12-31-1991

A study of the potential funding mechanism for surface transportation in the New York Metropolitan Region

Krishnaveni Venkataswami
New Jersey Institute of Technology

ABSTRACT

The present network of highways, soaring bridges, airports, seaports, and transit systems that serve the New York Metropolitan region are part of this region's inheritance from the generation of Americans who built them before us. These massive and sometimes daring achievements supported the economic growth of the region. Now that inheritance is in danger. The quality of the region's transportation infrastructure is barely adequate to fulfill current requirements, and insufficient to meet the demands of future economic growth and development. We are spending our inheritance.

A major problem is financial. Overall investment in transportation has slowed down in the last two decades. We have worn out the cushion of excess capacity built into earlier investments. In effect, we are now drawing down from past investments without making commensurate investments of our own. There is no quick fix to the problem. It's much more likely to be solved through deliberate remedial steps rather than any dramatic actions.

This study considers the surface transportation funding requirements of the New York metropolitan region for the next 25 years (1990-2015) and discusses the financial contributions that the region's sectors have to make in order to support a transportation infrastructure capable of servicing the region's economic needs.

A STUDY OF

THE POTENTIAL FUNDING MECHANISM FOR SURFACE TRANSPORTATION IN THE NEW YORK METROPOLITAN REGION

BY

KRISHNAVENI VENKATASWAMI

A Thesis

Submitted to the Faculty of the Graduate Division of the

NEW JERSEY INSTITUTE OF TECHNOLOGY

in Partial Fulfillment of the Requirements for the Degree of

Master of Science in Civil Engineering

December 1991.

APPROVAL SHEET

Title of thesis : A Study of the Potential Funding Mechanism for Surface Transportation in the New York Metropolitan Region.

Name of the Candidate : Krishnaveni Venkatawsami
M.S. Civil Engineering, 1991

Thesis approved :

Athanassios K.Bladikas

Advisor

BIOGRAPHICAL SKETCH

Author : Krishnaveni Venkataswami

Degree : M.S. Civil Engineering

Date : December 1991

Date of birth :

Place of birth :

Undergraduate and Graduate Education :

* Bachelor of Engineering, PSG College of Technology, India.

* Master of Science in Civil Engineering, NJIT Newark, NJ.

Major : Civil Engineering

Positions Held :

July'91 - Sep'91 : Intern
New York City Department of Transportation.

Jan'91 - May'91 : Research Assistant
Center for Transportation Studies & Research , NJIT.

Sep'90 - Dec'90 : Graduate Assistant
Department of Civil Engineering, NJIT.

Feb'87 - Dec'89 : Assistant Executive Engineer
Neyveli Lignite Corporation, India.

ACKNOWLEDGEMENTS

The Author wishes to thank the faculty of the Interdisplinary Program in Transportation for their counsel and advice in the course of the study at New Jersey Institute ofTechnology, Newark. In particular the advice and encouragement given by Dr. Athanassios K.Bladikas is sincerely appreciated.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

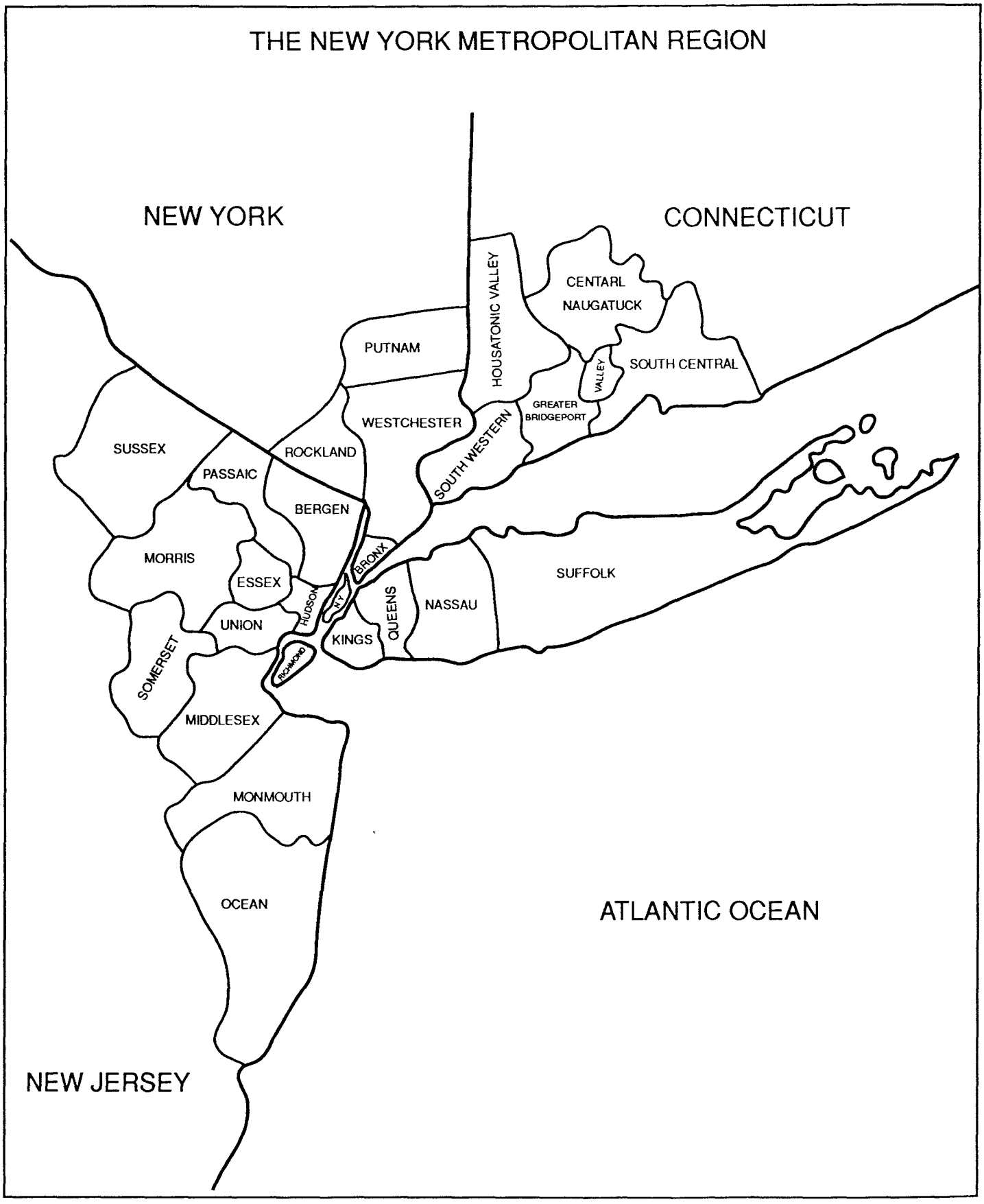
INTRODUCTION

In 1827, a 12 passenger horse-drawn passenger carriage began carrying passengers along Broadway in New York City marking the debut of mass transportation. Today, mass transit has become the most important mode of mobility in the New York City area. Transportation has played a major role in making New York the Nation's leading metropolitan area for the last 200 years.

The New York Metropolitan area occupies 7,125 square miles and comprises ten counties of New York State, eleven counties of New Jersey and six planning regions in Connecticut.(1). A map of the region is shown in Figure 1. It contributes 10% of the American GNP. In order to maintain its prosperity and economic competitiveness, New York has to continuously maintain and upgrade its surface, air and water transportation facilities. The existing transportation system provides a level of service that is well below the national average. "E" and "F" levels of service are common.

There appears to be an ever increasing demand for surface transportation. It is estimated that by the year 2015, annual work trips alone on all modes of transportation will exceed more than half a billion trips.(2) Unfortunately, today we are saddled with a 19th century infrastructure as we go into the 21st century.

FIGURE 1


THE NEW YORK METROPOLITAN REGION
NEW YORK
CONNECTICUT
HOUSATONIC VALLEY
CENTARL
NAUGATUCK
PUTNAM
SOUTH CENTRAL
VALLEY
GREATER
BRIDGEPORT
WESTCHESTER
SOUTH WESTERN
SUSSEX
ROCKLAND
PASSAIC
BERGEN
BRONX
MORRIS
ESSEX
HUDSON
N.Y.
QUEENS
NASSAU
SUFFOLK
UNION
KINGS
SOMERSET
RICHMOND
MIDDLESEX
MONMOUTH
OCEAN
ATLANTIC OCEAN
NEW JERSEY

Cost of improvements

The cost of providing surface transportation services which includes public transportation and highways and bridges, for the 25 year period (1990-2015) is estimated to be in the order of $188 billion in 1988 dollars.(3)

This estimate does not include other transportation costs like rail, air and marine freight.The need for these additional funds will have to be paid for by the people who live in this region and enjoy its benefits and by those who fund the region from outside like the federal and state governments.

Raising these additional funds will result in an all round increase in transit fares, gasoline tax, property tax, tolls, income tax and sales tax. In addition, the contribution of the state and federal governments in the form of subsidies should increase proportionally.

There exists a need to educate the public about

* The importance of transportation to the regional economy.
* The need for increased investments in transportation.
* The cost of neglecting transportation infrastructure.

The public and the business community must be made aware of the fact that they - the users, have to partly pay for these improvements, since they are the ultimate users and the major beneficiaries of the improvements.

The emphasis should shift from adding additional infrastructure, to extensive and innovative use of available resources. The focus should be on greater efficiency and economy which would result in improving quality of service.

The various transportation agencies should think of the region as a whole instead of only their narrow parochial interests. It also demands greater coordination among the various governmental agencies. An organization like the New York Metropolitan Transportation Council could take the role of a lead agency.

The federal government must accept a larger role in transportation funding and the funding mechanisms must be made more flexible. The local and state governments must be empowered to deal with changing modal priorities and needs.

Future Trends

Mass Transit

There will be increased emphasis on public transportation. This will be challenged by:

* The universal preference for use of the private automobile.
* The radial network of the transportation system in the area which is oriented towards Manhattan and not the suburbs.
* Transit policy basically influences work trips, which account only for one third of the total trips.

To counter this challenge public transit could offer a superior level of service like cleaner and safer coaches, increased frequency of service, greater schedule reliability,and cleaner and safer stations.In addition, the use of a single ticket for various modes of travel and the construction of transfer stations should be considered.

At the same time traditional means of restricting the use of the single-occupant automobile like increased parking fees, HOV lanes, car and van pooling, increased tolls and increased gasoline taxes should be enforced.

Demand Management

Demand management will be the most cost effective method for transportation improvements. The emphasis will be on moving people and not vehicles. The use of improved highway management, better communication systems, parking management, transit service improvements, priority treatment for HOV and corridor ride sharing programs will be emphasized.

Use of Alternate Fuels

There will be an increase in the number of vehicles using alternative fuels like compressed gas, electricity, methanol and ethanol. However, the demand for fossil fuels will continue to remain high.

Private sector involvement

There will be emphasis on mitigating traffic congestion by asking developers to pay for additional improvements brought about by increased construction activities.

Transportation management associations (TMA) formed by voluntary coalitions of developers and employers to deal with common transport concerns will play a major role in suburban areas. They would promote and market ridesharing programs, purchasing fleets of vans for employees, assisting members in meeting local traffic mitigation requirements, operating shuttle services to train stations, staggering work schedules, managing common parking facilities, financing traffic flow improvements and planning for long range transportation projects. In short, they would pool private resources to meet the needs for public mobility.

Conclusion

Future financing strategies must take into account

* Trends of the future.
* Potential costs of development

The subsequent pages will be devoted to identifying the improvements to be undertaken, working out likely costs of development and finding suitable financing sources in order to execute these plans.

CHAPTER 2

PROJECTED TRANSPORTATION IMPROVEMENTS AND COSTS

2.1 Transportation Improvements

2.1.1 Public Transportation

The following improvements are projected to accommodate future growth and improve the level of service from E to D.(4)

* The completion of the Second Avenue subway line from the lower tip of Manhattan to the Bronx.
* The connection of the Long Island Railroad to the subway lines on the East side of Manhattan to relieve congestion in the Grand Central and Penn Station terminals.
* Additional terminal and exclusive movement facilities for buses.
* An additional transit dedicated Trans-Hudson facility to carry rail and bus traffic from New Jersey to Manhattan.
* Improve East river crossing capacity by constructing of two additional tunnels.
* Increase services provided in the remaining commuter railroads and extension of services into the suburbs.

2.1.2 Highways and Bridges

The improvements envisaged aim to accommodate travel growth, save on energy consumption and travel cost, and improve the service level from E to D. The improvements earmarked are (5):

* Additional 415 lane miles of highways in the New Jersey sector.
* Additional 335 lane miles of highways in the Connecticut sector.
* Additional 50 lane miles of state touring routes in the NYC suburbs.
* Improving the lane width and lateral clearance in the New York City suburbs.

2.2 Cost of Improvements

For the purpose of this study Surface Transportation comprises of -

* Public transportation systems.
* Highways and Bridges.

The financial requirements for each of the above categories is discussed under two headings, capital and operating.

The following assumptions are made for calculating the financial costs of development for the next 25 years (1990-2015)

* Public transport will continue to maintain its present share of trips in all sectors.
* The costs of development will keep pace with inflation.

2.2.1 Public Transportation

Mass transit is the most important mode of mobility in the New York area. It is envisaged that by the year 2015 increasing demand for public transportation would require the following -

* Maintenance/replacement of ageing equipment.
* Augmentation of existing capacity to meet projected increases in demand.

These improvements will be financed at the "significant investment" alternative. This particular alternative provides for the following -

* It provides for expansion and intensification of operations that will serve future demand.
* The level of service will improve from the existing "E" or "F" to mid level service "D" in most parts of the system.

Cost of Public Transportation

The total operating cost for public transportation for the twenty five year period (1990 - 2015) is estimated to be $138.88 billion and the total capital cost is estimated to be $70 billion. The fare box revenue contributes $76.38 billion. This leaves a balance of $132.5 billion that has to be raised from other sources. (6)

The annual financial needs for public transportation are $5.3 billion($132.5/25 years). The present annual budget is $4.0 billion, leaving a deficit of $1.3 billion, out of which $500 million is the operating and $800 million is the capital deficit. If the federal government contributes 60% of the above capital deficit which amounts to $480 million. The balance of $820 million has to be raised locally. Traditionally, the federal government has subsidized 72% of the public transportation capital costs at the national level. However, in the last four years the federal contribution has shrunk to 38.5% for this region.

2.2.2 Highways and bridges

Owing to a large number of rivers and creeks there exist a large number of bridges and tunnels in the area. These constitute the major bottlenecks in the transportation network and need to be kept in a good state of repair.

The core improvements such as replacing, rehabilitating, restoring and resurfacing parts of existing facilities continue to be necessary to operate and maintain highways and bridges properly.

The significant investment alternative provides for a level of service "D", by the year 2015.

Cost of highways and bridges

It is estimated that for the 25 year period (1990-2015) the cost of Highways and Bridges is $55.5 billion and the cost of truck freight is $20.8 billion. This amounts to a total of $76.3 billion. Current funding provides $42.9 billion,leaving a deficit of $33.4 billion

It is assumed that the Federal government will provide 70% of this deficit which accounts for $23.38 billion. This leaves a balance of $10.02 billion to be raised by the local or state governments which is equivalent to $400.8 million per year.

2.3 Conclusion

The total deficit for surface transportation is $65.4 billion, of which $32.5 billion is needed for Public transportion and $33.4 billion for highways and bridges.The federal government is expected to contribute $34.88 billion and the balance of $30.52 billion has to be raised by local sources.

New funding sources have to be identified and the revenue generating capability of existing sources has to be expanded. The traditional sources include -

* Federal subsidy
* State subsidy
* Local subsidy
* Dedicated taxes
* Cross subsidies generated by the highway mode
* Private sector funds

The emphasis for raising local funds should be so designed as to discourage private automobile use and encourage mass transit.

CHAPTER 3

BASIS FOR SHARING COST OF DEVELOPMENT

The basis for sharing the cost of surface transportation is difficult to define. There are basically two groups of people who have to pay for the system - the users like automobile and truck drivers, fleet owners, and commuters, and the non-users who form the remainder of the population in that particular area.

Should transportation be treated as free market enterprise without any kind of protectionism? If so, the brunt of the cost has to be borne by the users. Charging beneficiaries directly for the cost of services has advantages. One such advantage is that all beneficiaries can be made to pay their fair share. This allocation of charges can help avoid the over building that may come with the perception that anything "public" is free.

However this does not answer the problem of the "free rider" - the non-user who also benefits from the positive economic climate created by the existence of a transportation system. The benefits could be easy access and improved mobility which reduce the cost of products and improve the standards of living. It also benefits business and commercial interests. At the same time it cannot be treated as an enterprise directed purely towards social welfare.

The artificial protectionism extended to this particular system would make other systems more expensive and render them obsolete since they compete in the free market without any protection. Thus there exists the need to consider surface transportation in both contexts - a free market and a government protected enterprise. This raises the issue of tax incidence, and as a result assigning financial responsibility for surface transportation is a difficult task.

Transportation investment is viewed as a catalyst for regional and economic development. This explains the transportation initiatives proposed by Governor Cuomo of New York State which is aimed at resolving the economic woes of the state like recession and unemployment. However, there exists no methodology to assess the economic impacts of transportation investments. If this could be determined it could help us to justify spending money on transportation projects. It could also create a basis for sharing transportation costs with the various local governments.

Thus the lack of a suitable method to measure the benefits that could be enjoyed by these states as a result of transportation initiatives, makes it difficult to earmark the contribution of each individual state / local government.

User fees may prove inadequate for major new investments in infrastructure technology and economic development. Such projects have few immediate or easily identified beneficiaries. Instead, they represent long term commitments to the future, and rightfully are a matter of common responsibility to be financed out of general funds or a user fee base that includes both present and future beneficiaries.(8)

3.1 Public Transportation

The basis for contribution by the individual constituents of the New York metropolitan area for public transportation can be assessed by any one, or a combination of the following factors:

* Population
* Annual public transportation vehicle revenue miles
* Annual public transportation passenger miles travelled
* Rail transitway mileage

Population

The success of any public transit system is heavily dependent on the size of the population it serves. A larger population in a limited area translates directly into increased ridership and fare box revenue. This explains the extensive mass transit services in Manhattan. For the same reason, it is not possible to have the same kind of service in the suburbs of New York. It is, therefore, logical to assume that areas with a relatively higher population and better public transportation must contribute a larger share in proportion to their population for any transit improvements.

The federal government uses "Population" as a major criterion for disbursing federal funds. Section 5 (a)(1)(A) of the Urban Mass Transportation Act of 1964 dealing with the urban mass transit program, states that urbanized areas shall receive federal money based on the following formula:

"(i) one half of the total amount apportioned multiplied by the ratio which the population of such urbanized area or part thereof, as designated by the Bureau of Census, bears to the total population of all the urbanized area in all the States as shown by the latest available Federal census; and
(ii) one half of the total amount so apportioned multiplied by a ratio for the urbanized area determined on the basis of population weighted by factor of density, as determined by the secretary. As used in this section, the term "Density", means the number of inhabitants per square mile."

The same or a similar formula is also used in the following sections of the Urban Mass Transportation Act of 1964:

1.Section 9(d)(1) dealing with block grants for urbanized areas with population less than 200,000.

2.Section 9A.(b)(1)(A) dealing with Mass transit account distribution.

3.Section 18(a) dealing with Formula grant programs for areas other than urbanized areas.

The above mentioned sections are a few examples used to illustrate the frequent use of "Population" as a major criterion in allocation of federal funds. This goes to underscore the importance accorded to this factor. Table - 1 and 2, shows the population and area of the various sectors.

TABLE - 1

POPULATION DISTRIBUTION IN THE METROPOLITAN REGION

SECTOR / COUNTY	POPULATION
CONNECTICUT (CT)	
Central Naugatauck	255,000
Greater Bridgeport	306,900
Housatonic Valley	190,100
South Central	535,200
South Western	339,200
Valley	80,800
Connecticut Total	1,707,200
NEW JERSEY (NJ)	
Bergen	831,800
Essex	843,500
Hudson	546,600
Middlesex	645,700
Monmouth	553,400
Morris	419,400
Ocean	346,038
Passaic	463,300
Somerset	221,300
Sussex	116,119
Union	502,200
New Jersey State	5,489,357
NEW YORK CITY (NYC)	
Bronx	1,222,800
Kings	2,313,300
New York	1,501,900
Queens	1,929,900
Richmond	380,000
New York City Total	7,345,000
NEW YORK STATE SUBURBS (NYS)	
Nassau	1,318,200
Putnam	82,100
Rockland	265,200
Suffolk	1,310,100
Westchester	864,400
New York State Suburbs Total	3,840,000
REGION TOTAL	18,381,557

Source : NY & NJ Federal - State Cooperative Program
U.S.Department of Commerce, Bureau of the Census.

TABLE 2

AREA OF INDIVIDUAL SECTOR/COUNTY IN THE METROPOLITAN REGION
(1987)

SECTOR / COUNTY	AREA (SQUARE MILES)
CONNECTICUT	
Central Naugatuck	
Greater Bridgeport	
Housatonic Valley	
South Central	
South Western	
Valley	
Connecticut Total	1,351
NEW JERSEY STATE (NJS)	
Bergen	237
Essex	127
Hudson	46
Middlesex	316
Monmouth	472
Morris	470
Ocean	641
Passaic	187
Somerset	305
Sussex	526
Union	103
New Jersey Total	3,430
NEW YORK CITY (NYC)	
Bronx	42
Kings	70
New York	22
Queens	109
Richmond	59
NYC total	302
NEW YORK SUBURBS (NYS)	
Nassau	287
Putnam	231
Rockland	175
Suffolk	911
Westchester	438
NYS total	2,042
REGION TOTAL	7,125

SOURCE : U.S. Department of Commerce. Bureau of Census
County & City Data Book - 1988

Vehicle Revenue Miles

Vehicle revenue miles are the total miles traveled by revenue vehicles while in revenue service. It excludes miles travelled to and from storage facilities and other deadhead travel. For rail, vehicle refers to rail cars.

The federal government has set a precedent in the use of vehicle revenue miles for allocation of funds. However, it has not been used as the sole criterion. Traditionally, it has always been considered along with population.

Section 9A(b)(1)(A) of the Urban Mass Transportation Act of 1964 dealing with mass transit account distribution, makes use of the formula based on a combination of revenue vehicle miles and population. It states that for urbanized areas with a population of 1,000,000 or more, 50 per cent of the money available shall be distributed by multiplying this amount with the ratio of total bus revenue vehicle-miles in the area to the total bus revenue vehicle-miles in the urbanized areas with a population greater than 1,000,000 in the country. The remaining 50 percent is disbursed based on total population and density of population.

Similarly Section 9(B) and Section (18) of the same Act make funds available on a similar basis for fixed guideway operations and bus operations in areas of varying populations. Table - 3, shows the annual revenue vehicle-miles travelled in 1987 in the region which could be used to determine individual contributions of the various sectors.

TABLE - 3

ANNUAL PUBLIC TRANSPORTATION REVENUE VECHICLE MILES TRAVELLED
NEW YORK METROPOLITAN AREA - 1987

SECTOR	REVENUE VECHICLE MILES (in millions)
CONNECTICUT	
Bus Transit	9.2 e
Total Connecticut	9.2 e
NEW JERSEY	
Bus Transit	
New Jesey Transit	45.40
New Jersey Independent	39.70
Total New Jersey Bus	85.10
Rapid Transit	
PATH	11.20
Newarkcity Subway	0.60
Total Rapid Transit	11.80
Suburban Rail	
NJ Transit in NJ	30.90
NYS West of Hudson	1.50
Total Suburban Rail	32.40
Privat Ferries	@
Total New Jersey	129.30
NEW YORK CITY	
Bus Transit	
NYCTA & MaBSTOA	97.30
New York City Private	31.1 e
Total Bus Transit	128.4 e
Rapid Transit	
NYCTA	293.90
SIRTOA	2.1
Roosevelt Island Tramway	+
Staten Island Ferry	0.20
Private Ferries	@
Total New York City	424.60
NEW YORK STATE	
MSBA	8.80
Long Island remainder	6.4 e
Westchester	8.10
Upstate New York	18.40
Total Bus TRANSIT	41.70
Suburban Rail	
M-N-Hudson & Harlam	16.10
M-N-New Haven	15.90
Total Metro North	32.0
Long Island Rail Road	51.60
Total Suburban Rail	83.60
Total New York Suburbs	125.30
TOTAL REGION	688.40

e - Estimated.
n/a - Data not available.
r - Revised.
+ - 43,000 aerial tramway cabin-miles.
@ - Less than 0.1 million ferry miles.

Sources : Transit operator's data and NYMTC estimates.

Passenger-Miles Travelled

Perhaps the most widely used measure of transit output is passenger-miles per year. This measure gives greater weight to longer trips such as those by commuter rail.(9)

Passenger miles travelled is defined as the sum of the product of the number of passengers and the distance travelled by them. It is a measure of service utilization. For example 10 passengers travelling in a vehicle for 5 miles generate 50 passenger miles. By using these figures it is possible to estimate the intensity of use of the transit services. Therefore, it can be used as a basis for determining the financial contribution of various geographical areas to maintain the system.

The federal government uses passenger-miles travelled as a criterion for allocation of block grants. Section 9(a)(B)(3) of the Urban Mass Transportation Act 1964 as amended through 1988 states that "4.39 per centum of the amount made available for expenditure among urbanized areas of 200,000 population or more under paragraph (1) of this section shall be apportioned as follows: in the ratio that the number of fixed guideway vehicle passenger-miles travelled multiplied by the number of fixed guideway vehicle passenger-miles travelled for each dollar of operating costs in each such urbanized area bears to the sum of the number of fixed guideway vehicle passenger-miles travelled for each dollar of operating cost in all such urbanized areas.

No urbanized area in which commuter rail service is provided and which has a population of 750,000 or more shall receive less than 0.75 per centum of the sums made available under this paragraph."

Similarly Section (9)(c)(3) states "9.2 per centum of the amount made available under paragraph (1) of this subsection shall be apportioned among urbanized areas of 200,000 population or more as follows: in the ratio that the number of bus passenger-miles travelled multiplied by the number of bus passenger-miles travelled for each dollar of operating cost in each such urbanized area bears to the sum of the number of bus passenger-miles travelled multiplied by the number of bus passenger miles travelled for each dollar of operating cost in all such urbanized areas."

The proposed U.S. Department of Transportation version of the Surface Transportation Assistance Act of 1991, states that data currently available for this factor are unreliable and difficult to obtain. Thus the weight of this factor has to be reduced.

Table - 4, depicts the annual passenger miles travelled in 1987 in the area of study.

TABLE - 4

ANNUAL PUBLIC TRANSPORTATION PASSENGER - MILES TRAVELLED
NEW YORK METROPOLITAN AREA - 1987

SECTOR	PASSENGER MILES (in millions)
CONNECTICUT	
Bus Transit	67.5 e
Total Connecticut	67.5 e
NEW JERSEY	
Bus Transit	
New Jesey Transit	1,086.8
New Jersey Independent	583.1 e
Total New Jersey Bus	1,669.9 e
Rapid Transit	
PATH	306.0
Newarkcity Subway	7.0
Total Rapid Transit	313.0
Suburban Rail	
NJ Transit in NJ	995.20
NYS West of Hudson	51.50
Total Suburban Rail	1,046.7
Privat Ferries	2.5 e
Total New Jersey	3,032.1
NEW YORK CITY	
Bus Transit	
NYCTA & MaBSTOA	1,613.0
New York City Private	350.9 e
Total Bus Transit	1,963.9 e
Rapid Transit	
NYCTA	6,863.0
SIRTOA	44.50
Roosevelt Island Tramway	1.6 e
Staten Island Ferry	111.5 e
Private Ferries	1.4 e
Total New York City	8,985.9 e
NEW YORK STATE	
MSBA	113.5 e
Long Island remainder	22.9 e
Westchester	109.4 e
Upstate New York	26.1 e
Total Bus TRANSIT	271.9 e
Suburban Rail	
M-N-Hudson & Harlam	714.70
M-N-New Haven	764.90
Total Metro North	1,479.6
Long Island Rail Road	1,720.9
Total Suburban Rail	3,200.5
Total New York Suburbs	3,472.4 e
TOTAL REGION	15,557.9 e

e - Estimated

Sources : Transit operator's data and NYMTC estimates.

Rail Transitway Mileage

Rail transitway mileage could be considered as one of the parameters for arriving at the individual financial contributions of the different areas comprising the New York Metropolitan region. Fixed guideways are exclusive rights - of- way for rail systems. Although the total miles of fixed guideways are limited, the maintenance cost is far higher than that for a corresponding length of the highway system.

The Federal government makes use of rail train route miles and train miles in the allocation of grants for construction and operating assistance for rail systems. Section 5(a)(3)(A) of the Urban Mass transportation Act 1964 as amended through February 1988 states that "To make grants for construction and operating assistance projects under this subsection involving commuter rail or other fixed guideway systems, the Secretary shall apportion for expenditure in each fiscal year the sums appropriated pursuant to subparagraph (B) of this paragraph.

Such sums shall be made available for expenditure in urbanized areas or parts there of on the basis of a formula under which urbanized areas or parts thereof will be entitled to receive an amount equal to the sum of

(i) two-thirds of the total amount to be apportioned as follows : one half multiplied by a ratio which the number of commuter rail train miles operated within or serving the urbanized area in the prior fiscal year bears to the total

number of commuter rail train miles operated in or serving all urbanized areas in the prior fiscal year, and one-half multiplied by a ratio which the number of commuter rail route miles operated within or serving the urbanized area in the prior fiscal year bears to the total number of commuter rail route miles operated in or serving all urbanized areas in the prior fiscal year. No single eligible State's portion of an urbanized area shall receive in any fiscal year less than one-half per centum or more than 30 per centum of the sums appropriated for such fiscal years pursuant to this clause; (ii) one-third of the total amount to be apportioned multiplied by the ratio that the number of fixed guideway route miles (excluding commuter rail route miles) in the urbanized area in the prior fiscal year bears to the total number of such fixed guideway system route miles (excluding commuter rail route miles) in all urbanized areas in the prior fiscal year.

For the purposes of the calculation to be made under this subparagraph, no single State's portion of an urbanized area shall receive more than 30 per centum of the sums apportioned for such fiscal year pursuant to this clause. Sums apportioned under this paragraph shall be available for expenditure only for capital or operating assistance projects involving commuter rail or other fixed guideway systems, except that such sums may also be available for expenditure for bus and bus related facilities if there are no commuter

rail or fixed guideway systems in operation and attributable to the urbanized area in the fiscal year of apportionment."

Table - 5 shows the rail transitway mileage for various transit systems in the New York Metropolitan region for the year 1987.

TABLE 5

RAIL TRANSITWAY MILEAGE, NEW YORK METROPOLITAN REGION

(1987)

TRANSIT SYSTEM	ROUTE MILES	MILES OF TRACK
New Jersey		
Newark - NJT Corp	755.2	779.7
Port Authority TC	30.5	37.1
Total	785.7	816.8
New York City		
New York CTA	488	691.0
Staten Island Rapid Transit	28.6	28.6
Total	516.6	719.6
New York State		
Long Island Rail Road	623.3	701.1
Metro north	535.3	757.7
PATH	27.6	35.8
Total	1186.2	1,494.6

SOURCE : US DOT. National Urban Mass Transportation Statistics, 1988 Section 15 Annual Report

3.1.1 Formula for Contribution by Individual Sectors

In order to provide a fair and equitable distribution of the financial burden to be borne by the different sectors of the New York Metropolitan region the following factors have been considered:

* Total population
* Density of population
* Vehicle revenue miles
* Passenger miles
* Directional route miles of rail transitway
* Track miles of rail transitway.

Population and Area of Service

Population and area of service are accounted for when we consider total population and density of population. Total population measures the number of people who are benefitting directly or indirectly as a result of the introduction of mass transit in their area. Even if the residents do not directly use mass transit they accrue other indirect benefits like increased property values and improved conditions for business and commerce.

Density takes into consideration the geographical area of the sector with respect to the population. Since mass transit has traditionally been concentrated in areas of high density, it is logical to assume that areas of high density are benefitting more than areas of lower density.

Hence, areas of higher density could contribute a larger share for mass transit improvements. It is, therefore, logical to attribute a total weight of 2/5 for these two factors. Each factor would contribute 50 percent of this total.

Table - 1 lists the total population and Table -2 lists the geographical area of the various sectors in the New York Metropolitan region. This has been used in Table - 6 to calculate the density of population and the factor for calculating the contribution to public transportation by each individual sector / area in the New York Metropolitan region.

Determination of Factors for Population

$$Fp = 2/5(1/2 \times Pi/TP + 1/2 \times Di/TD)$$

Fp = Factor for population

Pi = Population of Area (i)

TP = Total Population of the region

Di = Density of population in Area (i)

TD = Total density of population of the region

TABLE-6

FACTORS FOR POPULATION

AREA	POPULATION	DENSITY	FACTOR
Connecticut	1,707,200	1,263.66	0.027
New Jersey	5,489,357	1,600.39	0.0707
New York City	7,345,000	24,321.19	0.2492
New York State	3,840,000	1,880.51	0.0547
Total	18,381,557	29,065.75	0.4

Service Utilization

Vehicle revenue miles and passenger-miles are a measure of the size of the vehicle fleet and the number of passengers using these vehicles. They help to measure the effect of the direct users of mass transit. The primary users of the facility could contribute a larger share for using it. Hence these two factors could contribute another 2/5 of the total expenses for improving mass transit. Since vehicle revenue miles is a more accurate measure of use it could be the major factor of the two. Hence, it could be weighted to represent 80 percent and the balance of 20 percent could be attributed to passenger miles.

Table-3 lists the annual revenue vehicle miles travelled and Table-4 lists the annual passenger miles travelled for the individual sectors forming part of the area under study. These are used to determine the factor for contribution to public transportation by each of the individual sector/area of the New York Metropolitan region as shown in table 7.

Determination of factors for Service Utilization

$Fu = 2/5(4/5 \times RVi/TRV + 1/5 \times PMi/TPM)$

Fu = Factor for service utilization

RVi = Annual revenue vehicle miles of area (i)

TRV = Total annual revenue vehicle miles of the region

PMi = Annual passenger miles travelled in area (i)

TPM = Total annual passenger miles travelled in the region

TABLE-7

FACTORS FOR SERVICE UTILIZATION

REGION	REVENUE VEH MILES	PASSENGER MILES	FACTOR
Connecticut	9.2	67.5	0.00566
New Jersey	129.3	3,032.1	0.07569
New York City	424.6	8,985.9	0.2435
New York State	125.3	3,472.4	0.0761005
Total	688.4	15,557.9	0.4

Rail Transitway Mileage

Rail transit fixed guideways are an exclusive right-of-way used by the rail systems, which are primarily public transit systems. The cost is attributable to mass transit alone. Private vehicles do not make use of it and, therefore, do not help to defray this cost.

Directional miles of rail can be defined as the total miles of track over which public transportation vehicles travel while in revenue service, computed with regard to direction, but without regard to the number of rail tracks existing in the right-of-way. If vehicles travel in only one direction within the right-of-way, each mile is counted once. If vehicles travel in both directions, each mile is counted twice. They are a measure of the facility and not of the service carried on the facility. Miles of track refer to the total miles of track that is laid on the ground.

A weight of 1/5 is therefore attributed to rail transitway mileage. This weight is equally shared on a 50 percent basis between directional miles of rail and miles of track.

Table-5 lists the directional route miles and miles of track of the individual area/sector in the New York Metropolitan region which is used in Table-8 to determine the factor for contribution to public transportation by each of these areas.

Determination of Factors for Transitway Mileage

$$Ft = 1/5(1/2 \times DRi/TDR + 1/2 \times TMi/TTM)$$

Ft = Factor for transitway mileage

DRi = Directional route rail miles in area (i)

TDR = Total directional route rail miles in the region

TMi = Rail track miles in area (i)

TTM = Total rail track miles in the region.

TABLE-8

FACTORS FOR TRANSITWAY MILEAGE

REGION	ROUTE MILES	MILES OF TRACK	FACTOR
New Jersey	785.7	816.8	0.05852
New York City	516.6	719.6	0.04450
New York State	1,186.2	1,494.6	0.09692
Total	2,488.5	3,031.0	0.2

Determination of Funding Formula for Public Transportation

The factors listed in Tables - 6, 7 and 8 are used to arrive at the final funding formula for public transportation. Table - 9 lists the final funding factor for each of the individual areas in the New York Metropolitan region.

F = Fp + Fu + Ft

F = Final funding factor

Fp = Factor for population

Fu = Factor for service utilization

Ft = Factor for rail transitway mileage

TABLE - 9

FUNDING FACTORS FOR PUBLIC TRANSPORTATION

AREA	Fp	Fu	Ft	F
Connecticut	0.02727	0.0	0.00566	0.03293
New Jersey	0.07072	0.05852	0.07569	0.20493
New York City	0.24720	0.04450	0.24350	0.53520
New York State	0.05470	0.09697	0.07610	0.22770
Total	0.4	0.2	0.4	1.0

Contribution by Individual Areas for Public Transportation

The total annual deficit is $1.3 billion of which $800 million is the capital deficit and $500 million is the operating deficit. The Federal government is assumed to contribute 60% of the capital deficit. The total deficit to be covered by the local/state governments is $820 million.

The contribution of each individual area is determined by multiplying the total deficit by the factor "F", which is the sum total of the factors of population, service utilization and transitway mileage as shown in Table - 9.

Table - 10 lists the individual contribution of each area for public transportation.

TABLE - 10

ANNUAL CONTRIBUTION BY INDIVIDUAL SECTOR/ AREA

FOR PUBLIC TRANSPORTATION

AREA	FACTOR	CONTRIBUTION ($ million)
Connecticut	0.03293	27
New Jersey	0.20493	168
New York City	0.5352	438
New York State	0.2277	187
TOTAL	1	820

3.2 Highways and Bridges

The federal government is the major funding source for the capital needs of highways and bridges. However, its involvement in administration of these highways and bridges is minimal. They are administered and maintained by state and local governments. Several types of measures could be chosen to represent current physical assets and service utilization of the public highway system like:

* Highway mileage
* Number of vehicles registered
* Daily vehicle miles of travel
* Number of Bridges
* Geographical area
* Population

These are not all inclusive. For example the Federal government in its version of the Surface Transportation Assistance Act 1991 envisages major changes. U.S.Department of Transportation, Summary of Surface Transportation Assistance Act 1991 states, "The Surface Transportation Assistance Act of 1991 would simplify these formulas and place increased emphasis on use of the highway system. National Highway Program funds will be apportioned based 70 percent on each states's share of total highway use of motor fuel, 15 percent on each state's share of total road mileage, and 15 percent on land area.

There will also be an apportionment adjustment through the use of a low population density factor to give extra funds (capped at $35 million a year per state) to states with low population densities to ensure that national needs are met in these states. Each state would receive at least one-half of one percent of apportioned National Highway Program funds."

It is possible to use formulas incorporating various indicators for earmarking the amount of money to be paid by each sector of the New York Metropolitan area in order to meet the local share of the monies to be raised.

Highway Mileage

The most rudimentary measure of the physical assets of highways is the number of miles in the system. Highway mileage could be simply defined as the miles of highway that exist in a particular area.

The Federal government has set a precedent in the use of highway mileage for disbursing highway funds.

a) Section 152(e) Title 23 of the Federal highway program allocates 25% of the Highway safety funds on the basis of highway mileage.

b) Section 144(e) also allocates 25% of the funds for hazard elimination programs on the same basis.

The highway mileage is a measure of the asset value available to a particular area. The network of roads is designed to provide road access to other parts of the country. As such, they provide significant economic value primarily for local residents and businesses. If a particular state has more miles of highway it will need more funds for maintenance and operation.

In addition the presence of highways increases property value, encourages business, and promotes commerce. All this translates into increased tax revenue for the particular state. It is, therefore, reasonable to assume that the states must contribute in proportion to the miles of highway that exist in their domain.

Tables - 11, 12, 13 and 14 lists the highway mileage by jurisdiction in those areas of Connecticut, New Jersey, New York City and New York State that form part of the New York Metropolitan region.

TABLE -11

HIGHWAY MILEAGE BY JURISDICTION - CONNECTICUT (1987)

P.REGION	STATE HIGHWAY MILES	LOCAL ROADS	TOTAL
Central Naug	258.32	1,125.77	1,384.09
Greater Bridge	135.72	1,047.01	1,182.73
Housatonic V	229.61	1,083.42	1,313.03
South Central	386.70	1,873.94	2,260.64
South Western	178.86	1,298.42	1,477.28
Valley	64.68	322.97	387.65
TOTAL	1,253.89	6,751.53	8,005.42

Source: Connecticut Department of Transportation

TABLE -12

HIGHWAY MILEAGE BY JURISDICTION - NEW JERSEY (1987)

COUNTY	STATE HIGHWAY MILES	LOCAL ROADS	TOTAL
Bergen	133.18	2,676.07	2,809.25
Essex	76.14	1,570.49	1,646.63
Hudson	47.02	562.17	609.19
Middlesex	92.34	2,004.02	2,181.74
Monmouth	229.54	2,523.22	2,752.76
Morris	149.02	2,112.07	2,261.09
Ocean	168.91	2,342.90	2,511.81
Passaic	58.50	1,177.01	1,235.51
Somerset	117.88	1,233.78	1,351.66
Sussex	137.96	1,222.60	1,359.96
Union	76.53	1,325.53	11,402.06
TOTAL	1,371.40	18,750.26	20,121.66

Source: New Jersey Department of Transportation

TABLE -13

HIGHWAY MILEAGE BY JURISDICTION - NEW YORK CITY (1987)

COUNTY	TOTAL	STATE	COUNTY	TOWN	CITY	VILLAGE	OTHER
Bronx	789	35	X	X	744	X	11
Kings	1,502	19	X	X	1,478	X	5
New York	605	10	X	X	562	X	33
Queens	2,420	47	X	X	2,363	X	10
Richmond	759	21	X	X	730	X	8
TOTAL	6,075	131	X	X	5,878	X	66

NOTE : X - Not applicable

SOURCE : New York State Department of Transportation

TABLE -14

HIGHWAY MILEAGE BY JURISDICTION - NEW YORK STATE (1987)

COUNTY	TOTAL	STATE	COUNTY	TOWN	CITY	VILLAGE	OTHER
Nassau	4,097	210	493	2,129	117	1,138	11
Putnam	763	133	117	500	X	13	X
Rockland	1,113	99	149	548	X	239	79
Suffolk	6,945	426	413	5,391	X	612	104
Westchester	3,257	458	175	1,265	739	575	46

NOTE : X - Not applicable

SOURCE : New York State Department of Transportation , Planning Division

Number of Vehicles Registered

The number of registered vehicles is a measure of the private sector involvement in the highway system. The private sector has close to a trillion dollars invested in motor vehicles of all kinds - more than twice the public sector investments in roads and bridges.(10)

Further, considerable personal and work resources are dedicated to the movement of people and goods. In fact, for every dollar the public sector spends to construct, operate and maintain the highway system, the private sector spends $15 to move people and goods.(11)

However, the use of the number of vehicles registered to decide the allocation of funds by the Federal or State government has no precedence. It is obvious that the larger the number of vehicles registered in an area, the greater is the use of the highway system by these vehicles. This is reflected by a corresponding increase in vehicle-miles of travel. Similarly, areas with lesser number of vehicles registered will use the highways to a lesser extent.

In addition the number of vehicles registered is also proportional to the income of the state in the form of registration fees, gas tax and sales tax. It is therefore an important indicator that could be used to decide the proportion of use of the highways. Table - 15, lists the annual motor vehicle registrations in the study region.

TABLE - 15

1987 ANNUAL MOTOR VEHICLE REGISTRATIONS

CONNECTICUT		1,216,661
	Central Naugatuck	177,783
	Greater Bridgeport	202,798
	Housatonic Valley	145,372
	South Central	367,773
	Southwestern	262,783
	Valley	60,152
NEW JERSEY		3,609,865
	Bergen	577,497
	Essex	430,503
	Hudson	247,283
	Middlesex	451,290
	Monmouth	383,847
	Morris	316,925
	Ocean	272,900
	Passaic	306,304
	Somerset	142,583
	Sussex	92,700
	Union	388,033
NEW YORK CITY		1,922,975
	Bronx	276,650
	Kings	448,
	New York	221,725
	Queens	770,878
	Richmond	210,721
NEW YORK SUBURBS		3,063,691
	Nassau	1,020,868
	Putnam	69,951
	Rockland	196,949
	Suffolk	1,065,250
	Westchester	710,673

Notes : Motor vehicle registrations include passenger cars, rental cars, commercial vehicles, buses and taxis throughout the region and motor cycles in the states of New York and Connecticut.

Sources : New York State and Connecticut state Departments of Motor Vehicles.
R.L. Polk Co for New Jersey

Daily Vehicle Miles of Travel

Vehicle miles of travel is the most comprehensive measure of highway output as it captures both passenger and freight highway use. It is predominantly made up of passenger vehicle travel. While useful as a measure of the physical output of the highways, vehicle-miles of travel masks an important shift in highway use. Passenger-miles are growing at a faster rate than automobile vehicle-miles of travel. This implies a shift toward higher vehicle occupancy. Consequently, the measure of vehicle-miles of travel alone underestimates the increased use of the system.

The Federal government has set a precedent in the use of vehicle-miles for allocating funds. Section 104(b)(5)(B) Title 23 of the Federal highway program allocates 45% of the funds for interstate resurfacing, restoration, rehabilitation and reconstruction on the basis of vehicle miles travelled.

Vehicle-miles of travel is a measure of service utilization. States that record greater miles of travel use the highways to a greater extent. Thus vehicle-miles could be used as one of the measures to decide the contribution of individual sectors / states for improving and maintaining the highway system.

Daily vehicle-miles of travel for the year 1987, in the New York Metropolitan region are presented in Table - 16.

TABLE - 16

DAILY VEHICLE MILES OF TRAVEL - 1987
(1000's)

Sector	DVMT
Connecticut	33,255
New Jersey	105,273
New York City	49,229
New York State	80,000
Total	267,757

Source: NJIT

Number of Bridges

Bridges are a measure which represents current physical assets in the highway system. The New York Metropolitan region has a relatively large number of rivers, both large and small. This accounts for the large number of bridges in the area. The existing bridges are very old and poorly maintained. The country as a whole and New York in particular is scrambling to repair its crumbling bridges. The cost of maintaining these aging bridges is huge. These bridges improve access for the areas in which they are located. It is therefore logical to expect these areas to provide a share of money which is proportional to the number of bridges in their domain. Table - 17 contains the number of bridges in each sector of the New York Metropolitan region.

TABLE-17

INVENTORY OF BRIDGES

SECTOR	NUMBER OF BRIDGES
Connecticut	1,200
New Jersey	5,953
New York City	618
New York State	600
Total	8,371

SOURCE : National Strategic Transportation Planning Case Study for the New York Region Vol 1, Sep 1989

Geographical Area

The Federal government uses area as an important criterion while disbursing funds for highway programs.

a) Section 104(b)(1) Title 23 of the Federal highway program allocates 2/9 of formula "A" funds for the primary system based on area.

b) Section 104(b)(2) of the same program provides 1/3 of the funds for the secondary system on the basis of area.

Geographical area represents the area that is served by the highway system. In order to be serviced effectively a larger area needs a larger network of roads. Thus larger areas must contribute a larger share to the common pool of funds devoted to maintenance and development of highways in the region. Table - 2 contains the geographical area of the individual sectors in the New York Metropolitan region.

Population

Population is the major factor for allocating a variety of funds under the Federal highway program.

a) Section 104(b)(1) which is used to determine formula funds "A" and "B" for the Primary system allocates 2/9 and 1/2 of the funds respectively on the basis of population

b) Section 104(b)(2) of the same program allocates 1/3 of the funds for the secondary system on the basis of population.

c) Section 104(b)(6) and Section 104(f)(2) of the program use population as the sole criterion for allocating funds for urban systems and urban transportation planning.

d) Sections 152(e) and Section 402(c) allocate 3/4 of the funds for hazard elimination and highway safety programs on the basis of population.

The larger the population the greater is the use of the highway system in the particular area, which in turn demands greater maintenance at corresponding higher costs.

3.2.1 Formula for Contribution by Individual Sectors

The following factors have been considered to arrive at a formula for the contribution by individual sectors of the region.

* Highway mileage
* Total number of bridges
* Daily vehicle miles of travel
* Number of registered vehicles
* Population
* Geographical area

Measure of Resources

Highway mileage and the number of bridges are together used as a measure of available resources. They are the input for the system and could influence vehicle miles of travel and the number of vehicles using these highways.

Most roads are local. About 80% of the urban system mileage is owned and operated by the local governments. Most of those that are not local are owned and operated by the state. Hence, these roads are an important measure of local resources and need a sizeable amount of funds for maintenance and improvement.

The second major resource is the number of bridges in the area. The bridges in the Metropolitan region are in a precarious condition and need large investments for maintenance. Bridges acquire added significance under the new Surface Transportation Assistance Act - 1991.

Current law prohibits the states from using federal funds for toll roads. The STAA of 1991 could change this in order to attract new public and private investments in the construction of both roads and bridges. Toll facilities could be eligible for inclusion in the National Highway System. States could be allowed to use federal funds to: improve existing toll facilities and also create new toll facilities.

These toll facilities could be a new source of revenue for the local government. It is therefore logical to assume that these areas could contribute funds for the Metropolitan region in proportion to the number of bridges in the area. Tables 11, 12, 13, and 14 depict the highway mileage by jurisdiction and Table - 17 shows the inventory of bridges of each sector that form part of the New York Metropolitan region. This data is used to determine the factor for resources in Table - 18.

Determination of Factors for Existing Resources

$Fr = 1/3(3/4 \times HMi/THM + 1/4 \times Bi/TB)$

Fr = Factor for resources

HMi = Highway mileage of area (i)

THM = Total highway mileage of the region

Bi = Number of bridges in the area (i)

TB = Total number of bridges in the region

TABLE - 18

FACTORS FOR RESOURCES

AREA	HIGHWAY MILEAGE (MILES)	NO OF BRIDGES	FACTORS
Connecticut	8005.42	1200	0.0516
New Jersey	20121.66	5953	0.1591
New York City	6075.00	618	0.0362
New York State	16175.00	600	0.0862
Total	50377.08	8371	0.3333

Service Utilization

Daily vehicle miles of travel and number of registered vehicle are used to reflect service utilization. Increased vehicle miles of travel account for increased wear and tear of the infrastructure which places an added emphasis on maintenance causing additional expenses. This increased wear and tear is also reflected by the number of vehicles using the system.

In addition, the registered number of vehicles directly contributes to increased revenue for the states in the form of registration fees, insurance, and sales tax from the purchase of gas and other accessories. Increased vehicle miles of travel also account for increased revenues from the sale of gas.

Thus the use of these parameters is justified in determining the share of the individual areas forming part of the Metropolitan region.

Table - 15 shows the number of vehicles registered in the region and Table - 16 shows the daily vehicle miles of travel. Table - 19 uses these facts to compute compounding the factor for service utilization which is used to determine the contribution of each individual sector for highways and bridges.

Determination of Factors for Service Utilization

$$Fu = 1/3(3/4 \times DVMTi/TDVMT + 1/4 \times RVi/TRV)$$

Fu = Factor for service utilization

DVMTi= Daily vehicle miles travelled in area (i)

TDVMT= Total vehicle miles travelled in the region

RVi = Number of registered vehicles in area (i)

TRV = Total number of registered vehicles in the region

TABLE - 19

FACTORS FOR SERVICE UTILIZATION

AREA	DAILY VEHICLE MILES TRAVELLED (THOUSANDS)	NO OF REGISTERED VEHICLES	FACTORS
Connecticut	33,255	121,661	0.04136
New Jersey	105,273	3,609,865	0.12683
New York City	49,229	1,922,975	0.06330
New York State	80,000	3,063,691	0.10182
Total	267,757	9,813,192	0.33333

Measure of Service Demand

The size of a geographical area and its population contribute to the demand for services in that particular area. A larger area obviously needs a large network of roads to facilitate travel as compared to a smaller area. Similarly a larger population places a heavier demand on the limited number of services like highways and bridges. These two factors are thus used to determine the share to be contributed by the sectors forming part of the region.

Table - 1 lists the population and Table - 2 lists the geographical area for the various sectors in the New York metropolitan region. Table - 20 uses this information to arrive at the factor for service demand in each sector of the region.

Determination of Factors for Service Demand

$Fd = 1/3(1/2 \times Ai/TA + 1/2 \times Pi/TP)$

Fd = Factor for required service

Ai = Geographical area of area (i)

TA = Total geographical area of the region

Pi = Population of the area (i)

TP = Total population of the region

TABLE - 20

FACTORS FOR SERVICE DEMAND

AREA	GEOGRAPHICAL AREA	POPULATION	FACTOR
Connecticut	1,351	1,707,200	0.04708
New Jersey	3,430	5,489,357	0.13000
New York City	302	7,345,000	0.07366
New York State	2,042	3,840,000	0.08258
Total	7,125	18,381,557	0.33333

Determination of Funding Formula for Highways and Bridges :

The final factor for determining the contribution of each individual sector/area in the New York metropolitan region is arrived at by adding the factors for existing resources, service utilization, and service demand. This final factor is used to determine the final contribution of each sector for the highways and bridges of the region.

The total deficit for highways and bridges for the 25 year period (1991-2015) is estimated to be $33.4 billion. It is assumed that the Federal government will finance 70% of this deficit. The balance of $10.2 billion has to be financed by the local/state governments. The annual deficit to be financed by local/state governments is $400.8 million. Based on the total weights, the individual contribution of each area/sector is as shown in Table-21.

F = Fr + Fu + Fd

F = Factor for highway and bridge contribution

Fr = Factor for existing resources

Fu = Factor for service utilization

Fd = Factor for service demand

TABLE - 21

ANNUAL CONTRIBUTION BY INDIVIDUAL SECTORS/AREAS
FOR HIGHWAYS AND BRIDGES

AREA	FACTOR (F)	CONTRIBUTION ($ million)
Connecticut	0.14	56.11
New Jersey	0.42	168.34
New York City	0.17	68.14
New York State	0.27	108.21
Total	1.00	400.80

3.3 Contribution by Individual Areas for Surface Transportation

The contribution by individual areas for surface transportation is based on the total of the contribution for Public Transportation (Table - 10) and Highways and Bridges (Table - 21). Connecticut should contribute $27 million for public transportation and $56.11 million for highways and bridges making the total $83.1 million per year. Similarly New Jersey has to contribute $168 million for public transportation and $168.34 million for highways and bridges thus totalling $336.34 million annually. New York City has to contribute $438 million for public transportation and $68.14 million for highways and bridges making a total of $506.14 million per annum. New York State has to contribute $187 million for public transportation and $108.21 for highways and bridges making a total of $295.21 per annum. These contributions of the various sectors are shown in Table - 22.

The bar chart of Figure - 2 shows the annual contribution of each sector for public transportation and highways and bridges. The total annual contribution for surface transportation by each sector is depicted in the pie chart of Figure - 3.

TABLE - 22

ANNUAL CONTRIBUTION OF SECTOR/AREA IN THE REGION
FOR SURFACE TRANSPORTATION
(Millions of dollars)

AREA	PUBLIC TRANSPORTATION	HIGHWAYS & BRIDGES	TOTAL
Connecticut	27	56.11	83.11
New Jersey	168	168.34	336.34
New York City	438	68.14	506.14
New York State	187	108.21	295.21
Total	820	400.80	1220.80

NEW YORK METROPOLITAN REGION

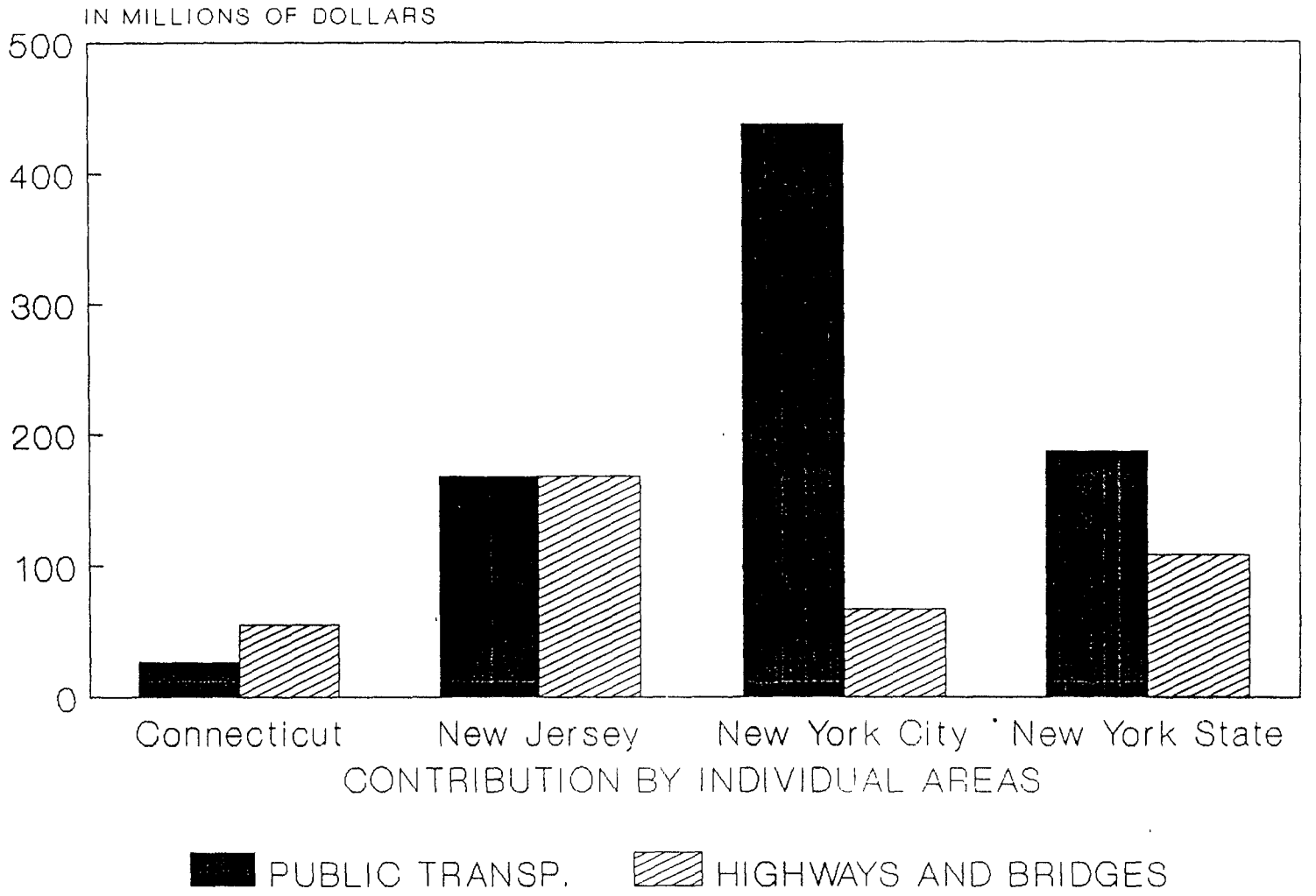
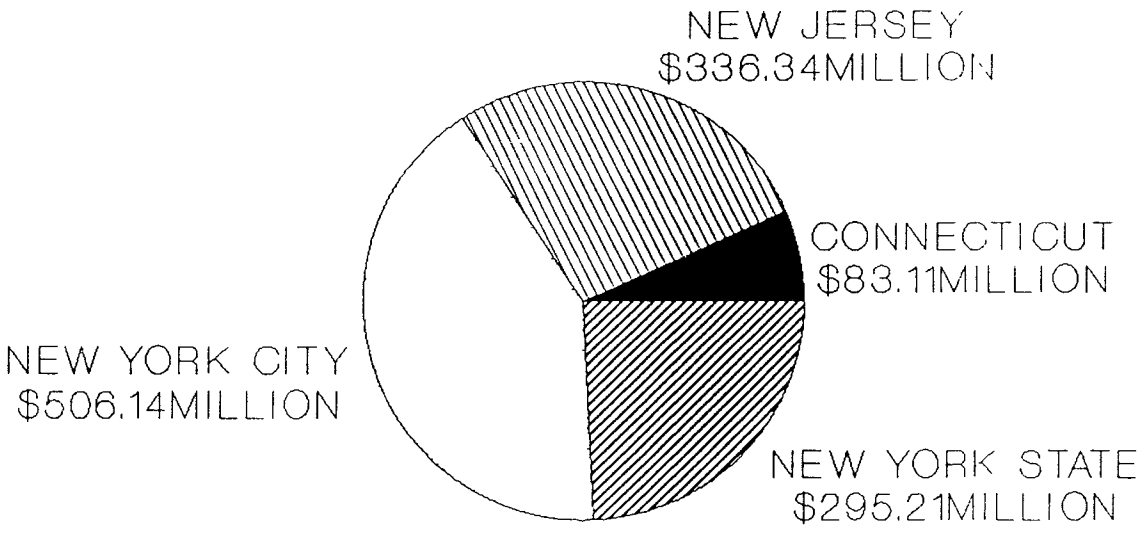


FIGURE 2

SURFACE TRANSPORTATION



CONTRIBUTION BY INDIVIDUAL
AREAS/ SECTORS

FIGURE 3

CHAPTER 4

FUND RAISING MECHANISM

A successful funding mechanism needs to incorporate flexibility in its funding programs. The financing needs for Public Transportation and Highways and Bridges could be grouped into a single category since their functions tend to overlap. This new category could be renamed Surface Transportation. This could help to allocate funds to the most needed sections of Transportation which could translate into greater productivity.

The sources of funding should provide a steady stream of income and should not be influenced by the vagaries of the economy. The funding mechanism can succeed only if there is greater coordination among the various agencies like the New York City Department of Transportation, New Jersey Transit, Port Authority of New York and New Jersey, and the Metropolitan Transportation Authority.The American Public Works Association in its booklet Paying for Transportation at the Local Level (1984), analyzes 16 mechanisms for raising local transportation dollars. These are - highway related revenue from property taxes; motor fuel taxes; motor vehicle fees and taxes; parking taxes; tolls; local sales taxes; income taxes; bonds; impact taxes; street utilities; billboard advertising and advertising on other public facilities; state lotteries; contracting out work; leasing arrangements; employer subsidies of transit fares; and developer fees.

When tied to effective policies these revenue generating mechanisms can bring about the support that public transportation programs require.

The above mentioned mechanisms basically suggest two methods for raising revenue

1. Strengthening the performance of existing systems by using the existing infrastructure to the optimum extent by maximizing efficiency and reducing waste.
2. Innovative and traditional financing schemes both new and old which could be tapped or augmented.

4.1 Strengthening the Performance of Existing Systems

There exists a need for innovative means to sustain services without increases in local taxation or transport user fares and fees. This could be achieved by making optimum use of available resources. One area for improvement is maintenance. Federal laws make it cheaper to replace than maintain. This is particularly true for buying vehicles funded by the Federal government. New incentives for repair and maintenance have to be introduced. The use of market competition in transit to improve efficiency and reduce cost could also be considered.

There is a need to introduce performance indicators to facilitate comparison. In addition innovation in the technical and management fields could help to reduce delays in siting, design and construction. Some of the means of achieving it are discussed in subsequent paragraphs.

4.1.1 Automation of ticket booths

Labor accounts for 80% of the operating expenses of the New York City Transit Authority (NYCTA). Personnel costs (higher wages and benefits per employee, and the need for more workers to produce the same output) accounted for over 62% of the increase in subway costs and 56% of the change in bus costs over the period from 1960 to 1984.

In fact, between 1960 and 1984 output per NYCTA worker dropped 25%, while the cost of a NYCTA worker in constant dollars increased over 75%.(9). Thus any savings in terms of labor is likely to have a pronounced financial impact.

The City of New York has about 489 subway stations. Each station has on the average at least two clerks selling tokens to commuters. These token booths are manned 24 hours a day. There is a minimum of three clerks for each station. The total number of clerks is about 1834, assuming an additional 25% to cater for clerks on leave and stations that have more than one clerk on duty at a time. Assuming conservatively that each clerk is paid $32,000, the total salary savings alone is $56.68 million.(13)

This does not take into account money paid towards other benefits like health, paid leave and pension. The machines will not only be cost effective but also more efficient. The approximate cost of a vending machine is estimated to be about $10,000. The cost of replacing all token clerks with vending machines is estimated to be $18.34 million. This is a one time capital investment. Hence we could realize a savings of $38.34 million in the very first year and subsequently $56.68 million per year. This does not take into account improved efficiency, lack of absenteeism, and 24 hour service in all stations. Maintenance cost is minimal, since the personnel responsible for maintaining the turnstiles could also take care of the vending machines.

Presently there are only 57 token vending machines in use. It is estimated that an additional 75 vending machines will be in operation by the middle of 1992.

Additionally, tokens could be sold in all the major retail outlets like fast food stores, candy stores and grocery shops. They could help the shop owners to capitalise on impulsive buyers, who came to buy tokens. At the same time, this could make the tokens easily available to customers in several locations. BART in San Francisco functions without any token clerks, New York can learn from this example.

Privatization of bus routes

The full cost of a ride on a New York subway or bus is estimated to be $3.22. It is subsidized and the fare charged is $1.15. In fact, the actual cost is much higher and tax payers make up the difference. At the same time private entrepreneurs like private van operators provide popular transportation services with licensed and inspected vehicles for as little as $1 a ride and receive no subsidies.(14)

The development of the suburbs has created awareness of the fact that the market for traditional transit service is progressively diminishing. Fiscal realties of reduced federal dollars and mushrooming operating costs have affected the level of service. Public transit systems lack flexibility to adapt to changes in the market place.

In order to make the public transit systems more responsive to the market, they should compete with private carriers to provide transportation.

It has been estimated that the net revenue loss per vehicle per year is about $87,321. If the NYCTA could remove just 10 percent of its vehicles from operations on its low revenue outlying routes, it could achieve annual gross savings of almost $76 million. (15)

There is an increasing number of gypsy cabs and jitney vans in the New York area. These vehicles compete with public transit for passengers. These van operators offer door to door service, faster rides, assured seats and drivers who make change for fares. This kind of personalized service can not be provided by public carriers. These van operators usually ply on major bus routes. More than 95% of the van passengers were original patrons of public buses. These vans have very low overheads as they are owner operated and carry minimum insurance.

It is therefore prudent to discontinue public bus service on such routes. The operations of these jitney vans should be regulated to conform to minimum standards of public service. An agency like the Taxi and Limousine Commission could be entrusted to enforce regulations.

These kind of private ventures in the domain of public transportation should be welcomed and encouraged in order to improve the existing standards and ensure competitive prices. Monopoly either by the private or public sector bodes ill for the consumer. Competition is likely to ensure quality and give the customer the best for his money.

4.2 Innovative and Traditional Financing Schemes

As traditional funding sources dry up there exists a need to identify new and innovative means of raising revenue for various transportation projects. Studies show that there is a strong relationship between economic development and transportation. It could be possible to raise funds by identifying potential benefits to speciic groups,taxing those benefits, and using the proceeds for transportation.

Tolls on East River and Harlem River Bridges

Tolls are a costlier way of raising funds than taxes, since they require the construction and operation of toll barriers. Toll bridges incur extra capital costs and have higher operating expenses than do comparable bridges with no tolls. To collect tolls costs twice as much (14% of receipts) as state highway taxes (7% of receipts). Tolling can also cause delays and circuitous travel for drivers choosing to avoid paying tolls.(7)

However, tolls afford a better guarantee of upkeep by providing a source of dedicated revenues over the life of a facility. Tolls also have the potential to relieve traffic congestion by rationing limited highway capacity during peak hours which can at least postpone the need for additional highway capacity.

Toll financed projects have the clearest prospects for financial success in urban areas and high growth regions that expect heavy traffic volumes. The bridges on the East river fulfill these requirements.

The Surface Transportation Assistance Act 1991, is likely to facilitate federal funds for toll roads and bridges. States could be allowed to use federal funds for improving existing toll facilities, constructing new toll facilities and converting non - Interstate free facilities to toll facilities. States could be permitted to continue the tolls on roads, bridges and tunnels after the initial construction costs are recovered as long as any excess revenue is used for other highway or transit projects.

Traditionally no tolls have been charged on the East River and Harlem River Bridges. It is estimated that a toll of $2.50 over these bridges could yield an additional revenue of about $700 million a year.(10). The installation of electronic toll collection equipment could handle three times the traffic handled by conventional methods. It could also prevent congestion and reduce pollution which is one of the common complaints lodged against toll booths.

It has been said that the charging of tolls taxes the poor who cannot pay these fees. However, it must be remembered that part of the revenue earned from toll facilities is used to subsidize mass transit.

The use of tolling effectively reduces congestion, increases revenue and reduces pollution. Such a combination of results cannot be achieved by any other single method. The use of tolls to raise revenue keeps with the federal spirit of charging fees to users for the services they consume.

Advertisement

Mass transit has a good potential for serving the advertising industry. This potential could be exploited to create additional income or alternatively reduce expenses. The New York City Transit Authority raises almost $17 million from advertising(5). This could be further increased by other innovations like adopt a station programs and advertising on license plates.

Adopt a Station Program

A recent survey showed that 68% of the subway patrons find the stations dark, dirty and smelly. Passengers are troubled by the large number of homeless people, illegal peddlers and beggars. In addition, robberies, turnstile jumpers, the smell of urine and cardboard homes contribute to riders' discomfort and fear.(12)

This could be attributed to a lack of identity for these stations. This identity could be gained if the station is affiliated with major businesses.

Stations could be effectively used by major businesses as a means of advertising their image and products. It could also improve public relations by portraying the image of a caring corporation which is sensitive to local needs and priorities. These businesses could develop direct access to the stations from their offices, if they are located near the station. A good example is the Dunn and Bradstreet building near Chambers Street. Painting the subway stations alone is estimated to cost $35.3 million. In addition the Transit Authority maintains a work force of 1,300 station cleaners.(9). If the average salary is assumed to be $25,000 per year for each worker, the total cost equals $32.5 million. The total amount of money on cleaning and maintenance equals $109.8 million. Even if the private sector adopts 25% of the stations in the area, it will yield savings of $27.45 million annually.

Advertising on License Plates

The purchase of special organization license plates to members of such groups as Veterans of Foreign Wars, Green Peace Movement, American Legion, World Wildlife Fund and other groups could be popularized and actively encouraged. These effectively publicize the different organizations and could be sold at prices ranging from $20 to $25. Pennsylvania has extended this concept of transportation related advertising by selling such plates to groups such as Elks, Masons, etc.

In 1984 alone the state sold 82,000 such plates at a cost of $20 and realized over $1.6 million in additional revenue as a result(5). The New York Metropolitan region has about 9,813,192 registered vehicles including commercial vehicles and trucks. It is estimated that if the Metropolitan region is able to market these plates to 5% of these vehicles at a cost of $25 it could raise $12 million annually.

Fast Food Booths / Food Vending Machines

None of the subway stations of New York have any fast food suppliers. Subway stations provide a steady stream of passengers that represents a captive market for vendors. It has been suggested that a forum be created for providing these services by competitive bidding. A monthly fee of $2,000 for each station could yield $12 million annually.

However, the presence of food vendors will cause a new problem - dirty subway stations. There is bound to be an increase in garbage, creating a sanitation problem. At present there exists no provision for waste disposal in the subway trains, which accounts for newspapers and empty beer and soda bottles littering the floors. The availability of food stuff in the stations will worsen the problem and increase the cost of cleaning. A cost benefit analysis will have to be undertaken to study the viability of this proposal.

The Southern California Rapid Transit District estimates that non food and beverage built in vending machines could generate $1 million in 1982 dollars for the Metro rail system(5). A full complement of kiosk and retail stall facilities augmented with vending machines in subway stations in New York could generate an additional $3 million. This assumes that only about 25% of the stations are suitable for these facilities. Some of the bigger stations could possibly accommodate more than one such vending facility.

Increases in Traditional Funding Sources

Traditional funding sources like sales tax, income tax, and property tax, generate the bulk of the funds that were needed for transportation. A marginal increase in these sources will yield substantial amounts of additional funds. However, any increases in taxes is not favored by the common man. Hence, this is likely to generate a lot of political opposition.

Since the funding is spaced over a period of 25 years it is possible to build in a gradual increment in taxes which reflects the changing standards of transportation and provides a justification for these additional tax increases.

General Sales tax

A general sales tax increase of 13.2% can yield $32 billion for the region. This 13.2% increase would imply that the tax rate for New York would increase from 8.25% to 9.35% and New Jersey's tax rate would increase from 7% to 7.92%.

Motor fuel tax

A 100% increase in motor fuel taxes could yield $ 27.4 billion. Since the fuel is consumed basically by motor vehicles, this in fact acts as a user fee. This suggestion keeps with the spirit of the federal government. The proposed Surface Transportation Assistance Act 1991, states that 70% of the National Highway Program funds could be apportioned, based on each state's share of total highway use of motor fuel.

Some of the traditional funding sources for the various sectors forming part of the New York Metropolitan region are listed in Table - 23.

Table - 23

Traditional funding sources

(1987)

Funding Sources	Revenues in million dollars			
	NY	NJ	CT	Total
Total sales tax	7,876	4,911	2,696	15,483
General sales tax	5,098	2,912	1,823	9,833
Motor fuels tax	496	344	254	1,094
Beverage / Tobacco tax	563	269	122	954
Individual income tax	12,477	2,603	466	15,546
Corporate tax	2,143	1,088	480	3,711
Vehicle registration tax	480	350	197	1.027
Lottery revenue	1,296	1,136	484	2,916
Highway trust fund receipts	648	248	240	1,136
Property taxes	13,293	5,766	2,331	21,390
Total	44,370	19,627	9,093	73,090

Source : Statistical abstract of the United States, 109th edition

Motor Vehicle Registration Fees

Currently a New York resident pays $60 for registering his vehicle. Since this is an annual payment, this payment could be raised to $120, which would reflect a 100% increase. Moreover, this increase is justified since the improvements are primarily aimed at improving the transportation network which would be used by these vehicles. Savings in the form of improved mileage and safety could be a direct result of these investments. Thus an increase of 100% could yield an additional $1,027 million for the entire region.

Property tax

A 10% increase in property tax in the three states could yield $53 billion. The major improvements are likely to enhance the value of property in the region. The actual increases could be modified to reflect the likely increase in property value which could vary from place to place.

Corporate income tax

A 12.3% increase in corporate tax in the three states could yield $12 billion. The major corporations could gain major advantages as a result of improvements in the transportation network. Easy access and increased mobility could offset the increased taxes.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Over the years, governments at various levels have been more actively pursuing various forms of innovative financing such as tax increment financing, tolls, traffic impact fees, air rights leasing, etc. Some governments have been more successful than others in implementing innovative mechanisms.

Traditional sources of revenue such as gasoline and property taxes continue to be the mainstay of the transportation sector, but innovative funding mechanisms are also being pursued actively. The success in implementing innovative funding mechanisms may very well decide the future of the surface transportation systems.

In the past, several states had adopted legislation to increase their fuel taxes by 1 cent (Oklahoma) to 4 cents (Arkansas). Some states like Arizona and Iowa had phased fuel tax increases over a period of several years, to minimize the burden on the tax payers. In several states legislation to increase motor fuel taxes failed.

Similarly, efforts to finance public transport by increasing sales tax, property taxes, gas taxes, self employment taxes, beer taxes and taxes on professional services were pursued by different states at different times with varying results.

The results with trying to implement financing mechanisms, both traditional and innovative are mixed. There is a need to understand, why some mechanisms are implemented and others are not; why some of the implemented mechanisms succeed and others fail.

The general conditions favoring the implementation of financing mechanisms include strained transportation systems, stabilized economy, and supportive market and other forces. These conditions by and large exist in the New York Metropolitan region. Hopefully, the economy will also improve to help administer some of the innovative funding mechanisms. A stable economy and favorable market forces will increase the chances of implementing financing mechanisms. Under a stable economy, one neither buffeted by high inflation nor recession, the general population is likely to have sufficient disposable income and industries and businesses are likely to make sufficient profit to accommodate likely tax increases. Under conditions of real increases in income for individuals and businesses, increases in local taxation, in general, are likely to find a more hospitable audience.

The New York Metropolitan region has a concise and explicit transportation program that identifies and justifies needed transportation improvements which is a base for seeking public support to implement financing mechanisms.

In addition, a concerted marketing effort could ensure that the public fully understands the need for the improvements, the necessity for implementing innovative financing mechanisms, and the consequences of failure.

The solution to the financial woes of the transportation industry in the New York region depends on the interplay of a variety of forces including good ideas, economic conditions, political culture, public opinion, interest group politics, bureaucratic politics and intergovernmental politics and finance. Some are significantly more influential in the transportation arena than others, but none are dominant. Change can occur only with the support of the stakeholders. Change always has inherent risk. It is hoped that we will have the political will to undertake the necessary changes to ensure that this region maintains its position as a world class city.

The various funding solutions that have been suggested can generate more than the revenue deficit that is currently projected for the New York Metropolitan region. However, the particular method or combination of methods must consider

* Evaluation of mechanism for appropriateness to local area.
* Consideration of the fairness issue in strategizing implementation of the financing mechanism.
* Selection of an agency able to administer the particular financing mechanism.

ENDNOTES

1.National Strategic Transportation Planning Case Study for New York Region - Rutgers University & NJIT, Vol 3, p.3.

2. Ibid., p.6.

3. Ibid., p.10.

4. Ibid., p.39.

5. Ibid., p.59.

6. Ibid., p.42.

7. Ibid., p.64.

8. National Council on Public Works Improvement, Fragile Foundations: A Report on America's Public Works, Final Report to the President and Congress. Feb 1988., p.12.

9. U.S.Department of Transportation, Urban Mass Transit Administration, The Private Sector in Public Transportation in New York City, Jan 1991., p. 32.

10.Ibid., p.138.

11. Ibid., p.132.

12. U.S.Department of Transportation, Moving America - New Directions, New Opportunities, Feb 1990., p.59.

13. Based on a telephone conversation with MTA officials.

14. U.S.Department of Transportation, Urban Mass Transit Administration, The Private Sector in Public Transportation in New York City. Jan 1991., p.30.

15. U.S.Department of Transportation, Urban Mass Transit Administration, Potentials and Problems of Private Sector Transportation Services, 1987., p. 90.

REFERENCES

1. Drucker,Peter F. "Information and the future of the city".The Wall Street Journal, Tuesday, April4, 1989.

2. MTA, Strategic Business Plan, Volume 1.

3. National Council on Public Works Improvement, Fragile Foundations : A Report on America's Public Works, Final Report to the President and Congress. February 1988.

4. National Strategic Transportation Planning Case Study for the New York Region. Vol 1,2,3.-Rutgers University & NJIT.

5. New York Newsday Oct 16,1991.

6. New York State Department of Transportation, "1985 Report on Transit Operating Performance in New York State." p.III - 52.

7. Regional Plan Association. The region in the global economy. May 1988.

8. U.S.Department of Transportation. Financing for the future. Changing roles in mass transit. Dec 1987.

9.U.S Department of Transportation,Innovative Financing for Transportation: Practical Solutions and Experiences. April 1986.

10. U.S.Department of Transportation, Moving America - New Directions, New Opportunities, february 1990.

11. U.S .Department of Transportation, Urban Mass Transit Authority. The potentials and problems of private sector transportation. Activities in the New York region. Jan 1987.

12. U.S.Department of Transportation, Urban Mass Transportation Administration, The private sector in public transportation in New York City : A policy perspective. Jan 1991.

13. U.S.Department of Transportation, Urban Mass Transportation Administration, Urban Mass Transportation Act of 1964, As amended through february 1988, and Related Laws.

14. U.S.GAO . Report to the Honorable Lawton Chiles U..S Senate. Highway funding. Use of Toll revenues in financing highway projects.