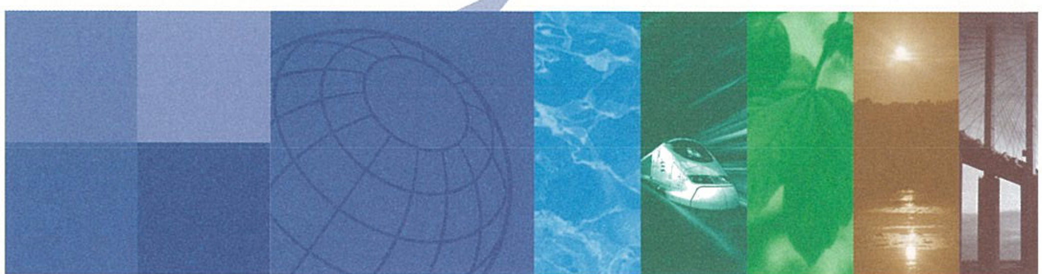
# vision42

Initiative for an auto-free light rail boulevard on 42nd Street
by the Institute for Rational Urban Mobility, Inc. (IRUM)



# Cost Estimate Update
# February 2008

Halcrow, Inc.

Halcrow

**vision42**

**an auto-free light rail boulevard for 42nd Street**

# Cost Estimate Update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February 2008


**vision42**
Roxanne Warren, AIA, Chair
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The **vision42** proposal is a citizens' initiative sponsored by the Institute for Rational Urban Mobility, Inc. (IRUM), a New York City-based not-for-profit corporation concerned with advancing cost-effective transport investments that improve the livability of dense urban places.


This study was performed to update costs developed in a prior study, review the current status of fuel cell technology, and revisit the surface power conductor system currently in use in Bordeaux, France. It was made possible through a generous grant from the New York Community Trust/Community Funds, Inc., John Todd McDowell Environmental Fund.



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# 1 Executive Summary and Recommendations

- Taking into account recent escalation in construction and materials procurement cost, a 2.5-mile surface light rail line in a landscaped 42nd Street, with 16 pairs of stops, will cost between approximately $411 and $582 million in 2007 dollars, depending upon the extent of utility relocations and the choice of propulsion system.

- Although hydrogen fuel cell technology remains relatively expensive and is expected to continue to be so until there is more local distribution, the single pilot installation on 42nd Street would not need an extensive distribution network. Several manufacturers are currently performing research and development to incorporate fuel cell technology into their vehicles with significant progress being made in hybrid applications.

- The surface power conductor system in use in Bordeaux since late 2003 had undergone major modifications and improvements in 2005 and has exhibited noticeable improvements in reliability, leading to its use on additional projects in France. A remaining area of concern is the affect of flooding on the system, which can be mitigated through proper drainage design and installation. The system is still unproven in regions with extreme sub-freezing temperatures.

# 2 Introduction

## 2.1 The vision42 Project Scope

This study is an update of a previous study performed in 2005, which examined the cost, in 2004 dollars, of providing a highly convenient and accessible surface public transportation system on New York City's famed 42nd Street.

This study updates the capital cost estimates for the three possible light rail options previously identified and the annual operating costs of the system, through the use of applicable cost indexes.

Additionally, an update is provided on the current status of fuel cell technology, and the surface power conductor system in use in Bordeaux, France is revisited.

# 3 Updated Cost Estimate

## 3.1 Cost Assumptions

The approach taken to develop the inputs for the updated cost estimate and the process by which costs have been updated is as follows:

### *3.1.1 Base Year*

The original cost estimate for the **vision42** program was prepared in a prior study and is based on 2004 dollars. This original cost estimate was updated to a base year of **2007** using analyzed historical data.

### *3.1.2 Inflation*

To calculate the future nominal costs of the **vision42** program, assumptions with regards to inflation have been developed. The updated cost model distinguishes between two inflation rates - Consumer Price Index (CPI) and Construction Cost Index (CCI). The reason for this differentiation is because the majority of operating cost items are typically influenced by CPI while capital expenditure items are typically influenced by the CCI.

A data review of publicly published sources was undertaken to identify CPI and CCI trends. The sources reviewed include the Bureau of Labor Statistics (BLS), Engineering News Record (ENR) - Construction Cost Index (CCI) and Building Cost Index (BCI), and the USDoT Federal Highway Administration.

Upon examining the data, it was apparent that greater fluctuations existed in the CCI compared to the CPI. Based on our analysis of published statistics, CPI averaged 3.44% per annum over the last two decades in the New York metropolitan area[1]. In contrast, the CCI, when adjusted for heavy and civil engineering construction projects using BLS wage rate statistics, averaged 5.75% per annum in the New York area during the same time profile[2].

## 3.2 Estimate of Capital Costs

Costs have been estimated for the following three steel wheel/steel rail options:

- conventional catenary system power supply,
- self-propelled vehicles using fuel cell technology or nickel cadmium batteries,
- self-propelled vehicles with beams (instead of a continuous slab) supporting the rails, to limit the diversion of the sewer mains and some of the other utilities.

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1 *All Urban Customers (New York-Northern New Jersey-Long Island).* Source: Bureau of Labour Statistics, BLS

2 *Building Cost Index for the State of New York*. Source: Engineering News Record

Table 3.1 indicates the capital cost estimate updated to 2007 dollars. The basis for these costs is the original cost estimate study that was prepared in 2004 dollars.

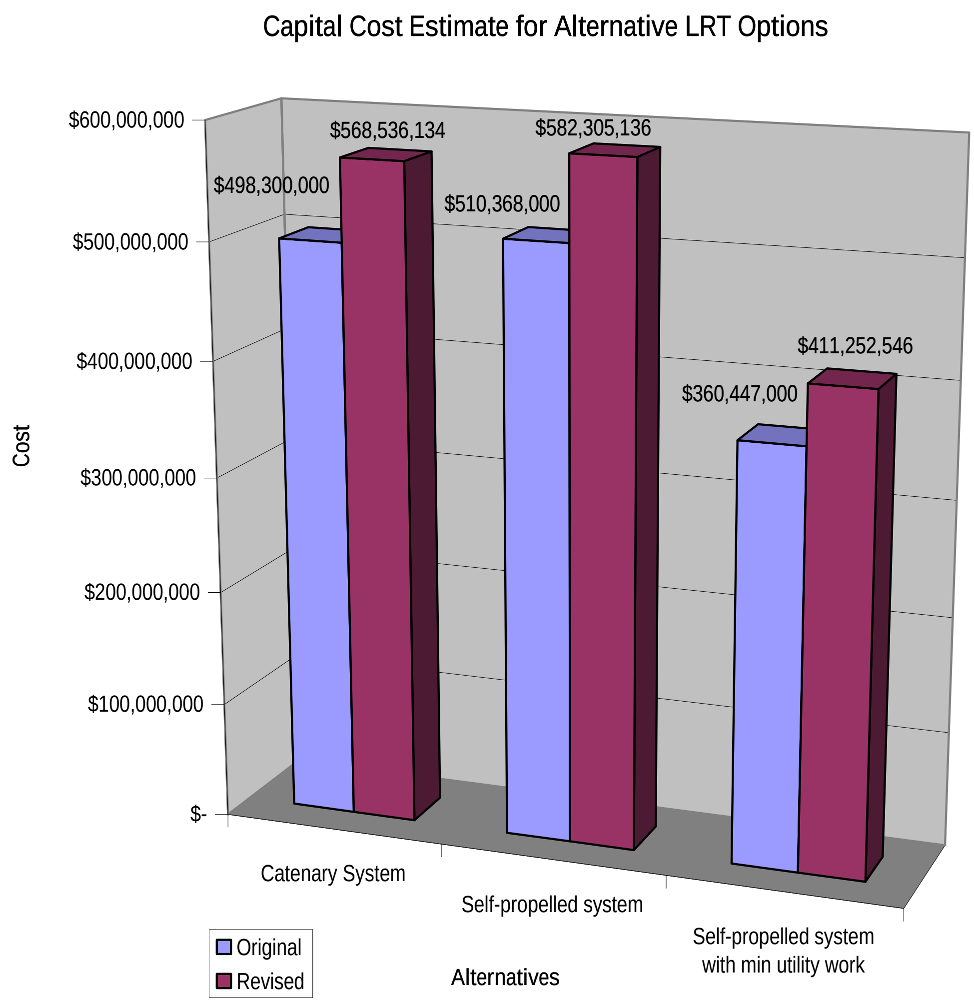
**Table 3.1 – 2007 Base Year Capital Cost Estimate for Alternative LRT Options**

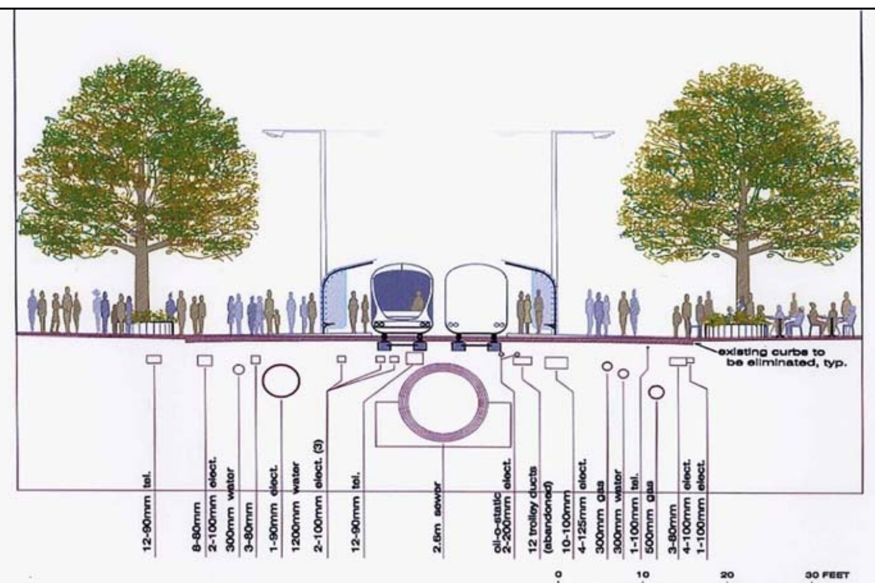
*2007 Price Level*

| Element | Catenary System | Self-Propelled System | Self-Propelled System with Minimum Utility Work |
|---|---|---|---|
| Utility Relocation * | $364,011,449 | $364,011,449 | $215,269,024 |
| Streetwork, Landscaping & Stops * | $66,973,853 | $66,973,853 | $66,973,853 |
| Trackwork | $22,305,602 | $22,305,602 | $22,305,602 |
| Electrification – feeder substations | $4,192,997 | $3,422,855 | $3,422,855 |
| Electrification - overhead wire or power rail | $5,590,662 | - | - |
| Control and communications | $3,822,188 | $3,822,188 | $3,822,188 |
| Yard and Buildings | $13,120,942 | $13,120,942 | $13,120,942 |
| Land & Property acquisition | $5,704,758 | $5,704,758 | $5,704,758 |
| **Subtotal** | **$485,722,451** | **$479,361,647** | **$330,619,222** |
| Vehicles (14 number) | $63,893,284 | $83,061,269 | $83,061,269 |
| Contingencies | $54,961,916 | $56,242,063 | $41,368,620 |
| Engineering & Construction management | $24,286,294 | $23,967,968 | $16,531,246 |
| Net Present Value of Savings in Capital Cost from Eliminating Bus Routes (Over 30 Year LRT Lifespan) | **-$60,327,811** | **-$60,327,811** | **-$60,327,811** |
| **Total Project** | **$568,536,134** | **$582,305,136** | **$411,252,546** |

All costs are in 2007 dollars.

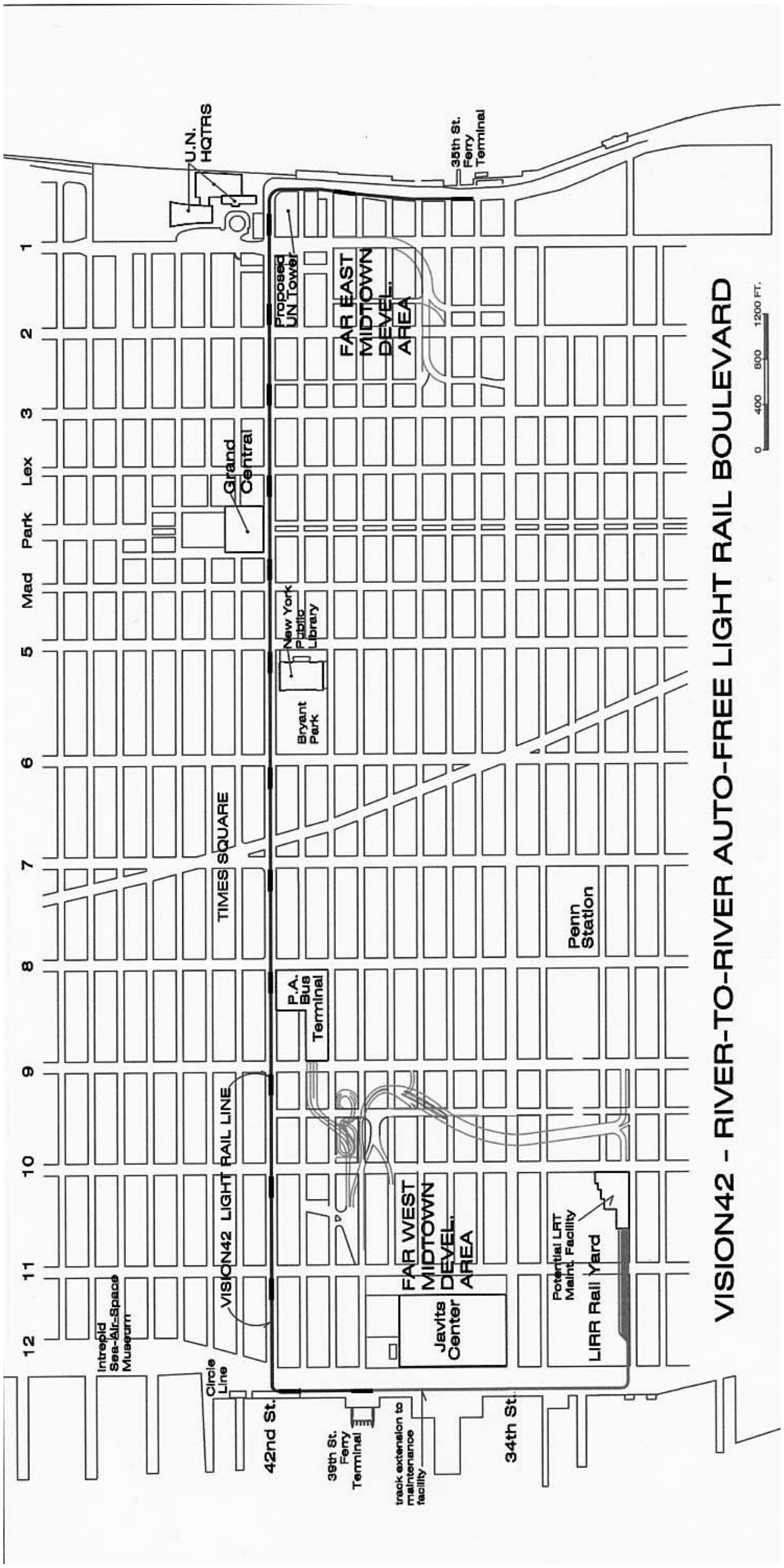
* See Appendix A –Base Capital Costs and Operating Expenses (2004 Dollars), Appendix B - Base Cost Details for Relocation of Utilities (2004 Dollars), and Appendix C – Base Cost Details for Streetwork, Landscaping and Stops (2004 Dollars) for original estimate values and details.




VISION42 - CROSS SECTION THROUGH UTILITIES AT 10TH AVENUE

## Map of vision42 Light Rail Route



## 3.3 Estimate of Operating Expenses

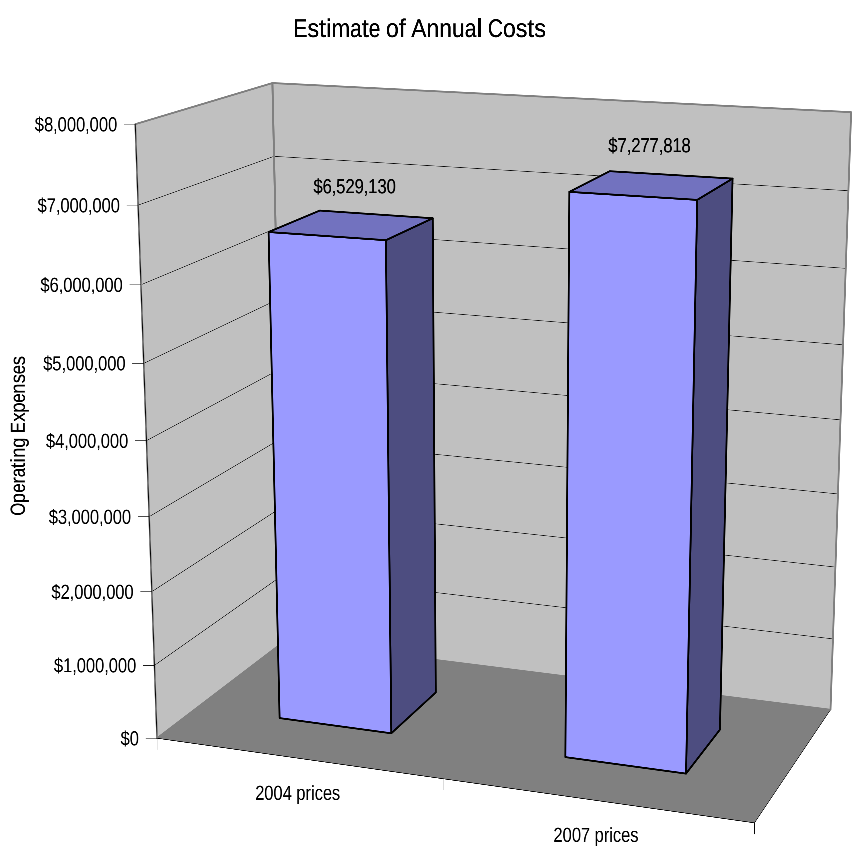
Table 3.3 indicates the Operating Expenses in the updated 2007 estimated cost.

**Table 3.3 – Annual Operating Expenses**

| Resource | Unit | Quantity | Unit Rate (2004 Dollars) | Annual Operating Expenses (2007 Dollars) |
|---|---|---|---|---|
| **Vehicle Operations** | | | | |
| Operations Manager | Person Years | 1 | $121,500 | $135,432 |
| Admin Support | Person Years | 1 | $40,500 | $45,144 |
| Crew Dispatcher | Person Years | 3 | $81,000 | $270,865 |
| Drivers | Person Years | 40 | $70,200 | $3,129,992 |
| Chief Dispatcher | Person Years | 1 | $101,250 | $112,860 |
| Dispatchers | Person Years | 5 | $81,000 | $451,441 |
| Revenue Collectors | Person Years | 4 | $40,500 | $180,576 |
| Security | Person Years | 3 | $47,250 | $158,004 |
| Electric Power | Vehicle kms | 530,800 | $0.32 | $191,180 |
| Casualty / Liability | Vehicle kms | 530,800 | $0.12 | $73,531 |
| | | | | **$4,749,025** |
| **Vehicle Maintenance** | | | | |
| Maintenance Manager | Person Years | 1 | 121,500 | $135,432 |
| Admin Support | Person Years | 1 | 40,500 | $45,144 |
| Foreman – Vehicles | Person Years | 3 | 87,750 | $293,437 |
| Mechanics | Person Years | 4 | 74,250 | $331,057 |
| Electricians | Person Years | 3 | 74,250 | $248,293 |
| Cleaners | Person Years | 2 | 47,250 | $105,336 |
| Spares and consumables | Per Vehicle | 13 | 9,300 | $134,764 |
| | | | | **$1,293,463** |
| Foreman - Way & Structures | Person Years | 1 | 87,750 | $97,812 |
| Electrical Maintainers | Person Years | 2 | 74,250 | $165,528 |
| Track Maintainers | Person Years | 2 | 67,500 | $150,480 |
| Storekeeper | Person Years | 3 | 67,500 | $225,721 |
| Track Materials | Track kms | 8 | 18,642 | $167,200 |
| | | | | **$806,741** |

| Resource | Unit | Quantity | Unit Rate (2004 Dollars) | Annual Operating Expenses (2007 Dollars) |
|---|---|---|---|---|
| **General Admin** | | | | |
| General Manager | Person Years | 1 | 141,750 | $158,004 |
| Office administrator | Person Years | 1 | 54,000 | $60,192 |
| IT Support | Person Years | 1 | 60,750 | $67,716 |
| Office Equipment including IT | Item | 1 | 30,000 | $33,440 |
| Office Utilities | Monthly Allowance | 12 | 2,000 | $26,752 |
| Office Consumables | Monthly Allowance | 12 | 2,000 | $26,752 |
| Contingency | Item | 1 | 50,000 | $55,733 |
| | | | | **$428,589** |
| | | | | **$7,277,818** |

All costs are in years as indicated.



**Comparison of Light Rail and Bus System O&M Costs**

| 2007 | LRT | Replaced Bus Services |
|---|---|---|
| Vehicle Operations | $4,749,025 | $6,272,245 |
| Vehicle Maintenance | $1,293,463 | $968,648 |
| Non-Vehicle Maintenance | $806,741 | $55,733 |
| General Administration | $428,589 | $55,733 |
| **Total** | **$7,277,818** | **$7,352,359** |
| **Cost/Place Mile** | **$0.10** | **$0.37** |

# 4 Fuel Cells

Fuel cells are still relatively expensive and have been mainly limited to specialized applications and limited pilot trials. Currently, there are no large scale passenger railways in service using fuel cells. More detailed plans, driven by environmental issues to create such a service, are developing. Groups based in Scandinavia are actively pressing to develop a prototype main line service. The emerging importance of energy conservation to prevent global warming is also increasing support for hydrogen fuel cells. Other developments, such as carbon footprinting, are becoming a standard requirement on all new projects in Europe. This is adding greater pressure to maximize sustainability and minimize the direct or indirect use of fossil fuel power sources.

Major manufacturers of street-running light rail vehicles are currently undertaking additional research and development aimed at incorporating fuel cell applications as an option in their standard vehicles. The manufacturers' studies have had direct relevance and help support ideas previously proposed for **vision42**. Alstom, whose clients include the MTA (New York), Amtrak, and New Jersey Transit to name a few, presented some of their initial findings in June 2006 at the 2nd International Hydrogen Train and Hydrail Conference held in Denmark. Alstom concluded that there is a real and growing need for "wireless" Light Rail systems; however, further progress is still required to make fuel cells a commercially viable alternative for light rail vehicle applications. Bombardier is also currently in the early stages of looking at similar developments for their vehicles.

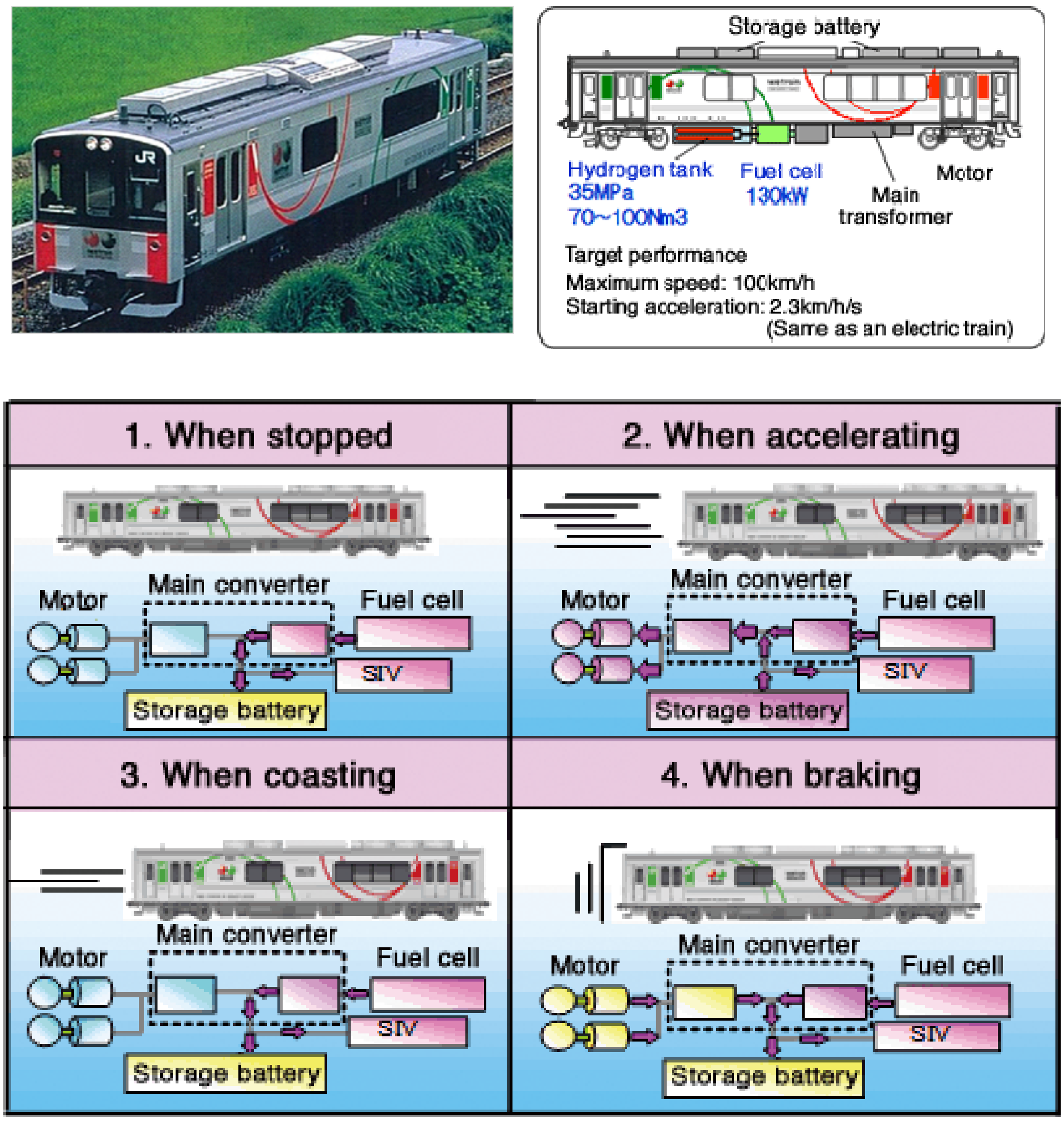
Progress has been made in the area of hybrid power supply applications. An important development is the increased recognition of the benefits in using energy conservation/storage systems that can be combined with and tailored to suit situations on any particular light rail route. A typical system application is to use an energy storage system that is charged during braking, such as a flywheel, and super-capacitors or batteries, such as lithium-ion or nickel/metal hydride. This energy storage system is connected in parallel with the prime source of power, which for example, could be fuel cell, hydrogen powered engine or external electrical power supply. Provided that there is sufficient available power in the energy storage system, the energy storage system will be used to power the propulsion drive line of the vehicle, thereby conserving capacity in the prime power source.

Yet another important advance is the continued operating cost and performance data being collected from many other bus-based fuel cell systems and the incorporation of this data into the research and development of light rail vehicle manufacturers.

As is evident from Mayor Bloomberg's initiative for congestion pricing, the need for environmentally friendly public transportation continues to grow in New York City.

Fuel cell powered light rail vehicles are a zero emission alternative that can also minimize costly utility diversions. Until there is more local distribution infrastructure for fuel, the cost of fuel cells remains a major issue prohibiting its wide scale use; however an extensive distribution network would not be required for the single pilot installation on 42nd Street.

**Figure 4.1 NE Train: Fuel Cell Hybrid Train Developed by East Japan Railway Company**




http://www.jreast.co.jp/e/development/theme/environment/environment01.html

# 5 Surface Power Conductor

The surface power rail system installed on 6½ miles (10.5 km) of the 15½ mile (25 km) 3 line light rail network in Bordeaux has been in revenue operation since December 2003. This system, installed by Alstom and originally known as Innorail, is now marketed as APS (the abbreviation for *Alimentation Par le Sol,* or power supply from the ground). From its introduction, the system suffered serious problems which caused frequent and unacceptable service disruptions and led to an ultimatum from the mayor to Alstom in 2005 to rectify the problems or remove the system.

In response to this ultimatum, Alstom undertook major and costly modifications and improvements including complete replacement of cables in the ground and some onboard equipment in the light rail vehicles. By the end of 2005, the reliability had noticeably improved with only 0.92% and 0.97% disruption caused by the APS system on lines A and B respectively. The technical improvements were incorporated in a new approximately ½ mile (1 km) extension of line A which opened to revenue traffic in September 2005. This extension has performed with good reliability from the outset.

As a result of the improved reliability, the Phase 2 extensions in Bordeaux will incorporate a 1¼ mile (2 km) route of additional APS. Three other suburbs in France have also either announced that they are planning to install APS or are seriously studying its use in some sensitive areas. These locations include new light rail networks in Angers and Reims and line 2 in Orleans.

The latest technical improvements now confirm that the APS system is technically sound and has proven it can achieve acceptable levels of reliability. The remaining weakness of APS is that when local flooding occurs in areas where good surface drainage cannot be achieved, service can be impacted. This can be overcome for an installation on 42nd Street, since the entire street roadbed between the curbs will be rebuilt with new paving and adequate drainage. (The original conduit power systems installed in the early 1900's in New York and Washington had dealt with this problem by incorporating deep drainage conduits below the power rails. For the APS installation, the power rails are on the surface, not in a conduit, and drainage can be incorporated in the overall design of the street.)

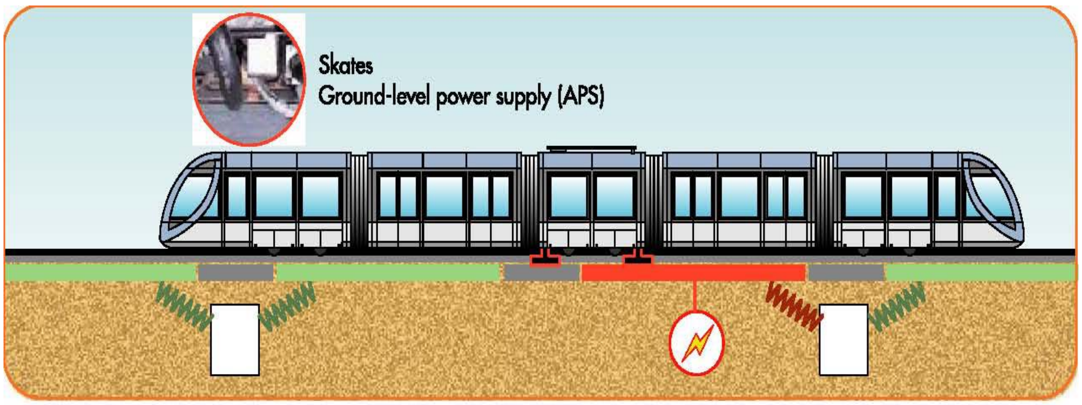
The main issue influencing the selection of APS for **vision42** is no longer an issue of reliability, but one of cost and disruption for the additional utility work that will be needed compared with those that would be needed for a self powered LRT vehicle. The additional utility work is a result of:

- The installation of the central power rail preventing the location of shallow utilities and manholes between the rails; and

- Stray currents from the DC power rail inducing electrochemical corrosion in metallic services including pipes, conduits and cables.

Although Bordeaux does experience freezing temperatures in the winter, Bordeaux's temperatures tend to be milder than those experienced in New York City. While the radio operation function of the APS should still function in the New York winter, the subsurface system is not yet proven in long periods of extreme sub-freezing temperatures, and there is a risk that the APS will prove to be less reliable in extreme cold. In addition, snow and ice clearance is necessary to allow for contact with the conductor.

**Figure 5.1 Ground Power Supply used in Bordeaux, France**




http://www.veoliaenvironnement.com/visites/bordeaux_en/technologies/ground-level.htm

**Figure 5.2 Bordeaux LRT with Ground Power Supply located between tracks**

http://www.railway-technology.com/projects/angers/angers3.html

# Appendix A

**Table A.1 – Capital Cost Estimate for Alternative LRT Options in 2004 Dollars**

| Element | Catenary System | Self-propelled system | Self-propelled system with min utility work |
|---|---|---|---|
| Utility Relocation * | $319,042,000 | $319,042,000 | $188,675,000 |
| Streetwork, Landscaping & Stops * | $58,700,000 | $58,700,000 | $58,700,000 |
| Trackwork | $19,550,000 | $19,550,000 | $19,550,000 |
| Electrification – feeder substations | $3,675,000 | $3,000,000 | $3,000,000 |
| Electrification - overhead wire or power rail | $4,900,000 | $0 | $0 |
| Control and communications | $3,350,000 | $3,350,000 | $3,350,000 |
| Yard and Buildings | $11,500,000 | $11,500,000 | $11,500,000 |
| Land & Property acquisition | $5,000,000 | $5,000,000 | $5,000,000 |
| Subtotal | $425,717,000 | $420,142,000 | $289,775,000 |
| Vehicles (14 number) | $56,000,000 | $72,800,000 | $72,800,000 |
| Contingencies | $48,172,000 | $49,294,000 | $36,258,,000 |
| Engineering & Construction management | $21,286,000 | $21,007,000 | $14,489,000 |
| Net Present Value of Savings in Capital Cost from Eliminating Bus Routes (Over 30 Year LRT Lifespan) | ($52,875,000) | ($52,875,000) | ($52,875,000) |
| **Total Project** | **$498,300,000** | **$510,368,000** | **$360,447,000** |

All costs are at 2004 price levels. * See Appendix B – Details of Base Costs for Relocation of Utilities.

**Table A.2 – Estimate of Annual Costs in 2004 Dollars**

| Resource | Unit | Quantity | Unit Rate | Total Cost |
|---|---|---|---|---|
| **Vehicle Operations** | | | | |
| Operations Manager | Person Years | 1 | $121,500 | $121,500 |
| Admin Support | Person Years | 1 | $40,500 | $40,500 |
| Crew Dispatcher | Person Years | 3 | $81,000 | $243,000 |
| Drivers | Person Years | 40 | $70,200 | $2,808,000 |
| Chief Dispatcher | Person Years | 1 | $101,250 | $101,250 |
| Dispatchers | Person Years | 5 | $81,000 | $405,000 |
| Revenue Collectors | Person Years | 4 | $40,500 | $162,000 |
| Security | Person Years | 3 | $47,250 | $141,750 |
| Electric Power | Vehicle kms | 530800 | $0.32 | $171,513 |
| Casualty / Liability | Vehicle kms | 530800 | $0.12 | $65,967 |
| | | | | **$4,260,480** |
| **Vehicle Maintenance** | | | | |
| Maintenance Manager | Person Years | 1 | $121,500 | $121,500 |
| Admin Support | Person Years | 1 | $40,500 | $40,500 |
| Foreman – Vehicles | Person Years | 3 | $87,750 | $263,250 |
| Mechanics | Person Years | 4 | $74,250 | $297,000 |
| Electricians | Person Years | 3 | $74,250 | $222,750 |
| Cleaners | Person Years | 2 | $47,250 | $94,500 |
| Spares and consumables | Per Vehicle | 13 | $9,300 | $120,900 |
| | | | | **$1,160,400** |
| **Non-Vehicle Maintenance** | | | | |
| Foreman - Way & Structures | Person Years | 1 | $87,750 | $87,750 |
| Electrical Maintainers | Person Years | 2 | $74,250 | $148,500 |
| Track Maintainers | Person Years | 2 | $67,500 | $135,000 |
| Storekeeper | Person Years | 3 | $67,500 | $202,500 |
| Track Materials | Track kms | 8 | $18,642 | $150,000 |
| | | | | **$723,750** |
| **General Admin** | | | | |
| General Manager | Person Years | 1 | $141,750 | $141,750 |
| Office administrator | Person Years | 1 | $54,000 | $54,000 |
| IT Support | Person Years | 1 | $60,750 | $60,750 |
| Office Equipment including IT | Item | 1 | $30,000 | $30,000 |
| Office Utilities | Monthly Allowance | 12 | $2,000 | $24,000 |
| Office Consumables | Monthly Allowance | 12 | $2,000 | $24,000 |
| Contingency | Item | 1 | $50,000 | $50,000 |
| | | | | **$384,500** |
| | | | | **$6,529,130** |

All costs are at 2004 price levels.

# Appendix B

## Details of Costs for Relocation of Utilities in 2004 Dollars

METERS OF UTILITIES TO BE RELOCATED — Option A - Middle of 42nd Street

| Location | Station Start | Station End | Sewer Main | Sewer | Water | Electric | Gas | Telecom | Oil | Vaults | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12th Ave Intersection | 40+108 | 40+160 | 60 | 0 | 6 | 12 | 0 | 24 | 0 | 0 | **102** |
| W. 42nd Street | 40+160 | 40+260 | 20 | 110 | 0 | 18 | 0 | 6 | 0 | 0 | **154** |
| W. 42nd Street | 40+260 | 40+380 | 0 | 120 | 0 | 6 | 0 | 0 | 0 | 0 | **126** |
| 11th Ave Intersection | 40+380 | 40+440 | 0 | 84 | 6 | 38 | 30 | 12 | 12 | 0 | **182** |
| W. 42nd Street | 40+440 | 40+540 | 0 | 100 | 100 | 208 | 0 | 0 | 0 | 4 | **408** |
| W. 42nd Street | 40+540 | 40+660 | 38 | 82 | 22 | 240 | 0 | 0 | 0 | 2 | **382** |
| 10th Ave Intersection | 40+660 | 40+700 | 60 | 24 | 18 | 34 | 12 | 12 | 0 | 0 | **160** |
| W. 42nd Street | 40+700 | 40+800 | 100 | 0 | 0 | 66 | 6 | 18 | 100 | 0 | **290** |
| W. 42nd Street | 40+800 | 40+940 | 140 | 0 | 0 | 316 | 0 | 0 | 140 | 4 | **596** |
| 9th Ave Intersection | 40+940 | 40+980 | 45 | 29 | 20 | 90 | 12 | 30 | 0 | 2 | **226** |
| W. 42nd Street | 40+980 | 41+080 | 0 | 100 | 0 | 112 | 12 | 100 | 100 | 1 | **424** |
| W. 42nd Street | 41+080 | 41+200 | 0 | 120 | 18 | 144 | 6 | 0 | 120 | 2 | **408** |
| 8th Ave Intersection | 41+200 | 41+260 | 0 | 0 | 108 | 330 | 12 | 24 | 0 | 3 | **474** |
| W. 42nd Street | 41+260 | 41+360 | 0 | 100 | 100 | 300 | 0 | 0 | 100 | 1 | **600** |
| W. 42nd Street | 41+360 | 41+460 | 0 | 110 | 110 | 146 | 110 | 0 | 0 | 3 | **476** |
| 7th Ave & Broadway | 41+460 | 41+580 | 0 | 0 | 125 | 678 | 0 | 48 | 120 | 1 | **971** |
| W. 42nd Street | 41+580 | 41+640 | 0 | 6 | 80 | 250 | 0 | 150 | 100 | 2 | **586** |
| W. 42nd Street | 41+640 | 41+760 | 0 | 0 | 120 | 510 | 120 | 10 | 120 | 2 | **880** |
| 6th Ave Intersection | 41+760 | 41+800 | 0 | 0 | 40 | 254 | 12 | 30 | 0 | 0 | **336** |
| W. 42nd Street | 41+800 | 41+920 | 0 | 25 | 0 | 700 | 12 | 0 | 0 | 4 | **737** |
| W. 42nd Street | 41+920 | 42+080 | 0 | 12 | 0 | 706 | 160 | 0 | 160 | 4 | **1038** |
| 5th Ave Intersection | 42+080 | 42+100 | 0 | 6 | 38 | 112 | 26 | 12 | 0 | 1 | **194** |
| E.42nd Street | 42+100 | 42+200 | 0 | 80 | 70 | 560 | 112 | 20 | 0 | 3 | **842** |
| E.42nd Street | 42+200 | 42+230 | 0 | 18 | 30 | 175 | 30 | 0 | 20 | 2 | **273** |
| Madison Ave Intersection | 42+230 | 42+280 | 0 | 6 | 40 | 330 | 25 | 36 | 0 | 3 | **437** |
| E.42nd Street | 42+280 | 42+480 | 10 | 30 | 50 | 1024 | 200 | 48 | 200 | 8 | **1562** |
| E.42nd Street | 42+480 | 42+540 | 0 | 0 | 60 | 252 | 60 | 0 | 0 | 2 | **372** |
| Lexington Ave Intersection | 42+540 | 42+580 | 8 | 0 | 6 | 168 | 0 | 30 | 0 | 1 | **212** |
| E.42nd Street | 42+580 | 42+700 | 0 | 0 | 120 | 540 | 0 | 12 | 0 | 5 | **672** |
| 3rd Ave Intersection | 42+700 | 42+740 | 10 | 6 | 18 | 120 | 12 | 12 | 0 | 0 | **178** |
| E.42nd Street | 42+740 | 42+900 | 160 | 0 | 160 | 320 | 100 | 25 | 160 | 2 | **925** |
| 2nd Ave Intersection | 42+900 | 42+960 | 60 | 0 | 45 | 180 | 6 | 24 | 0 | 0 | **315** |
| E.42nd Street | 42+960 | 43+140 | 186 | 6 | 156 | 600 | 30 | 30 | 12 | 4 | **1020** |
| 1st Ave Intersection | 43+140 | 43+200 | 60 | 6 | 80 | 250 | 50 | 100 | 0 | 3 | **546** |
| **Total** | | | **957** | **1180** | **1746** | **9789** | **1155** | **813** | **1464** | **69** | **17104** |

Notes:
1) Utility and vault relocation based on 6 meter effected area. (3 meters on either side of street center.)
2) All values in meters. (Convert to feet multiply by 3.28)
3) Sewer main represents 2.6 meter diameter pipe. Sewer represents .8 meter diameter.
4) At intersections, minimum of 6 meters of utilities running north/south will have to be deepened to allow for LRT foundations.

ESTIMATED AMOUNT OF UTILITIES TO BE RELOCATED

| Location | Street Station Start | Street Station End | Sewer Main |
|---|---|---|---|
| West Side Extension | 39+193 | 40+108 | - |
| 12th Ave Intersection | 40+108 | 40+160 | 60 |
| W. 42nd Street | 40+160 | 40+260 | 20 |
| W. 42nd Street | 40+260 | 40+380 | 0 |
| 11th Ave Intersection | 40+380 | 40+440 | 0 |
| W. 42nd Street | 40+440 | 40+540 | 0 |
| W. 42nd Street | 40+540 | 40+660 | 38 |
| 10th Ave Intersection | 40+660 | 40+700 | 60 |
| W. 42nd Street | 40+700 | 40+800 | 100 |
| W. 42nd Street | 40+800 | 40+940 | 140 |
| 9th Ave Intersection | 40+940 | 40+980 | 45 |
| W. 42nd Street | 40+980 | 41+080 | 0 |
| W. 42nd Street | 41+080 | 41+200 | 0 |
| 8th Ave Intersection | 41+200 | 41+260 | 0 |
| W. 42nd Street | 41+260 | 41+360 | 0 |
| W. 42nd Street | 41+360 | 41+460 | 0 |
| 7th Ave & Broadway | 41+460 | 41+580 | 0 |
| W. 42nd Street | 41+580 | 41+640 | 0 |
| W. 42nd Street | 41+640 | 41+760 | 0 |
| 6th Ave Intersection | 41+760 | 41+800 | 0 |
| W. 42nd Street | 41+800 | 41+920 | 0 |
| W. 42nd Street | 41+920 | 42+080 | 0 |
| 5th Ave Intersection | 42+080 | 42+100 | 0 |
| E.42nd Street | 42+100 | 42+200 | 0 |
| E.42nd Street | 42+200 | 42+230 | 0 |
| Madison Ave Intersection | 42+230 | 42+280 | 0 |
| E.42nd Street | 42+280 | 42+480 | 10 |
| E.42nd Street | 42+480 | 42+540 | 0 |
| Lexington Ave Intersection | 42+540 | 42+580 | 8 |
| E.42nd Street | 42+580 | 42+700 | 0 |
| 3rd Ave Intersection | 42+700 | 42+740 | 10 |
| E.42nd Street | 42+740 | 42+900 | 160 |
| 2nd Ave Intersection | 42+900 | 42+960 | 60 |
| E.42nd Street | 42+960 | 43+140 | 186 |
| 1st Ave Intersection | 43+140 | 43+200 | 60 |
| East Side Extension | 43+200 | 43+795 | - |
| **Total** | | **4602 m (15,094 ft)** | **957 m ( 3,138 ft)** |

Notes:
1) Utility and vault relocation based on 6 meter effected area. (3 meters on either side of street center.)
**2) All values in meters. (Convert to feet multiply by 3.28)**
3) Sewer main represents 2.6 meter diameter pipe. Sewer represents .8 meter diameter.
4) At intersections, minimum of 6 meters of utilities running north/south will have to be deepened to allow for LRT foundations.

| ESTIMATED COST BREAKDOWN PER LINEAR FOOT OF STREET |
|---|
| A) NO SEWER MAIN |
| 11,955 ft x $17,500/ft = $209,212,500 |
| B) SEWER MAIN |
| 3,138 ft x $35,000/ft = $109,830,000 |
| ESTIMATED TOTAL COST |
| **$319,042,000** |

Note:

1) General linear foot cost escalated 35% based on conversation with NYCDEP and NYCDDC.

2) For areas of sewer mains, linear foot cost doubled on recommendation of NYCDEP.

3) Linear foot cost based on escalated prices from May 1997 NYCDOT report.

4) NYCDEP and NYCDDC indicated price escalations are very approximate.

# Appendix C

### Details of Base Costs for Streetwork, Landscaping and Stops in 2004 Dollars

Langan
Engineering and Environmental Services

Project # 5625201
July 2004

## FEASIBILITY COST SUMMARY

*Vision 42*
*City of New York, New York*

NOTE: Estimate is based on 42nd Steet Light Rail Transit Line Surveys and Feasibility Testing dated May, 1995 prepared by Seelye Stevenson Value & Knecht.
Capital Project HW 1130

| COST SUMMARY: | TOTAL COST: *"A" LEVEL FINISHES* | | TOTAL COST: *"B" LEVEL FINISHES* |
|---|---|---|---|
| 1. SITE PREPARATION/ DEMOLITION | $1,788,200 | | $1,788,200 |
| 2. UTILITY DEMOLITION/ RELOCATION | $0 | | $0 |
| 3. SITE IMPROVEMENTS | $2,731,920 | | $2,731,920 |
| 4. FINISH ITEMS | $41,698,000 | | $32,758,400 |
| 5. DRAINAGE | $0 | | $0 |
| 6. UTILITY | $0 | | $0 |
| 7. SITE LIGHTING | $2,222,870 | | $815,800 |
| 8. LANDSCAPE PLANTING | $451,500 | | $241,000 |
| **SUBTOTAL -** | | | **$38,335,320** |
| **20% CONTINGENCY** | | | **$7,667,064** |
| **TOTAL ESTIMATED COST-** | | | **$46,002,384** |
| | | **SAY** | **$46.1 million** |
| **SUBTOTAL-** | **$48,892,490** | | |
| **20% CONTINGENCY** | **$9,778,498** | | |
| **TOTAL ESTIMATED COST-** | **$58,670,988** | | |
| **SAY** | **$58.7 million** | | |

Notes:

1. See final page of 'Cost Estimate' for inclusions and exclusions.
2. Costs identified in Cost Summary are based on the Cost Estimate but have been rounded up to the nearest thousand dollars.

U:/Data2/5625201/Office Data/Streetscape estimate-07-13-04

Langan
Engineering and Environmental Services

Project # 5625201
July 2004

# FEASIBILITY COST STUDY

*Vision 42*
*City of New York, New York*

NOTE: Estimate is based on 42nd Steet Light Rail Transit Line Surveys and Feasibility Testing dated May, 1995 prepared by Seelye Stevenson Value & Knecht.
Capital Project HW 1130

| DESCRIPTION OF ITEM | QUANTITY | UNITS | UNIT COST | TOTAL COST |
|---|---|---|---|---|
| **1. SITE PREPARATION/ DEMOLITION** | | | | |
| A. Asphalt Pavement Surface Removal (8" Thick) | 68,500 | SY | $ 10.00 | $685,000 |
| B. Underlying Paving Material (8" Thick) | 68,500 | SY | $ 10.00 | $685,000 |
| C. Curb Demolition 6" Wide x 21" Deep | 6,500 | LF | $ - | $0 |
| D. Standard Concrete Sidewalk Demo. (6"Thick) | 38,000 | SY | $ - | $0 |
| E. Removal of Street Light Fixture | 143 | EA | $ 300.00 | $42,900 |
| F. Existing Street Tree Removal (8" Caliper) | 159 | EA | $ 700.00 | $111,300 |
| G. Inlet Protection | 0 | EA | $ 200.00 | $0 |
| H. Construction Fencing | 3,000 | LF | $ 8.00 | $24,000 |
| I. Traffic Controls/ Security/ Safety | 0 | LS | $ - | $0 |
| J. Miscellaneous Demolition/ Disposal | 12 | Block | $ 20,000.00 | $240,000 |
| | | | **SUBTOTAL** | **$1,788,200** |
| **2.UTILITY DEMOLITION AND RELOCATION** | | | | |
| | | | **SUBTOTAL** | **$0** |
| **3. SITE IMPROVEMENTS** | | | | |
| A. Information / Newspaper Kiosks (Prefabricated) | 6 | EA | $ 100,000.00 | $600,000 |
| B. Steel Faced Concrete Standard Curb (6"x9"x20") | 1,770 | LF | $ 50.00 | $88,500 |
| C. Flush Steel Faced Concrete Standard Curb (6"x9"x20") | 890 | LF | $ 78.00 | $69,420 |
| D. Benches (6 Per. Block) | 72 | EA | $ 3,500.00 | $252,000 |
| E. Trash Receptacles (6 Per. Block) | 48 | EA | $ 1,500.00 | $72,000 |
| F. Wayfinding Signage and Graphics | 1 | LS | $ 200,000.00 | $200,000 |
| G. Decorative Steel Bollards (36"Height) (4' O.C.) | 580 | EA | $ 2,500.00 | $1,450,000 |
| | | | **SUBTOTAL** | **$2,731,920** |
| **4. FINISH ITEMS** | | | | |
| **A. Finish Items, Level A 'High Build'** | | | | |
| 1. Hex Asphalt Pavers (6" Thick Concrete Base) | | | | |
| a. Light Rail Stops/ Footprint | 164,000 | SF | $ 22.00 | $3,608,000 |
| b. Roadway Intersections | 135,000 | SF | $ 22.00 | $2,970,000 |
| c. Sidewalk/ Plaza | 656,000 | SF | $ 20.00 | $13,120,000 |
| 2. Steel Prefabricated Pergolas w/ planters and bench | 110 | EA | $ 200,000.00 | $22,000,000 |
| | | | **SUBTOTAL** | **$41,698,000** |
| **B. Finish Items, Level B 'Low Build'** | | | | |
| 1. Poured In Place Concrete | | | | |
| a. Sidewalk/ Plaza | 524,800 | SF | $ 8.00 | $4,198,400 |
| 2. Cobblestone Paving (6" Concrete Base) | | | | |
| a. Light Rail Stops/ Footprint | 131,200 | SF | $ 50.00 | $6,560,000 |
| 3. Steel Prefabricated Pergolas w/ planters and bench | 110 | EA | $ 200,000.00 | $22,000,000 |
| | | | **SUBTOTAL** | **$32,758,400** |

| DESCRIPTION OF ITEM | QUANTITY | UNITS | UNIT COST | TOTAL COST |
|---|---|---|---|---|
| **5. DRAINAGE** | | | | |
| A. Area Drains | 0 | EA | $ 2,500.00 | $0 |
| B. Convert CB Grate | 0 | EA | $ 1,500.00 | $0 |
| C. Roof Leaders | 0 | EA | $ 200.00 | $0 |
| D. Replace Outfall Grates | 0 | LS | $ 10,000.00 | $0 |
| E. Reset Outfall Manhole Covers | 0 | EA | $ 1,000.00 | $0 |
| F. Existing Outfall Improvements (allowance) | 0 | LS | $ 25,000.00 | $0 |
| | | | **SUBTOTAL** | **$0** |
| **6. UTILITY** | | | | |
| A. Fire Hydrant w/ Valve | 0 | EA | $ 3,000.00 | $0 |
| B. 6" Waterline w/in Sleeve and Insulate | 0 | LF | $ 100.00 | $0 |
| C. 2" Waterline w/in Sleeve | 0 | LF | $ 75.00 | $0 |
| D. 6" Valve | 0 | EA | $ 500.00 | $0 |
| E. 8" Sanitary w/in 12" Sleeve | 0 | EA | $ 100.00 | $0 |
| F. 8" Sanitary in Road | 0 | LF | $ 100.00 | $0 |
| G. Sanitary Manhole | 0 | EA | $ 3,000.00 | $0 |
| H. Tie into Existing Manhole | 0 | EA | $ 500.00 | $0 |
| I. Flexible Connections | 0 | EA | $ 2,500.00 | $0 |
| J. Gas w/in Sleeve | 0 | LF | $ 50.00 | $0 |
| K. Cable w/in Sleeve | 0 | LF | $ 25.00 | $0 |
| L. T-Phone w/in Sleeve | 0 | LF | $ 25.00 | $0 |
| M. Electric w/in Sleeve | 0 | LF | $ 25.00 | $0 |
| N. Electric (hung from pier) | 0 | LF | $ 35.00 | $0 |
| O. 2" Water Valves | 0 | EA | $ 500.00 | $0 |
| P. Backflow Preventor | 0 | EA | $ 1,000.00 | $0 |
| | | | **SUBTOTAL** | **$0** |
| **7. SITE LIGHTING** | | | | |
| **A. Level A 'High Build'** | | | | |
| 1. Pole Foundations, 24" Dia. (Pre-cast) | 198 | EA | $ 1,500.00 | $297,000 |
| 2. Twin Hess Pollux Light Fixture (250 Watt Metal Halide) Mounted on 30' High Pole | 95 | EA | $ 9,560.00 | $908,200 |
| 3. Single Hess Pollux Light Fixture (250 Watt Metal Halide) Mounted on 30' High Pole | 103 | EA | $ 8,010.00 | $825,030 |
| 4. Underground Feeder Cable (includes exc. and backfill) | 13,760 | LF | $ 14.00 | $192,640 |
| 5. Specialty Lighting (20 Per Area) | 140 | EA | $ 9,000.00 | $1,260,000 |
| 6. Demolition of Existing Footings | 143 | EA | $ 300.00 | $42,900 |
| | | | **SUBTOTAL** | **$2,222,870** |
| **B. Level B 'Low Build'** | | | | |
| 1. Retrofit Existing Footings | 143 | EA | $ 300.00 | $42,900 |
| 2. Twin Sterner Light Fixture (Grand Central) (250 Watt Metal Halide) Mounted on 25' High Pole | 56 | EA | $ 7,700.00 | $431,200 |
| 3. Single Sterner Light Fixture (Grand Central) (250 Watt Metal Halide) Mounted on 25' High Pole | 85 | EA | $ 4,020.00 | $341,700 |
| | | | **SUBTOTAL** | **$815,800** |

| DESCRIPTION OF ITEM | QUANTITY | UNITS | UNIT COST | | TOTAL COST |
|---|---|---|---|---|---|
| **8. LANDSCAPE PLANTING** | | | | | |
| **A. Level A 'High Build'** | | | | | |
| 1. Trees, furnished and planted, 3.5"-4" Caliper | 243 | EA | $ | 1,500.00 | $364,500 |
| 2. Misc. Plant Material, Purchased & Planted | 0 | EA | $ | 40.00 | |
| 3. Drainage For Planters | 0 | LF | ? | | |
| 4. Soil For Tree Pits | 174 | Truck | $ | 500.00 | $87,000 |
| | | | | **SUBTOTAL** | **$451,500** |
| **B. Level B 'Low Build'** | | | | | |
| 1. Trees, furnished and planted, 3.5"-4" Caliper (35' O.C.) | 132 | EA | $ | 1,500.00 | $198,000 |
| 2. Soil For Tree Pits | 86 | Truck | $ | 500.00 | $43,000 |
| | | | | **SUBTOTAL** | **$241,000** |
| | | | | **TOTAL - (A Finishes Included)** | **$48,892,490** |
| | | | | **20% CONTINGENCY** | **$9,778,498** |
| | | | | **ESTIMATED COST** | **$58,670,988** |
| | | | | **SAY** | **58.7 million** |
| | | | | **TOTAL - (B Finishes Included)** | **$38,335,320** |
| | | | | **20% CONTINGENCY** | **$7,667,064** |
| | | | | **ESTIMATED COST** | **$46,002,384** |
| | | | | **SAY** | **46.1 million** |

**Notes:**

1. Costs are preliminary and are for budgetary purposes only. Unit costs are based on several sources and are approximate.
2. Festival Sheds and Kiosks figures are based on open-air structures with no walls (interior or exterior) or amenities.
3. Cost does not include traffic control, temporary improvements, permits, or fees that may be required.
4. Underlying removal of pavement material does not include removal/ demolition of concrete pavement, cobblestone, or any other paving materials or obstructions.
5. Subway stairs/ stations adjustments, removal, and installation are not included in cost estimate.
6. Kiosk construction/ installation not included in cost estimate.
7. No Structural Slabs @ vaults or subway strair, concourses, etc.