The Massachusetts Story:

The Current State of Sustainable Design at Massachusetts State Agencies and Authorities

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The Massachusetts Sustainable Design Roundtable

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1.0 INTRODUCTION

The Massachusetts Sustainable Design Roundtable was launched in the beginning of 2005 with the goal of developing recommendations on how to best promote effective sustainable design strategies in State-influenced vertical construction projects. The Roundtable is composed of volunteer members from both the private and public sector, who meet twice a year as a large group, as well as monthly in smaller working groups. Their final recommendations, and a schedule for implementation, will be published in a report issued by the Roundtable, the Secretary of the Executive Office of Environmental Affairs (EOEA) and the Commissioner of the Division of Capital Asset Management (DCAM) in the spring of 2006.

As part of the Roundtable's efforts, in July 2005 an intern was hired to research and report on the current state of vertical construction management in Massachusetts State Government Agencies, and the level of sustainable design considered in the construction projects these entities influence. The goals of the research project can be broken down into five (5) main questions:

1. *What State government entities (agencies/authorities) have a direct role in vertical construction projects in Massachusetts?*
2. *How do they fund, plan, design and/or construct these projects?*
3. *What is the scope of each agency/authority's current and future construction plans?*
4. *How do these agencies/authorities currently foster sustainable design in their organizations?*
5. *What, if any, future plans do these agencies/authorities have in terms of sustainable design efforts?*

Over a two-month period, the intern conducted research to help answer these questions, the results of which are outlined in the following report.

2.0 Research Methods

As mentioned above, the purpose of this report is to examine what government entities influence vertical construction in Massachusetts, and to determine their level of sustainable design implementation. To achieve this, various resources were utilized for research purposes.

The main research technique was face-to-face interviews with key agency personnel. Eleven representatives from nine (9) State Agencies and Authorities were interviewed over a four-week period. The agencies/authorities were:

- Division of Capital Asset Management (DCAM)
- Department of Housing and Community Development (DHCD)
- Department of Education (DOE)
- Massachusetts Schools Building Authority (MSBA)
- Massachusetts State College Building Authority (MSCBA)
- University of Massachusetts Building Authority (UMBA)
- Massachusetts Port Authority (Massport)

- ✍ Massachusetts Bay Transportation Authority (MBTA)
- ✍ Massachusetts Environmental Policy Act Program (MEPA)

A twelve (12) point questionnaire was created as a tool to guide these interviews, and was e-mailed to every key agency representative prior to each meeting (see Appendix 2). Interviews of 60 to 90 minutes were then conducted on-site at each agency. After every interview, summary meeting notes were sent to each representative to allow for feedback. Follow-up correspondence took place via telephone, e-mail, or face-to-face meetings, as needed, for clarification and to gather information that was not readily available initially.

Secondary research was done by:

- Reviewing agency presentations made at previous MA Sustainable Design Roundtable sessions
- Exploring web sites of key agencies/authorities, and
- Ongoing communication with various Sustainable Design Roundtable members.

A cyclical approach of continuous learning was incorporated during this process, and the project approach and goals were updated as needed. Additionally, agency representatives were encouraged to provide further input and feedback throughout the process.

3.0 SETTING THE STAGE: CURRENT AGENCY/AUTHORITY CONSTRUCTION ROLES

3.1. STATE AGENCIES/AUTHORITIES THAT INFLUENCE CONSTRUCTION IN MASSACHUSETTS

Various State agencies influence, to some degree, construction projects in Massachusetts. The extent of their control varies from complete funding and oversight to offering suggestions. Below is a brief description of the nine (9) key agencies/authorities addressed in this report, and their role in vertical construction in Massachusetts.

3.1.1 Division of Capital Asset Management (DCAM)

DCAM handles the majority of Massachusetts' vertical construction for State owned (non-authority) properties, encompassing an average of $300 million capital projects annually, including both major renovations and new construction projects. DCAM's responsibilities also include many real estate transactions, although this report does not address them. DCAM construction projects fall primarily under two (2) Massachusetts General Laws (MGL) – MGL Chapter 149 and MGL Chapter 25A (section 11C).

MGL Chapter 149 establishes the laws governing "bond funded" construction projects whose funds come from general obligation bonds set up by the legislature at a low interest rate for individual projects and/or separate agencies. The *majority* of DCAM's work goes into providing oversight into the designing and building of these Chapter 149 construction projects.

MGL Chapter 25A (Section 11C) is a performance contracting statute that allows financing of energy efficiency projects through *Energy Savings Performance Contracts* (ESPC). These Performance Contracts allow DCAM to finance a project out of the post-reconstruction savings stream.[1]

Unlike Chapter 149, Chapter 25A only applies to major renovations and retrofits to existing facilities, not new construction. This is because such projects provide a guarantee on savings based on baseline conditions. Therefore, no capital appropriations are used for this program.[2]

Project Types - State building that include, but are not limited to: office buildings, courts, prisons, higher education buildings, public health buildings (mental health centers, public health centers, human services), police barracks, laboratories, and recreation buildings.

3.1.2 Department of Housing and Community Development (DHCD)

DHCD offers programs, funding and technical assistance towards affordable housing opportunities and community development initiatives that serve those with low-to-moderate incomes in all Massachusetts communities. The bulk of new construction and redevelopment projects that receive financial assistance through DHCD are sponsored and owned by private entities such as for-profit and not-for-profit developers. In addition DHCD provides operating, modernization and new construction funds to Local Housing Authorities (LHAs) which collectively own and manage approximately 50,000 units of state-supported public housing.

There are three (3) divisions under DHCD that deal with vertical construction projects:

- Division of Community Services
- Division of Public Housing and Rental Assistance
- Division of Housing Development

Project Types – Affordable Housing and Community Development Projects

3.1.3 Department of Education (DOE)

The Massachusetts DOE administered the School Building Assistance Program until 2004, overseeing the State's role in funding and construction of public schools for the Commonwealth. By mid-2004, the program was transitioned to a newly created entity called the Massachusetts School Building Authority (MSBA) (see Section 3.1.4). However, the DOE is included in this report because it was an important partner in Massachusetts Technology Collaborative's Green Schools Initiative, which began in 2001. This Initiative piloted a process for designing and constructing high performance green schools in the Commonwealth. The

[1] For example, a DCAM client may initially spend $1 million in energy annually for a building. After reconstruction through an ESPC, the client may only spend $600,000 annually on energy - with a $400,000 savings. Most of this savings initially goes towards paying off the tax-exempt loan, with the net amount of money used towards other client needs

[2] Most projects are funded for a term up to 10 years, unless the project includes cogeneration at which point it can receive financing for up to 20 years. It is estimated that the ESPC Program saves the Commonwealth $20 million annually in utility bills.

successes and lessons learned from the Initiative will guide the MSBA as it reconstitutes the School Building Assistance Program.

Project Types – Public Schools (Elementary, Middle, High and Vocational – Renovations and New Construction)

3.1.4 Massachusetts School Building Authority (MSBA)

In 2004, legislation was signed creating the MSBA as a new independent authority formed to take over the process of funding and constructing schools.[3] As a result, the MSBA inherited from the Department of Education (DOE) the responsibility of managing the costs and operations of the state School Building Assistance Program. The MSBA is in the process of promulgating finance, design, and construction regulations, completion of which is anticipated for July 2006.

In addition to this responsibility, MSBA inherited $10.7 billion in School Building Assistance Program debt for previously approved school building projects. Because of this debt load, the DOE instituted a moratorium on new school construction projects in 2003. Chapter 208 of the Acts of 2004 extended the moratorium to July 1, 2007.

The $10.7 billion debt includes:

- $5.4 billion towards 427 *Priority Waiting List* schools [4]
- $5.3 billion towards 720 *Contract Assistance* projects [5]

A reform plan was recently created to reduce this debt, which dedicates twenty percent of the State's future sales tax as a revenue stream. This tax is estimated to infuse roughly $500 million per year into the program.

Project Types – Public Schools (Elementary, Middle, High and Vocational – Renovations and New Construction)

3.1.5 Massachusetts State College Building Authority (MSCBA)

MSCBA was established in 1963 and holds statutory authority to manage financing, development and construction, and maintenance oversight of revenue generating facilities (primarily residential) at the nine (9) Massachusetts state colleges. [6] Projects are financed through revenue bonds that are repaid through student fees; vendor contributions; and college operating and reserve funds. As such, the MSCBA is revenue financed and receives no direct appropriation from the Commonwealth.

[3] MSBA was created by Chapter 208 of the Acts of 2004 Amendment of Chapter 70B School Building Assistance Program
[4] Schools whose construction projects were approved but not completed before the 2004 moratorium
[5] Projects completed before the moratorium that DOE was previously obligated to make debts service payments for on their listed bonds
[6] Bridgewater State College, Fitchburg State College, Framingham State College, Massachusetts College of Art, Massachusetts College of Liberal Arts, Mass Maritime Academy, Salem State College, Westfield State College, and Worcester State College

Project Types – Residence Halls, Student Life Facilities (athletic facilities, student centers, cultural facilities), parking facilities

3.1.6 UMass Building Authority (UMBA)

UMBA handles the construction process for capital projects at the five (5) University of Massachusetts college campuses located in Lowell, Boston, Worcester, Dartmouth and Amherst. UMBA projects are funded by bonds through UMBA or a campus' capital budget, depending on the individual situation.[7]

Project Types – academic buildings, dorms, and other capital projects.

3.1.7 Massachusetts Port Authority (Massport)

Massport is a self-financed, independent public authority which develops, promotes and manages airports, the seaport and transportation infrastructure in Massachusetts. As an independent agency, it is not under direct control of the Governor and does not receive state tax support. They own Logan Airport, the Port of Boston, the Tobin Bridge and Hanscom Field. Altogether Massport owns, manages, or ground leases approximately 585 acres of maritime, industrial, and commercial waterfront property (including both land and water area) in South Boston, East Boston and Charlestown.

Massport influences two main types of construction projects:

A) Massport Funded Projects

These Massport-developed projects are used to support Massport's own operations. The authority is responsible for developing the project scope, designer selection, design management, public bidding, construction management, and start up.

Project Types – Office buildings, parking structures, cargo buildings, airport hangers, some terminals, however mostly project infrastructure

B) Private Commercial Development

For these projects, Massport executes long-term land leases with private developers to provide a revenue stream for the authority. In such cases,[8] Massport is responsible for development of a request for qualifications (RFQ), request for proposals (RFP), management of the selection process, and they participate in oversight of the design and construction phases.

Project Types – Apartment buildings, hotels, and other commercial development.

[7] Any UMass vertical construction projects funded through the *Commonwealth's* capital budget are carried out by DCAM, not UMBA
[8] Except for commercial real estate ventures by Massport's Business Development team

3.1.8 Massachusetts Bay Transportation Authority (MBTA)

MBTA is the transit agency for Massachusetts. As the fifth largest of its kind in the country, it serves 4.5 million people and 175 communities, with 1.1 million passengers a day. Responsibilities include the State's buses, subways, bus rapid transit, commuter rails, ferries, trackless trolleys, and paratransit. In addition, the MBTA is one of the largest landowners in the state, and their real estate group leases out land to private developers to raise funds.

The two main types of MBTA influenced vertical construction projects are:

A) MBTA Projects

These MBTA-developed projects are used to support MBTA's own operations. The authority is responsible for all phases in the construction process of the projects.

Project Types – Subway stations, bus facilities, car houses, transit police substations etc.

B) Private Commercial Development

As one of the largest landowners in the State, MBTA's Real Estate Department leases out surplus land to private developers to provide a revenue stream for the authority. Working together with Transit Reality Associates (MBTA's asset manager), they identify and advance appropriate sale and development opportunities of MBTA land. At times these developments are at or near transit stations. In such cases, the MBTA issues an RFP to identify suitable developers to purchase, or lease, and develop the land into a Transit Oriented Development (TOD) – a walkable development centered around the transit station. The MBTA provides technical assistance for outreach, planning, marketing, and RFP development for these projects.[9]

Project Types – Can include a variety of development including residential, retail, and commercial.

3.1.9 Massachusetts Environmental Policy Act (MEPA) Program

The MEPA office is responsible for enforcing the Massachusetts Environmental Policy Act, which requires that any development deemed to exceed a certain environmental threshold undergo a MEPA review. Environmental thresholds apply to a variety of environmental aspects influencing a project, including rare species, traffic, water usage, energy, and air pollution.

The MEPA applies to projects above a certain size that involve some state agency action. That is, such projects are either proposed by a state agency or are proposed by municipal, nonprofit or private parties; and require a permit, financial assistance, or land transfer from state

[9] TOD sites are completed in cooperation with the Office for Commonwealth Development (OCD), which is the office charged with focusing state resources on smart growth and sustainable development.

agencies. Through the MEPA office, the Secretary of the Executive Office of Environmental Affairs (EOEA) conducts environmental impact reviews of the aforementioned projects.

Project Types – Any development, public or private, which exceeds a specific environmental threshold and must go through a state agency permitting process.

3.2. MAPPING AGENCY/AUTHORITY ROLES

Each of the nine State entities mentioned in Section 3.1 have varying levels of control and influence over their construction projects. These levels differ according to factors such as who funds the project, the level of authority each agency requires over the project, and any legislation, standards, and other mechanisms that determine their role. Understanding these influence levels helps us gauge who the key decision makers are, at what point in the process power is held by the agency/authority, and where they have the capability to promote or infuse sustainable design concepts into their construction processes.

This type of analysis also illustrates where the agency/authority has the *least* influence, and thus where their actions towards sustainable design incorporation may be stalled or blocked. Such information is pertinent to isolating agencies that are the best candidates to reform their construction process for sustainable design incorporation.

Figure 1 – Level of State Agencies' Influence on Vertical Construction Process

		FUNDING	BIDDING & AWARD	PLANNING	DESIGN	CONSTRUCTION
Dept. of Housing and Community Develpm't (DHCD)						
	* Division of Public Housing and Rental Assistance	High	Moderate/Low	Moderate/Low	Moderate/Low	Moderate/Low
	* Division of Housing Development	High	Moderate/Low	Moderate/Low	Moderate/Low	Moderate/Low
	* Division of Community Services	High	Moderate/Low	Moderate/Low	Moderate/Low	Moderate/Low
Division of Capital Asset Management (DCAM)		Moderate/Low	High	High	High	High
Mass Bay Transport Authority (MBTA)		Moderate/Low	High	High	High	High
Mass. Environmental Protection Act Program (MEPA)		None	None	None	Moderate/Low	None
Mass. School Building Authority (MSBA)/DOE		High	TBD (minimal input in the past, but MSBA would like more oversight in the future)			
Mass. State College Building Authority (MSCBA)		Moderate/Low	High	High	High	High
Massport	Massport Funded Projects	High	High	High	High	High
	Private Commercial Development	None	High	Moderate/Low	Moderate/Low	Moderate/Low
UMass Building Authority (UMBA)		Moderate/Low	High	High	High	High

Level of Influence	High	Moderate/Low	None

Figure 1 (above) rates the levels of state agency influence on the vertical construction process as either **High, Medium/Low**, or **None.**

Five of the agencies - DCAM, MBTA, MSCBA, UMBA, and Massport - have a *High* level of influence over the construction process from the bidding and awarding stage through to the construction stage. In other words, these entities hold enough influence to drive decisions regarding the execution and essentials of these phases; and which individuals partake in the process.

Agencies that do not exhibit such authority over a majority of their construction process still do hold some influence in specific parts. For example:

- DCHD shows a *High* level of control in their funding stage because they finance large portions of their construction projects. Thus, they could utilize their funding mechanisms and allocation process control to influence a project's green building integration.
- Massport has a *High* level of influence over *private commercial development* projects during only the bidding and awarding stage. Here they could require developers to involve professionals with green experience, and/or incorporate sustainable design in their projects.

Lastly, there are two unique agency situations depicted in Figure 1. First, the MSBA is promulgating its new school construction regulations (slated for completion in July 2006), and their level of influence on the construction phases has yet to be determined. In the past DOE had minimal oversight on the design elements of schools, yet it is anticipated that this will not be the case at MSBA - particularly with the influence of the new Massachusetts Collaborative for High Performance Schools (MA-CHPS) Guidelines (See Section 5.1 for more information on MA-CHPS). MSBA's *High* level of influence as a major funding body, however, will not change.

Secondly, MEPA stands apart from other key agencies as they are a review authority, and do not actually construct anything themselves. Nothing explicit in the Massachusetts Environmental Policy Act requires developers to consider sustainable design or materials, therefore the MEPA program currently shows a low/moderate level of influence over the construction process. However there is room, through interpretation of the regulations, to increase MEPA's level of influence, particularly on projects undertaken by a state agency or involving state financing. In these cases, MEPA holds a broader jurisdiction than they would with projects involving private developers with no state funding. Unfortunately, though, MEPA's involvement most often occurs in the post-planning stages near the end of the design phase.

From this analysis it is clear that key agencies/authorities hold varying levels of influences that could present opportunities for sustainable design to become a part of the vertical construction projects in which they participate.

4.0 THE SCOPE OF STATE AGENCIES

Data was requested from all key state agencies involved in this research project to identify their scope of work, and gain an understanding of the scale of their vertical construction projects. Although consistent data is not readily available from all of the targeted entities, obtainable data was used to determine an approximate scope of their impact. The average annual dollars spent, number of projects and square footage of buildings constructed with the influence of state agencies is depicted in Figure 2. Despite data gaps, it is apparent that Massachusetts State agencies have a considerable impact on building construction in Massachusetts, with a minimum of $1.7 billion dollars spent annually on over two million square feet of building space.

Figure 2 – Annual Scope of MA State Agency Vertical Construction Projects

	ANNUAL AVERAGE*		
	Funding/Cost (in millions)	# of New Projects (New/Mjr renovations)	Square Footage**
DCAM	$270	25	n/a
DHCD			
* Div. of Community Services	n/a	n/a	n/a
* Div. of Public Housing & Rental Assist	$7.88	35	35,000
* Div. of Housing Development	n/a	n/a	n/a
MBTA	$150	6	n/a
MEPA	n/a	174	n/a
MSBA**	$500	25	1,100,947
MSCBA	$79	6	624,086
MASSPORT	$125	n/a	500,000
UMBA	n/a	n/a	n/a
n/a = data not available **approximate data estimates* ***estimated ft² not including mjr renovations*	$1.730 Billion	276	2,260,033

There were some difficulties in obtaining scope data, as well as questions regarding available data's accuracy. In most cases, this data gap was the result of limited and inconsistent tracking of project information. However, some agencies were hesitant to provide information, particularly forecasted information.

5.0 SUSTAINABLE DESIGN IMPLEMENTATION

5.1 Programs of Interest

Various state agencies and authorities are taking action steps to create programs aimed at increasing the level of green building incorporated into a project. Although most of these initiatives are *voluntary*, they are promising. Some of these projects are described below:

✍ **MA-CHPS/Green Schools Initiative**

In 2001, the Department of Education in partnership with the Massachusetts Technology Collaborative launched the Green Schools Initiative. This Initiative was designed to promote renewable electricity projects for K-12 public schools and to test a process for incorporating energy efficiency and high performance design into school construction. Eighteen Green School pilot projects were selected on a competitive basis to receive funding towards construction of high performance schools. These schools will act as demonstration buildings for innovative green technology and approaches to optimal school construction. For example, energy modeling predicts that on average the pilot projects will exceed state energy code requirements by 30%. This 30% savings translates to average projected savings of $70,000/yr in avoided utility costs per school.

The ultimate goal of the Green Schools Initiative Program is to help establish regulations requiring minimum high performance criteria for all K-12 new public school construction and major renovations in Massachusetts. To achieve this, DOE is finalizing Massachusetts Collaborative for High Performance Schools (MA-CHPS) Guidelines, (based on a similar California initiative), slated for completion in late 2005. It is anticipated that these guidelines will influence school construction regulations being formulated by the MSBA.

✍ **Professional Client Support**

Certain state agencies/authorities are striving to provide technical assistance to developers and clients to support the voluntary incorporation of sustainable design in their projects. For instance:

- DCAM has an in-house sustainable design team that is available to provide technical assistance and consulting expertise to assist ongoing projects in sustainable design implementation.
- DCAM also periodically utilizes house doctors - professionals brought in to provide consultant expertise specific to a certain project aspect related to sustainability - on projects. This includes energy modeling, green building feasibility studies, and energy audits on areas such as renewable energy elements and storm water management.
- Massport provides the assistance of a consultant team lead by an architect with extensive green building knowledge to aid developers in project design.

✍ **Sustainable Design Guidelines**

Sustainable design guidelines have been in place at DCAM for more than 5 years in the hopes of establishing a norm that all designers should adhere to for energy efficiency, materials use, indoor air quality and so on. These guidelines are a mix of mandatory provisions guided by legislation and guidance suggestions.[10] However, a majority of these guidelines are voluntary, and frequently there is no follow-up to ensure that the green building aspects are implemented.

[10] For example, LCA must be conducted for major electrical and mechanical equipment.

✍ **Endorsement of LEED Certification**

There is a momentum within Massport and DCAM for clients to strive towards LEED certified buildings. More specifically, DCAM is pushing (although not as a mandatory requirement) that major projects be registered with LEED and strive for LEED Silver certification. Additionally, Massport supports a "Best Efforts" program towards LEED certification. This program requires commitment from the project owner/developer, and involves an active engagement process with project team integration and required work sessions. Whether or not they become LEED certified, those involved in Best Efforts must create a document using the LEED checklist to state what they did in terms of green building on their project.

5.2 Projects of Interest

Although a coordinated and consistent sustainable design program does not exist in State agencies, certain projects have become leading examples of successful green building performance and achievement. These State agency-influenced projects are both private and public and range from airport terminals to elementary schools. Some such developments include:

✍ **Delta Terminal A – Logan Airport**

Terminal A is the first truly green structure at Boston's Logan Airport, and is anticipated to be a national model for similar facilities. Massport's design team designed and developed this project to achieve LEED rating for energy use, lighting and material use. Through recyclable materials, natural lighting, energy conservation plans, water efficiency, alternative fuel utilization, and other innovations, this terminal takes advantage of a variety of sustainable design technology.

✍ **Salem State College – New Central Campus Student Village**

Built on a reclaimed industrial site, this 145,000 ft^2, 442-bed student dorm facility cost roughly $30 million to construct over a 22-month period.[11] In the course of reclaiming the parcel of land, the impervious area on the site was reduced by 3 acres and groundwater was recharged as a result. Other notable project elements include daylighting in student suites and common rooms, and the incorporation of a significant amount of recycled content (furnishings and finishes).

✍ **Cape Cod Community College (CCCC) Applied Technology Center**

Opened in the fall of 2005, this $7.7 million, 26,500 ft^2 DCAM constructed building is anticipated to be the first LEED certified green building (LEED Gold) constructed with state funds in Massachusetts. Major green technologies used at the center include grey water systems and storage, photovoltaic roof panels, acoustic ceiling tiles (ecophon), high energy performing glass, lighting control systems (with daylight and occupancy sensors), daylighting, and recycled interior design materials and construction waste. (See case study in Appendix 4)

[11] Facility was completed in July of 2004.

- **Manulife Financial Corporate Headquarters**

  Completed in 2003, Manulife Financial's US corporate headquarters encompasses 470,000 ft^2 on the South Boston Waterfront - land leased from Massport. Anticipated to receive LEED Silver certification, this building's sustainable design highlights include smart growth considerations (public transport access, bike racks, minimal parking); green roofs; an efficient HVAC system; and a unique double-skin curtain wall whose triple glazing exterior and operable panel interior allows for lower building heating and cooling costs.

- **William F. Stanly Elementary School**

  Of the 18 Green Schools Initiative participants, The William F. Stanley Elementary School is one of the first to be evaluated for a case study. Located in Waltham, Massachusetts, this pre-kindergarten through fifth grade elementary school houses 600 students in a 93,000 ft^2 sustainably designed building. Their high performance design approach focused on daylighting, indoor air quality and energy efficiency. Specific elements include operable windows and lighting control zones, low volatile organic compound (VOC) emission carpets, zero-VOC paints, Forest Stewardship Council wood products, solar orientation building site positioning, cool roof techniques, photovoltaic sunshades, and an interpretive wetlands walkway on-site. Additionally, this site's Environmental Management System (EMS) manual has become a model for other cities throughout Massachusetts.

5.3 General Overview

Although, as mentioned above, positive efforts are being made towards sustainable design at state agencies/authorities, they are inconsistent and piecemeal. There is no coordinating body to advise on such efforts, and a majority of agencies interviewed for this research project have no formal green building minimum standards or requirements. While all are required to meet general state standards and building code requirements, many do not exceed them.

At most agencies, if green building elements were included in a project it was driven by the public or through individual staff desire, not through agency priority. For example, the MBTA's Shawmut Train Station has a rainwater collection cistern and other green building elements (lighting, building materials, drainage), which came about because of public demand derived through public consultation. The MSCBA also conducts some non-coordinated efforts. Although they feel they are a small organization that does not have enough volume to generate a new green building policy internally, there are some green practices that they generally observe including installation of water efficient plumbing fixtures, a high percentage of natural daylighting, and maintaining or increasing permeable site surface areas.

However, overall, through discussions with key agency staff, it is apparent that there is a low level of *mandatory* sustainable design implementation and consideration in State government-influenced vertical construction projects.

6.0 SUSTAINABLE DESIGN IMPLEMENTATION: LEVERAGE POINTS

6.1 General Leverage Points

Leverage points are pivotal periods in the construction process that present an opportunity for green building to be infused. Within the typical construction process, which has five main stages - funding, bidding and awarding, planning, design, and construction, there are a variety of opportunities for the incorporation of sustainable design elements. Through discussions with agency staff, a number of leverage points were identified within each phase of the construction process, which are shown in Figure 3. Three crucial leverage points frequently mentioned were:

- **Early Planning Stages**

  Overwhelmingly, agency staff stressed that sustainable design must be brought in early, during the planning and programming stages of the project. It is during this time that the agency/authority and client determine a project's scope, key objectives and goals, and what standards will be applied. Feasibility studies are conducted, timelines are firmed, constraints are discussed and an overall consensus as to the project's direction is determined. Most often this is also when green building decisions are made, including if it will be a LEED project, energy modeling possibilities, water use reduction strategies, and the use of Life Cycle Costing Analysis (LCCA). Other essential green elements such as building siting, transportation issues, solar and wind access, and smart growth potential are also decided.

  However, frequently, green building aspects do not get considered until after the planning stage (often in the design development stage), when timelines have already been determined and time pressures begin to become a factor. Project costs become a roadblock as the farther along you are on a project, the greater the cost to incorporate green building options. Also, once the design process starts there is limited time to explore new approaches and research design possibilities.

- **Project Hand-off Points**

  As each new stage of the construction process begins, the project typically comes under another's control. The project moves from the planner, to the designer, to the contractor, and then to building operations and maintenance. When an integrated design team is not used (see Section 7.1.4.), green elements can get lost in the project's transition.

  Agency staff suggest this may be due to a general lack of knowledge or motivation regarding green building among project development staff, causing some green elements to get discarded. Thus, it is essential to monitor the project's transition to ensure sustainable design aspects get carried through to construction. Such oversight would provide an opportunity to not only ensure green building goals are understood and implemented, but also educate on green building options and resources.

✍ **Project Financing**

Frequently, green building aspects are suggested too late in the process (as mentioned above), after the project's financing has been discussed. It is imperative to consider sustainable design options in the initial budget discussions in order to accommodate for such technology to be successfully incorporated into a project.

6.2 MEPA Specific Leverage Points

As mentioned, the Massachusetts Environmental Policy Act program (MEPA) is unique from the other key agencies in this report because they are a review authority and do not actually construct anything themselves. As such, leverage points exist which are unique to their process, including:

✍ **Pre-Application Meetings**

At times, an opportunity exists where developers request a meeting early on to discuss their project. Although infrequent, and typically only with larger projects, these meetings would provide MEPA with a chance to suggests sustainable design elements to the developers.

✍ **Public Consultation**

MEPA's public consultation process can provide an opportunity to educate about green building. First, it can educate the public on the benefits and types of green building technology, which may spur interest and add pressure to the developer to explore green building options. Secondly, if MEPA supports sustainable design at such events this could show developers that the State is serious about such issues, potentially influencing developers to be proactive.

✍ **Certificate Phase (MEPA)/Alternatives Analysis**

The scope Environmental Impact Report (EIR) and Certificate Phase of the MEPA process provides a leverage point for MEPA to recommend developers undertake LCCA and sustainable design alternatives analysis.

✍ **Existing Regulations**

Existing provisions in MEPA could be used to promote sustainable design including:

- Section 11.07(6)(f).9. - This section requires an analysis of alternatives "…in light of …executive orders and other policy directives…"
- Section 11.07(6)(f)5 - This section requires discussion and rationale for alternatives ruled out (opportunity for evaluation of barriers)
- Section 11.07(6)(h) - This section requires assessment of impacts to include "…short and long-term impacts for all phase of the project (e.g. acquisition, development, and operation) and cumulative impacts…"
- Single EIR provision incentive - This provision includes criteria that "…planning and design of the project use all feasible means to avoid potential environmental impacts."

Figure 3 – Leverage Points in a Typical Construction Process

	TYPICAL CONSTRUCTION PROCESS				
	FUNDING/FINANCING	**BIDDING & AWARD**	**PLANNING****	**DESIGN**	**CONSTRUCTION**
DESCRIPTION	Stage when a project's financing is determined. For those agencies involved in funding projects (i.e. DHCD, MSBA), this is when the application process occurs.	Stage when the architects and construction professionals are selected through a competitive evaluation & bidding process. Request for Qualifications and Request for Proposal released and a bid is submitted.	When a project's scope, schedule, and goals are determined, and feasibility studies are conducted.	Project design phase, which includes creation of schematic design, design development, and construction documents.	The period during which the project is built. This includes demolition, excavation, building of shell and core, envelope, mechanical systems interior finished and landscaping.
LEVERAGE POINTS ***Planning occurs throughout the entire construction process.*	✍ **Conduct Life Cycle Cost Analysis (LCCA)** to determine long term benefits of sustainable design elements ✍ **Address front end cost burdens of green building technology**, and allow room in budget to support their inclusion ✍ **Grant more funding points to projects that include sustainable design** (specific to funding agencies i.e. MSBA, DHCD) ✍ **Include green building information and resources in funding application** package. (specific to funding agencies i.e. MSBA, DHCD)	✍ **Require green building experience & knowledg**e of architects and construction companies ✍ **Require that project incorporates sustainable design elements**	✍ **Solidify green building goals** , as decisions further along in the process will incur higher costs and extend timelines ✍ **Determine pursuit of LEED certification** to allow time to register ✍ Allow time for **advanced energy modeling calculations** ✍ Allow time for **water use reduction strategies** ✍ **Planning for Smart Growth** must occur during this stage, as siting decisions are formalized here. ✍ **Require sustainable design techniques under the developer's ground lease obligations** (if applicable) ✍ **Ensure green building goals are understood** and implemented when project is handed off to next phase (planner to architect) ✍ **Integrate project team** for interdisciplinary perspective and integrated design process	✍ **Incorporate green building aspects in scale and layout decisions** . Such decisions are difficult & costly to change later ✍ **Important stage for energy efficiency & indoor air quality (IAQ),** as systems selected and building materials chosen ✍ **Require sustainable design approach be considered as part of the design approvals review** (ex: Massport) ✍ If project involves public consultation (MEPA, MBTA), **opportunity to educate public on green building** ✍ If project involves public consultation (MEPA, MBTA), **opportunity for public to influence amount of green building in project** ✍ **Ensure green building goals are understood** and implemented when project is handed off to next phase (architect to construction manager) ✍ **Require designer use LEED design checklist** ✍ **Require sustainable design approach be submitted by designer**	✍ **Establish and monitor construction phase waste management and air quality plans** ✍ **Consider green products in materials selection** ✍ **Ensure sustainable design elements are constructed as designed**

7.0 SUSTAINABLE DESIGN IMPLEMENTATION: BARRIERS AND OPPORTUNITIES

7.1. Barriers

As a result of agency/authority interviews, a number of barriers to sustainable design implementation were identified. The following list provides them in no particular order:

7.1.1. Limited Knowledge and Expertise (internal and external)

One of the major obstacles mentioned by agencies is the lack of sustainable design knowledge that internal and external decision-makers exhibit throughout the construction process. This includes project managers, architects, engineers, developers, contractors, other various construction professionals, and internal agency staff. In general, there is a lack of understanding of what green building is, what its benefits are, how it is measured, and how it is implemented. More specifically, stakeholders need to be educated on such things as:

- The process of implementing sustainable design concepts;
- Green building products and systems;
- Associated cost benefits (energy savings etc.);
- Information resources; and
- Timelines for return on investment.

For example, it has been suggested that some architects are reluctant to incorporate sustainable design aspects into a project because they feel it requires too much work and time for the budget. It was also mentioned that in cases where client agency staff is involved, they come into a project with limited knowledge of green building concepts and the various agency requirements. To incorporate green building in such cases would require learning curves and soft costs that they do not want incur.

This knowledge gap can be best described through a product life cycle comparison. Green building is currently in an early adopters stage. That is, those that have become involved thus far are aware of the benefits over past building types, and are actively seeking such technology. In some cases green building has been used as a marketing tool; other times for its long-term benefits; and still others have used green building design for its environmental benefits. Because it is a relatively new and complex issue, the challenge is to push sustainable design to the next stage where a greater majority of stakeholders understand its benefits, and in turn chose to incorporate such concepts.

Beyond the general lack of knowledge, two specific gaps mentioned were:

1) <u>Lack of LEED accredited staff</u>

   Many agencies have a limited number of LEED accredited professionals on staff. DCAM in particular mentioned a desire to ideally have one LEED accredited professional on every project. However, even when agencies have LEED accredited staff, it was seen to have a negligible impact on increasing the incorporation of green building, because many times it is not a project priority.

2) Lack of Life Cycle Costing Analysis (LCCA) Knowledge

LCCA is a vital tool to providing evidence in support of the argument that green building features have a positive economic trade-off (i.e. that higher up-front capital costs are counteracted by lower future operating costs). Such information can be used to combat the traditional approach of considering only lower up front capital costs. However, few agencies have the technical knowledge to incorporate LCCA into their projects, and they are unsure where to turn for guidance.

7.1.2. Sustainable Design Data Gaps

Coupled with the lack of green building knowledge is the perception by agencies/authorities that there is a lack of data regarding the benefits, longevity, and payback of sustainable design features and green products. Whether this data gap exists or not, it is *perceived* to exist, and thus a resource needs to be created which can provide agencies with information to help sell sustainable design internally and to clients. Data is needed to convince people that green building is worthwhile, and cost effective (or at least cost neutral).

7.1.3. Lack of Directives from High Level Leaders

One of the most critical barriers to sustainable design implementation at State Agencies is the lack of directives from high-level leadership. High-level leaders include the Governor, Executive Directors, Board of Trustees, General Managers, and Policy Makers. Currently, no executive orders or policies exist that require state influenced construction projects to demonstrate sound green building/sustainable design. This lack of action has a waterfall effect through State Agencies, as is illustrated in Figure 4:

Figure 4

The lack of support from high-level influencers leads to a lack of mandatory sustainable design standards and control mechanisms (conditional reforms etc.). As a result, when and if sustainable design initiatives are created, they are typically voluntary and not enforceable. Frequently, there is no ownership attached to these initiatives, and thus no accountability for their promotion/adoption. This results in a lack of acceptance and support by agency staff, who see no clear leadership for the cause.

7.1.4. Lack of Integrated Design Team

Traditionally the design and build process is quite segmented, and professionals involved in the process (including architects, engineers, builders, project managers and clients) frequently do not collaborate. Projects are launched and designed without the input of the entire team; and changes required later in the process, due to previous miscommunication or mismatched goals, can be costly.

In an integrated design approach, project team members are involved from the beginning of the process, and an inter-disciplinary decision-making method is used throughout. Project goals are agreed to early on, and collaboration throughout the process is encouraged. As such, problems and issues can be addressed upfront, allowing for fewer changes later in the process - reducing costs and confusion.

7.1.5. Separation of Capital and Operating Budgets

Currently the *capital budget*, which pays for the up-front construction and major renovation costs, and the *operating budget*, which covers the ongoing operations and maintenance cost, are separately established. There is no incentive or disincentive to build projects with more efficiency because the project manager is only concerned in keeping within the allotted capital budget, and may be reluctant to add to upfront costs. Therefore, the potential long-term savings from green technology are not considered, and facilities and maintenance savings are not part of the budgeting equation.

7.1.6. Timeline Issues

It is perceived that incorporating green building technology adds to a project's timeline, thus projects with time constraints will avoid its implementation. Generally, pressures to accelerate project delivery override desire to implement sustainable design. For example, the MSCBA has schedule pressures to accelerate project delivery to achieve fall semester occupancy in support of bond-funded revenue projects.

7.1.7. Conflicts with Agency Goals

Some agency staff believe sustainable design conflicts with their agency's goals. For instance, one of DHCD's main goals is to provide low-income housing for those in need. It was suggested by agency members that DHCD staff may feel sustainable design conflicts with these goals, because the costs of implementing it would limit the number of affordable units they can build. Also, green is frequently seen as just helping the environment, which also does not support the agency's goal of helping those in need. Another agency stated that their focus was to get projects built - green building was a secondary consideration.

7.1.8. Up-Front Cost/Perception of Cost

Green building technology is perceived as more expensive than traditional building design. As such, budget pressures to reduce project front-end costs, because of lack of resources (staffing and monetary), may prevent the inclusion of green building. For example, MSCBA needs low front-end

costs to provide affordable student rent structures. Another example is the MBTA, who funds projects through public transport revenue. Recently this revenue has been down, and internal staff will see green building as an exorbitant cost.

7.2 OPPORTUNITIES

Below is a brief list of opportunities to address the barriers outlined above, which surfaced through discussions with key agency/authority members:

7.2.1. Education and Training

Providing education and training to stakeholders involved in the construction process (i.e. developers, project managers, architects, consultants, and agencies), may change green building perceptions as well as provide the knowledge needed to incorporate green building technology into a project. Specific trainings mentioned include LEED accreditation courses and LCCA instruction for relevant professionals.

7.2.2. Leadership and Vision

Agency staff members agree that there needs to be a clear statement of leadership and vision from top-level influencers for agencies to adhere to sustainable design programs.

7.2.3. Link Capital and Operating Funds

By connecting these budgets, it is believed that the long term costs and benefits of a project will become an elevated factor in project planning and design.

7.2.4. Accountability

Currently there is little accountability downstream for existing initiatives. An individual or entity must be responsible and accountable for the implementation of sustainable design initiatives.

7.2.5. Demonstration Building

A demonstration building is constructed to provide a real world model of successful sustainable design implementation, while simultaneously meeting the client's/agency's needs. Such buildings present sustainable design as a tangible, realistic option. By recording the project's history and performance these buildings can also provide evidence that energy and resource efficient technology can be feasible and successful.

7.2.6. Creation of mandatory standards and mechanisms

Updating mandatory buildings standards to include sustainable design requirements will provide measures that are consistent and enforceable. This must be done in conjunction with education and training information and support.

7.2.7. Funding Incentives/Cost Reduction Tactics

Agency members felt they would be inclined to install green products if there was an economic benefit or at least no additional cost for such technology. For example, one agency staff member suggested exploring partnerships with manufacturers to reduce costs. In this scenario, manufacturers would agree to offer their products at a competitive price, and with

appropriate warranties, in return for the government providing information on long-term operating characteristics. However, the State could not guarantee business for the partnering company, as State agencies are required to go out to bid.

7.2.8. Mandate LCCA

Agency/Authority staff suggested that mandatory LCCA on projects would motivate stakeholders to consider technology to help reduce resource and energy usage.

7.2.9. Provide Sustainable Design Data and Resources

Agencies need solid, easily accessible guidance documents and resources on sustainable design presented in a coherent, statistical way that is defensible and understandable.

8.0 CONCLUSION

Within Massachusetts State government, there are a host of agencies and authorities that have a wide range and significant influence over an array of vertical construction projects. From discussions with agency staff, there seems to be a clear willingness and excitement about sustainable design and its possibilities. However, what currently exists is an inconsistent variety of green building initiatives that lack knowledge, guidance, and support for them to be solidified. The lack of support from high-level influencers, and the absence of a coordinating body to advise on such efforts, are deficiencies to be overcome. There is also a clear need for better tracking and data regarding vertical construction projects within State agencies and authorities. If these issues are addressed, the State of Massachusetts has the capability to build on its sustainable design successes and become a leader amongst other States.

APPENDICES

APPENDIX 2

Research Questionnaire

MA SUSTAINABLE DESIGN ROUNDTABLE
MA Story: Interview Questions

INTERVIEW GOAL

As part of the MA Sustainable Design Roundtable effort, the following questionnaire has been developed to help the Roundtable understand the process through which public buildings are constructed in Massachusetts. More specifically:

- agency/authority construction procedures;
- plans for building in the future; and
- to what degree sustainable design features are or will be incorporated into the construction process.

Thank you for taking time to be involved in this information gathering process!

INTERVIEW QUESTIONS

MAPPING GENERAL AGENCY ROLE

1. How is your agency involved in the funding, planning, design and/or construction of public buildings in Massachusetts?

2. What are the key stages of the funding, planning, design and construction process?

3. What are the key leverage points in this process?

4. How does the funding for a construction project get decided? (i.e. who decides on funding and how much?) What is your capital budgeting process, and does this take into account life cycle analysis?

FUTURE PROJECTS/DEVELOPMENT

5. As of now, what are UMBA's future construction plans (new construction and major renovations), and how far out do you plan?

6. What is the specific data regarding UMBA's existing and projected plans for new construction and/or major renovations (i.e. type, number, size, ft^2).

GREEN BUILDING EXPERIENCE

7. What does your Authority currently do to foster green building in construction projects? What are your minimum standard requirements?

8. Has your Authority already completed projects using sustainable design/green building features? If so, can you describe them and have you completed any case studies?

9. Are you considering initiating or expanding green building efforts now or in the future?

BARRIERS/OPPORTUNITIES TO GREEN BUILDING PROJECTS

10. What are barriers to incorporating green building elements to your agency's projects?

11. What would be helpful to your agency in alleviating these barriers?

GENERAL

12. Do you have any reports or documents that may help further explain your agency's process or any of the other questions asked?