basis diesel vehicle maintenance costs are 60 percent higher than for trolleys because placing energy and maintenance on an hourly basis tends to equalize actual work done; this ratio (1.60) should tend to apply over a wide range of service situations or average service speeds.

Vehicle purchase costs have tended to range from 33 percent to 50 percent higher for trolley coaches. However, they last at least twice as long. Because a third less maintenance is required for trolleys, it should be possible to perform maintenance with a third fewer spares.

The total average annual savings per vehicle for vehicle-related costs is $13,550.

The cost estimates for installing trolley coach overhead wire given in the table below are for a light line and are based on recent experience with the 24-DIVISADERO crosstown line now being built in San Francisco:

Item	Cost per Double Track Route Mile ($000s)
Straight wire	405
Switches (2 per mile)	85
90° turns (1 per mile)	40
Crossings (2 per mile)	6
Substations (0.66 per mile, no feeder)	425
Utility relocation (0.75 mile per route mile)	300
Construction cost	1265
Engineering and miscellaneous at 26 percent	328
Project cost	1593

Heavier lines, especially those with steep grades, may require parallel feeder cable. It is assumed here that coaches will be equipped with auxiliary power supplies such as batteries or generators obviating the need for most emergency switches and turn back loops.

It should be noted that costs can go much higher with extras. For example, the 1.6-mile Sacramento line electrification cost $7.9 million or $3 million/mile. This, however, included all new street lighting on the trolley support poles, an average of 11 switches/mile, three turnback loops, and underground feeder cable along the entire route with some expensive underground work in the financial district. Where there are no low aerial utilities, there will be utility relocation costs--a substantial savings.

As noted earlier, the most expensive item listed--support poles--can last indefinitely. Utility relocation, a high-cost item, is a one-time cost. Rectifiers have essentially no moving parts and can be expected to last at least 35 years. Wear components--wire, switches, and crossings--constitute only 12 percent of the total and can be expected to last in the 15- to 75-year range on a light line with about 140 trips/weekday and a 10-min headway at the peak.

The total project cost per mile for overhead is on the order of $1.6 million. To demonstrate the relationship of construction cost to vehicle-related savings of $13,550/year/vehicle, a line with a 5-min peak headway would pay for itself in 45 years. A light trolley line with a peak headway of 10 min and about 140 trips/day would still pay for itself within the life of the overhead in 90 years. If we were to assume a patronage increase of 10 percent and add in an amount of $17,000/vehicle/year, which is equal to the fare reduction required to accomplish the same patronage increase, a line with a 5-min peak headway would pay for itself twice over in 80 years.

These conclusions are based on the following assumptions. A 10-min headway will result in an average of 1.33 vehicles/mile at an average speed of 9 mph. The payback figures above assume that savings will inflate annually at a rate equal to the prime interest rate resulting in a net discount rate for future savings of zero. The present value of future savings can then be calculated simply by multiplying annual savings by the expected life of the investment. These inflation and discount rate assumptions seem reasonable, because over the past decade wage rate increases have usually been about equal to the prime interest rate whereas bus price escalation has exceeded the prime rate. It is safe to assume that energy price increases will also probably continue to equal or exceed the prime rate in the future.

The Electric Trolley Bus Feasibility Study by UMTA estimated that there are 26 cities that can justify trolley bus systems of 75 or more vehicles on routes with headways of 10 min or better and 140 or more trips/day per route. The study estimated the total potential trolley coach fleet for these routes at more than 10,000 vehicles nationwide. Our experience at MUNI indicates that not only can the trolley coach pay its way but also is well worthwhile in terms of noise and pollution reduction as well as improved reliability.

MUNI, which operates 16 trolley coach routes, is considering converting 13 of its motor coach routes to trolley. One route, the 24-DIVISADERO, is now under construction. Two of the 13 are also being studied as possible light rail routes. Vehicle densities on these routes range from 5.3/mile to 2.5/mile. Total route mileage is 55. If these lines, which would require 170 coaches, are converted, more than 70 percent of MUNI service would be then electrically propelled.

The Trolley Bus and the Environment

Bo Persson

The increased use of fossil fuels for transportation, heating, and energy production has aggravated the problem of air pollution in most densely populated areas around the world. Exhaust from motor vehicles is the dominating source of air pollution in almost every urbanized area. Furthermore, it must be noted that exhausts from motor vehicles are emitted directly at breathing level, which make their contribution to the pollutant content of the air inhaled even more significant.

In addition to the local air pollution problem created by high numbers of motor vehicles on narrow city streets, motor vehicle emissions may also make a significant contribution to areawide environmental problems, such as the formation of photochemical smog and the acidification of rainfall.

Several strategies exist that aim at the control of air pollution. The development of alternative transportation solutions, such as public transportation, is a strategy that tends to be increasingly important due to increasing energy costs.

The trolley bus is a public transportation system that has the advantage of making only a small impact on urban environment when compared with automobiles or diesel-powered buses. This is true not only in relation to the air pollution problem, but also in relation to the noise problem. Those advantages are most important when the trolley bus is to be used in downtown areas or in heavily traveled corridors of major cities.

The current discussion concerning health effects from diesel exhaust is an issue that may be an important argument favoring the introduction of trolley buses. This is a recently recognized problem, partly because new research methods have indicated high levels of mutagenic and possible carcinogenic substances in diesel exhaust, and partly because modern and more fuel-efficient diesel engines appear to produce more of these substances.

AIR POLLUTION IN URBAN AREAS

There are several reasons for the dominating role of transportation as a source of urban air pollution. First, the transportation system is primarily based on large numbers of motor vehicles with polluting combustion engines. Individual transportation has led to urban land planning policies that have increased substantially the number of vehicle miles traveled per inhabitant during the past 50 years. During the same time, other sources of air pollution, such as industrial sources and power stations, have reduced their share of air pollution problems in most countries.

The fact that in the transportation sector the pollutants are emitted directly from tailpipes at street level, whereas pollutants from industry or power utilities are emitted from high smokestacks, makes the pollution contribution from transportation to individual exposure far greater. A recent Swedish study indicates that the same amount of pollutants emitted from an automobile in an urban area makes a 30 times greater contribution to the exposure of the average citizen to such emissions than emissions from industry or power utilities.

In the transportation sector, the main interest so far has concentrated on the control of emissions from gasoline-powered automobiles. In some countries, such as the United States and Japan, fairly stringent regulations of exhaust emissions have been introduced. Those have led to substantial reductions in the amount of air pollutants emitted from gasoline-powered automobiles. In Europe only minor reductions of the emission level have so far been achieved because of less stringent emission regulations.

As for the emissions from diesel-powered vehicles, only limited legislation concerning the control of some of the components of diesel exhaust exists in some countries. The increasing number of diesel vehicles, both heavy-duty vehicles such as trucks and buses and diesel passenger cars, together with the less stringent control of diesel emissions, is the reason why the contribution from diesel vehicles to urban air pollution problems is rapidly increasing around the world.

The automotive air pollution problem is widespread. Not only in the great cities but also in downtown areas of smaller cities high levels of air pollution may occur during unfavorable weather conditions. Swedish studies indicate that violations of air quality standards recommended by the World Health Organization and of standards adopted in the United States may be expected along busy streets in almost any city with more than 25,000 inhabitants.

During the past few years the possible content of mutagenic and carcinogenic substances in urban air has been the subject of intensive discussion. New methods of biological testing have made it possible to detect mutagenic effects of urban air pollution and of exhaust from combustion engines used in automobiles and buses.

EXHAUSTS FROM MOTOR VEHICLES

Two principal differences between the exhausts from gasoline and from diesel engines exist: (a) the uncontrolled gasoline engine emits more components like carbon monoxide and low-molecular hydrocarbons whereas the direct-injected heavy-duty diesel engine emits more nitrogen oxides; and (b) the diesel combustion process generates more soot and particles in the exhaust (5 to 10 times more than an uncontrolled gasoline engine and 30 to 100 times more than a gasoline engine equipped with a catalytic converter).

The low particle rate produced by a gasoline engine that runs on lead-free gasoline makes it possible to use advanced exhaust control devices like the catalytic converter, which significantly reduces the emission levels of almost all exhaust components. This technique has made possible the strict regulations on exhaust emissions from gasoline-powered automobiles in the United States and Japan.

The introduction of such effective exhaust control measures for gasoline-powered automobiles and the trend of rapid increase in the number of diesel-powered vehicles are two reasons why diesel vehicles may play a much greater role as precursors of urban air pollution in the future.

No effective technique exists for control of diesel exhaust. In the future, catalytic converters may be developed, which may help reduce some of the emissions from the diesel engine, i.e., particles. This may make it possible for engine manufacturers to meet the stringent regulations on diesel particulate proposed in the United States. However, it will be difficult to reduce the emission of nitrogen oxides while ensuring proper function of the devices for longer periods of time.

MUTAGENICITY OF EXHAUSTS

The most widely used method to measure mutagenicity is the Ames test, where salmonella virus is exposed to active substances and the mutagenic effect is observed within 24 to 48 hr. The Ames test has, when used in recent research projects in the United States, Japan, and Sweden, indicated a high mutagenic potential for diesel exhaust emissions compared with other known emissions. A recently concluded research program with the aim of testing biologically various combustion emissions in Sweden gave the following average mutagenic potentials:

Item	Revertants/kg of Fuel Consumed
Gasoline engines	190,000
Diesel engines	2,700,000
Coal combustion in power utilities	800

In this study, the gasoline engines were not equipped with catalytic converters. If they were and if the automobiles were run on lead-free gasoline, the mutagenic potential would drop to the same low level as for a well-controlled coal combustion process.

These values are also based on biological testing of the particulate fraction of the exhausts. It is generally assumed that most of the carcinogenic and mutagenic potency of combustion emissions is associated with the particulate fraction. However, some contribution is also made by the gaseous phase. This is especially true for emissions from gasoline engines. It has not been possible to consider the gaseous phase due to the complexity of the sampling procedure until recently, when a few results have been obtained. Combined consideration of the gaseous phase and the particulate phase appears to indicate that the ratio of mutagenicity gasoline/diesel changes from 1:15 to about 1:6 compared with investigations made separately on the particulate phase.

The reason for the high mutagenicity of diesel exhaust as indicated by the Ames test in comparison with other combustion emissions appears to be the formation of highly mutagenic and possibly carcinogenic nitro-aromatic compounds during the combustion process. The high concentration of nitrogen oxides in the exhausts from especially heavy-duty diesel engines is an important factor for the formation of these compounds. Among the mutagenic and carcinogenic nitro-aromatics now identified in diesel exhaust is 1-nitropyrene, which may be one of the most important of these substances. Partly oxidized organic compounds may also be an important contributor to the mutagenicity of diesel exhaust.

It also appears likely that a high proportion of the nitro-aromatic compounds present in diesel exhaust is attracted to the surface of diesel particles, and that this makes the particulate fraction interesting.

It appears that more of these compounds, especially nitro-aromatic compounds, are formed in the exhausts from a modern turbo-charged diesel engine, compared with older, smoky diesel engines. This has to do with the increased formation of nitrogen oxides in newer, more energy-efficient, diesel engines. The few comparable test results available confirm this hypothesis.

Diesel-powered trucks are the most important contributors to diesel emissions in most areas. Other contributions of importance in urban areas are light-duty diesel vehicles, diesel passenger cars, and diesel buses. It has been estimated that the buses contribute about one-eighth of total diesel emissions in a typical major city in Sweden, and the figures appear to be similar for cities in other parts of Europe and in North America.

However, if one takes into account the contribution of diesel buses to the exposure of urban citizens, the role of the diesel buses may be significant because of the concentration of bus traffic in central areas of cities, where many people will be exposed to high concentrations of diesel exhaust along streets with several bus lines, along combined pedestrian/bus streets, at nearby bus terminals, and at major bus stops. The concentration of diesel exhaust inside buses may in some cases also be high, especially inside articulated buses.

It should be noted that the observed mutagenicity in ambient urban air is not necessarily the direct result of the emission of mutagenic compounds. Some mutagenicity may be the result of atmospheric reactions in the urban air mainly involving nitrogen oxides and polyaromatic hydrocarbons. Diesel emissions are, however, important contributions of these precursors of mutagenic substances.

Another matter of controversy is the interpretation of the presence of mutagenic air pollutants in terms of a real cancer risk. It is generally agreed that there exists an increased risk of cancer in urban areas due to the presence of mutagenic substances in urban air. But the level of risk as well as the possible interaction with exposure to cigarette smoke are areas of intense debate among researchers.

So far, the issue of most concern has been lung cancer. It is generally believed that about one-tenth of lung cancer cases are caused by air pollution. The majority of lung cancer cases have been blamed on cigarette smoking. However, it is questionable whether the mutagenicity of cigarette smoke is high enough to explain the high share of lung cancer cases among smokers. The mutagenicity of cigarette smoke is low when compared with urban air pollution sampled at locations with high exhaust concentrations. It has been suggested that the dangers of cigarette smoking instead lay in the high amounts of certain substances that act as promoters together with carcinogens, and that this might lead to the conclusion that the higher risk of lung cancer among smokers may be caused by the combined effect of exposure to cigarette smoke and mutagenic particles from urban air or other exposures.

The fact that mutagens are carried to other parts of the body from the lung alveoli and the fact that they may be transformed into other but related chemical compounds, which may have an even higher mutagenic effect, suggest that the mutagens in urban air do not only influence the risk of lung cancer but the risk of other cancer forms as well. The conclusion might be that the contribution of emissions from the transportation sector, especially exhausts from diesel engines, to the population risk of cancer and genetic effects appears to be greater than has been anticipated previously. It is and will be an area of intense discussion among researchers for many years to come. Several research programs have been launched in the United States as well as in Europe and Japan, but due to the complexity of the matter it is probable that the definitive answer concerning the cancer risk caused by diesel emissions will not be given in the near future.

IMPACT OF TROLLEY BUSES ON AIR QUALITY

The use of trolley buses would probably be feasible on bus lines with high frequencies or where corridors with several bus lines exist. This would mean that trolley buses can substitute for diesel buses at those locations where the environmental disadvantages of diesel buses are most observed, that is, along streets with a large number of passing buses in the inner parts of major cities. In addition, it would be interesting to possibly consider the introduction of trolley buses in the case of a bus-only street in an area with high demands on environmental quality--i.e., a pedestrian mall with bus traffic in an inner city or a separate busway in a residential area.

Even if diesel buses are a minor source of diesel emissions in urban areas as a whole, significant improvements in the local situation may arise from the introduction of trolley buses. And even if the contribution of such a measure to the total improvement of urban air quality is small, it must be recognized that those streets that have high bus frequencies also often have high numbers of pedestrians, as well as passengers of the public transportation system waiting at stops, at bus terminals, or even inside buses, who are exposed to diesel exhaust. Recent Swedish research has shown that the air quality inside buses is affected by the buses' own exhausts, especially in articulated buses where diesel exhaust may leak into the passenger compartment through the articulation. The status of bus maintenance is also a factor--new and well-maintained diesel buses seldom have problems with high oxide pollution levels caused by their own exhausts.

The improvement in personal exposure (i.e., reduction of the individual dose of diesel exhaust products) from the introduction of trolley buses may be quite significant. A calculation of the effect on individual doses (population dose) may constitute a suitable method to evaluate the environmental (air pollution) effects of such a measure.

Even if the cancer risks are difficult to interpret, the fact that there exists a suspicion of such a risk is a strong argument to discuss possible methods to limit this risk. It is evident that the public would welcome all measures that decrease the amount of mutagenic substances emitted into the urban air, including the substitution of diesel buses with trolley buses. It must be noted that a public transportation system based on electric modes, such as commuter rail, metro, light rail, or trolley bus, with diesel bus lines acting as feeders, could allow a significant improvement in urban air quality, especially if the existence of this low-polluting public transportation system motivates a traffic policy with the aim of shifting from private to public transportation.

Even if the electricity used by the trolley buses is generated in a coal-fired utility, the gains relating air pollution will be considerable. The emissions of mutagenic substances from a coal-fired electricity production utility are more than 3000 times lower per kilogram of fuel consumed compared with diesel fuel combusted in a diesel engine. Also the emissions of nitrogen oxides are lower whereas the emissions of sulfur oxides might be higher for a trolley bus system compared with a diesel bus system if electricity is derived from coal-fired utilities. In addition, there is a significant difference concerning the contribution to individual exposure between emissions spread from high smokestacks and emissions spread from tailpipes in the streets.

It must also be mentioned that in many cases the electricity is not produced in the "worst-pollution-case." A large part of the electricity used in various parts in North America and Europe stem from hydroelectric or nuclear facilities, which do not generate combustion emissions.

VISUAL INTRUSION

The visual intrusion problem refers most often to the catenary of trolley buses. This is a clear disadvantage of trolley bus systems from the environmental point of view, which has to be balanced against other environmental factors such as the air pollution situation and the noise problems.

However, several possible solutions to this problem exist. One is to use a trolley bus concept with some potential of energy storage (battery or flywheel). The catenary may then be avoided at sensitive locations for short distances. Another is to design the catenary in a careful manner, e.g., to fasten the catenary in house walls instead of using poles.

NOISE

Noise is perhaps the most obvious source of environmental disturbance as observed by the public, even if the health effects from urban air pollution may be far more serious. This may be the reason why discussion of noise problems often receives the most attention.

Traffic is by far the most important noise source in urban areas. A diesel engine produces more disturbing noise than a gasoline engine. This is why local bus traffic (at streets with many passing buses) may create a noise problem. The noise problem is most obvious for buses accelerating from a stop or going uphill.

Even if the modern diesel bus is much more silent than older diesel buses because of new noise abatement techniques, the trolley bus would provide a substantial improvement for urban residents living on those streets where bus noise is a problem. It must also be noted that an increasing share of road traffic noise depends on the interaction of tire/road surface, which is a significant factor for vehicles running at constant speed or generally at higher speeds. The introduction of trolley buses has the most positive influence on noise problems in situations where the engine noise is dominating, which is most often the case at those locations where bus noise problems occur. The diesel buses running on freeways are generally not a significant factor in the noise situation, and trolley buses running the same freeways would also not create any problems.

Some noise might be generated by the friction between the overhead and the trolley shoe. This has been the source of some noise problems for older existing trolley bus systems, but may be almost totally eliminated by modern trolley bus techniques.

RESEARCH NEEDS

It is obvious that there is a need for increased knowledge of the environmental factors related to trolley buses. Such knowledge is important to verify raw estimates of the possible environmental benefits of trolley buses, which might be essential to justify the higher costs involved when compared with diesel buses. Some of the areas, in addition to ongoing and planned research programs, that might be of special interest are

1. Increased research on the content of toxic agents in diesel exhaust, especially concerning the emissions of mutagenic substances as well as the emissions of such substances that might form mutagens in the urban air;
2. Increased research activities concerning the dilution of diesel exhausts in the street environment, measurements of diesel exhaust components in areas affected by diesel buses, such as on bus streets, close to bus stops, and bus terminals; and
3. Increased knowledge of individual doses and how calculation or measurement of individual doses may be used as a method to evaluate various traffic planning policies, i.e., the introduction of trolley buses.

DEVELOPMENT IN SWEDEN

Since the abolishment of the existing trolley bus systems in Sweden (in Stockholm and in Gothenburg) in the mid-1960s, there have been several proposals for the introduction of electric bus systems in these and in other major cities.

The most obvious result so far is that two battery-powered electric buses were to be put in service on an inner-city bus line in Stockholm during 1982. In Malmo the government is sponsoring a study on the possible introduction of trolley buses. The Swedish mass transit industry has also developed a proposal for a Swedish-built trolley bus (Scania/ASEA), which, if the result of the study is positive, eventually might be used in Malmo.

A problem in Sweden is the financing of trolley bus systems. A proposal to divert highway construction funds and thus make state grants possible for cities that wish to invest in trolley bus systems was recently rejected by the Swedish parliament.

However, the official policy of the National Swedish Environmental Protection Board is to promote development and new technology that contribute to the improvement of the environment, including the urban environment and the air pollution situation. The agency is discussing the use of some of its funds for the development of trolley bus systems in Sweden. A project has been initiated in Linkoping, which includes the conversion of three diesel bus lines to trolley bus.

CONCLUSION

From the environmental point of view, the possible introduction of trolley bus systems in larger cities would have important positive effects. Trolley buses provide an alternative to the conventional diesel bus. The use of electric traction in public transportation can contribute to policies that aim at the substitution of individual transportation with public transportation in urban areas--an important strategy for reducing air pollution in those areas. It is with this background that the transportation community has to evaluate the possible profitability of trolley bus systems.

The negative effects of trolley bus systems in the form of visual intrusion by the catenary have been debated for many years. In light of current knowledge about the environmental impact of diesel emissions, it might be expected that the significance of these negative aspects on the use of trolley buses in larger cities will be small when compared with the positive aspects of trolley buses in the eyes of a well-informed public.

Trolley Bus Operations

L.A. Lawrence

Edmonton is a city of interesting contrasts. A brief history of the city will aid in understanding how it came to be one of the select group of North American cities operating trolley coaches. As a place, Edmonton is senior to most U.S. and Canadian cities, having been founded in 1795 as a fur trading post. As a city, however, Edmonton belongs to the 20th century. In 1983 Edmonton Transit will be celebrating its 75th anniversary. The city skipped the horse-car and cable-car periods, but by the 1911 census it had a population of 30,479 who made use of 17 streetcars. The operation began under municipal ownership and has continued as a city department to this day. Although its history has included many ups and downs, the department avoided the damaging sequence of crisis after crisis that stifled long-range thinking in the privately owned public transit systems.

Edmonton's contrasts include geographical factors. Although it appears to be a typical prairie city in most respects, it has a deep river valley cutting through its center. This is at exactly the point where streetcars and the early motor buses would be most heavily loaded on lines linking residential areas with the central business district across the river. The inauguration of trolley coach service in 1939 introduced a route that tackled the big grades directly, eliminating the circuitous route used by streetcars.

Some of the cities represented at this conference also introduced trackless trolley operations in the 1930s and Edmonton's civic administration was impressed by these. A specific report on Portland influenced the decision on trolley coach service, according to Tom Schwartzkopf, who is coauthoring a book on Edmonton's trolleys. Despite the interest in U.S. systems, however, Edmonton still was a part of the British Empire and its initial trolley coaches were British.

During the war, the original trolley coaches and the American Mack and Pullmans, which supplemented them, proved to be reliable performers. Canada's own industrial strength was also growing. In the post-war period, replacement of the streetcars continued with the most successful series of trolley coaches ever built--the Canadian Car and Foundry Brill. In its post-war peak in 1964, Edmonton operated 100 trolley coaches. The last Brills ordered in 1954 were literally that, because no more trolley coaches were turned out by that firm.

During the 1950s and early 1960s, Edmontonians were preoccupied with the automobile. However because the city itself was growing, Edmonton Transit did not experience severe cutbacks. It gradually spread itself over the area with motor-bus feeder lines.

It is hard to put a label on the 1960s. Although that decade was full of crashing final curtains in the U.S. transit industry, the scene in Canada was mixed.

On the one hand, there were people who wanted to imitate the decisions being made in the United States. The new look diesel was on the streets in Edmonton, with the front that drivers loved, a back that equipment people loved, and passenger facilities tossed in as an afterthought.

But Canada was not the United States, and there was no Interstate freeway money to influence the city's decisionmaking process. Groups opposed to freeway construction carried more weight in that environment. Post-war immigration combined with Edmonton's position on the trans-polar air routes kept decisionmakers open to European influences. The development of integrated rail bus operations in Toronto and Cleveland interested transit officials. And the most important step was taken when the right men, ideas, and technology were brought together. In annexing the town of Jasper Place, Edmonton implied that it would offer that sprawling low-density suburb the same level of transit service enjoyed by city residents. How could that be done without great expense?

The timed transfer concept has been and will be discussed in other forums. I will be brief in describing what happened. An existing trolley coach route was extended to a terminal built beside the Jasper Place Town Hall. Motor-bus feeder routes were timed to meet both trolleys and each other. And in peak hours, the heaviest trips were extended to downtown as expresses. This put each bus mode into the range in which it could perform best. Trolleys covered the stop-and-go main line operation to lower the distributed capital cost of the electrical system. It fits our system's need to be a good neighbor in areas where main lines cut through residential areas and hospital grounds. Glenora, the most affluent inner-city residential neighborhood in Edmonton, is served quietly and efficiently by our main line to Jasper Place.

Diesel buses perform well in express operations, where their engines can run at a fairly constant speed. Their noise levels are not as severe a problem on routes served infrequently, or where late-night service and Sunday service are not offered. Feeder routes sometimes have the potential to use smaller buses as well, but traffic has grown on most of these lines to the point where the use of 40-ft buses is necessary.

The timed transfer concept has also allowed us to run a fairly simple system from the customer's standpoint. The traditional North American radial system often makes the outlying express route points difficult to reach from intermediate areas. This presents planners with a choice of adding stops to expresses, running expresses and locals over the same route, or just writing off the people who want to reach points in the part of the older city that falls between downtown and the suburbs. This area