INTRODUCTION AND BACKGROUND

The Gowanus Elevated Expressway

The Gowanus Elevated Expressway (the Expressway) is a four mile, Robert Moses era elevated highway running parallel to the South Brooklyn Waterfront that is now part of Interstate Highway 278 (I-278). The Gowanus begins one mile after I-278 comes off the Verrazano Narrows Bridge. It proceeds north to where the Prospect Expressway joins it from the east, then turns westerly and crosses the Gowanus Canal, then drops down to the Brooklyn Battery Tunnel toll plaza, with a fork to the right that becomes the Brooklyn Queens Expressway (BQE).

The Gowanus is one of New York City's most important roads. It is a main truck freight artery for both the City and Long Island, and the City's principal southern connection to the Interstate highway system. And, it is the only direct road link between Staten Island and the rest of New York City (see Map 1). Its annual traffic volume highlights its importance: 50 million cars, four million trucks and 100,000 buses.

First built in the 1940s, the Gowanus has reached the end of its useful life. The highway has substandard designs throughout. The northbound merge of the Gowanus and Belt Parkway at 65th Street is the source of recurrent congestion. Regular congestion also occurs at the Prospect Expressway Gowanus interchange and at the westbound climb over the Gowanus canal with its 3.9% grade.

After 50 years of use, the road is in poor condition. Extensive structural deterioration has taken place. Emergency repairs have been common for years, and New York travelers have long resigned themselves to hearing the Gowanus featured when they tune in to traffic alerts. Earlier this year, the American Automobile Association (AAA) named the Gowanus one of the country's ten most congested interstate highways.

Since the early 1990s, the New York State Department of Transportation (NYSDOT) has been planning the reconstruction of the Gowanus. NYSDOT originally planned a reconstruction of the current facility over a period of at least a decade, beginning sometime in the mid-nineties. But the start date has slipped and the project has gradually grown more complicated. Widespread community concern over the impacts on local neighborhoods of reconstructing the Expressway prompted NYSDOT to try to shorten the construction period and to try to identify construction techniques that could reduce traffic diversions onto local streets and assuage community fears.

The Elevated Expressway reconstruction is now scheduled to begin in 1999 or 2000, to last approximately seven years, and to cost an officially estimated $700 million. Many community and transportation interests believe that the ultimate cost will be $1 billion plus, with construction taking as long as ten years.

The Gowanus Reconstruction Problem

The problem reconstructing the Expressway presents can be simply stated. Since the traffic volume using the Gowanus Expressway must continue to go through the Gowanus corridor, the lane closings on the Gowanus that the reconstruction will likely require are expected to lead to massive congestion and the diversion of as many as 50,000 vehicles a day into adjoining South Brooklyn neighborhoods as drivers try to pick their way through local streets. This is likely to produce:

- significant delays and unpredictability costs for truckers, bus riders and car commuters and the businesses they work for and serve;

- widespread neighborhood disruption whose impacts have been variously estimated to cost local businesses and residents up to $200 million annually;

- an almost insurmountable hurdle for any new economic development in the Gowanus corridor;

- major increases in air pollution.

Fearing these potential consequences, South Brooklyn neighborhoods and Metropolitan traffic and environmental interests have long sought a workable, urban compatible alternative. But none of the initial proposals put forward—usually some combination of a surface boulevard with enhanced mass transit—provide the needed transportation services. The problem is that the Regional transportation need in the Gowanus corridor is for a road with interstate capacity. The only realistic above-surface alternative that provides that capacity is rebuilding the Elevated Expressway.

Thus, until recently, rebuilding the Gowanus Elevated Expressway appeared to be the only alternative, however painful. Accordingly, NYSDOT, pushing the project forward, continued to regard it as a replacement in kind. That categorization has important legal and planning implications. Originally, when that conclusion was expected to be non-controversial, that finding permitted NYSDOT to proceed without preparing a Major Investment Study (MIS) or an Environmental Impact Statement (EIS), two analyses that are generally required for all significant new Federally supported construction, and which provide a vehicle for a more structured analysis of both project impacts and a broader set of alternatives.

At the beginning of 1997, in response to growing community concerns, NYSDOT finally agreed to prepare an EIS and to include in its alternatives some treatment of a tunnel. The scope of that EIS, which will indicate how those community concerns will be addressed, is pending release.

The Regional Plan Association's Involvement

The Regional Plan Association (RPA) has long been concerned with the issues raised by the Gowanus project. As laid out in the 1996 RPA Third Regional Plan, "A Region at Risk," the

New York Metropolitan Regions's future prosperity is dependent on building a new generation of 21st Century infrastructure. Moreover, if the Region is to create the quality of life needed to maintain its international urban preeminence, future infrastructure investments must be "urban friendly" and not repeat the indifference to environmental and community impacts of so many infrastructure projects of the past.

Viewed from this perspective, RPA found the NYSDOT plans to just reconstruct the Gowanus unsatisfactory. The City and the Region would spend up to a billion dollars (or more) and endure up to a decade of disruption to just perpetuate an outdated transportation facility and to leave South Brooklyn to continue to struggle for another fifty years with its consequences.

The Gowanus Expressway slices in two the neighborhoods that adjoin it, isolates the South Brooklyn waterfront, and blights Third Avenue and Hamilton Avenue: darkening the streets, obstructing local traffic and devaluing local real estate. The Expressway turned some of Brooklyn's most attractive neighborhoods into urban backwaters. RPA believes that perpetuating this without first making every possible effort to find a better alternative is the wrong way to build a better future.

At the same time, RPA recognized that the transportation needs of both Brooklyn and the Region required a road with interstate capacity. Providing such a road had to be a starting point of finding an alternative to reconstructing the Gowanus. But, RPA felt, such an alternative should serve both travelers and the local communities they passed through. The question was how to do so?

THE RPA PROJECT - EXPLORE A GOWANUS TUNNEL

The Emergence of a Bold New Urban Alternative

A growing number of the world's cities are solving such problems through a new generation of underground construction. Cities such as Paris, Lyons, London, Tokyo, Sydney, Singapore and Oslo have been finding that underground road systems are win-win solutions to the conflict between urban interests and the need for modern, high capacity transportation infrastructure. The conflicts the proposed Gowanus reconstruction is generating could similarly be replaced by dramatic benefits if a Gowanus Tunnel was a feasible alternative to reconstructing the Gowanus Expressway.

First, a tunnel could be built while the existing Expressway continued to operate at full capacity, reducing any traffic disruption to manageable proportions.

Second, for the same reason, a major source of increased metropolitan air pollution would be eliminated.

Third, once a tunnel was built, the Elevated Expressway could be torn down, allowing South Brooklyn's waterfront neighborhoods to be reunited, opening up Third and Hamilton avenues, and greatly facilitating local access and better use of the South Brooklyn waterfront, one of the City's most under-utilized urban assets.

Fourth, a tunnel would have a better life cycle costs and benefits. Its useful life would be at least twice that of an elevated expressway, its maintenance costs would be lower, and its reliability in adverse weather conditions markedly better.

Finally, by being more acceptable to local communities, a Gowanus Tunnel might actually be completed sooner than rebuilding the Expressway.

RPA Organizes a Gowanus Tunnel Study

Accordingly, RPA decided to seek funds to conduct an initial feasibility assessment of a Gowanus Tunnel as a possible alternative to rebuilding the Gowanus Elevated Expressway. RPA wanted to take a short, focused look at the engineering and design issues, and the potential benefits to both transportation interests and local communities of a tunnel alternative.

Initial seed grants from Brooklyn's Independence Savings Bank and Forest City Real Estate enabled RPA began its search for project funding in early 1996. RPA first approached NYSDOT with a proposal to treat a Gowanus Tunnel as an engineering option and to work cooperatively on it, but NYSDOT declined to participate. But, thanks to a City Council Gowanus study grant obtained through the leadership of Brooklyn City Councilman Kenneth Fisher, RPA was able to obtain the funds needed to undertake this Gowanus tunnel feasibility study.

RPA began work last fall by assembling a highly professional and well respected project team. First, it formed a working partnership with the University Transportation Research Center at City College (URTC). Both the Center Director, Dr. Robert (Buz) Paaswell, and Center Associate Dr. Mitsuru Saito played crucial roles in the project. Other RPA team members were Herbert Levinson, transportation and traffic consultant; RPA Senior Fellow Albert Appleton, who served as project coordinator; RPA Senior Transportation Fellow Jeffrey Zupan; and Ms. Antonia Bryson, an environmental lawyer and former New York City official with wide experience of the environmental impacts of car traffic, air pollution and environmental review.

The RPA study team also drew on information from several sources. Dr. Ray Sterling, Director of the Center for Trenchless Technology at Louisiana Tech, and a longstanding leader in the urban use of underground space, generously help track down cost information on other urban tunnels. The engineering firm of Dames and Moore provided access to the cost estimates and the results of their geotechnical literature review of the Gowanus area that supported a tunneling proposal they had made to NYSDOT. Carolyn Konheim and Brian Ketchum of Community Services Consulting shared their work on a number of important topics, including impact cost analysis, local traffic patterns, and implications of a Gowanus Tunnel on other Brooklyn traffic concerns.

RPA also acknowledges with appreciation the assistance and feedback it has received from the members of the Gowanus Task Force of the Brooklyn Borough President and its staff

coordinator, Mr. Greg Brooks. The many community interests and elected officials from Bay Ridge to Brooklyn Heights participating on it generously shared their hopes, concerns, knowledge and insights about their neighborhoods, Brooklyn and the City.

RPA further notes the work of Congresswoman Nydia Velazquez who, in conjunction with her colleagues, Representatives Susan Molinari, Jerry Nadler and Edolphus Towns, coordinated the introduction of legislation amending the new Federal Highway legislation to provide the funding support needed to carry out a preliminary design of the Gowanus Tunnel, as recommended by this study.

Finally, special mention and acknowledgement needs to be made of the leadership of City Councilman Kenneth Fisher in providing the resources needed to carry out this analysis and in his thoughtful input and support as the tunnel study evolved. The work of the RPA study team would not have been possible without his efforts.

Study Tasks and Methods

Given the limited resources available for this study, RPA decided to concentrate its feasibility effort on five tasks:

First, identify at least one feasible tunnel proposal that provided transportation service comparable to that of the Gowanus Elevated Expressway;

Second, establish an initial cost estimate for a Gowanus Tunnel;

Third, shape the tunnel proposal in accordance with community input and urban needs to make a Gowanus Tunnel an integrated, dual purpose transportation and neighborhood enhancement project;

Fourth, establish an ongoing, iterative dialogue with communities and other concerned groups about the Gowanus Corridor's transportation, social, economic and environmental needs to test and improve various Gowanus Tunnel proposals and ensure they meet community needs, and to identify ways that transportation investment in the Gowanus corridor can be made urban friendly;

Fifth, work to make certain that the choice between reconstructing the Expressway and a Gowanus Tunnel is made in a timely manner, with full participation of all affected interests and with all alternatives weighted impartially and fairly on a level playing field. That way, when a choice is made between reconstructing the expressway and building a tunnel it will command general assent as the most appropriate public investment.

The Gowanus Corridor Must Have a Road Facility with Interstate Capacity

From the beginning of its active involvement in the Gowanus project, RPA has stressed the need for all parties to recognize that the Gowanus Corridor must have a road facility with interstate capabilities. The Gowanus is one of the busiest road corridors in the United States. There are only two realistic options for traffic in the Gowanus Corridor: reconstruct the existing Expressway or replace it with a tunnel. If a tunnel is not a practical alternative, or if there is no agreement on a specific tunnel option, then the Expressway must be reconstructed in as community friendly a manner as possible.

A Tunnel Compatible with Future Growth in Brooklyn

Although tearing down the Gowanus will have enormously beneficial land use implications, the RPA Tunnel proposal is not tied to any one specific land use proposal. Instead, the RPA team assumed that any tunnel proposal must be consistent and compatible with all of the various proposals for revitalizing the South Brooklyn waterfront (i.e. the Hubport, the Sunset Park 197-A Plan, etc.) and not foreclose any of the community's choices.

A special concern is the trans-Hudson rail freight tunnel, a project that RPA has long sought and that, thanks to the efforts of Congressman Jerome Nadler and New York City Mayor Rudolph Giuliani, is beginning to gain some real momentum. RPA has taken special steps to ensure that each proposed Gowanus Tunnel alignment is compatible with a rail freight tunnel, for a Gowanus Tunnel and a rail freight tunnel would cross each other's alignment.

The Right Perspective on the Gowanus Problem - An Opportunity for the City

RPA believes the significance of the Gowanus Tunnel proposal goes far beyond the specific concerns of the Gowanus corridor. RPA sees the tunneling of urban transportation facilities as a leading tool of future transportation and urban planning in the Region. In that regard, RPA hopes that the Gowanus Tunnel discussion will spur serious consideration of a long term Regional policy of phasing out all elevated transportation structures when their useful life has ended.

The Gowanus Tunnel debate is ultimately about finding a way out of the dilemma of choosing between compelling urban concerns and equally pressing regional transportation needs. For the communities adjacent to the Gowanus, the stakes are the removal of a structure that tore their neighborhoods apart a half century ago and that has blighted them ever since. For those communities, the prospect of enduring years of traffic congestion so that the Gowanus will remain planted in their midst for another half century seems almost too bitter to contemplate.

For hard-pressed NYSDOT, the stakes seem equally high. Having sunk tens of millions of dollars and years of effort into planning the reconstruction of the existing Gowanus and facing the continuing ire of motorists and truckers, it is natural to want to move forward with the reconstruction as they have defined it, rather than start over.

RPA urges a new perspective on the Gowanus problem: that it represents an enormous opportunity for the City. What to do about the Gowanus is probably the single most important decision that will be made in this decade about the look and shape and working of the City in the future. It is from that perspective that RPA has proceeded to its work in the hopes of turning the name Gowanus into one that can be a source of civic pride and achievement.

WHAT A GOWANUS CORRIDOR SOLUTION MUST DO

Requirements Any Road Facility Must Satisfy

The choice as to whether to reconstruct the existing Elevated Expressway or build a tunnel should be based on weighing both alternatives against a series of common criteria. These requirements are a first screen though which both the Expressway reconstruction and any Tunnel alternative must pass.

Any solution should 1) be physically and operationally feasible, 2) provide sufficient capacity to maintain or ease the existing levels of highway use, while remaining in conformance with the Federal Clean Air Act; 3) accommodate the major traffic exchanges with connecting highways and 4) provide space for disabled vehicles and emergency actions.

In addition, any solution should also 1) minimize traffic disruption and community impacts during construction; 2) be reasonably priced; 3) minimize total life-cycle costs (operating and capital); 4) provide needed access for freight movement and local traffic without inducing traffic or worsening local congestion problems; 5) be able to be constructed as quickly as possible; 6) limit long term negative impacts on the environment and adjacent communities such as traffic disruption, added local traffic, street closings, land takings, park impacts, noise and air pollution; and 7) be a positive urban asset and a vehicle to improve both the quality of life of local residents and the economic well-being of communities in the Gowanus corridor.

Requirements That Particularly Apply to Tunnels

There are also requirements that apply uniquely to any tunnel solutions. A tunnel must 1) have adequate ventilation facilities sited to minimize local community impacts; 2) avoid existing underground transportation facilities and utility infrastructure; 3) avoid conflicts with the use of economically viable and navigable waterways.

More Detailed Discussion of a Number of Key Requirements

Sufficient Highway Capacity The segment of the Gowanus Expressway considered for replacement carries over 150,000 vehicles a day on average of which over 10,000 are trucks. At its peak location along the elevated Gowanus, peak hour traffic on weekdays—northbound in the morning peak averages about 4,600 vehicles and southbound in the evening peak averages 5,400 vehicles north of 65th Street. In addition, current bus lane arrangements accommodate about 120 buses northbound during the A.M. peak hour.

Any road facility serving the Gowanus Corridor must carry these volumes. Some have argued that the highway's function in carrying passenger cars can be reduced if improved mass transit is provided. However, the patterns of origins and destinations of the vehicles using the Gowanus show only a small portion of trips begin and end near existing transit networks or near any likely new elements of a transit network, so that the hope of reducing the need for highway transportation capacity in the Gowanus corridor is not realistic.

Similarly, it has been suggested that the proposed rail freight tunnel under New York Harbor would shift goods from trucks to rail, lowering truck volumes. The recent New York City sponsored Mercer study of a rail freight tunnel concluded that from 600 to 1,000 truck trips per day each way could be diverted from the entire East of Hudson road network. This would produce important overall Regional benefits and heightens the urgency of constructing a Trans-Hudson railroad freight tunnel, but would reduce the Gowanus truck volume of 10,000+ trucks a day by only a few percentage points.

Any solution that did not provide current interstate capacity levels would leave thousands of trucks and tens of thousands of cars daily with no option except to pick their way through local streets. Thus, whatever new road is selected for the Gowanus Corridor must have at least six lanes of freeway south of the Prospect Expressway and eight lanes north and, preferably, an additional dedicated lane for bus service.

Reasonably Priced Project with Commensurate Costs and Benefits Any alternative should not be so expensive to build that it would impose an unreasonable and unmanageable financial burden. At the same time, alternative selection should not be determined solely or even predominantly by short term, upfront costs. Rather, the total investment return taking into account full life cycle costs should be the deciding factor. Investment return must be defined not only by narrow transportation concerns, but by all the societal interests—economic development, environmental and urban—that the project will impact.

Time of Construction The longer an alternative takes to complete, the longer the potential for traffic disruption, negative impacts on users of the highway, and community traffic impacts. All efforts to shorten construction periods and minimize community impacts, whatever alternative they are tied to, should be supported by all the interests in the Gowanus debate.

Negative Impacts It has now become widely accepted that the hidden costs of major infrastructure projects need to identified and assessed and, wherever possible eliminated or minimized if correct decisions are to be made about public investment. For the Gowanus, these hidden costs will be the negative impacts of the project on the quality of life of urban residents: added local traffic with associated safety problems, noise pollution, air pollution, loss of parks or open space devoted to community purposes; reduction in local property values, and closing of streets. Broader negative impacts are those that would adversely affect the economic vitality of the Gowanus corridor, limit access to key areas such as the waterfront, fracture local neighborhoods or undermine the local sense of neighborhood.

Positive Impacts Similarly, large infrastructure projects, especially if creatively structured to incorporate related community needs, can have many associated positive impacts for both users and surrounding urban areas and regions. For example, they can be integrated with local traffic calming to provide better traffic service, designed to reduce noise and air pollution, or be structured to add land or other resources for community purposes. Infrastructure agencies, who tend to think of themselves as single purpose entities, are often reluctant to recognize or pursue these possibilities. But they can bring a whole new dimension to public investment, making possible urban improvements that would be done piecemeal, with great delay and at considerably more expense. Their consideration should be an essential part of all infrastructure investment.

Tunnel Ventilation Facilities Ventilation of any transportation tunnel is a health and operating necessity. Unless jet technology can be used, any tunnel will be accompanied by ventilation structures.

Modern tunnel ventilating structures are far different facilities than the massive ventilation structures of the tunnels of the first half of this century. Individual cars now pollute drastically less than the vehicles of that period and computer based air modeling permits far more precise technological planning, including the use of the movement of the vehicle stream as part of the ventilation strategy.

In addition, the science and acceptability of jet ventilation, in which ventilation facilities are essentially self contained within the tunnel structure is advancing rapidly and tunnel facilities overseas (i.e. Tokyo) are beginning to be fitted with scrubbers when above ground facilities are still used. This will give many options to reducing or even eliminating the problem of siting ventilation facilities in community compatible ways that were not previously available.

Like all infrastructure facilities, siting of any ventilation structures needs to be done in conjunction with community input and to be sensitive to community concerns over air pollution emissions, possible noise for ventilation equipment and visual design. This is a process that should be initiated as soon as the preliminary design process begins, to insure maximum community education, input and participation. Confidence building devices such as an independent community engineer are especially important on issues like ventilation siting, particularly in New York.

Interference with Underground Infrastructure Underground, particularly in a city like New York, is often a very crowded place. In the Gowanus corridor, particularly in the vicinity of 65th Street, there are many levels of existing infrastructure above and below ground. These include the Bay Ridge rail line and the Fourth Avenue Subway. The tunnel alignment must not interfere with the many utility services under city streets including electricity, telephone, TV cable, and storm and sanitary sewers. In addition, a tunnel right-of-way must not conflict with a proposed freight rail tunnel under New York Harbor which, it is generally expected, would run under the existing Bay Ridge rail line right-of-way, rising at a 1% grade as it moves inland from the bulkhead to eventually surface.

Navigable Waters The Gowanus corridor involves two critical sets of navigable waters: the South Brooklyn waterfront and the Gowanus Canal. The South Brooklyn waterfront has, after a long period of neglect broken only by valiant local efforts to reclaim this asset for civic use, regained attention following Mayor Giuliani's proposals for a future Hubport at the site. The term "Hubport" refers to a port capable of becoming an international port for a new generation of ocean freighters, drawing 50 to 55 feet of water as opposed to the current 35 to 42 feet. This means that water depth at the bulkhead line must be assumed to be at least 60 feet deep. Thus, if a Gowanus Tunnel were to be constructed on an alignment that passed under the Harbor, it would have to be at a depth consistent with such future plans. This means the ceiling of the tunnel would need to be 75 feet below sea level, allowing for a recommended minimum of fifteen feet between the harbor bottom and the tunnel roof.

These requirements make a harbor alignment for a Gowanus tunnel very difficult.

The Gowanus Canal must also be considered. If tunneled under, the Tunnel must be able to rise within appropriate climbing grades to connect with the Prospect Expressway to the east and the Brooklyn Battery Tunnel and the BQE to the west. Future uses for the Canal need to be examined so that the parameters for any tunnel are clear and as efficient as possible. In addition, to the extent a tunnel proposal were to incorporate a new treatment of Hamilton Avenue and different traffic uses, the capacity of the current Hamilton Avenue Drawbridge and the long term need for it would become questions as well, as well as the current vertical clearance requirements of the Canal.

DESIGN STANDARDS

In addition to the performance and benefit criteria and the tunnel specific issues discussed above, there are a set of technical design standards that any road—including a road placed in a tunnel—must meet. These are based on standardized engineering analysis, derived from long years of experience, as to how a road should be laid out for traffic to flow smoothly and road management to function properly. For example, if a road has a climbing grade of more than 3% (i.e. it rises more than 30 feet per 1,000 feet of horizontal distance traveled), or a tangent grade of more than 3.5% (i.e. grade on turns) trucks can be expected to slow down and traffic behind them to become congested. The current Gowanus Expressway, for example, has a grade of 3.9% between the Prospect Expressway and the Brooklyn Battery Tunnel and traffic congestion caused by trucks is common there. The technical standards used by the RPA study team are the normal ones for Interstate road facilities, and for modern highway tunnels.

Tunnel Configurations and Technology

A Gowanus Tunnel would actually consist of several tunnel tubes. The technology does not exist to routinely build long seven lane stretches of roadway underground.

The dimensions of the tunnel tubes are generally determined by the technology used to create them. The tunnel boring technology which would be the RPA team's first preference, is currently limited to three lane tubes. Cut and cover technology, by contrast can build four lane tubes.

Tunnel boring technology generally configures tubes side by side. Cut and cover technology can accommodate a vertical tube arrangement, one over the other.

For a seven lane road incorporating three general purpose lanes in each direction and a dedicated bus lane, a good configuration would be a three four system of two tubes vertically arranged. However, cut and cover technology traditionally involves much more surface disruption than boring machine use. The RPA team believes that technologies that minimize surface disruption should be favored so it has focused on boring machine technology. However, a number of engineering sources argued that new forms of construction management combined with what is called slurry wall construction have made cut and cover tunneling faster and less intrusive. The RPA team lacked the time and resources to investigate this claim. However, it believes that the possibility of using slurry wall construction should not be **a priori** excluded and that a fuller examination of the technique, including a realistic assessment of how it may have altered community impacts and risks, would be warranted.

As to the use of tunnel boring, the obvious configuration for a seven lane tunnel would be 2-3-2, with the bus lane tube in the middle. However, examination of this tube configuration in the Gowanus corridor, with its double merges, suggested that the problem of getting exits and entrances into a middle tube that had car traffic flowing in two different directions and buses in a middle lane would be an engineering task of enormous complexity. The RPA team concluded that the outside tubes had to each be three lanes with one direction of traffic flow.

This leaves an issue of what to do with the middle lane. Sticking strictly to the seven 7 lane configuration produces a 3-1-3 tunnel configuration. However, a one lane tunnel would be an operational impossibility. Thus RPA has opted for a two lane bus tube, permitting both way service and providing road backup in case of breakdown.

The following would be the road specifications the RPA team used to determine acceptable tube size.

Lane Width:	11.5 - 12 feet (3.5 - 3.7 meters)
Edge Clearance:	1 - 2 feet (0.3 - 0.6 meters)
Minimum Curve Radius	850 - 900 feet (260 - 275 meters)
Minimum Vertical Clearance	13.5 feet (4.1 meters)

A possible tunnel cross section is included in the illustrations accompanying this study report. Dimensions should be regarded as illustrative.

THE REVIVAL OF URBAN TRANSPORTATION TUNNELING: THE CONTEXT FOR THE RPA GOWANUS TUNNEL FEASIBILITY ANALYSIS

Over the last two decades in both the Region and the country, a revolt has been growing against the first generation of interstate freeways and the damage they did to many urban areas. In city after city, those freeways tore gashes through downtown areas and urban neighborhoods. In New York, building the Gowanus is still remembered with bitterness in Brooklyn fifty years later. Many regard the construction of the Cross Bronx Expressway as permanently mangling the soul of the Bronx and triggering a long period of Bronx decline. Since the successful fight against the Lower Manhattan Expressway in the late sixties, widening the City's urban highways or building new ones has been an anathema to the bulk of the City's population. This has left New York

City and many other areas of the Region with a painful dilemma: further damage the urban fabric with bitterly controversial new roads or settle for an aging and increasingly out of date transportation infrastructure that precludes important new road links.

Altered urban land use patterns are heightening this conflict. When the current network of urban expressways and freeways was built, urban waterfronts were largely industrial areas that the general population avoided. Putting roads along waterfronts made sense, given both commercial traffic patterns and land values.

But now a revolution in urban waterfront land use is underway. City after city, including New York, are looking to their waterfronts to lead urban redevelopment through attractive new mixed commercial and residential use. The presence of the current road network is an enormous obstacle to that redevelopment and an enormous loss of potential urban value.

This changing land use has been being paralleled by a change in the political role and capabilities of the urban communities that traditionally had to bear the price of freeway construction. Once society was willing to override their protests. It does so much less often now. New tools of empowerment such as environmental impact statements, a history of demonstrated damage from ill-designed freeway projects, and a growing social consensus to heed the protests of communities have effectively combined to make it far harder to build or even rebuild the roads that were originally created with so much indifference to urban concerns.

Yet the freeways that criss-cross our cities are also indispensable assets in a country where motor vehicle transportation remains the dominant form of transportation. Even in the New York Metropolitan Region—with its vast mass transit system—modern, efficient automobile and truck transportation facilities are indispensable to the Region’s well being and quality of life.

This conflict between the need for modern road infrastructure and the need to protect or reclaim equally high value urban land and neighborhoods has created a need for new thinking, for new solutions that can meet both concerns.

A growing number of cities have found that solution in urban tunneling. Three examples of recent urban tunneling projects highlight urban tunneling offers a solution to otherwise unsolvable urban community-transportation facility conflicts.

One is **Oslo**, where a freeway was built along its downtown waterfront in the early sixties. Now, as the before and after picture of Oslo in the opening illustrations shows, Oslo has replaced that freeway with a tunnel and using the land freed up for public waterfront access and exciting new mixed use development.

Another is **Paris.** Following the uproar that greeted proposals in the sixties and seventies to build a freeway along the left bank of the Seine, Paris found its solution in going underground. Paris now has built or is building over 100 kilometers of high speed limited access underground roads that speed traffic under Paris along routes traffic could never follow above ground.

The third is **Boston.** In the fifties and sixties, downtown Boston was fractured by the construction of the Central Traffic Artery (now Interstate 93), which cut off several major neighborhoods from the rest of the City. The roadway was poorly designed and a blighting influence. Thus, even before the time when rebuilding those elevated roads would have absolutely been necessary, Boston made the bold decision to remove the elevated highway and build a replacement road system with its key components underground.

As part of this new Central Artery Project (CAP), Boston is building over 50 lane miles of new underground road, including going directly under the current right-of-way of Interstate 93, which the project is enabling to be torn down. Underground roads are giving Boston a radically improved transportation system, a reunited City and a downtown full of new and vibrant revitalization potential.

In these and other tunneling projects throughout the world there are certain common realities. The projects take place in dense urban areas, they free up land of high commercial, historical, neighborhood or waterfront value, and they return high value for innovative engineering thinking and forward looking political leadership.

In short, these are projects with high value added, not only for urban areas but for road users who can get going underground improvements that merely reconstructing existing highways do not provide them. The desire to recapture this urban value is catalyzing the kinds of engineering innovative and thinking that is overcoming problems that a decade ago would have been thought to preclude urban road tunneling.

A major new innovation has been the adaption of tunneling boring technology for use in shallow ground, urban highway settings. Tunnel boring technology, originally developed for water system tunnels, avoids the surface disruption of a cut-and-cover approach. A tunnel boring machine is assembled underground at a tunnel starting point. It then begins to bore its way forward, dragging a metal sleeve behind it to maintain pressure at the working surface, pressure that previously had to be provided by compressed air at great expense. Prefabricated tunnel sections are brought forward and assembled inside the sleeve, than the sleeve is dragged forward leaving the tunnel in place. There is never any unsupported surface.

Other tunneling innovations have also contributed to the rebirth of urban tunneling. Slurry wall construction combined with new construction management technique has, some engineering experts argue, made cut and cover tunneling simpler, faster and more reliable thereby, they claim, making it a feasible urban option again. Modern information technology and advances in geotechnical sensing equipment have reduced the uncertainties of managing subsurface conditions, an advance of particular value in terms of anticipating and resolving potential surface disturbances that can cause major delay in urban areas.

Now the question is whether it is feasible for New York to follow their path.

There are powerful reasons to do so. The use of tunnels would go directly to some of the key urban problems New York faces: opening up its waterfront, restoring the integrity of its neighborhoods, recreating land value, and building new roads that are impossible even to contemplate when just thinking about surface construction.

Moreover, urban tunneling would be less of a new innovation for New York than a return to one of New York's great traditions. In the first half of the twentieth century, New York City was a world leader in urban transportation tunneling. Four road tunnels and over 20 subway and passenger rail tunnels under City waterways, not to mention all the miles of underground subway, are what make transportation in the New York area possible.

Finally, tearing down an elevated transportation facility and replacing it with underground transportation facilities is not a new course for either Brooklyn or New York City as a whole. The replacement of the Third and Fifth Avenue elevated railways with the 4th Avenue subway, the tearing down of the Fulton Street elevated railway, and the similar liberation of Manhattan's Third Avenue by the tearing down of the Third Avenue Elevated all testify to the ability of previous generations of civic leaders to recognize technological obsolescence and the need to free the City from it. The question the Gowanus poses is: is the time to make New York a leader in urban tunneling here again?

THE FEASIBILITY OF A GOWANUS TUNNEL

A Gowanus Tunnel is Feasible

The feasibility of a Gowanus tunnel depends on being able to positively answer the following questions:

First, is there at least one feasible tunnel alignment that would clearly provide interstate level transportation service in the Gowanus Corridor?

The RPA team has concluded that, YES, there is.

Second, is a road tunnel physically feasible along that alignment, are geotechnical conditions consistent with use of boring machine technology, and can it be built without undue traffic disruption?

The RPA team has concluded that it is feasible to build a road tunnel along that route without undue traffic disruption, assuming proper planning and design management, and that there appear to be no conditions that would preclude use of boring machine technology.

Third, Does a Gowanus tunnel produce the kinds of urban benefits that have made it cost effective elsewhere? What would be the right project scope to maximize the benefits of a Gowanus tunnel?

The RPA team has identified a dramatic set of urban benefits that create a Gowanus Tunnel proposal that is an integrated transportation-urban revitalization proposal.

The RPA Recommended Tunnel Alignment

Unlike many tunnel projects, which must merely connect one point to another, replacing the Gowanus Expressway with a tunnel presents a far more complicated alignment problem. As seen on the alignment map upfront, the Gowanus must interact with the Belt Parkway, the Prospect Expressway merge with the Gowanus, and the Brooklyn-Battery Tunnel/BQE spilt where the Gowanus ends. Three other road features in the Gowanus corridor—the Interstate 278 Brooklyn approach to the Verrazano Narrows Bridge (sometimes called the Gowanus Extension or, as in this study, the Verrazano Approach Trench) with its ramps connecting to both levels of the Verrazano Narrows Bridge, the 39th Street exits, and the Gowanus Canal—further complicate the tunnel design issue. The limited access that the Red Hook community has to the rest of the City due to the current layout of the Gowanus and Hamilton Avenue must also be taken into account.

Thus, designing a Gowanus tunnel is a far more complicated question than drawing some lines, making sure the grades work and checking for community impacts of potential portals. A long series of engineering problems and community concerns had to be integrated into the analysis. In consequence, alignment design took far more of the project effort than was initially anticipated and proved to be a major challenge. RPA examined many options for alignments, often finding that when one tentatively seemed to work, other refinements suggested themselves or new issues arose out of feedback from discussions with community interests or other stakeholders. All of these prompted further work to meet as best as possible all of the goals outlined for road service in the Gowanus corridor and for a feasible tunnel project.

The many alignments that RPA reviewed can be characterized by how the south portal was treated, what route they followed, how they handled connections with other roads, and how the north portal was treated. These alignments included a water route, routes that roughly followed Second and Third avenues, routes that took different courses through Red Hook, and routes that would be aligned obliquely to the street grid but, using soft ground tunnel boring technology, would be deep enough to avoid any possibility of building disturbance by utilizing tunnel boring technology.

Different north portal locations—including sites just east of the Brooklyn Battery Tunnel Plaza, Clinton Street, and ending the tunnel at the Prospect Park Expressway connection—were examined. Similarly, a variety of south portal locations, including 65th Street near Second Avenue, the Army Terminal parking lot, and various points in the Verrazano Approach trench, were also examined. How to handle the merge at the south end with the Belt Parkway and the merge in the north with the Prospect Expressway required extensive engineering and traffic analysis.

The following is a full listing of the alignments examined. Further information on them may be obtained by reviewing the technical material and drawings listed in the technical attachment.

This extensive analysis, combining engineering, transportation and urban planning, and community input end with the RPA team identifying an alignment that was not only feasible but highly desirable in terms of its added urban benefits.

The RPA team's preferred tunnel alignment would have its south portal in the Verrazano Approach Trench at a point just south of where I-278 begins to climb out of the trench and turn to the west (roughly near the line of 72nd street if it were extended across I-278). It would then angle underground and follow the Gowanus right of way up to Third Avenue and then remain under Third Avenue at a safe depth until it reaches the Prospect Expressway Interchange. It would then turn northwest and follow the current Gowanus right-of-way under the Gowanus Canal, then climb and exit at a north portal at a point where traffic could either enter the Brooklyn Battery Tunnel or turn onto the BQE.

This alignment takes the proposed Gowanus Tunnel safely under the Fourth Avenue subway and the current Bay Ridge rail line right of way, and over the right of way a future rail freight tunnel would occupy.

<u>The Critical Choices That Shape This Alignment and the Ways Its Features Respond to Them</u>

The South Portal The width of I-278 and its placement in a depressed trench combined with the terrain grades gives room to place the south portal in a site where there is room to manage both the construction impacts, to provide room for smooth traffic diversion around the construction site while the portal is being cut into I-278, and for minimizing impacts on community interests. A siting proximate to 72nd Street is recommended for several reasons. A major portion of the Brooklyn bound traffic coming off the Verrazano Narrows Bridge exits off of I-278 before 72nd Street, so that placing the portal at 72nd Street provides for minimal disruption of exit traffic. 72nd Street already crosses the I-278 trench from Bay Ridge and is used as a freeway entrance, so that impact on Bay Ridge traffic patterns would be minimal. Finally, that location, because it provides the right distances for both grades and traffic to flow smoothly, facilitates a solution to the Belt Parkway merge.

Bringing Belt Parkway Traffic into the Gowanus Tunnel The problem at the south end of a Gowanus Tunnel is merging the Belt Parkway traffic into the Gowanus. RPA has identified two ways of achieving this merge.

A conservative approach would be to keep the current Belt Parkway and begin to take it underground after it clears the Bay Ridge Parkway, exit, carry it over the tunnel and build an underground merge roughly around 60th Street.
However, after studying the problem, RPA favors a bolder solution that may be no more expensive or disruptive and would have far greater benefits for both travelers and the City, particularly the Bay Ridge community.

The Belt Parkway rims Bay Ridge from Fort Hamilton Avenue to where it joins the Gowanus, but it has no exit directly into Bay Ridge. It is a rim road that blocks Bay Ridge from direct resident access to the magnificent waterfront it possesses, while providing no equivalent service in return.

RPA therefore recommends that the main Belt Parkway travel lanes join the I-278 Expressway by constructing two partially underground connections between the Belt Parkway and I-278. All the traffic that now circles Bay Ridge on the Belt Parkway would use those new connections, which would provide direct access to the Gowanus Tunnel and to the local destinations for that portion of the Belt Parkway traffic that exits locally north and eastward when the Belt ends. The Belt Parkway traffic which uses the Fort Hamilton Avenue exit for local Bay Ridge destinations would continue to do so undisturbed.

This plan would enable the Belt Parkway to be permanently closed west of the Fort Hamilton exit and the right-of-way be given over to the Bay Ridge community, providing residents with untrammeled waterfront access and providing space for neighborhood recreational and other community facilities. Alternately, should the community prefer, there could be a modified park with local traffic features. Such decisions would, RPA assumes, be addressed in a locally based planning process, utilizing the knowledge of Bay Ridge's energetic civic community to the fullest. The asset potential for Bay Ridge once the 1800 cars an hour that use the road just to commute around Bay Ridge to get to the Gowanus or points north can take a more direct route via the I-278 right-of-way appears enormous.

The new connection would also provide better service for motorists. Seventy percent of the traffic using the Belt Parkway exits onto the Gowanus. This would provide a shorter, more direct route with a simpler merge. As to the portion of traffic exiting locally when the Belt ends, a considerable portion of that traffic is headed for destinations east of Third Avenue. This new connection system would also serve them better, essentially balancing the drivers headed for destinations west of Third Avenue, who would have a slighter longer trip.

Creating the connection for traffic traveling westbound on the Belt Parkway to the Gowanus would involve passing under Fort Hamilton in a mini-tunnel and then depressing the connection in the trench between the main travel lanes and the northbound service road, with an off-ramp to the 86th Street exit lanes so traffic exiting locally could join the flow of bridge traffic exiting onto local streets.

The connection would then join the northbound Gowanus and enter the tunnel portal north of the 72nd Street off ramp. The lightly used 92nd Street northbound on-ramp might have to be closed; other northbound ramps would remain unchanged.

The connection going southward from I-278 to the Belt Parkway eastbound would require a mini-tunnel, starting within the current I-278 right-of way immediately south of the 92nd Street exit. The tunnel would keep to the right of the bridge supports, pass around them and then merge into the Belt Parkway from its right. This would require construction immediately outboard of the bulkhead, which would probably involve an Army Corps 404 Permit. On the basis of an initial environmental survey, doing so would not appear to raise any significant issues, particularly in the context of making the entire Bay Ridge waterfront car free and opening it up for resident access.

Some southbound ramp changes may be required to provide acceptable distances for traffic to join and separate, particularly at the 92nd Street on-ramp. Additional traffic planning study and preliminary design work should be undertaken to refine these possibilities.

Finally, though these connections may appear complicated and expensive, an underground merge north of 65th Street would likely be as expensive and could be more disruptive in terms of construction. Eliminating the Belt Parkway as a through traffic route actually makes the Gowanus Tunnel project easier, as well as adding to it a major urban benefit that offers Bay Ridge the possibility of a magnificent new community asset.

Entrances and Exits at 39th Street Currently, the Gowanus provides exits in both travel directions off the Elevated at 39th Street, but no entrances. NYSDOT has agreed to include entrances as well to the Gowanus at 39th Street.

The RPA team's recommends that future tunnel planning include provision for northbound and southbound entrances and exits. The recommended location for a south portal adds some length to the current Gowanus and moves the portal point eastward, making intermediate access potentially more beneficial. In addition, it could have benefits in terms of facilitating jet ventilation. Finally, the RPA team noted the support from many business and residential interests for including both entrances and exits at 39th Street in a tunnel design, as expressed in both resident and business community comments, and in the position of the only official body to speak so far, Community Board 7.

At the same time, RPA must also note the community interests who expressed concern over an exit and its potential for inducing traffic, therefore adding not reducing congestion. Such concerns are well justified by history, both regionally and nationally.

Unfortunately, from a traffic planning and highway design viewpoint, the strong feelings of local stakeholders are the principal planning reality at the moment. There is a notable absence of the hard data and alternate planning scenarios, not only about existing traffic, but even more critically about what new traffic patterns could be expected to emerge over the next decade with various future development scenarios such as a Hubport, the construction of the Trans-Hudson rail freight tunnel, the adoption of the proposed Sunset Park 197-A Plan, or other foreseeable development options.

The existing 39th Street ramp volumes are as follows:

	Northbound	Southbound
AM Peak Hour (all vehicles)	320	200
PM Peak Hour (all vehicles)	500	380
7 AM - 7 PM (trucks)	460	600

As can be seen from these volumes, access traffic at 39th Street area could undergo major changes if traffic patterns are altered by the addition of entrances, by major port improvements, or if car dependent development begins to cluster around the 39th Street entrances and exits.

Getting better data on how this use demand could change and what traffic potential exits and entrances in the 39th Street area might have to handle is a necessary preliminary to identifying feasible access designs that would serve the community. Access design will be constrained by the narrow width of the side streets and the steep grade rise eastward of Third Avenue, which will require all access to the tunnel to take place from Second Avenue.

Thus, the design process must assemble additional data, and will require close and careful community consideration of various alternatives, to select the most feasible access system.

Finally, it should be noted that the inter-action of exit traffic with load road systems and business needs to be an integral part of the planning process.

The Prospect Expressway Connection Traffic volumes moving between the Gowanus and the Prospect Expressway require a continuing connection between the Prospect Expressway and any Gowanus Tunnel. This is a major reason for RPA's selection of a Third Avenue alignment as the most feasible for a tunnel. Though the RPA team also regards several other alignments as potentially feasible, once a Gowanus Tunnel moves away from the current site of the Prospect Expressway/Gowanus Expressway interchange, the problem of connecting them rapidly becomes unmanageable. The RPA team ultimately concluded that whatever advantages other alignments possessed, as long as Third Avenue is a feasible route, it should be used to facilitate creating a successful Gowanus, Prospect Expressway interchange as part of a Gowanus Tunnel project.

The Gowanus/Prospect Expressway interchange, with its four connections (a double merge) would be difficult and costly to reproduce underground and would present a high probability of project delay and cost overrun. There are also major physical constraints to such extensive underground construction in that area, most notably the proximity of the Gowanus Canal and the high ground east of Third Avenue. Moreover, a purely underground solution would require the tunnel tubes moving west to be expanded to provide four lanes each way to take the additional Prospect Expressway traffic, a resizing in mid-stream that is too complex and full of construction risk to be confidently regarded as practical and feasible.

These problems mean that the current Gowanus configuration cannot be reproduced underground west of the Gowanus/Prospect Expressway merge. This leaves two choices: end the Tunnel at the Prospect Expressway Exchange, or find a different way to deal with the Prospect Expressway traffic flow and maintain the advantages of a tunnel.

A Conservative Scenario: Ending the Gowanus Tunnel at the Prospect Expressway Interchange

From its proposed South Portal to the Prospect Expressway, the RPA team regards the Gowanus Tunnel as a relatively simple and straightforward undertaking that solves many traffic and urban problems. A conservative scenario would be to end that tunnel at the Prospect Expressway and to use the existing Gowanus Elevated Expressway to go west to the Brooklyn Battery Tunnel and the BQE.

Doing so has a number of advantages. It would be simpler and easier to construct and would involve less disruption in building the northern portal of the tunnel, which would be sited at about 26th Street and Third Avenue, from which the road would climb back up to the Elevated Expressway. While the portal would eliminate traffic crossings of Third Avenue between roughly 28th and 20th streets, that would have minimal impact on local traffic. In addition, ending the tunnel short of the Prospect would allow use of the existing exit and entrance systems between the Gowanus and the Prospect Expressway, producing major construction savings.

However, to end the Gowanus Tunnel at the Prospect Expressway exchange would mean leaving in place the Elevated Expressway as it passes through Red Hook, where it is intrusive, disruptive and ugly. It would leave Red Hook in its state of semi-isolation from the rest of the City, and its limited and difficult access to the rest of the City across Hamilton unaltered. The 3.9% congestion causing climb as the Gowanus passes over Hamilton would also remain intact, and Hamilton Avenue would remain a congestion ridden, urban backwater. And such conditions would remain baseline factors in the life of Red Hook and southern Carroll Gardens well into the next century.

The RPA Teams's Recommendation: Continue the Gowanus Tunnel to the Brooklyn Battery Tunnel, while creating a Redesigned Hamilton Avenue with a parkway-boulevard type treatment that has the capacity to smoothly serve the Prospect Expressway traffic and new design features to provide Red Hook with the improved traffic access and management it needs.

The most formidable problem in creating a Gowanus Tunnel and obtaining the removal of its blight upon South Brooklyn is the problem of what to do about the traffic currently moving westward from the Prospect Expressway that now uses the Gowanus for the three quarter of a mile trip between the Prospect and the Brooklyn Battery Tunnel/BQE junction. As discussed above, that traffic cannot be put into the Gowanus Tunnel in a practical and feasible way. But it must be provided for and given a commensurate level of service. What other options are available to do so?

RPA first explored the idea of satellite tunnels, going directly between the Brooklyn Battery Tunnel/BQE interchange. The RPA team concluded that this alternative was not feasible. Such an alternative would have required a triple merge of the main Gowanus Tunnel, the satellite tunnel and the Hamilton Avenue traffic in both east and west bound directions, producing unworkable traffic flows.

That left one other option, using the space made available by taking down the Gowanus on Hamilton Avenue to add additional lanes as part of a multi-lane boulevard treatment that would integrate the Prospect Expressway and Hamilton Avenue from the west of Third Avenue to the Brooklyn Battery tunnel. Four or five through lanes in each direction of travel would be separated by a landscaped median. Provisions would be made for local service traffic and a new low level fixed bridge would carry the boulevard over the Canal. This would require modernizing and altering current navigational practices and clearances over the Canal that are now generally regarded as obsolete, as well as addressing the issue of what the future depth of the Canal should be.

The other element of the Hamilton Avenue redesign would be identifying design features that would address the access problems that Red Hook currently faces and help Red Hook meet its goals for traffic management within the community. For example, Clinton Street, the principal Hamilton Avenue crossing for Red Hook traffic is now a difficult intersection to cross. Grade conditions there would appear to make it relatively easy to construct an underpass for Red Hook traffic as part of a Hamilton Avenue redesign. There should be many design options for aiding Red Hook. This should be explored through a community based traffic planning process, one that ideally would be integrated with the Downtown Brooklyn Traffic Calming Study.

The reason that the RPA team recommends undertaking these challenges is what could be gained if successful and what would be lost if not. A redesigned surface boulevard on Hamilton Avenue appears to be the only feasible way the RPA team has identified to take down the Hamilton Avenue portion of the Gowanus Elevated Expressway and make a Gowanus Tunnel work. If it cannot be done or if the community interests involved are unwilling to have it done, then the Gowanus Tunnel will have to end at the Prospect Expressway and Red Hook and southern Carroll Gardens will have the presence of the Elevated Expressway, with all that means for community access, community character and traffic on Hamilton Avenue for at least another two generations.

A Tunnel Alignment Under Third Avenue

RPA recognizes that a proposal to construct a tunnel under Third Avenue raises questions about the possibility of undermining and disruption of the existing Gowanus Expressway during construction. That would negate one of the main purposes of a tunnel, to allow the current Gowanus to operate undisturbed. For these reasons, RPA was originally hesitant to consider a Third Avenue route. However, RPA has been convinced by the experience of the Boston Central Artery Project and the professional engineering opinion it has consulted that, particularly given the width of Third Avenue and the span of the current Gowanus supports, tunneling work could be safely done under Third Avenue. While a fail safe answer requires a full preliminary design, the RPA team has concluded that a Third Avenue route appears feasible and that, given its many advantages, particularly simplifying connections with the Prospect Expressway, it should be pursued.

Should a Third Avenue route ultimately appear questionable, RPA has examined and concluded that a Second Avenue route is also feasible for the north-south portion of the Gowanus Tunnel, with the route then swinging in towards the Prospect Expressway/Gowanus Interchange via Third Avenue.

THE GOWANUS TUNNEL: NOT JUST A TRANSPORTATION PROJECT, BUT AN INTEGRATED TRANSPORTATION/URBAN REVITALIZATION PROJECT

A New Strategy for Infrastructure Investment

RPA has had two goals in its Gowanus tunnel project. The first was to establish that a Gowanus Tunnel was a feasible alternative to meeting the transportation needs of the Gowanus Corridor. The second was to identify as many urban interests as possible that could be integrated with a Gowanus Tunnel transportation investment.

RPA believes that the Region must develop a 21st Century infrastructure strategy that replaces traditional single purpose thinking about infrastructure investments. The Region should recognize that the large amounts of money being invested in infrastructure offer an opportunity to leverage multiple benefits across a wide range of civic interests. Developing integrated infrastructure projects that serve more than one social purpose provides synergies and economies of scale that the Region must have if it is to afford all of its future public investment needs.

The RPA team believes that a Gowanus Tunnel project can serve as a paradigm for that strategy. The Gowanus Tunnel project the RPA team recommends combines a cutting edge transportation strategy with major urban benefits. Each make the other possible, so that the Gowanus Tunnel is a transportation/urban revitalization program, not just a better way to build a road.

The Major Urban Opportunities Integrated Into the Gowanus Tunnel Project

The major urban opportunities integrated into the Gowanus Tunnel project the RPA team recommends include:

- giving back Bay Ridge its waterfront by making it possible to close the section of the Belt Parkway that circles Bay Ridge;

- reuniting the Sunset Park community and providing it with a wide open Third Avenue for community use as desired;

- reuniting Red Hook with the rest of the City and removing the Gowanus as a barrier to its revitalization;

- redesigning Hamilton Avenue as a parkway-boulevard that provides Red Hook with adequate access and Carroll Gardens with a dynamic new southern border.

- providing modern urban transportation that would facilitate pursuit of a Trans-Hudson rail freight network, a Hubport, and other programs of community based revitalization such as the Sunset Park 197-A plan and the development of a Gowanus Canal mixed use area.

A GOWANUS TUNNEL PRELIMINARY COST ESTIMATE

A major issue with tunnel feasibility is cost. RPA has developed an initial cost estimate for a tunnel of $1.5 to $2.5 billion. That path to that estimate is as follows.

RPA carried out a preliminary comparison with the Boston Central Artery Project (BCAP) to use those costs to establish an initial range. BCAP involves over 50 lane miles of underground road with a number of underground interchanges, and another 50 lane miles of surface road, including new bridge crossings and other complex facilities. Cost estimates for the total project run from an official $8.8 billion to a United States General Accounting Office (GAO) project cost estimate of $11 billion. Taking that number and assigning 75% of the total project cost to the 50% of the lane miles that are underground yields an approximate cost of $8 billion for the underground portions. Adjusting that cost for the 30 lane miles of a Gowanus tunnel would yield a proportional cost of $4.8 billion.

The next step was to do a constructibity comparison.

BCAP tunnel construction was much more difficult than the Gowanus. BCAP includes tunnel sections built with three different tunnel technologies, all of which have separate mobilization costs. BCAP tunnels have had to be threaded through subways, placed near of the foundations of center city buildings and pass through what has been characterized as an underground swamp. Arguably the Gowanus would be only half as complex to construct, it could be only a third as complex. That sets an initial range of $1.5 to $2.5 billion dollars.

RPA then took that estimated range through two other screens. The first was tunneling costs in other cities. Except for Tokyo, the cost estimates again fell in that range. Then RPA reviewed construction cost estimates of tunneling, based on a Dames and Moore project submission to NYSDOT, and best professional initial judgements as to the cost of dealing with portals, exits and entrances, Hamilton Avenue, traffic management and tearing down the Gowanus. In all cases, the cost range held.

While this is a necessarily preliminary estimate, at the moment it represents the most reliable cost estimate that has been undertaken to date on a Gowanus Canal. RPA regards it less as setting a definitive cost figure, then establishing a range of cost difference with reconstructing the Elevated Expressway. It demonstrates that, with the investment returns a Tunnel would bring Brooklyn and the Region, the cost difference is within affordable limits.

NEXT STEPS

Where should the Gowanus project go from here? This feasibility study is meant to be the first stage of a work in progress. To make a definitive decision on the tunnel and the details of an overall Gowanus project, a number of steps should now be taken.

1. A preliminary design of a tunnel alternative, with additional detail in areas like Hamilton Avenue where more than one treatment maybe may be possible, and additional geotechnical analysis to enable the project to go to take a design build if so desired must be carried out over the next year.

2. The Environmental Impact Statement Scope must be realized for review to insure it incorporates all the issues, such as induced traffic under new development, that original planning failed to address.

3. A Major Investment Study, long sought by the community, should be carried out in tandem with it.

4. The role of community and business interests in shaping the Gowanus Corridor debate must be facilitated and expanded, and a philosophy of urban friendly transportation investments developed to address the best investment strategy for the Gowanus corridor.

5. NYSDOT should follow a process that will produce a generally agreed upon decision with respect to either rebuilding the elevated expressway or replacing it with a tunnel.

CONCLUSION

In concluding, it is appropriate to reflect on the choice the RPA Gowanus feasibility study presents.

A Gowanus Tunnel is feasible. It is feasible physically, it appears to be affordably close to the cost of reconstructing the Gowanus Elevated Expressway and, though community scrutiny and input will still continue to refine it as tunnel planning evolves, in its broad outlines it is consistent with the needs of South Brooklyn’s communities and other interested parties as expressed to RPA.

But the RPA team's findings go beyond that conclusion. The study has identified a Gowanus Tunnel project that is more than just an alternate way to build a road. The RPA Gowanus Tunnel project is a way to build the City. Thus, in contemplating the choice between current proposals to reconstruct the existing Elevated Expressway and a Gowanus tunnel, it is important to recognize that this is a choice between two very different infrastructure strategies. It is not just two different prices, it is too vastly different products. And the benefits of a tunnel approach are such that, dollar for dollar, it is the better buy, the cheaper approach.

There has been much talk in the mid-nineties that New York can think big again. If so, then the next step is to act big. No decision in this decade will have more to do with the future shape and look of the City than the decision about what to do with the Gowanus. To the RPA team the question is no longer why build a tunnel. Increasingly the right question would seem to be: why not?

ATTACHMENT A

RPA TEAM MEMBER BACKGROUNDS

I. Regional Plan Association Gowanus Tunnel Team Members

Albert Appleton, a Senior Fellow at RPA and the Gowanus Tunnel project coordinator, is a former Commissioner of the New York City Department of Environmental Protection, responsible for both directing the New York City water and sewer system and managing the City's environmental protection programs. Mr. Appleton's work at RPA focuses on developing a new generation of 21st Century infrastructure that integrates cutting edge engineering with financial, environmental and community concerns to produce more cost effective, urban friendly public investment. Mr. Appleton has also served as an advisor to various public and private entities on issues of water and environmental system management, public finance, and urban management.

Jeffrey Zupan, a Senior Fellow at RPA, is a nationally recognized expert on transportation whose latest work includes developing the master plan for upgrading and integrating regional mass transit (known as Rx) that is a centerpiece of the RPA Third Regional Plan. He is particularly known for his work on the use of market based transportation management techniques to create innovative strategies that could break the back of some of the Region's most persistent congestion problems.

Robert Paaswell is Distinguished Professor of Civil Engineering at City University of New York and Director of the University Transportation Research Center (UTRC), a federally funded center that provides research and training to transportation professionals in New York and the other states the comprise United States Department of Transportation Region II. UTRC carries out a wide range of studies and training programs addressing current and emerging transportation problems.

From 1986-1989, Mr. Paaswell served as Executive Director (CEO) of the Chicago Transit Authority, the second largest system in the U.S. Dr. Paaswell has also served as Director of the Urban Transportation Center at the University of Illinois, from 1982-1986 and as Professor of Civil Engineering at State University of New York at Buffalo (1964-1982), where he organized and directed the Center for Transportation Studies and Research. He has served on the Executive Committee of the Transportation Research Board, and as an advisor to many public agencies, in America and internationally.

Mitsuru Saito, is a faculty/researcher at the Institute for Transportation Systems of the City University of New York (CUNY) and a Associate Professor in the Civil Engineering Department of the City College of New York at CUNY. He is a registered professional engineer (NJ) in the field of civil engineering since April 1993. Dr. Saito will be a faculty/researcher (Associate

Professor) in the Department of Civil and Environmental Engineering, Brigham Young University, Provo, Utah starting August 1, 1997.

Dr. Saito's academic interests include traffic engineering, traffic operation, traffic theory, traffic safety, advanced highway geometric design, civil engineering systems analysis, computer applications to civil engineering,
transportation facility management, and traffic safety. He has worked on several Intelligent Transportation Systems (ITS) related studies including the compilation of a master plan of high-tech traffic control systems for the Bureau of Traffic of NYCDOT and an analysis of delay reduction by electronic toll collection for the Sloan Foundation. He also conducted ITS related studies for the University Transportation Research Center, Region II, and for the New York/Paris Joint Urban Studies program.

Herbert Levinson is a transportation consultant to many public agencies in the United States and abroad. He is a recognized authority in transportation planning, traffic engineering, public transport and public policy. He has authorized several major books and numerous transportation abstracts and papers on those subjects.

Mr. Levinson is a former Senior Vice President of Wilbur Smith Inc. He played a central role in the planning studies that lead to the selection of the Baltimore Harbor Tunnel alignment as an alternative to an originally planned Freeway across Baltimore's Inner Harbor area.

Antonia Bryson is currently an attorney specializing in environmental representation of non-profit and community organizations. From 1991 to 1995 she was a Deputy Commissioner in the New York City Department of Environmental Protection, responsible for directing the City's air and noise pollution control and hazardous materials programs. She was responsible for overseeing the City's innovative program to convert municipal vehicles to alternative fuels, for the remediation of closed municipal which had been declared hazardous waste sites, for an innovative program to regulate interior lead abatement practices, and for the City's ongoing programs to control air and noise pollution and remediate hazardous sites.

Prior to that, Ms. Bryson served in the New York City Department of Law. She organized the environmental unit at the Law Department of the City of New York and served as its first director, where she was responsible for the many major environmental issues confronting the City, including its review of environmental impacts statements on City projects and matters affecting City interests. She also served as head of a Department of Law defensive litigation unit and as a private attorney at the firm of Cravath, Swaine & Moore.

ATTACHMENT B

Preferential Treatments (Bus Lane or HOV Bus Lane)

As the issue of preferential treatments is independent of whether a tunnel is feasible or whether reconstruction of the existing Elevated Expressway or a tunnel is ultimately chosen, this discussion is presented separately.

Currently, the Gowanus Expressway provides a preferential treatment during peak hours for buses and carpools with three or more persons. This preferential treatment, commonly referred to as an HOV (high occupancy vehicle) lane has been designed by using an existing lane. Though its effectiveness is limited by the conflicts at the Belt Parkway merge and the fact that the Gowanus was not originally designed for preferential treatments, it does help expedite movement during rush hours.

Whatever alternative is chosen in the Gowanus Corridor, preferential treatment should be provided. Preferential treatment for buses should clearly be retained and expanded under either alternative to maximize the people-carrying capacity of the highway. With the large number of commuters who travel on the Gowanus by bus to Manhattan, 25,000 from Brooklyn and 19,000 from Staten Island daily, it is critical to encourage and expand bus use with whatever alternative is built. The exclusive treatment should begin in Staten Island at the Verrazano Narrows Bridge and extend across the bridge through the I-278 approach trench, onto the Gowanus if the elevated is constructed, into the bus tube if a tunnel is chosen, and then continue directly through to the Brooklyn Battery Tunnel. This should be a dedicated lane, permanently set aside for bus traffic.

Transportation policy for new York City emphasizes public transit. Allowing car pools to share the bus lane would run count to that policy and could be counter-productive to the goal of improving Regional traffic flow.

The carpools would be destined for Manhattan, where the Region has no interest in encouraging car traffic. Moreover, given the large majority of Brooklyn (87%) and Staten Island (71%) residents who already travel into Manhattan using buses, a carpool lane could have the perverse effect of encouraging a shift from transit into cars, thereby increasing automobile traffic in the Gowanus Expressway corridor.

Though there are, in RPA's opinion, occasional circumstances in which HOV lanes might be warranted the Gowanus Corridor is not one of them. Creation of a dedicated bus lane, with its greatly reduced travel times and ease of commuting could be a critical factor in linking Staten Island to the City and reducing the traffic use on the Island that is increasingly threatening local quality of life. Providing these benefits should be the focus of any preferential treatment in the Gowanus Corridor.