Data Documentation
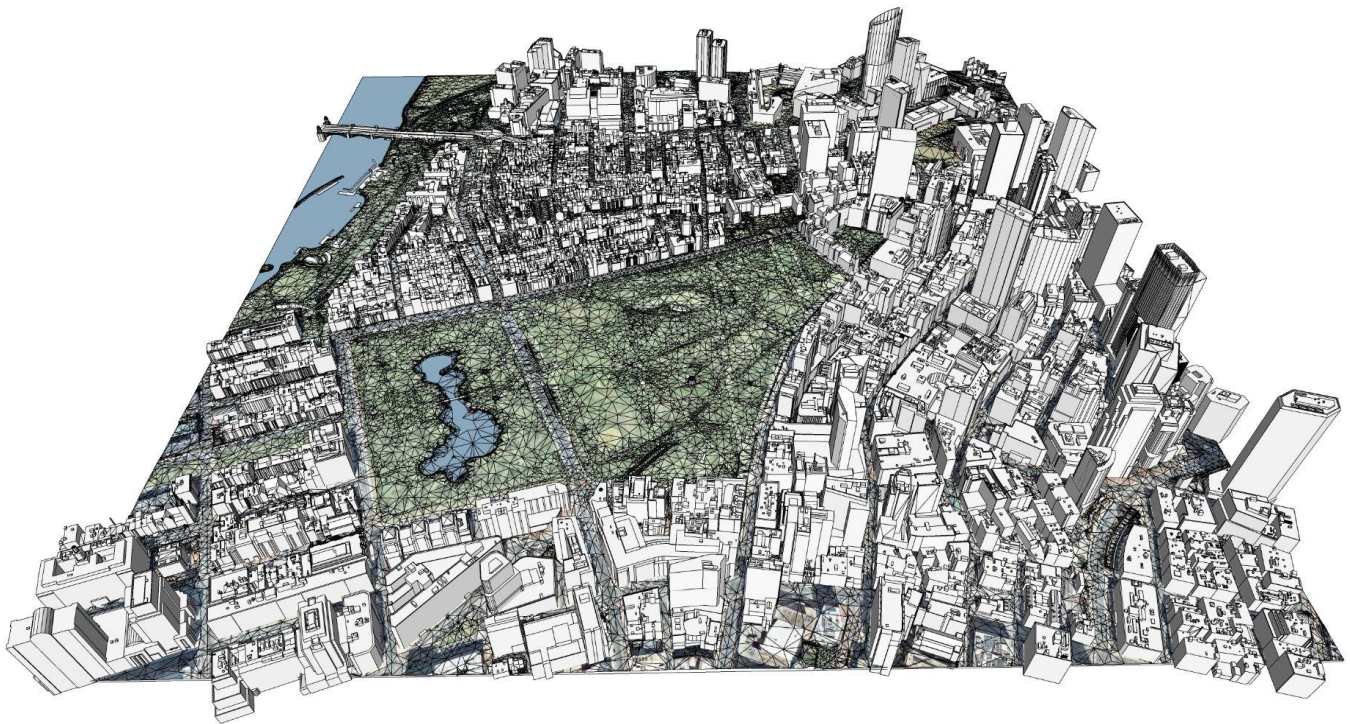
Boston Citywide 3D Model

boston planning & development agency

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Introduction

The Boston Planning and Development Agency (BPDA) maintains a virtual 3D model of the City of Boston as a resource of public information available for all to download. It is intended to aid 3D modelers, planners, and urban designers as a background context for 3D design software. The citywide 3D model is a snapshot of the City of Boston in 3D at a specified point in time. This downloadable city model is updated on a semiannual basis.

Available 3D Data Formats

The BPDA 3D model is constructed of several components: Terrain, Groundplan, and 3D models of buildings. Each of the city-model components is made available in open-source data formats, and as an all-in-one SketchUp format model that combines all of the components in one model per tile that can be imported into most 3D modeling applications.

All-In-One Sketchup SKP   **Terrain Mesh OBJ**   **Building Models OBJ**

Groundplan JPG   **Aerial Photo JPG**   **Vector Groundplan DXF**

Use the interactive **3D Data Download Map** on our website to find and download 3D data for different parts of Boston.

General Information

Tiling Strategy

The BPDA utilizes the [CitySchema](#) workspace to manage and update the virtual city model. It utilizes a tile grid as the framework to organize model collections, aerial photography, and terrain meshes. These modules seamlessly connect and can be layered with various tiled ground plan images.

Coordinate System - Metro Boston 3D

State Plane Massachusetts Mainland
Units: Feet
Horizontal Datum: North American Datum of 1983 (NAD 83)
Vertical Datum: North American Vertical Datum of 1988 (NAVD 88)

Offset and Origin

The Metro Boston 3D coordinate system places the origin to the South-West of Boston and neighboring cities. Preserving the insertion point and tile boundaries in models simplifies the transfer of geo-located models across different projects. The origin of the Metro Boston 3D coordinate system serves as the insertion point for models.

Origin Coordinates

X: 731,100 MA State Plane Feet
Y: 2,902,900 MA State Plane Feet
Longitude: 71.223391 W
Latitude: 42.213379 N
Elevation: 0
Earth Model: WGS84
Rotation to align with True North: Clockwise 0.34 Degrees

Obj Orientation

Many modeling tools treat the Y axis as vertical. Geographical coordinate systems use a Z-Up, Y-Forward orientation. If you experience mis-orientation when importing OBJ format models into your design projects,check the orientation options in your importer. The Z-Up orientation is sometimes obtained by rotating the model -90 degrees around the X axis.

1. All-In-One Sketchup Model (.skp)

File Name:

BOS_[Tile]_Sketchup_[IssueDate].skp

Last Update: 11/15/2023

Format: SketchUp 2015 (.skp)

Description: The SketchUp models combine all of the citywide model components into a single model per tile. They use a tag system to control what is visible. Each building model is grouped and named with unique identifiers referring to Boston's 3D Tiled Building Collections documentation.
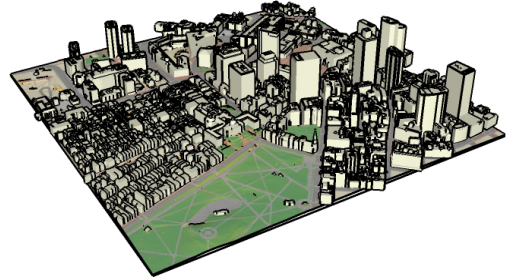
Sources: For information about sources, visit the metadata page for each of the components:
- [Terrain Mesh](#)
- [Aerial Photo](#)
- [Building Model Collection](#)

Coordinate System: [See General Information Page](#)

For more details and tips on the coordinate system, visit
https://www.cityschema.org/tile_scheme/index.htm

Offset and Origin: [See General Information Page](#)

Obj Orientation: [See General Information Page](#)

Usage Notes:

- The terrain looks better if you use the Window > Soften / Smooth Edges to soften coplanar edges within 50 Degrees.
- To skin the terrain with the 2021 Aerial photo or any other base map image clipped to the Metro Boston 3d tile scheme, use the Materials > Eyedropper to select the terrain material, then choose the desired ground planimage in the Edit tab.
- The tile frame included with each SketchUp model can be used to register models with neighboring tiles or with the city-wide tile grid. The elevation of the tile polygon is always 0.

Georeference:

To georeference your SketchUp model for interoperability with SketchUp's Geo-Location features, including export of properly located KMZ files:

- Load the SketchUp tile grid and see the latitude and longitude references for tile centers and corners.
- Choose a tile center or corner to be the origin point for your model. This works best for models that are just one or two tiles wide.
- Select all and click your chosen origin point with the Move tool
- Type [0,0,0] - which should appear in the Measurement Box (lower right corner of the SketchUp window.)Your model origin should now be at your chosen point.
- Click your origin point with the Rotate tool and begin a clockwise rotation. Then enter 1.3 (degrees) in the Measurement box. This orients your model to the local Universal Transverse Mercator grid, which SketchUpexpects.
- FInally, Go to Model Info > Geolocation and enter the latitude and longitude for your origin point.
- Test your geolocation by trying to add some imagery from File > GeoLocation > Add Imagery

2. Terrain Mesh (.obj)

File Name: BOS_[tile]_TerrainMesh_2011.obj

Last Update: 11/15/2023

Format: Wavefront Object (.obj)

Description: The tiled terrain models provide a precise reference for placing and visualizing 3d models. They can be used to represent the initial conditions for detailed design studies. These models also provide an accurate terrain reference for shadow and visibility studies.
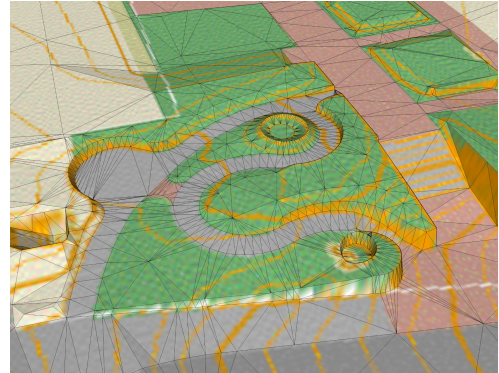
Sources:
- Boston terrain observed April 2011
- Outside Boston, terrain represented with MassGIS 2005 DTM

Coordinate System: See General Information Page

For more details and tips on the coordinate system, visit
https://www.cityschema.org/tile_scheme/index.htm

Offset and Origin: See General Information Page

Obj Orientation: See General Information Page

3. Building Model Collection (.obj)

File Name: BOS_[Tile Name]_BldgModels_OBJ.zip

Last Update: 9/27/2023

Formats: Wavefront Object (.obj), Comma Delimited (.txt), GeoJSON

Description: Our open-format model collection is a compressed archive of individual OBJ building models located within the tile area. The Wavefront OBJ file type is an open source file type ideal for sharing and archiving 3D models.

Finding Models in the Collection: Each tile's model collection consists of a zipped folder of obj files that are named with the unique model identifier.
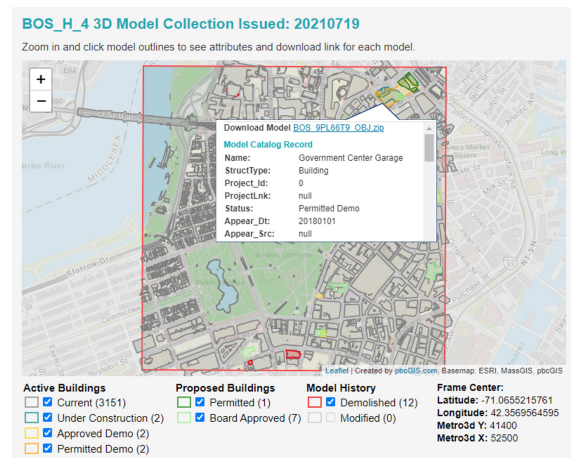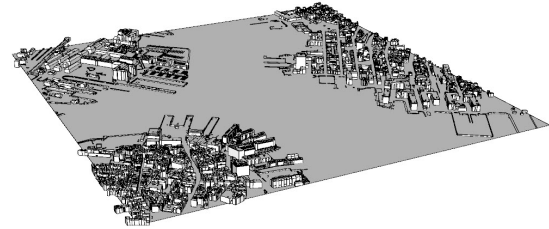
The **ModelFinder.htm** file is a simple html reference tool intended to be used in the browser to search for models within a tile. It is a Javascript / Leaflet application that presents a clickable model index map that sorts models according to their current, proposed or historical status. Clicking a model on the map opens a pop-up with a table of that model's attributes and a link to the model file in the collection.

The included **catalog.csv** file is a reference table for the collection of model files in the **objz** folder. The [Data Dictionary](#) explains the attributes of this table and how they are used to classify the models.

Sources: Models come from a variety of sources and methodologies and dates. The provenance of each model is recorded in its catalog attributes: **Model Credit**, **Model_Date**, **Survey Source, Survey Date** explained in more detail in the data dictionary, below.

Coordinate System: See General Information Page

For more details and tips on the coordinate system, visit
https://www.cityschema.org/tile_scheme/index.htm

Offset and Origin: See General Information Page

Obj Orientation: See General Information Page

Data Dictionary for Model Collection

The Bos3d City Model Collection is organized according to the CitySchema Data Dictionary. This model management schema provides a system of attributes that can be used to understand the provenance of models and track them through their life-cycle. The Model Catalog is a single table with a reference for each model in the structure model collection. The model catalog can be found in each collection as the **catalog.csv** file.

General Attributes

These attributes are used to determine whether or how the model should appear in various scenarios involving the time period, or planning context. These are the attributes most often used for controlling the styling of models and the attributes most frequently updated in the model management workflows.

Name Text	The name of the structure. This may be the name of an existing or proposed structure or this could be the address taken from the parcel intersected by a model's centroid.
Status Text	A phase in the life cycle for proposed, built, demolished or renovated structures. Values of Status are taken from the Status_Code domain (see below)
Appear_Dt Date	Date of the latest observation or document that confirms the current value of Status. The Appear date should refer to the same document referred to in the Appear Source fields.
AppearSrc Text	The observation or document that confirms the Appear_Dt.
Disapp_Dt Date	When the structure was demolished. Usually the date of the earliest observation that confirms that a structure has been demolished or substantially renovated.

DisappSrc Text	A reference to the document that established the Dissap_Dt. The Disappear Date should refer to the same document referred to in the Disappear Source fields.

Provenance Attributes

Information for understanding the provenance of models as documents that have authors, contributors, sources and issue dates.

Model_ID Text	A unique ID for each model. The ID is a random arrangement of seven upper-case letters and numerals prefixed with "BOS_". This is the name of the .obj model in the model collection.
Model_Cred Text	Reference to the person or enterprise responsible for creating the model.
ModelBatch Text	A folder within the Archive/ModelWork folder where the original source file can be found.
Model_File Text	Name of the original source file for the model.
ModelStore Text	Name of the model store holding the open-format model in the Archive Repository. The value of this field is normally set automatically when producing Geodatabase andModelStore snapshots of the collection. The ModelStore string is combined with Model_ID to create path references and URL end-points for open-format models.
Model_Dt Date	Date when the model was created. This value should reflect the date that the model was enrolled in the collection. In the case of modified models, it should reflect the date that the modified model was enrolled. This field will be used to discover updated models.
ModelNote Text	This is the text that would appear as the description of the model. This note might describe the context of the model's creation. This note might also reflect technical aspects of the model, for example, if the model has been modified.
Model_LOD Double	Levels of Detail
Survey_Src Text	The observations that were used for establishing the shape of the model. Should describe the responsible party and the methodology where possible.

Survey_Dt Date	The date that the model geometry was captured or published.

Geometric & Reference Attributes

These attributes describe the geometric positioning of the model and how it is referenced in other geographic databases: parcels, tile grid, Google Maps, etc.

Centr_Lat Double	Latitude of the model centroid (2D) in decimal degrees.
Centr_Lon Double	Longitude of the model Centroid (2D) in decimal degrees.
Centr_X_Ft Double	X coordinate (Feet) of the model centroid in the Metro Boston 3D coordinate system.
Centr_Y_Ft Double	Y coordinate (Feet). See above.
Min_El_Ft Double	The lowest elevation of the model. This may be below ground.
Max_El_Ft Double	Elevation of the highest point of the model.
Gnd_El_Ft Double	The elevation where the model intersects the ground. This measure uses vertices of the 2D footprint to sample elevations.
Height_Ft Double	The relative height from the Max Elevation of the model to the lowest corner.
Tile_ID Text	ID for the tile that the model centroid falls within.
Parcel_ID Text	The Parcel ID for the parcel that falls under the centroid of the model's footprint.
Parcel_Lnk Text	A url that opens the Assessor's web map centered on the parcel that is identified by theParcel_ID.

GoogleLnk Text	A url that brings up an oblique view of the building in Google Streetmap.
NearMapLnk Text	A hyperlink that brings up an oblique view of the building in NearMap. Requires aNearMap login.

Project Attributes

Attributes for models that are in the development process, either approved or under construction.

Project_ID Text	The Project ID in the BPDA's Article 80 Development log.
ProjectLnk Text	A URL linking model to the project's landing page on the BPDA website if applicable.
A80Status Text	The latest status associated with the project in the Article 80 Development Log.
Plan Text	For models associated with proposed or internal studies, the name of the overall plan that may cover multiple buildings, phases or scenarios.
Scenario Text	For models that are part of alternative scenarios within a plan. The value for Scenario can be used to identify or select all of the models associated with an alternative scenario.
Phase Text	For models within a plan or scenario that are contingent on time and/or grouped by geography.
LegClass Text	This field provides flexibility of controlling symbolization of models for webscenes and other cartographic products.

Structure Attributes

These are attributes that refer to the real-world or proposed structure/s represented by the model.

Struct_ID Text	If there is a table about structures, this would be a reference to the primary key of that table.
Struct_Type Text	Type of structure. See domain values. Refers mostly to the physical aspect of the structure. Must have one of the following values: Building, Bridge, Wall
Struct_Use Text	Use of the structure. More specific than Type. Refers to the functional aspect of the structure. Examples: School, Library, Civic, Residential, Commercial, Subway Headhouse, BusShelter
Struct_Lnk Text	A URL that provides more information about the structure. For example, a Wikipedia page or a library branch page.

Edit Tracking Attributes

These fields are automatically assigned during the management of the model to help track edits.

RecInitDt Date	The time stamp for the creation of the table row. This defaults to the time that the feature class was issued. Automatically generated.
RecInitUsr Text	The username for the person who initialized the row. Automatically generated.
RecModDt Date	The time stamp for the last modification of the table row. Automatically generated.
RecModUsr Text	The username for the person who last modified the row. Automatically generated.
Editor Text	The user name for the person who did the last meaningful change to this record.

Edit_Dt Date	The timestamp of the last deliberate edit.
Edit_Action Text	Explanation of the last deliberate edit.
QA_Flag Text	Short code used to redirect models to procedures in the model management process. Pre-coded domain consisting of: 3D Edit, Promote Status, Demote Status, Stop, Alt
QA_Issue Text	Use this field to explain any issues with the model or catalog information that may need addressing in the model management process.

Model Status Dictionary

The Model Collection is organized into Model Status Classes. Individual structure models are sorted into these classes according to the value of their Status attribute. Changing the Status will cause these models to be sorted into a new Feature Class when the database is updated.

Feature Class

The category of model according to their Status value. This allows models to be filtered and displayed according to their physical existence in the real world.

Feature Class	Description
Existing_MP	Comprised of structures that are currently in existence whose models are measured with photogrammetry or LiDAR and drawn according to those measurements. Status: Existing, Approved Demo
History_MP	Holds models reflecting the shapes of structures that once existed. Status: History
Approved_MP	Holds hand-made models reflecting projects under development. These models are shared with the public having Status: Approved, Under Construction, Current

Model Status

A category scheme that reflects the life-cycle state of the building or proposal that the model represents. This field controls when the model is rendered in applications. The GIS-Based model management applications use Model Status to segment the collection into feature classes that streamline applications that may be focused on the current, proposed or historic views.

Status	Feature Class	Description
Current	Existing_MP	This status is for models of existing structures that are based on measurements.
Approved Demo	Existing_MP	A structure that overlaps with a model that has status Approved.The Approved Demo status is used to hide a model when portraying Approved projects. The building still exists according to the latest observation. This observation can be recorded using theDisappear Source attribute.
History	History_MP	A measured model that has been replaced by a newer model in the Existing_MP feature class or by models in Approved_MP that have been promoted to Under Construction or Complete. History status may be applied to models of clumps of structures where a new model is replacing part of the historical model. In these cases, the entire old model is historical. Such a model may be flagged for splitting (QA_Flag = 3dEdit) to be divided to create a pocket for the new model. The original model (the entire clump of structures) has status History. The remaining part(s) of the model will be kept in the existing collection with status Current.
Board Approved	Approved_MP	The building project has been approved by the planning board.
Complete	Approved_MP	Hand-made models of proposals. The shell of the building including external finishes appear to be complete. These models remain in the Existing feature class until they are replaced with measured models. This status is used only for hand-made models of proposed projects.

Under Construction	Approved_MP	The foundation (or more) of the new building is visible.

Guidelines for 3D Model Structure and Level of Detail

The architecture of this schema is well suited to handling mesh objects that represent only the exterior shell of the structure. It is preferable that the mesh be a closed "solid" that has all of its faces oriented toward to outside. Within this guideline, there are many possibilities for levels of detail as listed in the table below.

- Models that are not closed or include two-dimensional planes with single faces are problematic and can behave unpredictably with regard to shading, importing, and exporting.
- We are unable to publish models that incorporate textures or materials at this time. We may be able to represent these as multipatches, but the textures or materials will be stripped when the models are exported to SketchUp or OBJ.
- Level of detail (LOD) 3 is preferred. If models of building shells may be divided when building parts have distinct functions, like parking structures. Or when parts have different construction dates.
- Models of LOD 4 or greater require a lot of work to assimilate and may be impossible to clean up to the point of working within the citywide 3D model.

3D Model Levels of Detail

These levels of detail are compatible with the CityGML LOD scheme but are subdivided according to the types of rough massing models that we commonly see shared by architects and other 3D modelers.

Code	Description
LOD 0	Polygon Footprint
LOD 1	Extruded Polygon Footprint
LOD 1.5	Massing model made from extruded roof prints when a structure with parts that have different heights.

|	
LOD 2	3D roof detail, extruded to the ground along drip-line.
LOD 2	Model portrays undercuts where appropriate. E.g. entryways, porticos or arcades.
LOD 3.25	Architectural details indicated by materials or image textures.
LOD 3.5	Building model expresses the location of windows and entryways as 3D indentations.
LOD 4	Model is divided horizontally as individual stories.
LOD 4.5	Model divides interior spaces: rooms or zones.

4. Groundplan (.jpg)

File Name: BOS_[tile]_Groundplan_2011.jpg

Last Update: 11/15/2023

Format: JPEG

Description: The 2011 Base map layer provides a reference map showing saved and planted areas, street names, pavement markings.In all, 20 layers from the Boston GIS were graphically ordered and styled and then clipped to each tile boundary.The original layers were developed from stereophotogrammetric methods, with a precision of about six inches. Areas outside the Boston city Limit are filled in with base map data courtesy of MassGIS. The cell size is one foot per pixel.
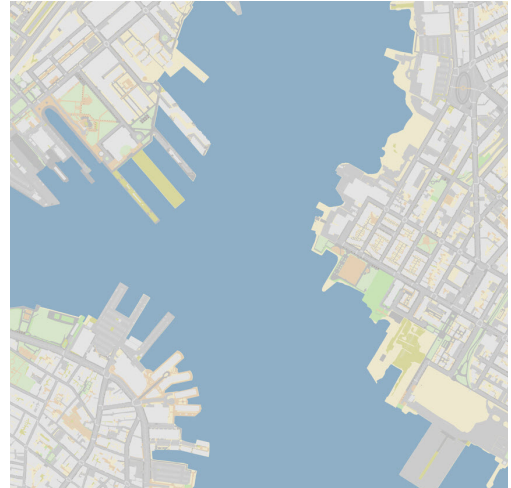
Coordinate System: See General Information Page

For more details and tips on the coordinate system, visit
https://www.cityschema.org/tile_scheme/index.htm

Offset and Origin: See General Information Page

Usage Notes: These images have extents that align precisely with the tile boundaries of the Metro Boston 3D Tile Grid. This allows them to be easily and precisely registered for draping on tiled terrain and SketchUp models.

5. Aerial Photo (.jpg)

File Name: BOS_[Tile]_Orthophoto_2023.jpg

Last Update: 5/25/2023

Format: JPEG

Description: The tiled aerial photo layer is a true color, true-ortho rectified aerial photo with a pixel resolution of one foot per pixel.

Source: Nearmap 2023

Coordinate System: See General Information Page

For more details and tips on the coordinate system, visit https://www.cityschema.org/tile_scheme/index.htm

Offset and Origin: See General Information Page

6. Vector Groundplan (.dxf)

File Name: BOS_[Tile]_Groundplan_DXF.dxf

Last Update: 11/15/2023

Format: Autodesk Drawing Exchange Format r.14 (.dxf)

Description: Vector information from several GIS layers has been exported to DXF format for the convenience of users of design tools including autoCAD, Rhino or Adobe Illustrator.They can be used as a location reference, source layers for modifiable ground plan linework, digital terrain models and extrudable building footprints.
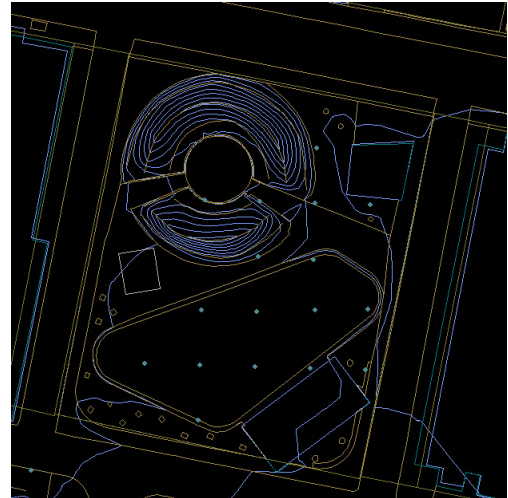
- Planimetric Groundplan Layers - edge of pavement, shorelines, etc. (Infotech, 2011)
- Digital Terrain Model Breaklines and Masspoints (Infotech, 2011; MassGIS, 2005)
- One-foot Contours (Elevated) (Infotech, 2011)
- Building Model Footprints (BPDA 3D Model, September 2023)
- Openspace Boundaries (MassGIS, 2023)
- Property Parcels (Boston Assessing, 2023)

Coordinate System: See General Information Page

For more details and tips on the coordinate system, visit
https://www.cityschema.org/tile_scheme/index.htm

Offset and Origin: See General Information Page

Usage Notes: Be sure to specify units of Feet when importing DXF layers related to the Boston 3D model.