1,093
Portland	1986	1998/2001/2004	78.8	1,843
Sacramento	1987	1998/2003/2005	64.7	728
San Jose	1987-91	1999/2001/2004/2005	67.6	1,607
New Orleans	1988	1990/1998/2004	21.8	228
Mexico City	1988	1991	29.8	N/A
Guadalajara	1989	1994	23.8	600
Toronto	1990	1997/2000	6.8	118
Los Angeles	1990	1994/2003	90.3	2,263
Monterrey, Mexico	1991	1994	24.0	570
Baltimore	1992	1997	39.9	624
St. Louis	1993	2001/2003	62.0	765
Memphis	1993	1997/2004	10.5	84
Denver	1994	2000/2002	25.3	300
Dallas	1996-97	2001/2002/2004	71.3	2,039
Cleveland	1996	(in planning)	3.5	55
Salt Lake City	1999	2001/2003	30.4	520
Hudson-Bergen, NJ	2000	2002/2003/2004/2005	25.8	1,287
Newark	2001	2002 and 2005	3.2	325
Ottawa	2001	(in planning)	8.0	10
Tampa	2002	(in planning)	3.8	27
Tacoma	2003	—	2.6	80
Houston	2004	(in planning)	12.0	324
Trenton-Camden, NJ	2004	—	55.5	1,100
Minneapolis	2004	2004	19.3	715
Philadelphia	2004	—	13.5	56
Little Rock	2004	(in planning)	3.2	20
Charlotte, NC	2004	(under construction)	3.2	17
TOTAL			**1,011.1**	**21,271**

Sources: Railway Age, Tramways & Urban Transit and John W. Schumann, LTK Engineering Services
Note: Includes major upgrade projects and new heritage lines integrated with urban transit systems.

This "Sparks Effect" has long been known throughout Europe. In his book, *Light Rail Transit Today,* author M.R. Taplin noted:

"The visible presence and permanence of a light rail line have been found to be an important traffic generation factor in comparison with a bus route, where there seems to be a greater element of uncertainty until the vehicle appears. This psychological consideration has been measured in The Hague, Holland, where a self-contained bus route operated with modern vehicles was directly replaced by an LRT line. In the first year after conversion, traffic increased by 22% overall and 32% in the off-peak, indicating the in-built attraction of rail transit."

The many new-build U.S. systems have reported on this passenger preference for streetcars over buses. Houston's Metropolitan Transit Authority President and CEO, Shirley A. Delibero, told *Mass Transit* magazine:

"… the interesting thing that you see throughout the country – and I haven't figured the whole phenomenon of this – there are a lot of people who won't ride on a bus who will ride on rail. We saw it here during the Super Bowl. We knew that we were going to have so many people that I needed buses as well as rail, especially to take people to the game. So, we had buses lined up … and people wouldn't get on the buses."

In their report, *The Role of Light Rail in Urban Transport Systems: Winning Back Cities from the Automobile*, Kenworthy and Laube quantified the difference in performance and the impact of transit systems that rely exclusively on buses and those that have made modern streetcar lines the backbone of their operations. They compared the performance and effectiveness of Ottawa's OC Transpo and Calgary Transit, with its extensive, modern C-Train streetcar operations, and observed:

"… OC Transpo's boardings declined from 111 million in 1991 to 91 million in 1996, which represents an 18% absolute decline in transit ridership, while the serviced population has increased by 8%. Calgary, a similar size city with a light rail backbone similar in extent to Ottawa's busway system (29 km. of dedicated right-of-way in Calgary vs. 26 km. in Ottawa), has increased ridership over the same period by 30% with a serviced population increase identical to Ottawa's 8%. The implication is that if Ottawa has reached its targets, the target must have foreseen a gradual phase-out of transit, because this kind of transit performance would not normally be applauded. The difference is that in Calgary, the system has been integrated to cultivate transfers and capture new riders and varying trip purposes."

It should be noted that Ottawa has since established a variant, diesel-powered light rail line in the western suburbs, near Carleton University, and is seriously contemplating a massive, electrically-powered streetcar system for the entire urban region, as well as electrification of the demonstration line.

STAMPEDE CITY TAKES TO THE RAILS

After a gap of 31 years, streetcar service returned to Calgary and was immediately successful, leading to system expansion that continues today. The three-line C-Train service uses a transit-only right-of-way downtown (left) and dedicated median alignments similar to Toronto's Queensway elsewhere (right).

Photos by Neil McKendrick, courtesy of the Light Rail Transit Association

4.1 **Rights-of-Way and the Renaissance**

> *"… the right-of-way category is usually the most important factor determining transit system performance and its ability to attract passengers."*
>
> *Place of Light Rail Transit in the Family of Transit Modes,* Vukan R. Vuchic, University of Pennsylvania, 1975

Speed and the ability to compete with the automobile on a time basis are among the chief factors in the success of modern streetcar systems such as Calgary's C-Train. Mixed-traffic running – which still constitutes the bulk of the TTC's streetcar operation – is minimized on new systems throughout North America and other continents. In some cases, these new lines are components of downtown malls accessible only to streetcars, pedestrians, cyclists and emergency vehicles; ample off-street parking is provided within easy walking distance, as well as at outer points along these lines. This people-and-transit-only strategy has aimed to revitalize and "humanize" older retail and tourist areas.

Streetcar right-of-way design and alignment has been studied extensively. In March, 1994, the U.S. Transit Cooperative Research Program retained a team led by Korve Engineering, Inc., to conduct research to improve the safety of modern streetcars operating on, adjacent to or across city streets at low to moderate speeds (about 55 km./hour or less). The research team selected 10 transit properties across the U.S. and Canada with extensive experience in the operation of streetcars in shared rights-of-way. The subsequent guidelines developed by the Korve Engineering team include:

- separate streetcars from motor vehicles by a more substantial element than striping;
- design the streetcar line to run in the median – not outside curb lanes – of the street;
- coordinate traffic signal phasing and timing near streetcar crossings to preclude motor vehicles from stopping on and blocking the tracks;
- control motor vehicle turns that conflict with streetcar operations;
- maximize the visual impact of streetcars in motion.

These guidelines have been followed on the new-build streetcar systems and applied in the rebuilding of existing lines in other cities. The overwhelming majority of North American streetcar systems operate on segregated rights-of-way.

The TTC has attempted to increase the percentage of its streetcar system operated free of automotive congestion. Beginning with The Queensway reconstruction/extension project of 1957 and including the 1990 Harbourfront and 1997 Spadina lines, new TTC lines have been built on private rights-of-way. As well, attempts have been made since the 1970s to implement streetcar-only lanes during peak hours on routes such as St. Clair and King Street. These attempts have failed, due to a lack of compliance and the difficulty in enforcing the rules, a situation that mirrors the experience in other major cities.

Despite the fact that it enjoys the highest streetcar ridership of any North American system, the TTC operates the smallest proportion of its service on private rights-of-way.

BAY AREA PRIORITIES
San Francisco's Municipal Railway uses various designs for its streetcar rights-of-way. On city streets, these include road stripes and traffic prohibitions (left) and more effective dedicated separations with curbs and other street appliances to give streetcars complete priority (right).
Photos by Darrell Clarke

NORTH AMERICAN STREETCAR RIGHTS-OF-WAY: 2003

CITY	ROUTE KM	MIXED TRAFFIC (KM)	RESERVED R-O-W (KM)	PROPORTION RESERVED
Baltimore	47.0	0.0	47.0	100%
Boston	41.5	1.1	40.4	97%
Buffalo	10.4	0.0	10.4	100%
Calgary	32.3	0.0	32.3	100%
Cleveland	25.0	0.0	25.0	100%
Dallas	71.3	0.0	71.3	100%
Denver	25.6	0.0	25.6	100%
Edmonton	12.3	0.0	12.3	100%
Hudson-Bergen	25.8	3.0	22.8	88%
Los Angeles	90.3	0.0	90.3	100%
Newark	6.9	0.0	6.9	100%
New Orleans	14.1	1.3	12.8	91%
Philadelphia	55.6	32.6	23.0	41%
Pittsburgh	30.2	5.6	24.6	81%
Portland	66.0	4.1	61.9	94%
Sacramento	43.6	4.8	38.8	89%
St. Louis	61.5	0.0	61.5	100%
Salt Lake City	28.2	0.0	28.2	100%
San Diego	73.6	0.0	73.6	100%
San Francisco	41.5	20.4	21.1	50%
San Jose	49.5	0.0	49.5	100%
Seattle/Tacoma	2.6	0.0	2.6	100%
Toronto	79.6	70.5	9.1	11%
AVERAGE				**88.8%**

Source: John W. Schumann, LTK Engineering Services, and Benjamin Redd, Washington Group International

4.2 **The Melbourne Tram Priority Response**

> *"Unless we change the way we use our roads, then the future for travel in Melbourne is bleak, with longer travel times and increased congestion and pollution."*
>
> Peter Batchelor, Minister for Transport, Victoria, July 16, 2004

The need for freedom from automotive interference to reach peak efficiency and effectiveness is recognized by transit planners and operators wherever modern streetcars function as vital components of multi-modal public transportation systems.

Melbourne is one of these cities. It is often compared with Toronto on the basis of its size, population, ethnic diversity, multi-modal public transit system and mixed land use patterns. Just as in Toronto, Melbourne bucked a national trend of the 1950s and '60s by not abandoning its streetcars, known in Australia as trams. Owned by the State of Victoria and currently operated under contract by the private sector firm, Yarra Trams, the Melbourne system has been continuously upgraded and expanded.

Today, Melbourne's streetcar system is the fourth largest in the world, with more than 240 route-kms, 30 routes, 498 trams and 34,000 trips operated per week. In concert with the extensive regional electric commuter trains that circle through the downtown in an underground loop, Melbourne's trams provide virtually all of the transit service in the central business district and inner suburbs. Only two bus lines operate into the core; the rest of the large, privately-operated bus system is restricted to suburban service.

Downtown Melbourne has remained economically and socially vibrant despite the low-density, outer suburban growth that has been fuelled by the automobile. Melbourne's main inner city shopping thoroughfares are Collins, Bourke and Swanston Streets. Inner suburban shopping districts – comparable to Toronto's Bloor West Village and The Beaches – are located along Brunswick, Clarendon, High and Smith Streets, and Bridge and Sydney Roads. All are economically and socially vibrant. All are served by trams.

Over the years, Melbourne has tried many measures to keep trams and motor vehicles separated. Their Fairway concept has attempted to use passenger safety islands, road striping and signage to keep motorists off tram tracks at peak hours. It has not succeeded. As in Toronto, motorists in Melbourne routinely ignore the restrictions, causing congestion, accidents and delays to trams and motorists alike.

TRAM PRIORITY, PHASE I
Melbourne's Fairway concept uses road stripes and traffic prohibitions to separate trams and motor vehicles. In common with other cities that employ this approach, automobile drivers routinely ignore the restrictions and do not, as ordered, "Give way to trams."

Photo courtesy of the Canadian Urban Transit Association

More successful in Melbourne has been a combination of exclusive rights-of-way and pre-emptive priority signaling at intersections for trams. Some private rights-of-way have existed for decades in Melbourne, such as the landscaped routes along the park-like Victoria and Royal Parades. Extensions and new lines built since the 1960s have all been on reserved rights-of-way.

Currently underway is a comprehensive State of Victoria review of transportation infrastructure and services, which will result in a multi-modal master plan for investment. One element of the soon-to-be-released blueprint is Tram Plan, which contemplates four options for Melbourne's trams. These are described as "do-nothing, do-minimum, do-something and do-everything."

The first two options have already been rejected. The two preferred options – "do-something and do-everything" – include extensive measures to give trams greater priority, including increased private right-of-way operation. Also included within these preferred options are:

- greater enforcement of the automotive prohibitions on the tram Fairways;
- expansion of the system's advanced tram priority traffic control and signaling, known as the Tram Dynamic Fairway System; and
- reconstruction of the most congested portions of the lines, referred to as "redspots."

One of the criteria for evaluating the various options is "enhancing access to workplaces and commercial activities, including tourism and recreation." The "do-everything" option, which includes the maximum amount of reserved right-of-way and signaling priority, scores the highest in the State of Victoria Department of Infrastructure's appraisal framework.

TRAM PRIORITY, PHASE II
More effective than the road stripe/vehicle restriction approach is Melbourne's increasing construction of dedicated rights-of-way, especially in main shopping districts throughout the city. Generous platforms are also included to provide maximum safety.
Photo courtesy of the Canadian Urban Transit Association

On July 16, 2004, Victoria announced a $30 million Tram Priority Program for all the major retail areas served by Yarra Trams and other strategic, congestion-prone approaches to the inner areas of Melbourne. To be implemented over the next two years, the program will include reviews of all aspects of the transit, pedestrian, cyclist and motor vehicle flow on these streets and then use advanced technology and infrastructure to separate trams and motor vehicles to the maximum extent possible.

Peter Batchelor, Victoria State Minister for Transport, announced the Tram Priority Program will include "more curbs to segregate trams from motorists, some changes to parking arrangements and the extension of curbs at tram stops, making it safer for passengers to get on and off trams. These are innovative treatments aimed at moving trams efficiently through congested thoroughfares, resulting in shorter travel times for all road users."

5.0 **The Economic Benefits of Modern Streetcar Service**

> *"Pound for pound, the streetcar is still the best transit vehicle ever produced."*
>
> TTC General Manager J.H. Kearns, 1972

The adoption of the modern streetcar as a component of the broad transportation strategies of more than half of the U.S. cities with populations of more than one million has brought with it a host of quantifiable benefits. Because there was skepticism about the effectiveness of modern streetcar systems at the dawn of the North American renaissance, there have been numerous studies that have attempted to quantify its benefits. Cities with modern streetcar systems experience:

- 41% lower energy use per passenger-km. than cities with all-bus transit;
- 18% the level of energy use per passenger-km. of buses in bus-only cities;
- 14% lower automobile passenger kms. per capita;
- 22% less private transport energy use per capita;
- 23% lower total transport emissions per capita; and
- 38% fewer transport deaths per million people.

All of these factors in favour of modern streetcars have economic implications. Energy consumption, time lost due to automotive gridlock, and health costs related to automotive emissions and accidents all have values that have been calculated in numerous reports in recent years.

Furthermore, modern streetcar systems have played a major role in cities aiming to reform the nature of their growth and adopt transit-oriented development patterns, which also carrying with them financial considerations and effects. Kenworthy and Laube note:

"A major factor that affects the role of light rail transit in urban transport systems is the potential impact on land use. This factor, in particular, influences the medium- to long-term projections of ridership and, therefore, the whole perception about the future of transit in a city. …There is general agreement that light rail transit is a superior transit mode than busways in inducing major land use development effects….

"The advantages of light rail transit systems in terms of land use development are amply demonstrated by the wide range of cities that actively pursue projects that link urban villages or nodal developments to stations on their networks. Visits to cities such as Portland, San Diego, San Jose and Calgary in North America and Zurich, Freiburg and Hanover in Europe quickly give some indication of the extent of integration of development around light rail transit systems."

Less easily quantified is the impact of transit on retail activity. This applies to all modes, not just streetcars. One reason for this paucity of retail-related data is that collecting it is a massive undertaking that is complicated by retailers understandably not wanting to reveal the details of their financial performance for fear of compromising their competitive positions. As well, some systems are too recent to allow for any meaningful economic benefits analysis.

Measuring the impact of upgrades to transit routes that have historically shaped a neighbourhood's economic activity patterns is particularly difficult. Jeff Tumlin, a partner in the San Francisco planning firm of Nelson Nygaard Consulting Associates, comments: "It's an apples and oranges situation. You're trying to equate costs that occur locally, in the actual infrastructure or service upgrade, with benefits that are realized more broadly throughout the community."

Furthermore, transit planners contacted for this research report consistently stated the prime reason for the lack of such studies is a lack of need. They explained that, in the majority of cases, the economic benefits were clearly visible on the streets where the new and/or upgraded streetcars operate. These commercial districts, they say, are noticeably healthier economically since the implementation of the transit improvements.

As part of its consultation process on the proposed upgrading of the TTC's St. Clair line with a reserved right-of-way, a survey was conducted with the merchants on Spadina Avenue, where the similarly configured streetcar service was introduced in 1997. The survey of the merchants revealed that, since the opening of the streetcar service:

- 36% believe business is better;
- 50% believe there has been no change; and
- 14% believe their business has decreased.

Shopping patterns were surveyed and it was determined:

- 54% make a "special trip" to shop;
- 29% are casual shoppers; and
- 17% are tourists.

One of the few studies to examine the retail impact of modern streetcar service to any degree is *Sustainable Transport and Retail Vitality*, by Michael Carley, prepared in 1996 for the Historic Burghs Association of Scotland:

"Evidence from Europe and North America suggest that light rail encourages city centre developments which provide an enhanced retail base… Studies in Newcastle suggest that Metro [the region's modern streetcar system] has certainly helped the city centre to hold its own in the face of retail competition elsewhere. [The] Transportation Research Laboratory reports that 'Metro has helped to strengthen the dominance of Newcastle city centre as the pre-eminent shopping location in Tyne and Wear.'"

Anecdotal evidence also suggests many U.S. urban business associations have witnessed similar upswings following the construction of modern, second-generation streetcar systems. This has been well documented by the media in cities with recently-built lines:

Tacoma, Washington
(Tacoma News Tribune, September 26, 2003)

"Some businesses have seen profits surge as much as 30% since Sounder commuter trains began service at Freighthouse Square and the Tacoma Link streetcar service began operating [in August, 2003]. Each weekday, some 2,200 passengers on average are riding Link, while several hundred passengers are riding commuter rail to Seattle and back, according to Sound Transit passenger figures.

"'It was almost as if somebody flipped a switch,' said Gary Pieterman, owner of The Giving Place, a store that sells wine, magazines and gifts. In the past month, Pieterman began opening his store just before 6 a.m. to catch the northbound commuters… At night, Pieterman keeps his store open until 7 p.m. to catch returning commuters and the food court's dinner crowd – people who might buy a bottle of wine or groceries for dinner. 'Gradually, people are building some new routines,' Pieterman said."

SHORT, FAST AND SUCCESSFUL
The 2.6-km. Tacoma Link streetcar has received high praise from local merchants, who have seen business grow since the line opened in 2003. The dedicated right-of-way assures a fast trip between the commuter rail station, downtown offices, stores, cultural attractions and the Tacoma Dome sports complex.
Photo by Peter Ehrlich, courtesy of www.nycsubway.org

NJ Transit Trenton-Camden River Line
(Camden Courier-Post, September 3, 2004)

"Could it be that the River Line will be a success? Developers are scrambling for the privilege of turning the grand but decrepit Keystone Watch Case Co. building in Riverside into Burlington County's equivalent of Camden's residential treasure – The Victor. A short walk from the River Line stop, as upscale housing it would be a perfect 'transit village.'

"Restaurants are springing up near River Line stops and existing restaurants, such as Café Gallery in Burlington City, report increased business. Riverside's Madison Pub opened because of the River Line, and developer Jon Anesonco said business increased when the line began operations. Serrano's, a Portuguese restaurant, recently opened at 414 N. Pavilion Ave., across from the Watch Case building."

San Francisco F-Market & Wharves Line
(San Francisco Chronicle, August 13, 2004)

"San Francisco's Municipal Railway has a peculiar problem – its F-Embarcadero streetcar line, which runs from the Castro [district] to Fisherman's Wharf, is too successful for its own good. The F streetcar line, which is six miles long and cost $55 million to build, carries an estimated 20,000 passenger on an average day… That's as many people as all three cable car lines combined, and only 8,000 fewer than the entire Caltrain Peninsula train line, which stretches from San Francisco to Gilroy.

"However, the Muni doesn't have enough streetcars to meet the demand, and on many days the rail service is supplemented with buses. 'I saw a passenger refuse to board a bus the other day,' said Al Baccari, former head of the Fisherman's Wharf Merchants Association. 'It was hysterical. He wanted a streetcar, he said, not a bus.'"

In none of the above cases has economic spin-off analysis been undertaken. But all concerned with the operations say they don't need them; the business spin-offs from the lines are self-evident. In all these cases, there was merchant opposition to the projects originally. Salt Lake City retailers were greatly concerned about the effects of the construction and operation of the city's new streetcar system, which entered service in 1999. The results of the TRAX streetcar system have been so positive that the Utah Transit Authority was given the "Friend of the Retailer" award one year later.

In San Francisco, merchants in the Castro and Market Street districts supported the F-Line project, but those at Fisherman's Wharf said it would reduce motor vehicle flow and parking. They argued against the construction of the streetcar line and in favour of the rebuilding of a freeway along The Embarcadero, which had been structurally damaged by the 1989 earthquake. Ultimately, the freeway was demolished and an improved roadway with a dedicated right-of-way for the new F-Line streetcar was constructed.

RETAILER'S DELIGHT
Initial opposition by Fisherman's Wharf merchants to the San Francisco Muni/Market Street Railway F-Line has since turned to support. The line uses a dedicated right-of-way along The Embarcadero and vintage rolling stock from around the world, including ex-Milan Peter Witt cars such as this one.

Photo by David Pirmann, courtesy of www.nycsubway.org

The F-Line has boosted on-line business and contributed to the vitality of such recent retail attractions as the specialty food stores in the refurbished and historic Ferry Building, which has become popular with local and out-of-town shoppers alike. Now, Fisherman's Wharf merchants not only support the F-Line, but encourage its westward extension to the Presidio.

San Francisco Muni transit planner Suany Chough comments, "The Fisherman's Wharf merchants had fears when the F-Line was extended that way, but The Embarcadero has certainly seen a renaissance. Anyone can see that having the transit right-of-way and surface roadway has completely transformed the viability of that street from the freeway days."

As a result, San Francisco's Muni has felt no need to study the economic impact of the F-Line. However, in a few cities where new streetcar systems met initial and strenuous opposition, detailed studies and surveys have been undertaken. The following sub-chapters explore the experiences of four urban regions (San Diego, Portland, Dallas and Jersey City-Hoboken) that have built all-new systems. Each has taken a made-at-home approach to meeting its particular transportation challenges. One common denominator is that all four of these second-generation streetcar systems operate with a high degree of physical separation from the automotive congestion they were designed to reduce.

5.1 **San Diego Trolley**

> *"The public transit system may actually be subsidizing the livelihood of the San Diego region's residents and businesses."*
>
> San Diego Association of Governments, 1996

Following the inauguration of the German-influenced systems in Edmonton and Calgary, San Diego became the first U.S. city to introduce all-new, second-generation streetcar service. It was a virtual carbon copy of the Calgary system, complete with the same European-style infrastructure and rolling stock used there and in Edmonton. The north-south starter line links the downtown's many retail, institutional and tourist sites with the busy U.S.-Mexican border crossing at San Ysidro.

The objective leading to the decision to build the starter line of the eventual San Diego Trolley system was to redirect growth and manage it by linking transportation with land use. Only 200 km. from Los Angeles, San Diegans were determined to check the inner city deterioration and urban sprawl that was consuming that automobile-dependent metropolis. Although San Diego was experiencing all the negative effects of urban sprawl and automotive dependence, it hadn't reached the same proportions encountered in the larger city to the north. And San Diegans – many of whom had fled Los Angeles – were determined it wouldn't.

The first San Diego Trolley line opened in 1981. Its construction had been promoted for many years by a tenacious group of San Diegans, spearheaded by California State Senator, John R. Mills, who believed it could change the travel habits of San Diegans and visitors to the city. The first line was a "no frills" design using reserved median and side-of-the-road rights-of-way to avoid conflicts with motor vehicles. In this, San Diego was fortunate in being able to acquire a freight railway line that had been put out of service by a severe washout. This right-of-way, parallel to major streets south of the downtown, made it possible to build the trolley line faster and at lower cost than if it had adhered totally to street medians for its entire route.

The greater-than-anticipated success of the first San Diego Trolley line led to the creation of an ever-expanding modern streetcar system, major improvements to the connecting and complementary bus system, and the introduction of the GO Transit-styled Coaster commuter rail service.

Of the San Diego Trolley's success, Kenworthy and Laube noted:

"… the data show that many people have left their cars to use the new light rail transit system, something that the previous bus system was not able to do despite busways, and something that most Californians thought could never happen. In the northern corridor (where the next LRT line is partially built), a line-haul busway service currently operates and park-and-ride facilities are provided, but utilization rates were around 50% that of the park-and-ride stations on the LRT lines in the late 1980s.

"[In 1989, California State Senator James R. Mills stated] that 'one-third of the people who ride our system each day come to it in their cars and park at the lots at our stations … surveys show that most of these people, when asked how they would get to work if the light rail line did not exist, say they would drive the rest of the way.'"

THE BIG RED ONE
San Diego Trolley's simple and effective paint scheme heightens the impact of this highly successful transit service. A virtual carbon copy of Calgary's C-Train, it uses a similar transit-and-pedestrian mall in the downtown, aesthetically pleasing stations and dedicated median or side-of-the-road rights-of-way.

Photos courtesy of Light Rail Central (above) and San Diego Metropolitan Transit System (right)

The San Diego Association of Governments (SANDAG), which is responsible for planning within the urban region, has several times studied the effects of the streetcar system. The results of four studies conducted by and for SANDAG revealed:

- the San Diego Trolley caused a positive 10% benefit to hotel occupancy within one-half mile of stations (1992 study);
- the region received about $300 million in benefits from the local sales tax investment of $143 million in the construction of the streetcar system (1996 study);
- congestion relief related to transit saved $37.1 million annually, while air quality benefits provided by transit would cost $18 million per year to meet federally-mandated air quality standards (1996 study);
- the influx of $92 million of federal and state transit investment in FY 1993-1995 increased regional output by more than $101 million annually and supported 156 transit jobs and more than 1,400 private sector jobs (1996 study);
- the approximately 7,000 transit-dependent workers in the region contribute $140 million annually to the local economy (1996 study);
- about 80% of streetcar riders at the Fashion Valley and Mission Valley stations also shop at these malls as part of their trip (1997 survey);
- 57% of these riders said they would not have shopped at the malls without this transit service (1997 survey); and
- the average amount spent by these streetcar riders was $75 (1997 survey).

San Diego's commitment to its streetcar system, commuter trains and buses remains strong and the rolling program of expansion continues today. This on-going campaign to manage growth through transit-oriented development has made San Diego a much more vibrant, livable and sustainable community. The commitment to transit is strong and must be because, as SANDAG observes, for nearly 50 years the region "was primarily shaped by automobile travel. But this mode is beginning to break down."

The San Diego Trolley system currently totals 73.6 route-km., with the 8.9-km. Mission Valley East line scheduled to open in 2005. The streetcars carry between 80,000 and 100,000 riders on weekdays. Of San Diego Trolley's total existing and planned mileage, 100% is or will be operated on dedicated rights-of-way.

5.2 **Portland MAX**

> *"MAX has been a vehicle to move people, shape the region, defer highway investments, clean the air and enhance our quality of life."*
>
> G.B. Arrington, Jr., Director, Strategic Planning, Portand Tri-Met, 1996

Portland, Oregon, is the flip side of San Diego's coin. In San Diego, the modern streetcar system was used as a means to introduce comprehensive transportation planning and land use reform leading to the acceptance of region-wide transit-oriented development principles. In Portland, the redirection of the urban region through transit-oriented development policies had already occurred; it was light rail transit that would be one of the key delivery tools.

G.B. Arrington, Jr., director of strategic planning for the city's transit authority, the Tri-County Metropolitan Transit District (Tri-Met), describes this strategy as "community building with light rail… What is now becoming better understood is that MAX is more than a transportation investment. MAX is part of a conscious strategy to shape regional growth by coordinating transportation investments with land use policies. MAX has been a vehicle to move people, to shape the region, defer highway investments, clean the air and enhance our quality of life."

By the early 1970s, Portland's downtown had deteriorated badly. Residential, office and retail activities were declining, migrating to the automobile-dependent suburban housing tracts, industrial parks and malls. To combat this and numerous other trends that planners and civic leaders felt were unsustainable, Portland's various governments and government agencies adopted a new official plan that aimed to reverse the downtown decline and reform suburban land use.

Portland committed to transit-oriented development, embracing growth but only on Portland's own terms. A new official plan called for higher-density, mixed-use development in suburban areas and regeneration of older, inner-city areas. The plan also set a rigid urban growth boundary in 1979, legally defining what is urban and what will remain rural. A balanced transportation strategy has meant that no new road capacity has been added to the downtown in nearly 30 years. A six-lane highway was removed to create a waterfront park and money earmarked for two new freeways was invested in transit instead. Between 1971 and 1996, Tri-Met expanded total transit service by 140% and saw a 220% increase in ridership.

The Metropolitan Area eXpress (MAX) streetcar system has been a large part of this strategy since the opening of the 24-km. starter line in 1986. Known as Eastside MAX, it links the city's downtown core with the adjacent Lloyd District and the eastside communities of Banfield, Burnside and Gresham.

One of the key elements of this line was its use of private rights-of-way, including roadway medians and off-street alignments that reclaimed portions of an old interurban electric railway line. As in Edmonton, Calgary and San Diego, the physical design of MAX was guided by the premise that transit should have priority in order to provide a service with the speed, convenience and reliability to meet or exceed that of the automobile. Large parking facilities along the line, no increase in the downtown parking supply and maximum connectivity with the bus system were also elements of the plan.

CITY OF ROSES – AND STREETCARS
Similar in design to the Calgary and San Diego systems, Portland's MAX has played a major role in attaining the city's transit-oriented development reforms. MAX uses a wide variety of dedicated right-of-way designs to give the modern, second-generation streetcars priority.
Photo courtesy of Tri-Met

A 1996 study of the economic impact of the original Eastside MAX line found that this second-generation streetcar system has been responsible for $1.3 billion of development immediately adjacent to the starter line. As well, property values in the MAX service area exceeded those outside its catchment area.

PORTLAND PROPERTY VALUES: 1980-1991

AREA	INCREASE
Countywide	67.5%
MAX Lloyd Center	134.0%
MAX 162nd Avenue	112.0%
MAX 181st Avenue	491.0%

MAX has also had a measurable effect on retail businesses adjacent to the line. In a 1987 survey of 54 businesses, "66% of business owners said that their businesses had been helped by being located near MAX. More specifically, 54% said they saw increased sales volume as a result of being located near MAX."

Ironically, businesses and the city council in Gresham fought against Eastside MAX service to their community and, in the end, the proposal was passed by a margin of one vote. Opposition was based on a fear that MAX would damage business by usurping road space and allegedly import crime from the downtown. However, Gresham City Council forced the line away from its existing downtown business area. Since then, all these fears have proved to be unfounded; property values have risen and retail and residential developments have occurred along the realigned right-of-way. Gresham has also relocated its city hall to be near the MAX line.

Portland and its second-generation streetcar system have established standards that many other urban regions have attempted to copy. The effectiveness of Portland's land-use-management-by-transportation strategy is perhaps best measured by comparison with other communities that have not undertaken modern streetcar construction and have not gained control of their automobile-dependent urban sprawl.

Atlanta, for example, has spent billions on the construction of a subway system, but it has had a limited impact on transportation choices; transit's modal share remains low. The two cities have experienced similar population growth rates since the 1980s, but Atlanta's area of development has doubled while Portland's has remained stable. As well, property taxes rose 22% in Atlanta while they decreased by 29% in Portland. Atlanta is now seriously considering the construction of a second-generation streetcar system in its outer suburbs.

The success of the first Portland MAX line in 1986 has led to the creation of what is now a three-line system, which includes direct service to Portland International Airport. This system now totals 71 route-kms and carries about 80,000 weekday riders; additional routes are under planning. Dedicated right-of-way accounts for 99% of the MAX operation.

As well, Portland has added a heritage trolley operation to its main MAX system. Known simply as the Portland Streetcar and operated cooperatively by Tri-Met and a non-profit organization, its 4-km. loop through the downtown uses 8 km. of single track. The Portland Streetcar operates in mixed traffic on one way streets without any right-of-way separation. This street running purposely emulates Portland's original trolley system, which was abandoned in 1950. The line uses a combined fleet of modern replicas of 1920s Portland cars and new, low-floor European streetcars that are slightly smaller and lighter than those used on the main MAX system.

The Portland Streetcar has proved to be a successful complement to MAX and is popular with downtown merchants. It has been credited with sparking more than $1 billion worth of brownfield redevelopment within a 90-block area.

However, the Portland Streetcar's open street running has not been without its problems. There were 18 minor and three serious collisions between the streetcars and motor vehicles in the first two years of operation. In the most serious incident, a Jeep Cherokee broadsided a streetcar with enough force to drive it eight metres off the tracks. Remarkably, there were no serious injuries.

GOING WITH THE FLOW
The Portland Streetcar, which operates as a complementary service to the main MAX network, was purposely built without a dedicated right-of-way to evoke and old-time trolley atmosphere. Although highly successful, it must contend with the motor vehicle conflicts inherent in mixed-traffic, open street running.
Photo by Adam J. Benjamin, courtesy of Light Rail Central

5.3 **Dallas DART**

> *"In Dallas, the love affair with the automobile is over. Traffic congestion and urban sprawl, making travel increasingly inconvenient, have killed the freedom the automobile once provided."*
>
> Railway Age magazine, May, 1984

In many respects, Dallas in the 1980s seemed one of the least likely North American cities to be planning a modern, second-generation streetcar system. As one of the post-war boom cities of the so-called Sunshine Belt, Dallas had embraced the automobile and a suburban lifestyle with gusto. So, when the cross-jurisdictional Dallas Area Rapid Transit (DART) was formed in 1983 and announced its plan to build a 256-km. rail transit system by 2010, many observers were both impressed and shocked.

Dallas had once been an economically and socially healthy city, centred on a strong downtown core and with excellent streetcar service. All that changed in the 1950s. Automotive-dependent sprawl began, the core deteriorated and various merchants and politicians lobbied for the removal of the streetcars. The rationale was streetcar abandonment would allow downtown merchants to fight the retail flight to the suburbs by converting downtown streets to one-way operation, improve accessibility by automobile and do away with what they considered the old-fashioned image of the streetcars.

The elimination of the last four streetcar routes in 1956 was soon regretted. Sprawl accelerated and so, too, did the residential and retail deterioration of the once vibrant core. Inspired by San Diego and Portland's successful adoption of transit-oriented land use planning reform, based on a core system using modern streetcar service, DART's Final Service Plan identified a pressing need for relief from automotive transportation. As approved by voters, DART was armed with broad, cross-jurisdictional powers from the Texas legislature and dedicated funding from an additional one-cent local sales tax.

From the outset, modern streetcar lines with priority over and minimal interference from automotive traffic were seen as a solution. DART was planned as a hub-and-spoke system radiating out of the downtown core, which had been targeted for improvement and intensification. The DART streetcar

system would work in conjunction with beefed up bus service and an all-new Trinity Rail Express commuter train system (using surplus VIA Rail Canada and GO Transit equipment) to draw jobs, residents and shoppers to downtown venues and simultaneously reform land use adjacent to its suburban corridors.

The first north-south DART line was built totally on dedicated rights-of-way, both in street medians within the central business district and side-of-road reservations recycled from former freight railway lines outside the core. The first line opened in 1996 and it gained ridership rapidly. It also influenced location decisions for many major companies even prior to its opening. Some large firms relocated their offices to downtown and others scrapped their previous plans to relocate to automobile-dependent office sites in the outer suburban zone.

The economic impact of DART has been studied in detail on two occasions by the University of North Texas Center for Economic Development and Research. In its 1999 study, *The Initial Economic Impacts of the DART LRT System*, the Center's researchers collected appraisal data for the period 1994-1998 on nearly 700 commercial and residential properties within a quarter-mile of 15 DART streetcar stations. A comparison was then made with a control group of 160 properties in eight comparable areas not served by the DART streetcar line, but otherwise exhibiting similar neighbourhood characteristics. The Center's researchers determined:

- the increase in total valuations around DART stations was about 25% greater than in the non-DART control neighbourhoods;
- the average appreciation of land values around DART stations was double that in non-DART neighbourhoods;
- proximity to DART stations helped increase occupancy and rent levels for Class A and Class C office buildings and strip malls; and
- retail sales growth in the DART-served CBD was higher than citywide growth.

On the retail side of the investigation, the researchers found that for businesses adjacent to the DART line:

- community retail properties (those with at least one major retail anchor) experienced a slight decrease in occupancy, but rental rates increased 29%;
- neighbourhood establishments (convenience stores, supermarkets and personal services) saw occupancy and rental rates increase 3.3% and 6.2%, respectively; and
- strip retailers experienced a 4.2% increase in occupancy rates and an 18.4% increase in rental rates.

In 2003, the University of North Texas team again examined the economic impact of the DART streetcar service for the period 1997-2001, but using a slightly different methodology. They determined that median values of residential and office properties increased more rapidly near the DART LRT stations than they did in the control group (32.1% versus 19.5% in the case of residential and 24.7% versus 11.5% in the case of offices).

TRANSIT PRIORITY IN BIG D
Dallas employs a transit-and-pedestrian-only mall in the downtown and long stretches of transit-only right-of-way beyond. Downtown locations, such as the St. Paul station shown here, have become attractive, on-line destinations for living, working and shopping.

Photos courtesy of Dallas Area Rapid Transit

However, retail properties now showed no meaningful difference between those served or not served by DART. The researchers attributed this variance from the previous study to "the fact that retail growth during the boom years 1997 to 2001 was fairly evenly dispersed across Dallas County. Still, retail properties within one-quarter mile of DART stations are quite competitive and should fare well in the future as the LRT expansion improves access to these venues."

The DART system has more than doubled in size since the study periods covered by the two University of North Texas reports. There are now more than 50,000 weekday boardings. Streetcars cover 71.3 route-km., all of it on dedicated rights-of-way.

5.4 **NJ Transit Hudson-Bergen Line**

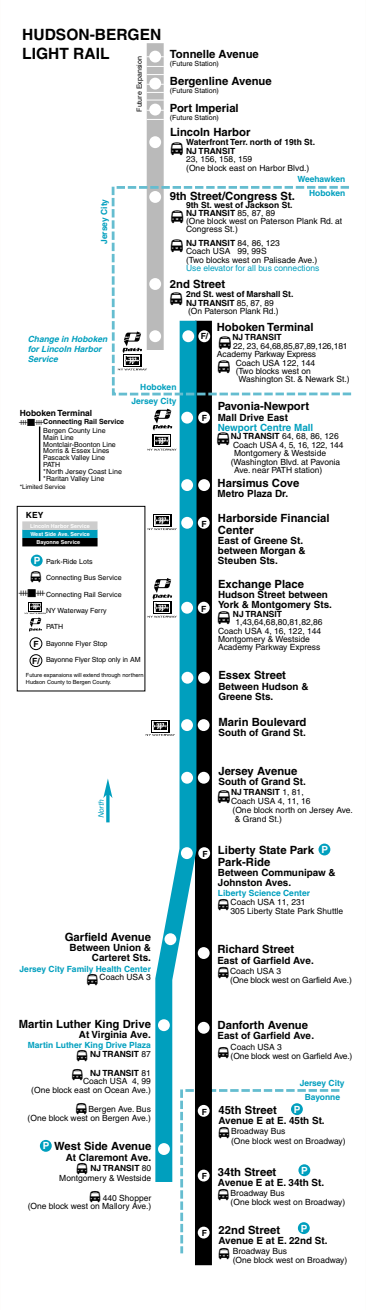
> *"It would be wrong to say we're the reason it's now called New Jersey's Gold Coast. But even though we're not responsible for the growth, we've definitely directed and influenced the shape of it."*
>
> Al Fazio, President, 21st Century Rail Corporation

During the 1980s, the population grew rapidly in New Jersey's Hudson and Bergen Counties and created ever-increasing congestion levels on the waterfront, particularly in the vicinity of the Hudson River crossings to Manhattan. The result was the undertaking of a series of mobility studies by NJ Transit – the state's equivalent of GO Transit – to plan alternate transportation systems.

These studies established that the phased construction of a light, rapid rail transit system would be the best and most cost effective solution. The new Hudson-Bergen Light Rail Line (HBLRT) would operate on city streets, small portions of elevated track to span railways and waterways, and abandoned or underused railway rights-of-way. This system would link the cities of Bayonne, Jersey City, Hoboken, Weehawken, Union City, West New York and North Bergen.

HBLRT would improve the quality of life for residents, the opportunities for businesses and the area's environment. The area consisted of closed factories, abandoned warehouses and deteriorated residential areas. Now dubbed New Jersey's Gold Coast, some sources in Jersey City have credited transit access with its explosive growth. Despite piecemeal corporate developments prior to the HBLRT, there was no effective access. The streetcar line provided the key.

It was essential to have HBLRT operational as quickly as possible to both relieve further congestion, support development on the waterfront and manage commercial and residential growth. In 1994, NJ Transit decided on a design/build/operate/ maintain (DBOM) contract with a private sector firm for the delivery of the complete transit system. The DBOM approach was selected as it would ensure that the system would be operational at least eight years earlier than the system could be built employing the traditional multiple design/bid/award/construction contracts. This would include the rolling stock, a guaranteed completion date and a price, in 1996 dollars, for 15 years of operation and maintenance. NJ Transit would be the actual owner of the project.



In 1996, NJ Transit awarded the contract to 21st Century Rail Corporation for the first 15.2-km. Minimum Operating Segment (MOS-1) of the planned 32.8-km. system. Washington Group International is the majority owner of 21st Century Rail (70%) and the prime contractor. Kinkisharyo International is the minority owner (30%) and responsible for the design, manufacture, assembly, commissioning and maintenance of the 45-car fleet (29 for HBLRT and 16 for NJ Transit's upgraded Newark City Subway streetcar). Washington Group will operate the system and maintain the infrastructure, stations and facilities through 2015.

HBLRT service started on April 17, 2000, on the first 12 km. segment, consisting of two branches in Bayonne, which unite near Liberty State Park to form the main line to Jersey City and includes 3 km. of street running. In 2000, revenue service was extended 1.6 km. north to serve a shopping mall, new offices and the Pavonia PATH subway station, which provides frequent, rapid service to lower and midtown Manhattan and Newark.

The full MOS-1 segment was completed in September, 2002, with the extension to NJ Transit's Hoboken Regional Rail Terminal. Transit connectivity is a primary feature, with four of the 16 stops linked directly to other transit systems, ferries and commuter trains, as well as four park-and-ride sites with nearly 3,000 parking spaces.

NJ Transit negotiated with 21st Century Rail to construct a 9.6-km. expansion of this original MOS-1 portion of the HBLRT, extending it south to a new terminal with a park-and-ride facility in Bayonne and north to North Bergen. Construction on MOS-2 is now in progress and scheduled for completion in 2005.

ON THE WATERFRONT AND BEYOND
Once an area of economic blight and decline, the New Jersey waterfront is now called the Gold Coast. NJ Transit's Hudson-Bergen Line is stimulating and shaping brownfield, in-fill development between the older residential and business districts, stitching them together along its route.

Photo courtesy of Washington Group International and 21st Century Rail Corporation

Since the inauguration of the first 12-km. section of the HBLRT in 2000, it has had a significant economic impact all along its route. In Jersey City, the increase in property development since the opening of the line's first phase in 2000 has been dramatic:

JERSEY CITY PROPERTY DEVELOPMENT:
BEFORE AND AFTER HBLRT

TIME PERIOD	DEVELOPMENT (SQUARE FEET)
1974-2001 (without HBLRT)	8,703,000 (actual)
2001-2003 (with HBLRT)	6,660,000 (actual)
2003-2005 (with HBLRT)	10,376,000 (approved)

As well, a study by New Jersey City University predicts a wide variety of commercial, residential and institutional investment in Jersey City along the HBLRT. This will include the Liberty Tower observation deck and media transmitter, substantial expansion of the popular Liberty Science Center and 400 new residential units at Liberty Harbor North. The city plans to develop an on-line transit village with 900 units of housing, including affordable units. The city is also planning an arts high school, a medical high school near the Medical Center and another traditional public high school, all in the western section of Jersey City near the HBLRT.

In Bayonne, tax assessor Joe Nichols says property data indicate the city "has been found because of the light rail." He reports that, since HBLRT's construction:

- in general, property valuations have increased 40%;
- rental residential rates have soared 60%;
- building permits for substantial rehab have jumped 500%;
- residential property sales increased from an average $130 per square foot in 2000 to the $200-300 per square foot range in 2002; and
- almost every building is in redevelopment along the HBLRT corridor on Prospect Avenue, once the most depressed economic area in Bayonne.

From the beginning, NJ Transit and 21st Century Rail officials understood community relations needed to rank high. This approach helped avoid possible confrontations during the project. Everyone involved was encouraged to be as innovative as possible and develop close working relationships with city councils, utilities and the public.

However, the City of Hoboken was not supportive of the alignment, with disputes arising over its effect on the waterfront. Seeing an opportunity, business leaders in the western section of Hoboken – convinced of the streetcar line's potential positive impact – lobbied the governor and elected officials to relocate it to support the ethnic businesses and small property owners. As a result, the alignment was diverted west and emerges on the waterfront only on the northern edge of Hoboken and into Weehawken.

A Hoboken planner stated initially there was little effect on development as a result of the HBLRT, but real estate professionals disagreed. Lower cost properties in the western section now have quick access to downtown businesses, as well as to intermodal transfer centres. According to one real estate broker, major development in this area is directly attributable to HBLRT. New mixed-use buildings, artists' studios and apartments are popular, starting at $375,000 for sale and $1,850 – $3,550 per month for rentals.

The HBLRT has operated flawlessly and has been a catalyst for the both residential and commercial development along its route. The system currently serves an average of 15,700 weekday riders and is expected to increase to more than 100,000 daily when completed to its full 32.8 route-kms in 2010. HBLRT will be at completion 88% in dedicated rights-of-way.

DEVELOPMENT FOLLOWS THE STREETCAR
In addition to stimulating new, transit-oriented urban growth, the Hudson-Bergen Line has also helped revive old and deteriorated residential and retail districts, such as Jersey City's Essex Street. Areas that opposed the streetcar alignment now regret that decision.
Photo courtesy of Washington Group International and 21st Century Rail Corporation

6.0 **Summary and Conclusions**

> *"… the rebirth of LRT has blossomed into a full renaissance. Far from being yesterday's technology, modern LRT systems … are proving themselves to be important elements in multi-modal transit systems that can attract more riders while helping use limited resources efficiently."*
>
> *Status of North American Light Rail Transit Systems,* John Schumann, LTK Engineering Services, 2003

To the surprise of many naysayers and the delight of advocates, the streetcar has made a remarkable comeback in North America in the last quarter-century. Prior to Toronto's 1972 decision to retain, modernize and expand what was then North America's largest remaining streetcar system, even many transit professionals saw little future for this technology. Now, it is being touted as the preferred transit mode for tomorrow.

Using tried-and-true principles developed on this continent before the Second World War – and improved in Europe afterward – the streetcar has evolved into a modern, efficient and cost-effective transit mode. It is increasingly filling the intermediate-capacity niche between buses and heavy rail technologies, such as subways and inter-regional commuter trains. The loss of this intermediate-capacity transit capability due to streetcar abandonments in the 1940s and '50s partially accounted for the severe decline in transit's market share versus the automobile. Now, that trend is being reversed in many cities where all-new, second generation streetcar systems have been built.

The North American streetcar renaissance has yielded a wide variety of technical design responses to address local travel patterns and urban conditions. One size does not fit all. Every city that has built new systems or revised and expanded their existing streetcar networks has devised their own approach. No two cities and no two streets are the same, therefore, the technical and service aspects of streetcar lines must be honed to meet specific needs.

Advocates have made the point that this is one of the key attributes of modern streetcars: they are easily adaptable and applicable to specialized conditions.

However, common threads have emerged from the experience of all streetcar system operators. All have said that, to succeed fully, modern streetcar systems must be viewed not as a means to an end, but as a delivery tool for broader goals. The adoption of transit-oriented land use policies and guidelines is paramount in realizing the full benefits of modern streetcar service. Although intermediate in cost and capacity within the family of transit modes, modern streetcar systems are still higher-order transit solutions. They involve substantial investment and require substantial numbers of riders to justify their capital and service investment costs. Modern streetcars are not efficient when applied to low-density routes that are the products of automotive-induced urban sprawl. To not reform land use and increase density prior to or in concert with the construction of these lines is to doom them to low ridership and cost recovery.

Along the existing lines in well-established cities such as Toronto and San Francisco, the necessary land use densities supportive of modern streetcar services have existed for many decades. These areas often owe their land use patterns to these transit lines. Here, intensification and in-fill development can be implemented because of the traditional provision of higher-order transit, such as streetcars.

Another key element in the streetcar renaissance in both "new-build" cities and those that retained their traditional, first generation systems is transit priority. To give modern streetcars the speed and freedom from congestion necessary to make them competitive with motor vehicles, they must have priority. Throughout the world, this priority is provided by both pre-emptive signaling at intersections and physical segregation of streetcars and motor vehicles along the routes. The proposed reconstruction and upgrading of the TTC's St. Clair streetcar line fits this proven template.

Toronto lags far behind the rest of North America on both counts. Although the TTC's streetcar system carries more passengers than any other on this continent, its users are afforded the lowest degree of priority. On a continent-wide basis, the proportion of streetcar mileage operated in dedicated rights-of-way is 88.8%. More than half of all North American streetcar systems now operate totally on dedicated rights-of-way. Only 11% of the TTC's streetcar system uses this type of transit priority infrastructure.

An obvious result of this is Toronto's standing as the lowest-speed streetcar operator in North America. The average speed of TTC streetcar system operation is 15 km./hour. New-build systems with 100% dedicated right-of-way operation typically attain system average speeds of 30 km./hour or more.

Another common thread in the North American streetcar renaissance has been the re-design of many of the streets served by these transit lines. This approach, first applied in European cities, has used the construction or upgrading of streetcar lines as an opportunity to re-engineer and improve city thoroughfares. This has had the effect of improving the utility of these streets for all users and, in many cases, reinvigorating deteriorated or declining corridors and neighbourhoods. This redesign has included a wide range of improvements, including physical separation of road users, more efficient signaling at intersections and aesthetic improvements through tree planting, landscaping and installation of street art and furniture.

As well, every North American city that has followed this pattern has faced some opposition prior to construction from residents and merchants fearful of the changes. This opposition has often centred on alterations to road and parking capacity for motor vehicles. Yet, the results have proved that the implementation of modern streetcar service improves mobility in general and yields a range of economic, social and environmental benefits. Both residents and shoppers are given an attractive alternative to the automobile. Streets become more appealing through the addition of user-friendly elements installed in parallel with the streetcar line construction. Businesses become easier – not more difficult – to access ...for all users, not just transit riders.

The consensus among planners, residents and retailers in cities that have built new streetcar systems operating on dedicated rights-of-way is that these investments have been beneficial. Both quantitative and qualitative analysis has confirmed this, including here on Toronto's Spadina Avenue.

Once on the brink of extinction, modern streetcar service is now thriving in North America, mirroring the prior experience in Europe and various other cities around the world. With at least 30 additional North American cities building, planning or studying new lines, the streetcar renaissance shows no signs of letting up. Indeed, it is accelerating.

ACCELERATION: ZERO TO 90 ROUTE-KILOMETRES
After the Second World War, Los Angeles trashed its city and interurban electric railway system – the largest on the continent. But even L.A. hopped aboard the streetcar renaissance in 1990. Three lines are in service and more are on the way, snatching away Toronto's title as owner of North America's largest streetcar system.
Photo by Darrell Clarke

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Streetcar/Light Rail Transit Links

Operating, Planning and Research Agencies

Calgary Transit	*www.calgarytransit.com*
Central Arkansas Transit Authority (Little Rock)	*www.cat.org*
Central Ohio Transit Authority (Columbus)	*www.cotafasttrax.com*
Central Phoenix/East Valley Corridor	*www.valleymetro.org*
Charlotte Trolley	*www.charlottetrolley.org*
Dallas Area Rapid Transit	*www.dart.org*
Denver Regional Transportation District	*www.rtd-denver.com*
Edmonton Transit	*www.edmonton.ca*
Federal Transit Administration	*www.fta.dot.gov*
Greater Cleveland Regional Transit Authority	*www.gcrta.org*
Hillsborough Area Regional Transit (Tampa)	*www.hartline.org*
Houston Metro	*www.hou-metro.harris.tx.us*
Los Angeles County Metropolitan Transportation	*www.mta.net*
Maryland Transit Administration	*www.mtamaryland.com*
Massachusetts Bay Transportation Authority (Boston)	*www.mbta.com*
Memphis Area Transit Authority	*www.matatransit.com*
Minneapolis Metro Transit	*www.metrotransit.org*
New Orleans Regional Transit Authority	*www.regionaltransit.org*
New Jersey Transit	*www.njtransit.org*
Niagara Frontier Transit Authority	*www.nfta.com*
OC Transpo (Ottawa)	*www.octranspo.com*
Port Authority of Allegheny County (Pittsburgh)	*www.ridegold.com*
Portland Streetcar	*www.portlandstreetcar.org*
Portland Tri-Met	*www.trimet.org*
Sacramento Regional Transit District	*www.sacrt.com*
St. Louis Metrolink	*www.metrostlouis.org*
San Diego Association of Governments	*www.sandag.org*
San Diego Trolley	*www.sdcommute.com*
San Francisco Market Street Railway	*www.streetcar.org*
San Francisco Municipal Railway	*www.sfmuni.com*
Santa Clara Valley Transportation Authority (San Jose)	*www.vta.org*
Sound Transit (Seattle/Tacoma)	*www.soundtransit.org*
Southeastern Pennsylvania Transportation Authority	*www.septa.org*
Toronto Transit Commission	*www.city.toronto.on.ca/ttc/*
Transportation Research Board	*www.trb.org*
Triangle Transit Authority (Raleigh/Durham/Chapel Hill)	*www.ridetta.org*
Utah Transit Authority	*www.rideuta.com/trax*
Victoria State Department of Infrastructure	*www.doi.vic.gov.au*
Washington Group International (Hudson-Bergen Line)	*www.wgint.com*
Yarra Trams, Melbourne	*www.yarratrams.com.au*

Industry Associations

American Public Transportation Association	*www.apta.com*
Canadian Urban Transit Association	*www.cutaactu.ca*
International Union of Public Transport	*www.uitp.org*

Advocacy Associations

Electric Railroaders' Association	*www.era.org*
Friends 4 Expo Transit	*www.friends4expo.org*
International Light Rail Network	*www.lira-network.com*
Light Rail Central	*www.lightrail.com*
Light Rail Progress	*www.lightrailnow.org*
Light Rail Transit Association	*www.lrta.org*
St. Clair Right-of-Way Initiative for Public Transit	*www.script2004.ca*
Transport 2000 Canada	*www.transport2000.ca*

Publications

Headlights	*www.electricrailroaders.org*
Mass Transit	*www.masstransitmag.com*
New Electric Railway Journal	*www.trolleycar.org*
Railway Age	*www.railwayage.com*
Tramways & Urban Transport	*www.lrta.org*

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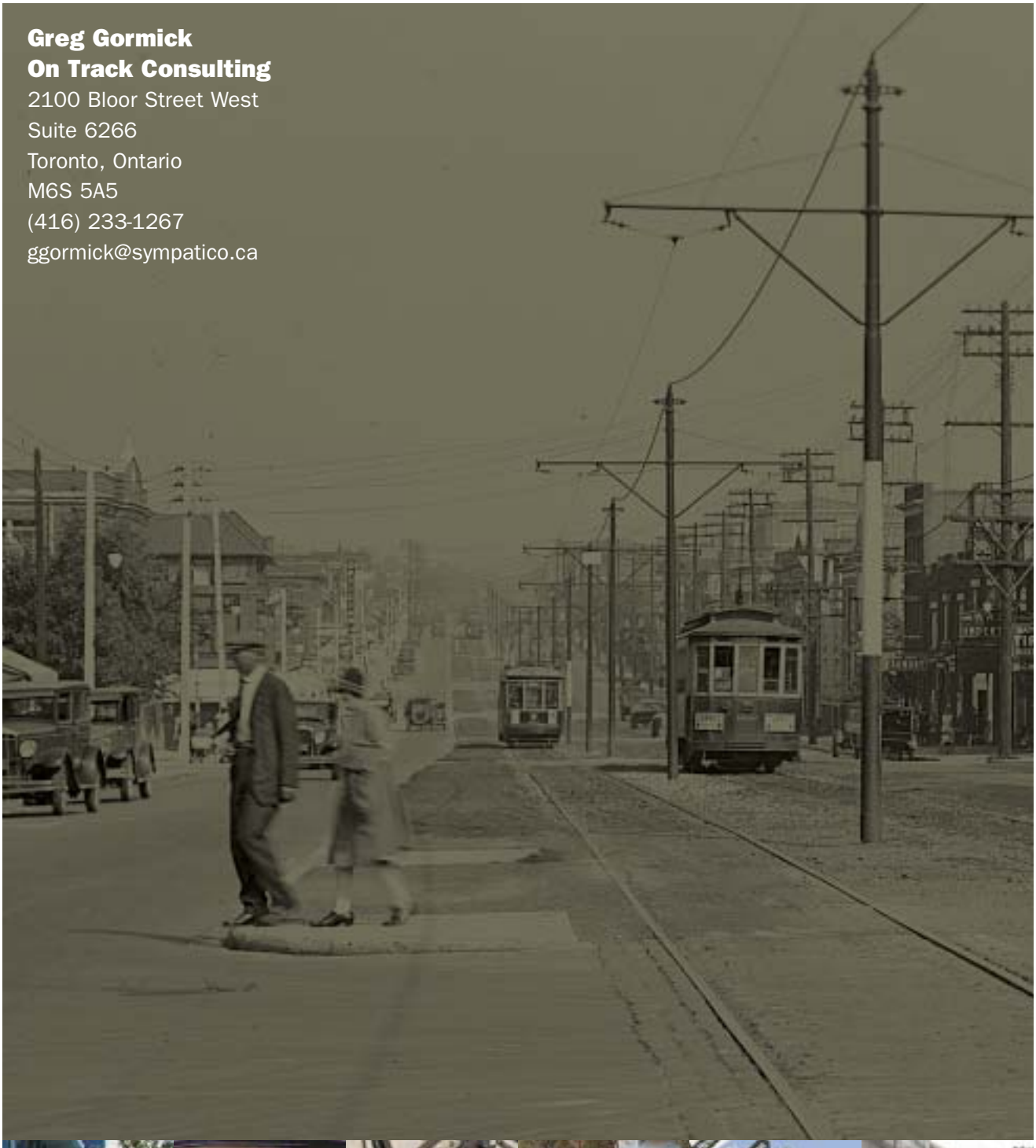

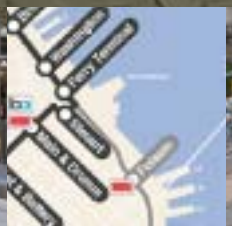

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