

DESIGN AND CONSTRUCTION GUIDELINES AND STANDARDS

INTRODUCTION

The DHCD Design & Construction Guidelines and Standards are intended to aid designers of DHCD-funded projects in developing durable and forward-thinking solutions for the design challenges of capital projects at local housing authorities (LHA) in the Commonwealth of Massachusetts. They also embed our evolving understanding about life-cycle investment and smart approaches to sustainability, climate resilience, indoor air quality, and environmental protection. The standards do not ultimately constrain the designer's choice of solutions; they are a practical benchmark of best practices at LHAs. The designer who proposes an alternative design solution must explain why the proposed solution will work better than our standard and be more cost-effective, and must back up that explanation with data and examples in the field. Such explanation would be considered part of the basic design fee, not an extra service and must be provided within the normal design contract timeframe.

These standards were launched in 2007 and have been periodically revised over time. These standards will be continually reviewed and revised as we gain more experience with existing products and techniques, and as new products and techniques become available and withstand the test of time.

Your feedback on these standards is most welcome. We would be particularly interested in designers who would like to share with us materials or design details which you have found to be extremely reliable and cost-effective over several years of use and observation. Please email all suggestions or comments to me at the address shown below. Thank you for your interest in DHCD-funded work.

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Design and Construction Guidelines and Standards

The Design and Construction Guidelines and Standards (the Standards) are DHCD's technical recommendations regarding materials, products, and installation, relevant to the development of construction drawings and specifications for projects at LHAs. The Standards summarize what works and what does not in order to promote high quality, sustainable construction that reduces initial costs without compromising long-term economies. The Standards are also intended to help reduce exposure to key climate change hazards.

USING THESE STANDARDS

These Standards provide useful information when making detailed, technical decisions about material, design, and installation. Architects and Engineers are the primary audience, although housing authorities and the Regional Capital Assistance Teams (RCATs) will likely use them as a reference for smaller projects that may or may not require engagement of design professionals. The information presented contains technical language that may be unfamiliar to those who are not design or construction professionals.

This is not an outline specification, but rather a reference source for Designers in the preparation of construction documents. Most of the standards are stated in the form of minimum standards and recommendations. Recognizing that each project has a unique context, alternative solutions to illustrate how a high level of construction quality can be achieved in different contexts and circumstances may be shown. DHCD expects the construction of state-aided public housing to meet the level of quality described in these Standards. When no specific information is provided, standards of professional practice apply.

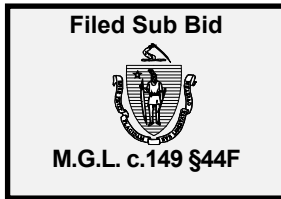
CODES

Architects and Engineers are responsible for identifying and addressing all relevant codes and regulations pertaining to the design and construction of buildings and sites. The Standards do not identify or interpret code requirements; in some cases, they do recommend materials and features that are more stringent than what is required in applicable codes. The

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Standards are not intended to contradict state codes and regulations. If recommendations in the Standards conflict with codes or regulations applicable to a particular project, the Designer should bring it to the attention of the DHCD design review architect or engineer. However, the Designer is still responsible for producing a design that complies with all codes, regulations, laws, ordinances, and by-laws.



FILED SUB BID TRADES

When using the Standards, the following symbol may appear in a section which may require Filed Sub Bids in a construction contract. M.G.L. c.149 §44F requires Awarding Authorities to make certain trades Filed Sub Bid Trades. These trades are identified by the symbol shown on the left. Technical specifications for Filed Sub Bid Trades require more administrative attention than the no-filed sub bid trades specification. For example the specifications must spell out exactly which drawings contain work to be completed by this trade, and the work in related sections needs to be spelled out clearly to avoid conflicts such as a sub bidder claiming work is not required under its section. If there are any questions regarding the requirements of c.149 §44F contact the DHCD assigned design reviewer. Additional information may be found on the DHCD Modernization webpage on [Public Housing Bidding Information](#).



ADA - AAB REQUIREMENTS

The symbol on the left indicates those items that may be seriously impacted by the Americans with Disabilities Act (ADA) or the Massachusetts Architectural Access Board (MAAB).

HOW THE STANDARDS ARE ORGANIZED

These Standards consist of sections that are organized as closely as possible to the Construction Specifications Institute (CSI) index. Each section includes the title of the section, the **general** CSI division to which the section belongs, and the topic areas included within the section. For example, section 07 40 00 Siding is part of CSI's Division 7, Thermal and Moisture Protection and covers within it Vinyl and Polypropylene Siding, Wood Clapboards, Fiber Cement Siding as well as other sidings used on housing. Requirements and recommendations for each of these topic areas is described in terms of materials, design, and execution.

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DHCD requires that specification numbers follow the CSI numbers as closely as possible. The actual numbering may differ as long as the specification sections are clearly identifiable.

The Standards include some drawings which describe DHCD's recommendations for the detailing and assembly of building and site components. The drawings are for illustrative purposes only, and should not be taken as standardized details.

SUSTAINABILITY and LIFE-CYCLE DESIGN CONSIDERATIONS

In Massachusetts, Executive Order 484 of 2007 requires public agencies to "Lead by Example" in promoting energy and water conservation, clean energy practices, waste reduction and recycling, environmentally preferable procurement, toxic use reduction, and resource conservation. Executive Order 484 has been replaced with Executive Order 594 which which also includes fuel oil reduction, zero emission vehicles and EV charging stations. These values are also captured in the Governor's Sustainable Development Principles and the Green Communities Act of 2008, as amended. Specific statewide greenhouse gas reductions targets are now set at net-zero emissions by 2050, per the Governor's Determination Letter in April of 2020.

Since 2007, DHCD's Bureau of Housing Development & Construction added a Sustainability Program, which has focused on seeking technical and financial resources for housing authorities in order to meet DHCD's and the Commonwealth's goals to reduce greenhouse gas emissions, save energy and water, improve indoor air quality, and deploy renewable energy technologies. With this sustainability undertaking, DHCD aims to achieve the Commonwealth's goals of net-zero emissions by 2050, to improve the living environments of public housing, and to ensure that future generations have the same ability to meet their needs as present peoples.

In recent years, experts in the sustainable building community have advanced Leadership in Energy & Environmental Design (LEED) certifications for existing buildings and new construction, ENERGY STAR® building and product certifications, Passive House standards and Life Cycle Assessment (LCA) approaches and tools, and Healthy Product Declarations. In soliciting design work for particular projects, DHCD may require designers

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to work with Mass Save® energy efficiency programs, use ENERGY STAR® certified products, design a project to be LEED-certifiable, or design to certain sustainability goals defined by DHCD. However, while the end goal is to achieve the directives, these Guidelines & Standards do not explicitly require application for certifications.

Throughout these guidelines, “Eco-Icons” are located adjacent to text to highlight how sustainability objectives might be applicable to design and construction approaches for public housing capital improvement:



- **Energy Performance and Intensity:** Saving energy in public housing decreases operating costs, reduces air pollutants such as those from greenhouse gas emissions, and preserves natural resources from depletion. The embedded energy intensity of building products (energy use in manufacture, distribution to market, installation and use) should be balanced with other attributes such as durability, ease of maintenance, and recyclability at end of life. DHCD is supportive of demonstrating renewable energy technologies such as solar photovoltaic and solar thermal, combined heat and power, and air source heat pump technology, which reduce consumption of fossil fuel and greenhouse gas emissions and help advance Massachusetts’ clean energy economy. Where possible, the elimination of products which consume fossil fuels is preferred and every effort should be made to achieve that goal.



- **Recycling/ Green Products:** Recycled content, non-toxicity, recyclability, and packaging waste are relevant to specification of products. Sound recycling practice in construction is also a high priority in Massachusetts given limited landfill capacity.



- **Water Conservation:** Saving water reduces operating costs, extends life of septic systems, and is consistent with resource conservation goals.



- **Health/Indoor Environmental Quality:** Health impacts on residents, housing authority staff, and the construction workforce can be affected by design decisions, product selection, construction period impacts, and operational practices. Indoor, environmental air quality in public housing can be affected by construction best practices relative to:
 - Mold, dust, and moisture management.

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- Off-gassing or other exposure to chemical contaminants in construction materials, including but not limited to VOCs (volatile organic carbon compounds), phthalates, etc.
- Pest-related contamination and pest management methods.
- Pollutants inside and outside of the unit

CHARM

In September 2016, Governor Baker signed *Executive Order 569: Establishing an Integrated Climate Change Strategy for the Commonwealth*. Complementing the Global Warming Solutions Act, which is aimed at greenhouse gas emission reductions that cause climate change, EO 569 directs public agencies to provide leadership and protect public safety by reducing emissions from operations, planning and preparing for impending climate change, and enhancing the resilience of government facilities and other assets.

Since then, state agencies and authorities, as well as cities and towns, have begun taking steps to prepare for the impacts of climate change by assessing vulnerability and adopting strategies to increase the adaptive capacity and resiliency of building facilities and other infrastructure.

In 2018, DHCD initiated the Climate Hazard Adaptation and Resilience Masterplan (CHARM) project to:

- assess the state-funded public housing portfolio's risk and vulnerability to climate change impacts,
- provide a detailed climate change resilience opportunity assessment of selected pilot housing developments, and
- develop design guidelines for DHCD facilities to implement capital projects that incorporate climate adaptation and resilience best practices.

CHARM provided a unique opportunity for DHCD to assess climate risk to its building portfolio and to the LHA residents, develop resilience guidelines, and advance a strategic plan for implementation.

RISK AND VULNERABILITY ASSESSMENT

The Risk and Vulnerability Assessment (RVA) was developed for 1,347 developments based on the latest climate hazard data to identify which developments are most at risk for climate change impacts from extreme weather events such as drought, precipitation flooding, sea level rise and

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increased storm surge, and extreme temperatures. For more information on the assessment, see the Appendix at the end of the Introduction.

The developments' site and building components most at risk have been identified and tagged in the DHCD Capital Planning System (CPS), so that the information is readily available to housing authorities as they select and scope the projects in their capital plans.

Therefore, engineers and architects working with these design guidelines should be informed by the housing authority, the planning document and DHCD staff whether the subject property requires particular focus on climate adaptation and resiliency measures. The design team should also take the initiative to bring up issues and questions related to resiliency if they seem pertinent to the scope in the design process.

CLIMATE CHANGE IMPACTS

DHCD has summarized best available resilient design guidance for these four categories:



Precipitation Protection: The risk of flooding is increasing as the impacts of climate change lead to more frequent and intense rainfall events. Flooding often occurs beyond designated flood zones, due to the site design and to the aging or undersized, storm sewer infrastructure which is unable to carry stormwater during extreme rainfall events.



Sea Level Rise & Storm Surge exposes some housing authority developments to increased coastal flooding. Impacts will continue to worsen over time. Adapting buildings and sites to sea level rise and storm surge is often similar to adapting for the flooding risk from extreme rainfall, but in some locations may require more expansive interventions to mitigate risk.



Extreme Heat: As the climate warms, the number of days with extreme, high temperatures and high heat indexes (the combination of

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temperature and humidity) is increasing across Massachusetts. Some parts of the state will experience this trend more acutely, and some locations already experiencing the effects of urban heat island will have increased heat impact in both temperature and length of time high temperatures are experienced.



Emergency Preparedness: To help ensure staff and resident safety during extreme events, and to shelter in place during power outages and extreme weather when and where possible, these items recommend strategies for preparing housing authority developments. These recommendations will be used in tandem with new operational emergency preparedness planning guidance from DHCD.

FINIS

DHCD technical and sustainability staff welcome suggestions from designers on innovative approaches to this capital project work, especially those that accomplish climate resilience and sustainability objectives. And while the focus must always be on the scoped project and budget constraints, DHCD and housing authorities may be subject to special awards, and resiliency and sustainability initiatives that may augment the budgets with utility rebates, targeted grants, power purchase agreements, tax credits, or DHCD Sustainability funding.

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APPENDIX:

RISK AND VULNERABILITY ASSESSMENT





The risk and vulnerability assessment ranked developments based on:

- **Criticality** parameters that include a development's size and density, type of housing occupants per DHCD categories, ability to provide for sheltering in place, environmental impact, interdependencies with other community resources, and if a development had experienced evacuations in the past.
- **Exposure** parameters that indicate the development's susceptibility to selected climate-related events including primary climate hazards (flooding due to sea level rise and storm surge, flooding due to extreme precipitation, and extreme heat) and related climate hazards (severe winter storms, extreme wind, landslide, drought, wildfire). Exposure is based on information from historic climate events as well as projected climate-related impacts as made more extreme by climate change and projected for 2030 and 2070. Developments that score higher in exposure are the ones that reported having experienced climate-related impacts and/or that are at risk to future climate-related impacts by 2030; and
- **Adaptive capacity** parameters that characterize the development's ability to adapt and/or sustain itself and its residents during an extreme event. Developments with significant on-site infrastructure (e.g., generator, wastewater treatment, etc.) have a higher adaptive capacity score. A higher score means that residents may be able to maintain livable conditions in at least a portion of the development during hazardous weather or power outages without evacuating the site.

SUSTAINABILITY ISSUES MATRIX				
Energy Issues -- Energy Use, Conservation Features or Embedded Energy in Products; Reduced Transport Energy for Local Sourcing; Use renewable energy materials				
Recycling/Recyclability - Recycled Content and Post-Use Recycling Opportunities				
Water - Conserve a limited resource; reduce wastewater				
Health - Limit exposure of humans (Residents, Maintenance and Construction Workers) to toxic materials, pests and allergens; ensure indoor air quality; protect groundwater and soil				
CATEGORIES by GUIDELINE SECTION	ENERGY	RECYCLING	WATER	HEALTH
01 74 19 -- Waste Management	X	X		
02 41 00 -- Demolition		X		X
02 61 00 -- Contaminated Site Material Removal		X		X
02 65 50 -- Underground Storage Tank Removal				X
02 82 00 -- Asbestos Remediation				X
02 83 00 -- Lead Paint Remediation				X
03 30 00 -- Concrete	X	X		
04 20 00 -- Unit Masonry	X			
05 10 00 -- Structural Steel	X	X		
05 50 00 -- Miscellaneous and Ornamental Iron		X		
06 10 00 -- Rough Carpentry	X	X		X
06 20 00 -- Finish Carpentry	X			
06 61 00 -- Plastic Tub and Shower Panels		X		
06 65 00 -- Plastic and Composite Trim		X		
06 70 00 -- Plastic Structural Plastics and Composites		X		
07 07 00 --Solar Photovoltaic Systems	X			
07 10 00 -- Waterproofing and Dampproofing				
07 20 00 -- Building Insulation & Moisture Protection	X			X
07 20 001 --Attic Hatch & Insulation Tent	X			
07 20 002 -- Soffit Insulation Dam	X			
07 30 00 -- Asphalt Roof Shingles	X	X		
07 40 00 -- Siding	X	X		
07 45 00 -- Gutters and Downspouts	X			
07 50 00 -- Membrane Roofing	X			

07 62 00 -- Sheet Metal Trim & Flashing				
07 90 00 -- Sealants	X			
08 10 00 -- Doors and Frames	X			
08 40 00 -- Entrances and Storefronts	X			
08 50 00 -- Windows	X			
08 70 00 -- Hardware	X			
09 20 00 -- Gypsum		X		X
09 30 00 -- Tile				X
09 64 00 -- Wood Flooring	X	X		X
09 65 00 -- Resilient Flooring		X		
09 68 00 -- Carpeting	X	X		X
09 90 00 -- Painting		X		X
10 00 00 -- Specialties	X			
11 31 00 -- Residential Appliances	X			
12 30 00 -- Casework	X			
14 20 00 -- Elevators				
21 00 00 -- Fire Suppression --Sprinklers				
22 00 00 -- Plumbing	X		X	
23 00 00 -- Heating, Ventilating & Air Conditioning	X			
23 80 00 -- Air Source Heat Pumps	X			X
26 00 00 -- Electrical	X			
28 00 00 -- Electronic Safety & Security				
31 00 00 -- Earthwork				X
31 31 00 -- Soil Treatment				X
32 12 00 -- Asphalt Paving			X	
32 30 00 -- Site Improvements	X	X	X	
32 80 00 -- Site Irrigation			X	
32 90 00 -- Landscaping	X		X	
33 00 00 -- Site Utilities				
33 36 00 -- Septic Systems			X	X



CLIMATE RESILIENCE ISSUES MATRIX				
<p>Precipitation & Flooding Protection: Climate change is causing more frequent and intense rainfall events. Flooding is often occurring beyond designated flood zones, because of site conditions or aging or undersized storm sewer infrastructure.</p>				
<p>Sea Level Rise & Storm Surge (SLR&SS): Coastal flooding impacts will continue to worsen through this century. Adapting to sea level rise and storm surge is often similar to adapting to flood risk from extreme rainfall, but in some locations may require more expansive interventions to mitigate risk.</p>				
<p>Extreme Heat: The number of days with extreme high temperatures and increased risk from high heat index (the combination of temperature and humidity) will grow drastically as the climate changes. Measures for reducing extreme heat impacts at a site and building are recommended in the relevant sections of this guide.</p>				
<p>Emergency Preparedness: Resilient capital upgrades plus operational emergency preparedness planning are both needed to help ensure staff and resident safety during extreme events. These items address capacity to shelter in place during power outages and extreme weather.</p>				
CATEGORIES by GUIDELINE SECTION	Precipitation Flooding	SLR&SS Flooding	Extreme Heat	Emergency Preparedness
01 74 19 -- Waste Management				
02 41 00 -- Demolition				
02 61 00 -- Contaminated Site Material Removal				
02 65 50 -- Underground Storage Tank Removal				
02 82 00 -- Asbestos Remediation				
02 83 00 -- Lead Paint Remediation				
03 30 00 -- Concrete				
04 20 00 -- Unit Masonry	X	X		
05 10 00 -- Structural Steel				
05 50 00 -- Miscellaneous and Ornamental Iron				
06 10 00 -- Rough Carpentry	X	X		
06 20 00 -- Finish Carpentry	X	X		
06 61 00 -- Plastic Tub and Shower Panels				
06 65 00 -- Plastic and Composite Trim				
06 70 00 -- Plastic Structural Plastics and Composites				
07 07 00 --Solar Photovoltaic Systems				X
07 10 00 -- Waterproofing and Dampproofing	X	X		
07 20 00 -- Building Insulation & Moisture Protection	X	X	X	
07 20 001 --Attic Hatch & Insulation Tent				
07 20 002 -- Soffit Insulation Dam				
07 30 00 -- Asphalt Roof Shingles	X	X	X	
07 40 00 -- Siding	X	X	X	
07 45 00 -- Gutters and Downspouts	X			
07 50 00 -- Membrane Roofing	X	X	X	
07 62 00 -- Sheet Metal Trim & Flashing	X	X		

07 90 00 -- Sealants	X	X		
08 10 00 -- Doors and Frames	X	X		
08 40 00 -- Entrances and Storefronts	X	X		
08 50 00 -- Windows	X	X	X	
08 70 00 -- Hardware	X	X		
09 20 00 -- Gypsum	X	X		
09 30 00 -- Tile	X	X		
09 64 00 -- Wood Flooring	X	X		
09 65 00 -- Resilient Flooring	X	X		
09 68 00 -- Carpeting	X	X		
09 90 00 -- Painting	X	X		
10 00 00 -- Specialties				
11 31 00 -- Residential Appliances				
12 30 00 -- Casework				
14 20 00 -- Elevators	X	X		X
21 00 00 -- Fire Suppression --Sprinklers				X
22 00 00 -- Plumbing	X	X	X	
23 00 00 -- Heating, Ventilating & Air Conditioning		X	X	X
23 80 00 -- Air Source Heat Pumps	X	X	X	X
26 00 00 -- Electrical		X	X	X
28 00 00 -- Electronic Safety & Security				X
31 00 00 -- Earthwork				
31 31 00 -- Soil Treatment				
32 12 00 -- Asphalt Paving	X	X		
32 30 00 -- Site Improvements	X	X	X	
32 80 00 -- Site Irrigation				
32 90 00 -- Landscaping	X			
33 00 00 -- Site Utilities	X			X
33 36 00 -- Septic Systems	X			X