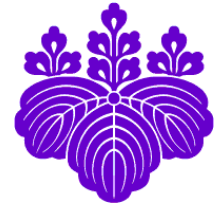


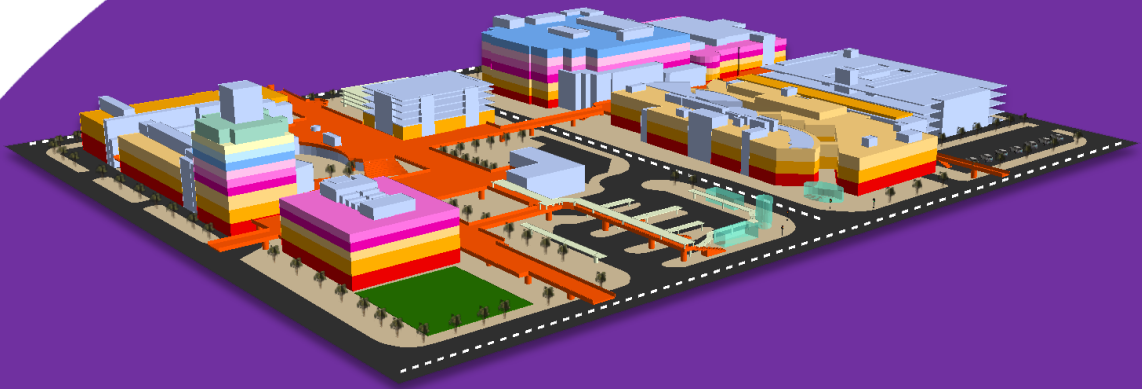


SIS

DIVISION OF SPATIAL INFORMATION SCIENCE
UNIVERSITY OF TSUKUBA



How to Construct Urban Three Dimensional GIS Model based on ArcView 3D Analysis



Ko Ko Lwin

Division of Spatial Information Science
Graduate School of Life and Environmental Sciences
University of Tsukuba

Level: Intermediate (Require 2D GIS and digitizing knowledge)

Preface

Visualization of three dimensional urban area is required for effective urban development planning, utility management, public facility management and environmental impacts studies. The ArcView 3D Analyst extension enables users to create, analyze, and display surface data along with other GIS dataset such as census, land use, transportation, vegetation, etc. Although ArcGIS supports 3D solid model, ArcGIS was extensively used in GIS analyses and other scientific purposes. In this tutorial, we will explain how to construct urban three dimensional GIS model based on ArcView 3D Analysis extension. Before digging this tutorial, I assumed that you have already experienced in two dimensional GIS and digitizing knowledge. This tutorial does not cover digitizing and database designing in 2D GIS. However, if you have experience in digitizing and database designing, you can explore each map layer in this tutorial and then you will understand how to create map layers for 3D rendering.

Enjoy!

Ko Ko Lwin

Division of Spatial Information Science
University of Tsukuba



Contents

1. Download Tutorial Data
2. Components of 3D GIS Model
3. Map Layers Creation
4. Construction of Urban 3D GIS Model

1. Download Tutorial Data

Download tutorial data from following URL.

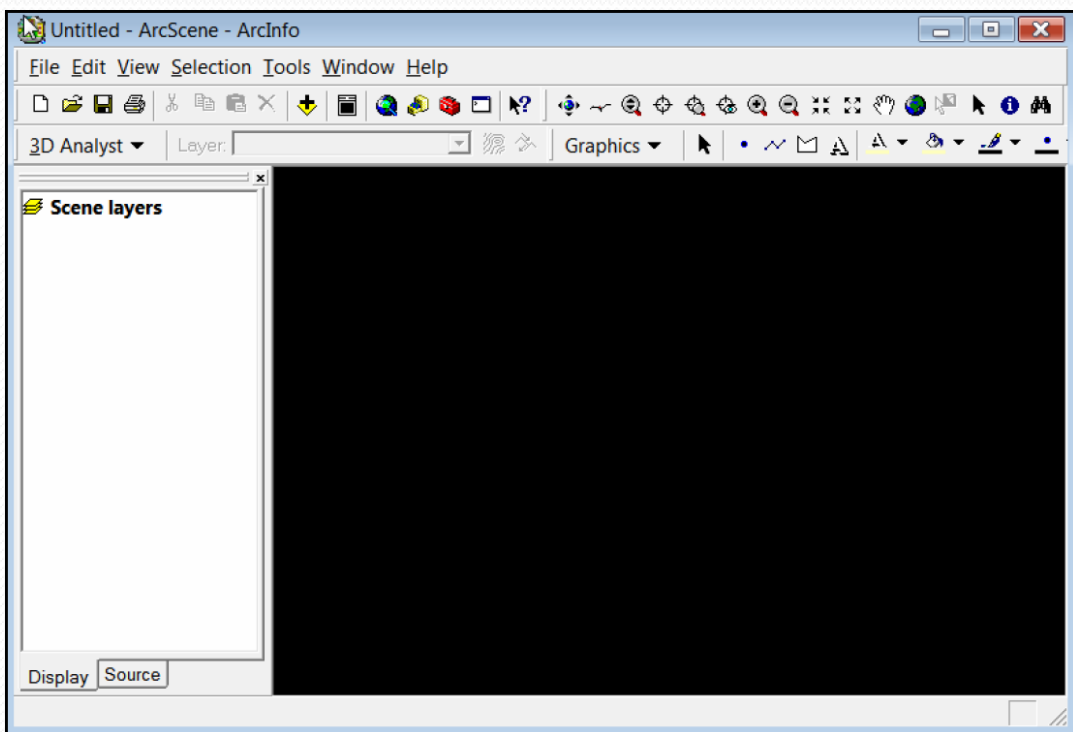
<http://giswin.geo.tsukuba.ac.jp/sis/tutorial/koko/3dgis/3dgisTutorial.pdf>

Unzip into your local disk (C or D)

e.g. D:\3D-URBAN

Start ArcScene

Start > All Programs > ArcGIS > ArcScene



2. Components of 3D GIS Model

Data requirement for 3D GIS model:

Essential

Every 3D GIS model requires surface elevation data which can be acquired from many remote sensing data sources such as SRTM (Shuttle Radar Topography Mission), LIDAR (Light Detection and Ranging) Elevation Data and so on.

Following URLs are free resources of digital elevation data for worldwide coverage.

GEOTOPO

http://eros.usgs.gov/#/Find_Data/Products_and_Data_Available/gtopo30_info

SRTM

<http://srtm.csi.cgiar.org/>

Optional

Depend on your interesting in detailed level of topographical features, additional optical images (satellite or aerial images) or fine scale GIS data (building footprints and other landscape features) are required to drape on surface elevation model.



Aerial photo + 10m DEM

Example of medium scale 3D GIS model

3. Map Layers Creation

In this tutorial we used following map layers to construct urban 3D GIS Model.

Map layer name	Layer order	Feature type
Platform	1	Polygon
Park	2	Polygon
Road	3	Polygon
Road center line	4	Line
Buildings	5	Polygon
GlassBuildings	6	Polygon
Bridges	7	Polygon
Roofs	8	Polygon
Trees	9	Point
Cars	10	Point
Traffic lights	11	Point


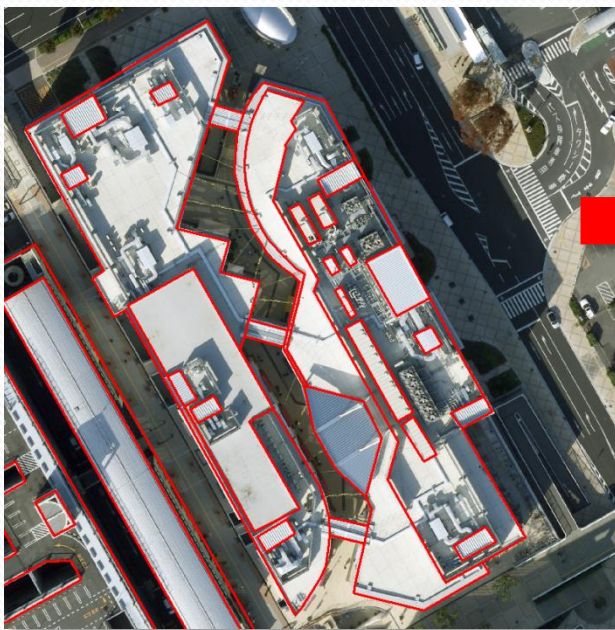
Note: 1 is lowest (bottom) and 11 is highest (top). See below.

3. Map Layers Creation

How to create map layers?

These map layers are digitized on high resolution aerial image (spatial resolution is 8cm) and height information is extracted from DSM (Digital Surface Model) generated by LIDAR (Light Detection and Ranging). LIDAR (Light Detection and Ranging) is an optical remote sensing technology that measures properties of scattered light to find range and/or other information of a distant target.

Digitizing and Database Designing (In brief)



Attributes of Building

FID	Shape *	Elevation	Height	FLOOR
19	Polygon	0	19.2756	0
20	Polygon	0	17.865601	0
21	Polygon	0	14.1986	0
22	Polygon	0	18.340401	0
23	Polygon	0	18.030701	0
24	Polygon	0	17.817499	0
25	Polygon	0	17.5924	0
26	Polygon	0	19.476101	0
27	Polygon	0	19.5522	0
28	Polygon	0	17.448799	0
29	Polygon	0	18.2117	0
30	Polygon	0	18.243	0
31	Polygon	0	22.874701	0
32	Polygon	0	23.1973	0
33	Polygon	0	5	1
34	Polygon	0	5	1
35	Polygon	0	20.409901	0

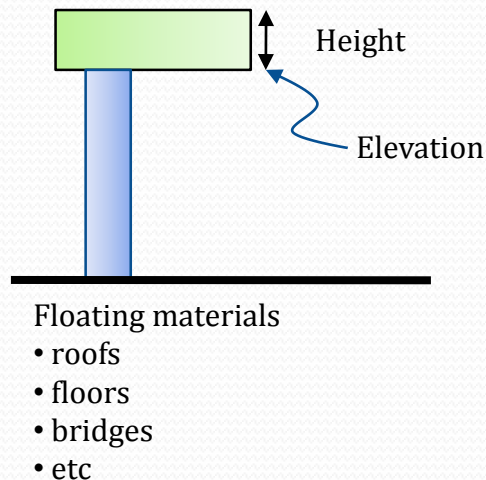
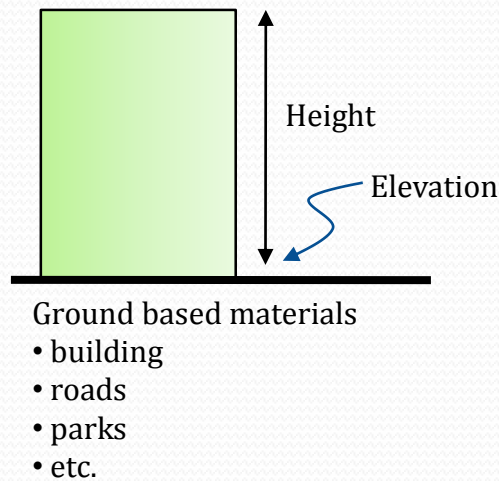
Record: 14 | 0 | Show: All | select

Example in Building map layer digitizing and database designing.

3. Map Layers Creation

Elevation and Height

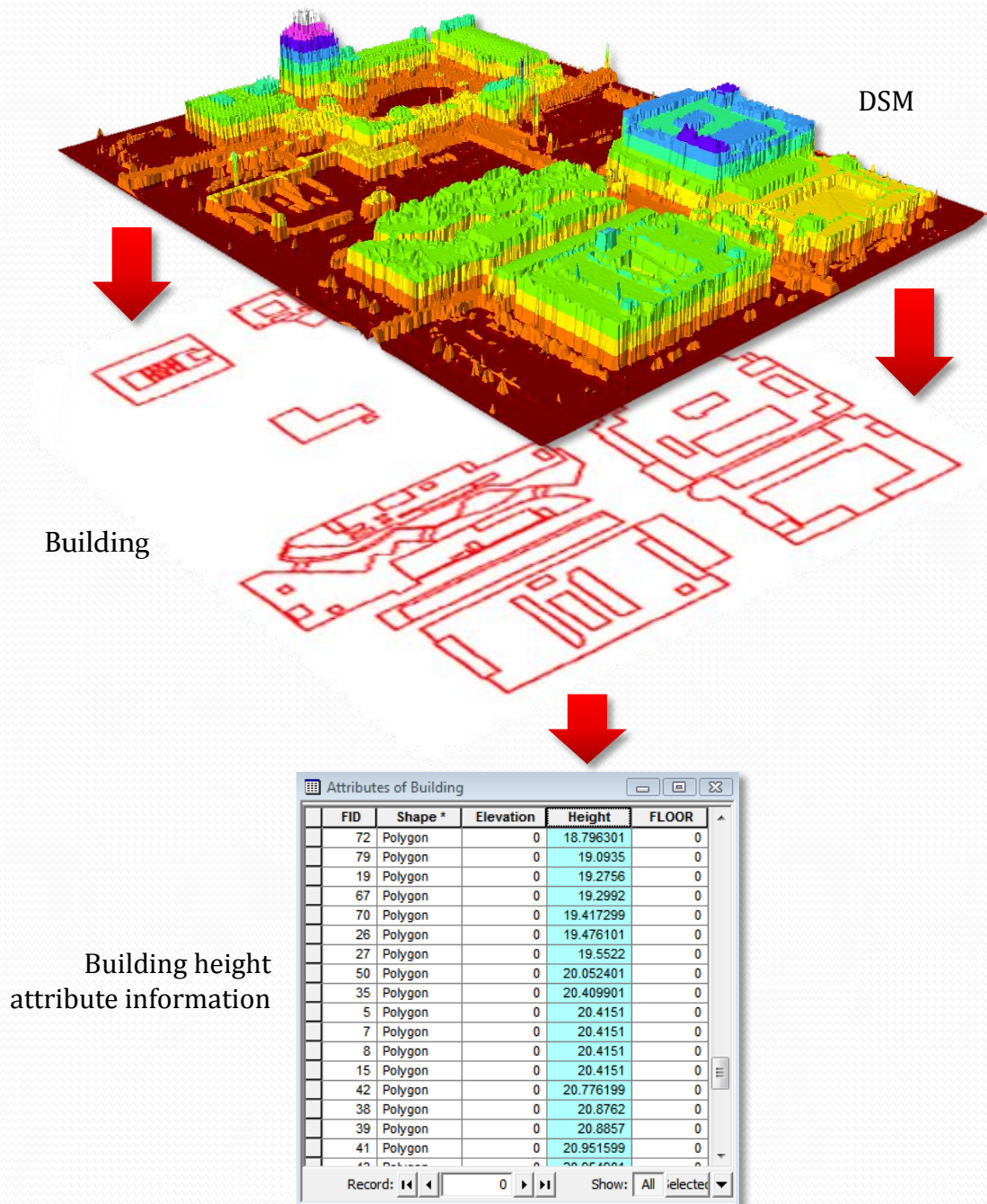
Each map layer requires two attribute fields, Elevation and Height for 3 dimensional rendering



3. Map Layers Creation

Height information extracted from DSM

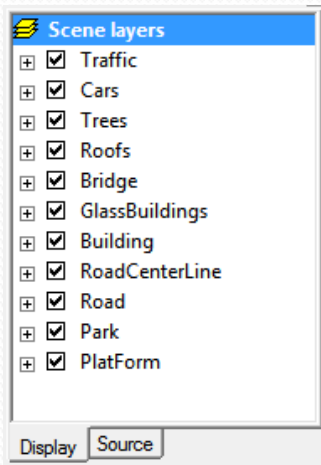
In this tutorial, we generated building height attribute information from DSM (Digital Surface Model) LIDAR data.



4. Construction of Urban 3D GIS Model

Add all map layers into ArcScene

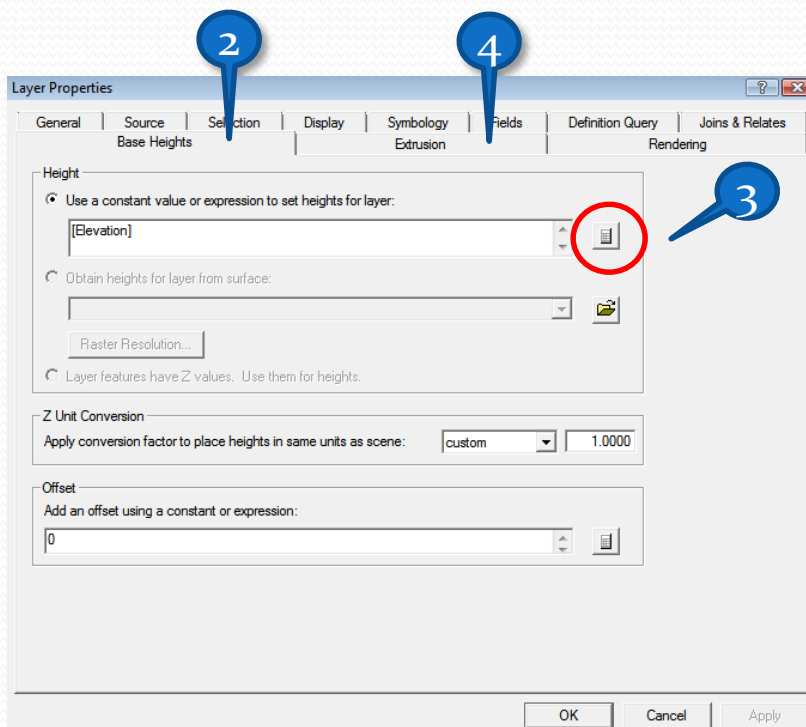
Add all map layers into ArcScene by following order.



How to change map layer 3D properties?

1. Right click on map layer and select properties.
2. Click on Base Height Tab.
3. Click on Table icon and browse Elevation field.
4. Click on Extrusion Tab.
5. Browse Height attribute field.

Do each map layer same as above.

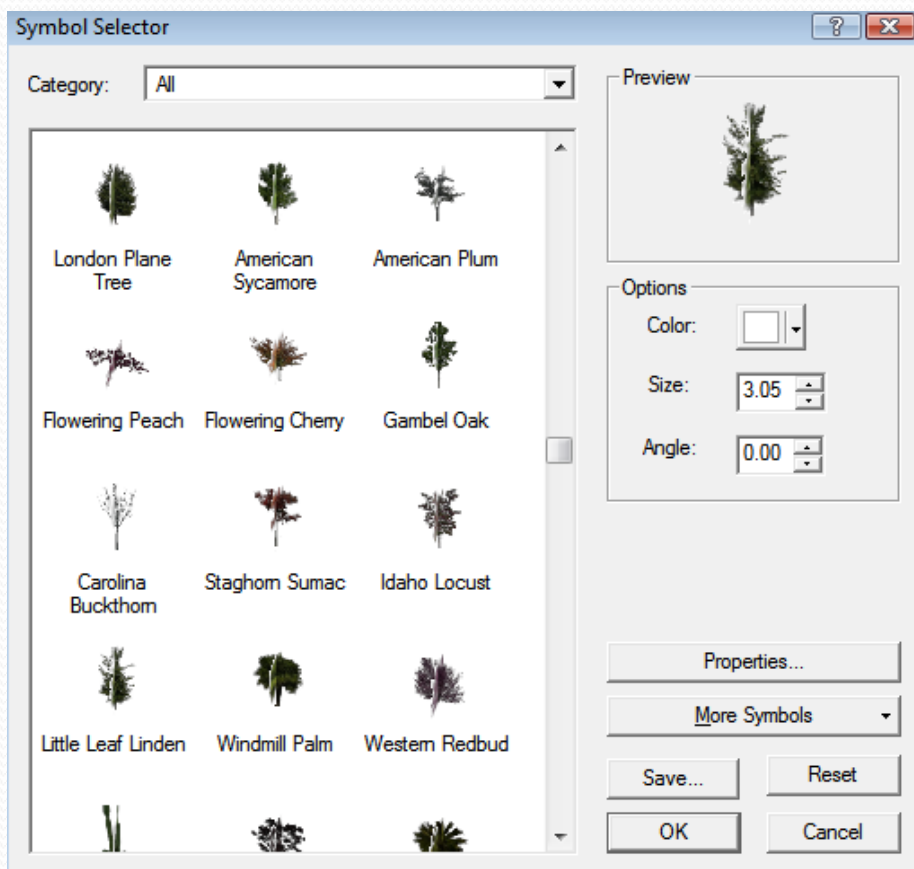
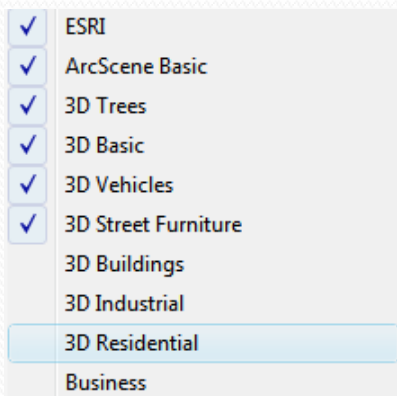


4. Construction of Urban 3D GIS Model

Using ArcGIS Built-in Symbols

For point features, you can use ArcGIS built-in 3D symbols such as trees, cars, traffic signs, chairs, etc.

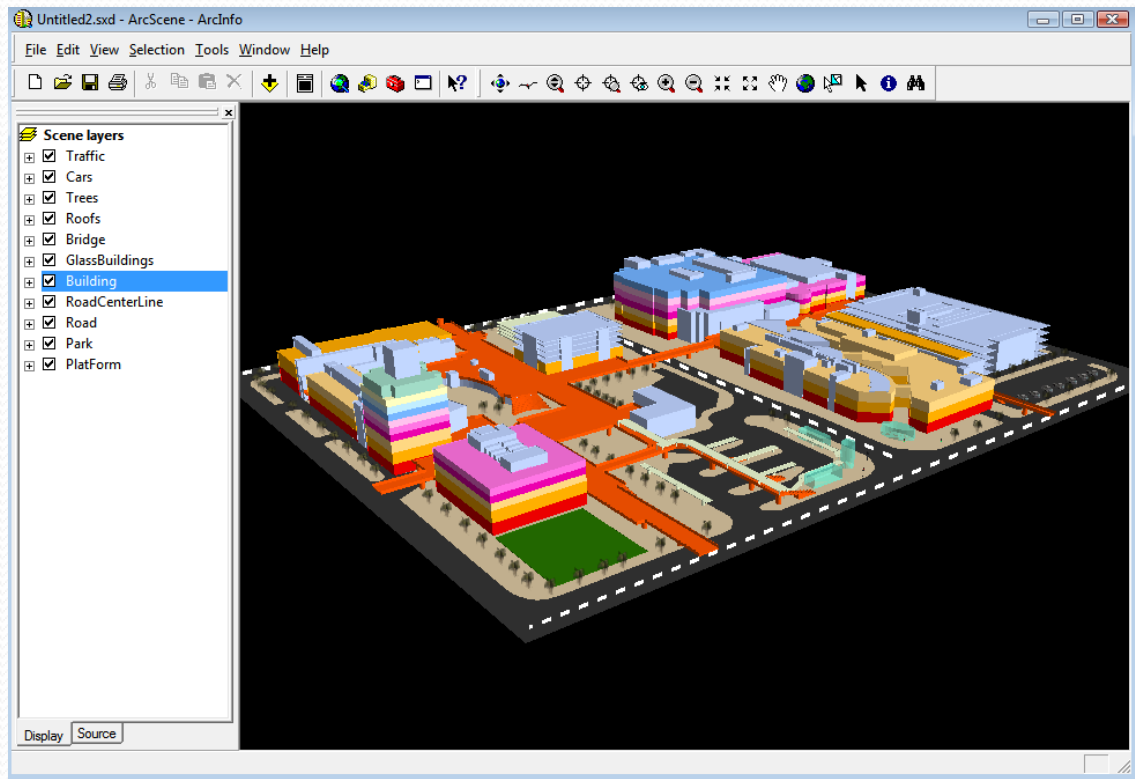
Click More Symbols, Select 3D Trees or etc.



Choose your favorite trees and cars and change their size, angle, etc.

4. Construction of Urban 3D GIS Model

Change color and transparency for each layer as you wish.



Navigate your 3D Scene

Moving, panning and rotating

Reset or zoom all layers



Using mouse

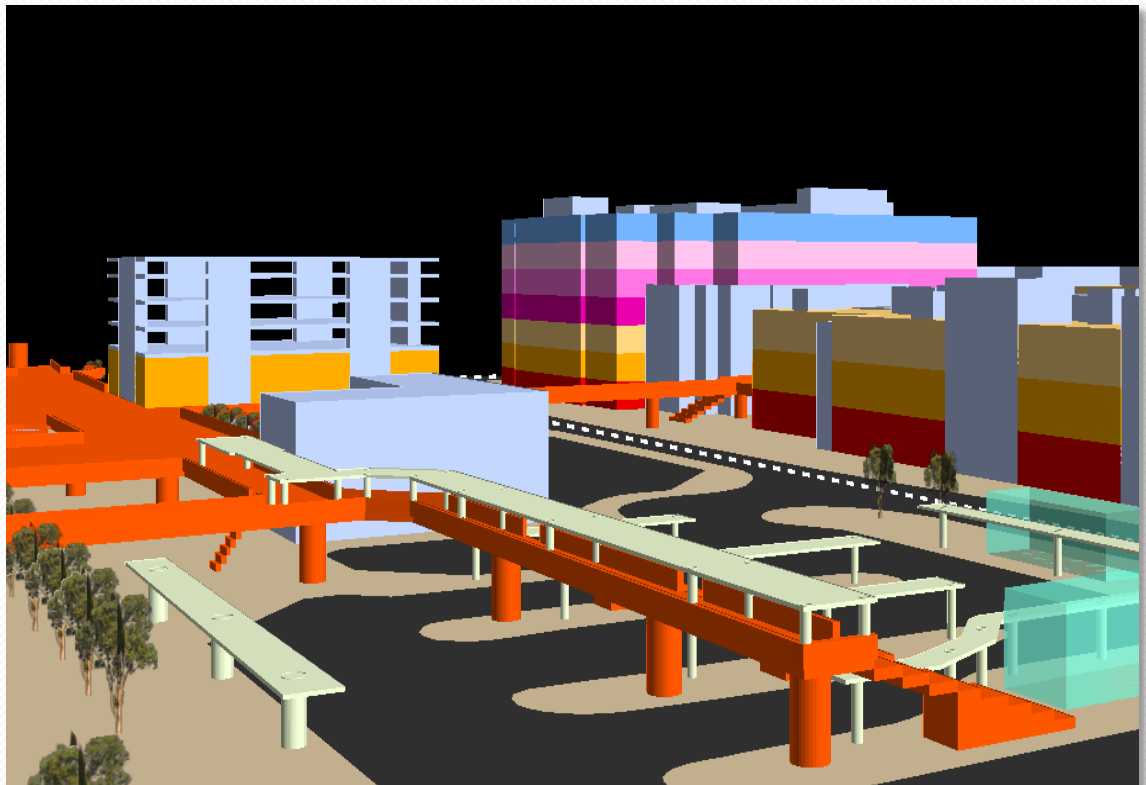
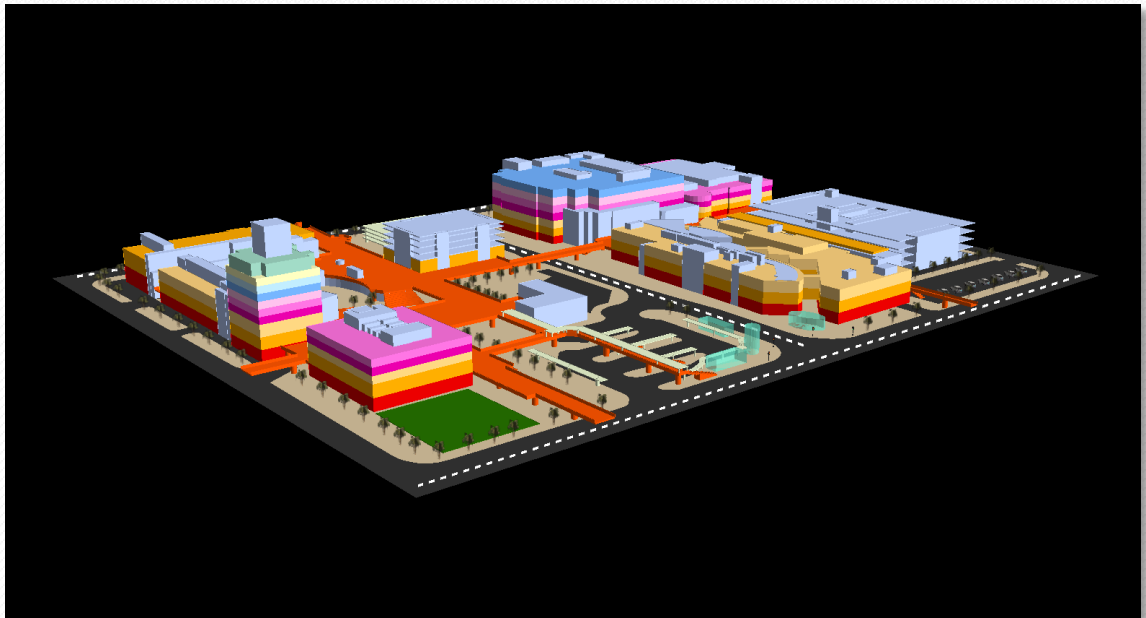
Zoom in: Mouse wheel up

Zoom out: Mouse wheel down

Panning: Click and hold both right and left buttons

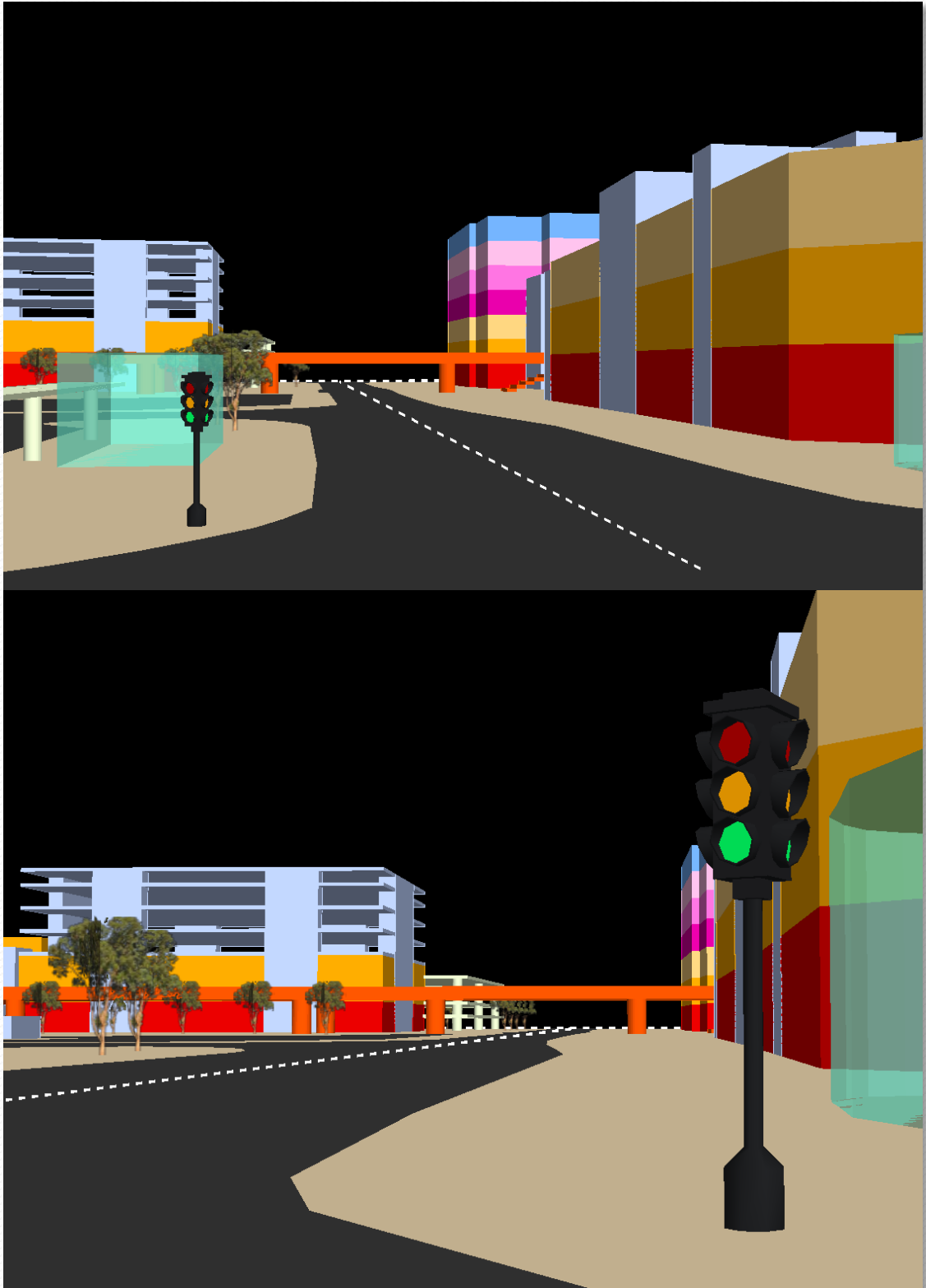
4. Construction of Urban 3D GIS Model

Moving and walking around the city



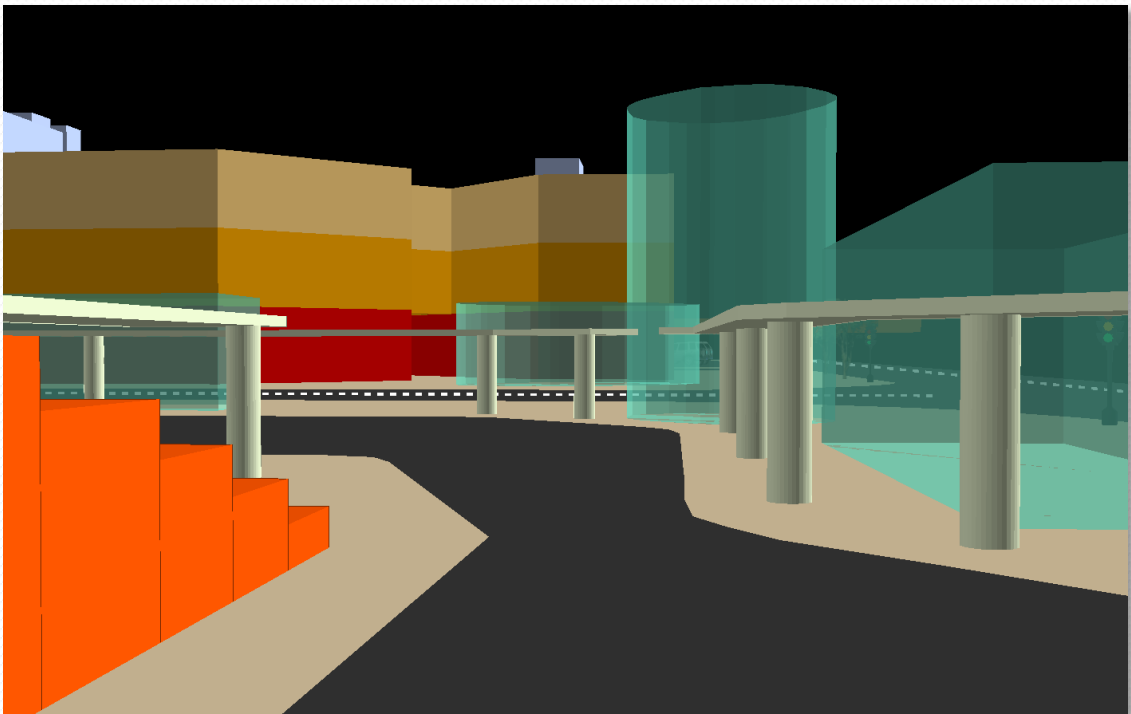
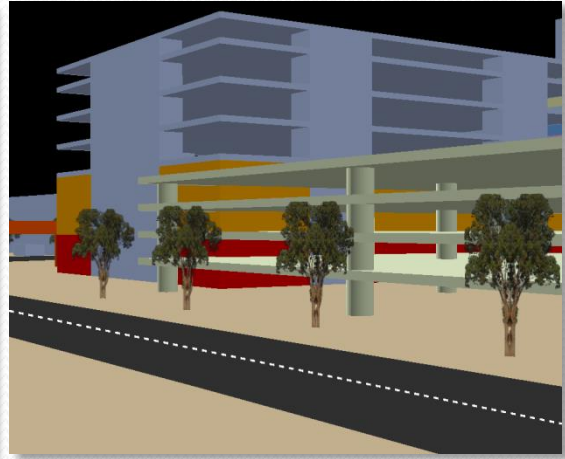
4. Construction of Urban 3D GIS Model

Moving and walking around the city



4. Construction of Urban 3D GIS Model

Moving and walking around the city



..... End of document

Division of Spatial Information Science,
Graduate School of Life and Environmental Sciences,
University of Tsukuba
1-1-1 Tennodai, Tsukuba, Ibaraki 305-8572 [Japan](#).