

Sustainable/Green Architecture For City Hall and City Hall Plaza

Concept Proposal from:
WENTWORTH INSTITUTE OF TECHNOLOGY
Architecture Department

The Project Team would like to thank Michael Galvin and his staff at Basic City Services for giving us access to Boston City Hall and its operational records, and for providing us with the opportunity to share this progress report.

Executive Summary:

- Wentworth's team would like to help the City of Boston explore a vision for the first Green City Hall in America. With help from Michael Galvin and Basic City Services we have greatly accelerated our understanding of the role sustainable architecture and green building can play in City Hall and the Plaza.
- We have found through these studies that we can pay for a sustainable building with the funds that would be otherwise spent on utilities alone. In this way we can create a more economic and healthy environment by engaging these issues with the city at large. The million dollar savings per annum that we have identified would pay for a sustainable \$20-30 million renovation required to achieve those savings in less than a generation.
- Our intent is to help stimulate the City, the Trust for City Hall Plaza and all of the other parties involved to join together to explore reducing costs while improving services. Through this study, we have identified specific economic, health and ecological possibilities which could help initiate a drive to create this country's most outstanding model in cutting edge sustainable architecture and landscape architecture for both the renovated and new construction proposed for the plaza.
- We would also like to suggest viewing City Hall as a keystone in the plan to revitalize the plaza by treating the building as a bridge between the marketplace/ waterfront and the revived plaza. As part of this master plan link, we have explored some exciting architectural additions and alterations to City Hall that allow for significant pedestrian movement under, over and through the structure. These additions and alterations to the existing building could result in reclaiming 100,000 s.f. of existing and new floor area (80% of our 20 to 30 million construction costs) for office and commercial use which would generate new jobs and a revenue stream from the integrated facilities. The new public use and appreciation of this building as a model for the rest of the city would play a significant role in the financing of the project, and reduce the payback period significantly.

- We have been able to update information furnished to us from Property Management at City Hall by calculating the current Energy Utilization Rate of the building at 277,000 BTU's per square foot. Comparing this to the Building Energy Performance Standards of 110,000 BTU's per square foot listed for a large office building in Boston, we recognize substantial opportunity for improving the building's performance.
- The first two phases of our proposal call for repairs and computer retrofit work. The third phase calls for a new insulated glass and panel skin on portions of certain exposed vertical faces of the structure and the roof opening that would result in a fully conditioned space or *winter garden*. This space could become a heart of activity for the building, made directly accessible from the new plaza and Faneuil Hall as well as transforming the building into one looped stack or continuous column of air.
- In addition to the opportunities this continuous column of air would offer architecturally, it would become a primary component of a state of the art mechanical heat recovery ventilation system. This system would reduce energy costs of the building in conjunction with the first two phases by 65% (we calculate from the current sum of \$1.6 million to roughly \$600,000). The building would also be given a new fresh air system as a result of this renovation, ultimately providing a very generous improvement to 40 c.f.m. (cubic feet per minute) minimum of fresh air per person.
- The themes of this proposal support Mayor Menino's notion of Boston as America's premier city in the Information Age, his desire for a Sustainable Boston, and his concern for building meaningful, local connections into the 21st century. These visions also support the goals of the Trust by offering a larger focus with respect to the revival of the plaza. An ecologically planned building and site plan for the plaza would provide an added boost to the economic engine the Trust is seeking to develop by positively increasing recognition of the City of Boston, again as in the 1960's, through the re-design of its City Hall. In addition, ecological planning would result in significant avoided costs associated with the hotel (currently under consideration for the plaza), which as a building type is very resource intensive.
- Most significantly, the proposal affords us the opportunity to retrofit this architecturally significant building from the 1960s and bring it gently into the 21st century, enabling it to reclaim its international reputation for transformative, progressive design.

II. Development of Project and Background Information

Events and activities which led to the Proposal for a Sustainable Renovation of Boston City Hall include the following:

- Public Symposium on Boston City Hall, sponsored by the City of Boston

- and Sustainable Boston, fall 1995
- Wentworth Institute of Technology Thesis Design Studio (Project: a Sustainable Renovation of Boston City Hall and Plaza), winter / spring 1996
- Presentation of a Concept Proposal for a Sustainable Renovation of Boston City Hall and Plaza during the Sustainable Boston Conference, Spring 1996
- Wentworth Institute of Technology Vital Signs Program, summer / fall 1996
- Concept Proposal delivered to Michael Galvin, fall 1996
- Materials and Methods in Sustainable Design, Wentworth Institute of Technology Architecture 475 class, fall 1996
- Concept Proposal delivered to the Trust for City Hall Plaza, January 1997
- Presentation to the Chief of Basic City Services and invited guests from the PFD and the Trust for City Hall, April 9 1997

Basic City Services (BSC) provided the Wentworth Institute of Technology Materials and Methods Class (475, fall 1996) with a report outlining the mechanical system of Boston City Hall as it was originally constructed. The report also included additions, repairs and refurbishments that have occurred since City Hall was first built. This document was updated with material from site visits and interviews that the class and its consulting Professional Engineer (PE) conducted with current City Hall operating and managing engineering staff. We have also cited \$3,500,000 in current projected routine repairs and renovations, expenses covering such things as new roofing and mechanical upgrades, requested and budgeted funds that could also help pay for the renovations we are proposing.

Using the BSC report, the class and its consultants devoted significant time and energy to isolating the current operational costs of City Hall by tabulating all of the current electrical, steam and water bills that the City pays out monthly. We were able to calculate that the building's Energy Utilization Rate (EUR) was 277,000 BTUs/sf (British Thermal Units per square foot). Compared with the Building Energy Performance Standards (BEPS) of 110,000 BTUs/sf listed in the Vital Signs catalog for a large office building, it is clear that there is substantial room for improving the building's energy performance. As automobiles were initially redesigned during the 1970's to improve fuel efficiency (MPG or miles per gallon), buildings are being built and renovated today to save BTUs/sf. Incidentally, buildings are directly and indirectly responsible for over 40% of our national energy bill, and automobiles and trucks are responsible for approximately 33%.

Based on the results of our investigation, we've developed specific architectural and engineering interventions for a Sustainable Renovation of Boston City Hall.

- The first intervention would upgrade the existing mechanical system equipment and repair or replace broken-down, abandoned, and inoperable components.
- The second intervention would be a complete review of the building's automatic temperature controls system, which would involve the reactivation

and salvaging of the existing computer control center. An important part of our sustainable approach is *least costs first*.

- The third intervention would be to renovate the interior court of City Hall, providing a new insulated glass and panel skin on the exposed vertical faces of the structure and the roof opening. The result would be a fully conditioned space or "winter garden" that would be accessible from the new plaza, from Congress Street, and from a balcony connection to the new Congress Street bridge.

Also, the interior atmosphere of the building could be transformed into one "looped" stack or continuous column of air by adding the new roof structure; removing the two upper roof monitors that top the existing interior building shafts; and, removing substantial sections of the window wall separating the current central core from the entrance concourse on the third and fourth floors. This new continuous column of air would become the primary component of a state of the art mechanical heat recovery ventilation system that would reduce the building's energy costs (in conjunction with the first two phases) by 65% (we calculate a reduction from the current annual cost of \$1.6 million to roughly \$600,000).

These changes would give the building a new fresh air system. The current air handling system is constantly pushing some 390,000 to 410,000 cfm (cubic feet per minute) of air through the building. The new proposed system would reduce air volume to roughly 196,000 cfm, 90,000 of which would be outside (fresh) air, ultimately providing a very generous improvement of over 40 additional cfm of fresh air per person.

The proposed renovation would also redevelop the existing 20,000 sf of garage and dead storage area, along with opening up about 300 linear feet of street frontage directly opposite the Quincy Market/Faneuil Hall area (one of the most successful commercial centers in the country) on level one of the building off of Congress Street. This area could be redeveloped into offices and street front shops, while the displaced parking for City Councilors could be efficiently relocated in the 10-15 thousand square feet left empty by obsolete mechanical equipment under the plaza.

Finally, the design would provide a new exterior elevator for public access to the roof of the building. This elevator could have an off-street entry from Congress Street with a stop at the new third level public atrium. The roof would also house a walking promenade and city-viewing platform, open year round, which could incorporate dioramas on the history of the city. Additionally, sections of the roof level and the open atrium might house components of a "living museum" geared to demonstrating and teaching sustainable and restorative approaches and technologies to the public.

In our exploration of ways to insure the successful implementation of such an ambitious project we have explored the possibility of linking the ongoing

operation and management of the project to the development of an Ecological Center for New England that might be housed in a few thousand s.f. of the reclaimed space. Through a collaboration of universities, museums, corporate, private and public sponsors, this Center could become a regional source of learning on sustainable practice and planning, with the Green Renovation of City Hall as its built in demonstration and teaching model.

III. Sustainable design: issues, trends and case studies of existing projects.

Greenhouse gases such as carbon dioxide and carbon monoxide (forty percent of which are a result of the operation and construction of buildings) are now being linked by scientists around the world to global climate change. Eighty percent of greenhouse gases come from the developed world (the United States is a major contributor), which hosts only 30% of the world's population. The average American uses twice as much energy of the average European. Scientists agree that fluctuations and changes in temperature patterns, greater than any seen in the geological record of the past 9000 years, and the resultant rises in sea level pose a growing threat to coastal communities like Boston.

Most of the technology and design tools required to implement ecological design are currently available and are being implemented in civic, commercial, and residential projects throughout the world. Case studies from Glasgow, Scotland and Oslo, Norway featured in a 1996 International Council for Local Environmental Initiative [ICLEI] report show city wide programs realizing significant savings of natural resources and energy. These buildings are much less costly to operate, and they provide dividends in capital expenditure that repay initial costs in a short time relative to the life span of the project.

Another notable development is that the insurance industry in the United States is now supporting sustainable development and rebuilding incentives as disaster related claims on buildings due to severe weather have gone from \$12 billion between 1980 to 1990 to \$52 billion between 1990 and 1995, a more than fourfold increase.

The 1996 ICLEI report states that because cities have power over land use, transportation, building construction, waste management, and energy supply, they will play a vital role in reducing energy use and greenhouse gases. The report also suggests that cities like Boston join the international organization Cities For Climate Protection that helps local governments address global warming through proper municipal energy policy. Boston could begin to participate in this process: as a component of our proposed retrofit to Boston City Hall, we suggest that the city reactivate the energy studies it began in the 1970's on over a hundred city-owned Boston buildings.

There are nothing like positive case studies to help reinforce the benefits of sustainable development. The ING Bank's 500,000 s.f. International Headquarters building in Amsterdam, built in 1986, has a 50,000 BTU/s.f. energy

utilization rate and saves \$2.4 million annually as a result of its progressive energy utilization strategies alone. As a result, the Bank recaptured its \$700,000 energy system investment in the first four months of operation. Avoided costs from utilities are joined by savings on health insurance cost as a result of improved employee health and significant cuts in employee absenteeism. The ING Bank reported in 1994 (In Context, No. 35) savings in excess of \$1.4 million due to reduced absenteeism alone.

Another project closer to home is the Greening of the White House, a comprehensive energy analysis program coordinated by the Rocky Mountain Institute in Snowmass, CO. By adopting sustainable or energy efficient heating, cooling, lighting and insulation strategies, the sustainable rehabilitation of the White House has been projected to save energy costs close to \$200,000 per year.

IV. Conclusion and Future Steps

We would like to suggest as an extension of our proposal (which may involve more student work at Wentworth) the formation of a forum to expand on some of the ideas presented here. Ideally, this forum would lead to the creation of an advisory committee that could work with the City, the Trust, and the newly formed Civic Advisory Committee on the integration of sustainable, restorative design to the plaza and City Hall. The forum might help develop an RFP that would attract the world's top experts in sustainable design and planning, some of whom are currently living and working in New England.

Boston is a place where limits have traditionally been exceeded, and where there is no shortage of vision. There are historical models such as the Sons of Liberty and their Tea Party tax protest, or the leveling of most of the tri-mount to create 70% of modern Boston from fill; and there are contemporary models such as Boston's recent initiatives that have come to serve as a national model for crime prevention. In our opinion, it is only reasonable to assume that Boston, the city with more open space per capita than any other city in the country, should be considered a leading example of sensible, forward looking American urban planning: Boston is the American Green City. In support of Mayor Menino's vision for the highest quality of life and strongest economy of any major city in America, an ecological renovation to Boston City Hall and its Plaza can set a new standard that the entire country will ultimately follow in preserving the earth for our children and into the next millennium.

Over the course of this past year, the following individuals have been contacted and have agreed to endorse this concept proposal.

Tony Cortese	Director, Second Nature
David DelPorto	President, ECOS; Founding Member, Newton Green Decade Coalition
Duane Day	Co-founder, Urban Solar Building Initiative
Andrew Euston	Senior Architect, HUD Washington D.C.
Pliny Fisk	Director, Center for Maximum Potential Building Systems

Bruce Fulford	President, Greenleaf Composting Co.
Michael Galvin	Chief of Basic City Services, City of Boston
Jennifer Green	Director, Waterforms Inc.
Phil Henderson	CEO, Ecological Engineering
Walter Hobbs	Chairman of the Board, QED
Gerard Ives	Architect, Designer of Mass Audubon Nature Centers
Elizabeth Kline	Sustainability Programs, Tufts University
Hunter Lovins	Rocky Mountain Institute
Abby Rockefeller	Institute for Low Entropy Systems
Leigh Seddon	President, Solar Works, Inc.
Peter Smith	Architect, Chair Urban Design Committee, Boston Society of Architects
Jeff Stein	Head, Architecture Program Wentworth Institute of Technology
Cathy Douglas Stone	Chief of Environmental Services, City of Boston
Steven Strong	Architect, Solar Design Associates
Tom Thompson	Director, Northeast Sustainable Energy Association
John Todd	Director, Ocean Arks International
Henry van der Mark	Boston Area Solar Energy Association
Sim van der Ryn	Director, Ecological Design Institute
Greg Watson	Director, Dudley St. Neighborhood Initiative
Henry Wood	Architect, Kallmann McKinnell and Wood

This Concept Proposal is a collaborative effort from a group of educators, architects, engineers and planners et al. This group is focused on identifying economic & ecological possibilities for the refurbishing of Boston City Hall and Plaza. The collaborative was initially inspired by a Thesis Studio and a Sustainable Technology Seminar both taught in 1996 at the accredited 5 year Architecture Program at Wentworth Institute of Technology. A progress report was presented to Michael Galvin and invited guests from the Public Facilities Department and the Trust for City Hall Plaza on April 9, 1997 by Architect and Adjunct Professor Henry MacLean. After the presentation Mr. Galvin invited the team to present the Proposal to Mayor Menino's cabinet.

Project Team:

- Henry P. MacLean, Architect and Adjunct Professor, Wentworth Institute of Technology
- John Cooke, PE, Energy Consultant, Professor Emeritus at Massachusetts Institute of Technology
- Peter Roudebush, Architect and Systems Consultant, ASR member
- Franziska Amacher, Architect, co-chair of Architects for Social Responsibility ASR, Adjunct Professor at Wentworth Institute
- Ambrose Spencer, Northeast Sustainable Energy Association (NESEA) and Adjunct Professor at Wentworth Institute of Technology
- Harvey Bryan FAIA, Architect & Energy Consultant, ASR member
- Peter R. Nobile III, AIA, Architect and co-chair of ASR
- Robert Hodgkinson, Wentworth Graduate, Designer and Builder

HM/pn