EMS Implementation Success at New York City Transit

By
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Phoenix, Arizona
Overview of NYC Transit

Largest Mass Transit System in the US
Approx 50,000 employees
Move 7.2 million passengers daily
4200 buses
6204 trains cars
Approx. 814 miles of track
20 Train maintenance facilities
20 Bus Maintenance facilities
468 Train Stations
24/7
Major Departments of New York City Transit

Buses
- Depots
- Maintenance Facilities
- Paint Shops

Subways
- Yards
- Maintenance Facilities
- Overhaul Shops
- Tracks
- Stations
- Signals & Lighting
- Structures & Bridges

Capital Program Management
- Design
- Construction
Capital Program Management (CPM) Overview

- Service Department
- Design and Construction Management Department that manages and maintains the infrastructure that supports the mass transit system
- Manages 2.1 Billion dollars in capital projects annually
- 1600 employees, mainly engineers and architects
Challenge – For CPM to Bring the System to a State of Good Repair

- Accomplish while recognizing and acknowledging the importance of environmental protection and preservation
- Uphold and exemplify sustained ecological, economic and social value

Circa 1970
Inheriting Historic Problems

- Future challenges married to previous practices
- Practices of yesteryears no longer acceptable

Examples:
- Leaking Underground Storage Tanks
- Spills
- High energy consumptions
- Air emissions (VOC from painting)
- Hazardous waste generation
- Environmental risk (lead, asbestos)
- Construction site environmental impact (dust, noise, emissions).
Need to Improve Environmental Management

• Negative public media coverage concerning environment compliance
• Reoccurring environmental mismanagement
• Associated environmental liability
• Increasing cost of operations
  – Millions in hazardous waste abatement and disposal annually
  – Insurance
  – Health
Choosing Between Solutions

- Meet minimum legal requirements and satisfy public demands
- Surpass minimum legal requirements and exceed public’s expectation
Choosing Between Solutions

• Raise the bar on environmental management
• Obtain management resolve
• Pursue ISO14001
Business Rationale for ISO 14001

- Keeping abreast with industry challenges
- Effective “environmental accountability”
- Need to reduce environmental risk
- Need to reduce cost
- Need to reduce liability
Social Rationale for ISO 14001

• Willingness to improve environmental performance
• Need to assure better relations with the public and community within which we operate
• Willingness to instill “change”
• Need to establish a legacy of environmental excellence
Establishing A Corporate Pillar Of Environmental Excellence

The pillar of Environmental Excellence is seen as an integral part of our business for the rebuilding and improvement of the NYC Transit system.
NYC Transit EMS Story

- Develop Environmental Policy
- Identifying aspects and impacts
- Set Objectives and Targets
- Implement EMS
- Achieve ISO14001 Certification
March 1999 ISO 14001 Certification

• 1st public sector entity in the United States

• Part of a US EPA pilot to ascertain benefits of EMS Implementation
Identifying Environmental Aspects

Root of most environmental concerns were identifiably linked to several key areas:

- Facility & Infrastructure Design and Construction
- Associated process operations and maintenance
- Maintaining the existing 100 year old mass transit infrastructure (hazard abatement)
Reduction in Environmental Footprint as a Measure Of Design

For all projects
2000 Objectives & Targets

- Develop protocol for High Performance Design for the Environment (DfE) and introduce into each discipline by June 30, 2000
Design for the Environment

• Birth of “Green” Designs at New York City Transit
• Applying Green Designs to all capital projects
Environmentally Responsive Designs

- Control point source and non-point source pollution through better design and engineering
- Potential for Design and Construction to play a more proactive role in pollution prevention
  - Historically conducted without rigorous long-term environment planning
  - Viewed as the source point for factoring out environmental concerns
Scope of DfE

• All Capital Project from Tunnels to Train Yards
DfE ELEMENTS (NYCT Green Guidelines)

- Sustainable Design
  - Energy Efficiency/Renewable Energy
  - Indoor Environmental Quality
  - Conserving Material & Resources
  - Full Commissioning
  - Water Conservation & Site Management
Circa 2000

DESIGN PHASE

20 year needs
5 Year Capital Program
MASTER PLAN
Incorporate
Design Start
Conceal Review
Preliminary
Preliminary
Value Engineering
Sustainability
Advanced Drawings
Final Design
Presentation
Sign-off
Procurement
Phase
Award

20 - 22 Month Design Duration

CONSTRUCTION PHASE

Award
Preliminary
6 Month

36 - 48 month Construction Duration

COORDINATE WITH USER GROUP FOR ACCEPTANCE

6 Month

CLOSEOUT

- INTERNAL CONTROLS & SPECIAL PROJECTS SUSTAINABILITY
- INTERNAL CONTROLS & SPECIAL PROJECTS CLOSEOUTS

AREAS OF SUSTAINABILITY DURING A PROJECT'S LIFE
Stillwell Avenue Terminal Station
Circa 1999

Translucent 145kW Photovoltaic Canopy
Aiming For LEED Silver Certification – Corona Shop Circa 2002

- 30% better than code for energy efficiency
- Optimize natural ventilation and natural day lighting
- Alternative power sources – PV’s and fuel cells
- Harnessing rain water for washing trains
- Selection of eco-friendly building materials
- Waste Management and recycling
- ULSD
Central Bus Maintenance Facility & Depot Circa 2003

- 30% better than code for energy efficiency
- Optimize natural ventilation and natural day lighting
- Alternative power sources – PV’s and fuel cells
- Harnessing rain water for washing trains
- Selection of eco-friendly building materials
Roosevelt Avenue/74th Street
Circa 2000

Conceptual Design
Roosevelt Avenue/74th Street
Circa 2003
Roosevelt Avenue/74th Street
Circa 2003
Station cooling loads are greatly reduced by extracting hot air from stations.
2nd Avenue Subway
Increased Natural Lighting &
Energy Efficiency

Station Lighting is designed around a power consumption which requires 20% improvement over current code.
All Projects - Material Selection

- Concrete Composition: R&D to formulate “green” concrete possibly using fly-ash, blast furnace slag and SAS spoils
- High Recycled Content: Materials with high-recycled content, such as structural steel with and aluminum will be specified
Using Life Cycle Analysis And Costing

GREEN DECISION MODEL
Use DOE-2 or similar computer models as an important interactive design tool.

Provide integrated Photovoltaic (PV) panels for both roof and façade surfaces.

Use double-glazed units with Low-E glass as the minimum standard for all windows and exterior glazing.

Provide daylight dimming in shop and office areas.

Incorporate the use of natural lighting and ventilation into the design.

Evaluate opportunities for heat recovery for the outside air system.
**Cost-Benefit analysis Decision Models**

<table>
<thead>
<tr>
<th>INDOOR ENVIRONMENTAL QUALITY</th>
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</thead>
<tbody>
<tr>
<td>CONSERVATION OF MATERIALS</td>
</tr>
<tr>
<td>WATER AND SITE MANAGEMENT</td>
</tr>
<tr>
<td>OPERATIONS AND MAINTANCE</td>
</tr>
</tbody>
</table>
2001 Objectives & Targets

• Incorporate Waste Management Guidelines in selected projects
At Roosevelt 86% recycled
- concrete 1869 Metric tons
- steel 112 Metric tons
- wood 17 Metric tons
- landfill 313 Metric tons
At Stillwell 85% recycled
- Concrete 4554 Metric tons
- Steel 351 Metric tons
- Debris 859 Metric tons
Beneficial Reuse of Spoils

- 2001 O&T of Waste Management was key to inspiring the beneficial use of spoils from major tunneling projects in Manhattan
Beneficial Reuse of Spoils

<table>
<thead>
<tr>
<th>Swelled rock volume (cubic yards)</th>
<th>No. 7 Extension (34th and 41st St. Station)</th>
<th>No. 7 Extension (2 Tunnels)</th>
<th>2nd Ave Subway</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>491,400</td>
<td>391,400</td>
<td>6,100,000</td>
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</tbody>
</table>
EMS and Waste Management

- Sets higher standards for spoils management and air quality
- 35,000 (20 cu. Yards) trucks trips required throughout project
- Clean fuel burning truck fleet
- ULSD with diesel oxidation catalyst
- CNG
2001 Objectives & Targets

- Create Eco-purchasing/greening of supply chain awareness

The Best Choice is Not Always Obvious

If only acquisition costs are considered, Product A seems like the better choice.

In the long run, Product B is more cost-effective.
The Best Choice is Not Always Obvious

If only acquisition costs are considered, Product A seems like the better choice.

In the long run, Product B is more cost-effective.
Pollution Prevention through Eco-Procurement

- NYC Transit’s Green Construction Product Database
- Buying Energy Star & Energy Efficient
- Procuring Alternative Fuel Vehicles
- EPA’s Comprehensive Procurement Guidelines
Alternative Fuel Vehicles Procurement
2002 Objectives & Targets

- Create awareness for State Executive Order on Energy efficiency/conservation
Executive Order 111

- EMS enabled preparation for implementing a 2001 State Executive Order on the environment
- Assumed a leadership role state-wide with our 3 year head start
- Stand out as a lead and very proactive agency when it comes to green buildings, eco-procurement & conservation
ISO 14001 EMS and Government Mandates

Voluntary Mandated
Mar 98 Jun 01

Governor’s Executive Order

Environmental Excellence

ISO 14001 EMS

Sustainable Design

Eco-procurement

Conservation

Common

Common
Energy Conservation Strategies

- Exploring New Energy Saving Technologies
- Remote Energy Monitoring
- Flywheel testing
- Thyristor Rectifier testing
- Humped tracks
- Aluminium contact rails
- Energy Savers
- Facility audits
Energy conservation through better designs
Flywheel Energy System

Stores excess 3rd rail voltage for later use
Water Conservation Strategies

- Water Conservation and Reclamation
- Rain Water Harnessing
Implement Construction for Environment (CfE) during the construction phase for projects for the 2000-2004 Capital Program.
CfE - Reducing Community Impact
Improving Air Quality – reducing diesel exhaust pollution

Diesel oxidation catalyst
Improving Air Quality

2200 gallons 15 ppm diesel used on non-road vehicles at pilot construction site
2003 Objectives & Targets

• Monitor Design for Environment solutions for the planned System Expansion and Lower Manhattan Transit Projects
## DfE Decision Model

### Second Avenue Subway
Design for the Environment Management Matrix

#### Main Report

<table>
<thead>
<tr>
<th>Topic</th>
<th>Link</th>
<th>Detailed Reference</th>
<th>Rating</th>
<th>Start Date</th>
<th>Finish Date</th>
<th>Status</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Track Alignment</strong></td>
<td>Chris Bennett</td>
<td>In section 2.1 of the Interim Resort, consider listing &quot;Energy Conservation&quot; or &quot;Maximize sustainable design&quot; as one (ninth) objective.</td>
<td></td>
<td>7/18/2002</td>
<td>8/5/2002</td>
<td>Accepted in discussion with Bill Norquist and Chris Bennett, who will add it to the final report.</td>
<td></td>
</tr>
<tr>
<td><strong>Sustainable Objective</strong></td>
<td></td>
<td>Consider optimizing the vertical alignment of the tracks to conserve energy expenditure. The resulting profile will have higher plateaus at the stations and valleys in between.</td>
<td></td>
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<tr>
<td><strong>Humped Tracks</strong></td>
<td></td>
<td>Consider adding a criterion to section 9.2.4 to state that radii of curvatures should be maximized in order to reduce friction and consequent wear and tear and noise.</td>
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<tr>
<td><strong>Intermodal Connections</strong></td>
<td></td>
<td>Consider optimizing connections to other modes of transportation, such as: Whitehall Ferries and the proposed east-west pedestrian mover for lower Manhattan. Coordinate with Lower Manhattan Development Corporation. See a similar topic in the Station entrances area.</td>
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<td>The downtown transportation hub and adjacent east-west people mover has attracted the first tranche of federal funds for lower Manhattan's reconstruction. The current scheme stops short of the 2 Ave. alignment. Appropriate steps should be taken in the design to facilitate a future connection at Seaport station. Refer to the attached link.</td>
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**Version E, Released October 1, 2002**

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2003 Objectives & Targets

- Obtain Corporate Acceptance of Sustainability
Sustainable Development – a Major Milestone for NYCT

- EMS paved the way for sound environmental management at NYCT
- Senior management’s resolve to further environmental commitment
- Extension to sustainable development
- Corporate reporting on social, economic and environmental indicators
Advantages of having an Environmental Management System

- EMS is all voluntary supporting and supplementing environmental compliance
- Stimulates continual improvements
- Continual Improvement affords pollution prevention
Advantages of having an Environmental Management System

- Pollution prevention sustains proactive environmental management
- Proactive environmental management drives cost avoidance
- Cost Avoidance maintains economic competitiveness
Advantages of having an Environmental Management System

• You don’t get ISO14001 simply to comply with regulatory requirements

• ISO 14001 is responsible for inspiring innovative areas of environmental management within NYCT
  – Green Buildings
  – Eco-Procurement
  – Conservation of energy and natural resources
Creating a legacy of Environmental Excellence

• Always room for continual improvements
  – Forward moving development of O&T
  – Broadening scope of undertaking
  – Learning while improving
  – Evolving environmentally, economically and socially
Summary of why EMS is important for the Organization

- Assists in meeting corporate objectives without impacting the environment
- Commits organization environmentally to reduce risk
- Sets short and long term goals and objectives
- Assures continual improvements parallel to management and administrative realignment
- Assist in attaining economic advantage
- Supports global commitment to sustainable development
EMS influences Beneficial Change

Upper Management

- Consultants
- Contractors
- Vendors
- Manufacturers
- Designers
- Engineers
- Users
- Foreign agencies
- Sister agencies
2004 Objectives & Targets (Proposed)

- Green all 2005 – 2009 capital plan projects (Lower Manhattan projects)
- Monitor all projects in construction phase
- Expand the scope of energy conservation to include all process type facilities
- Explore the feasibility of new abatement and remediation technologies
Shaping The Future - Green

- Transit Hub
- New South Ferry Terminal
- 2nd Avenue Subway
- # 7 Extension
Reducing Environmental Footprint
New York City Transit
Today from Yesterday

• A significant difference
• Moving towards a cost effective, socially responsible and environmentally sustainable future
Roosevelt Avenue/74 Street
Circa 2004
OUR GLOBAL COMMITMENT
Sustainable Mass Transit