3D CITY CARTOGRAPHIC MODELS

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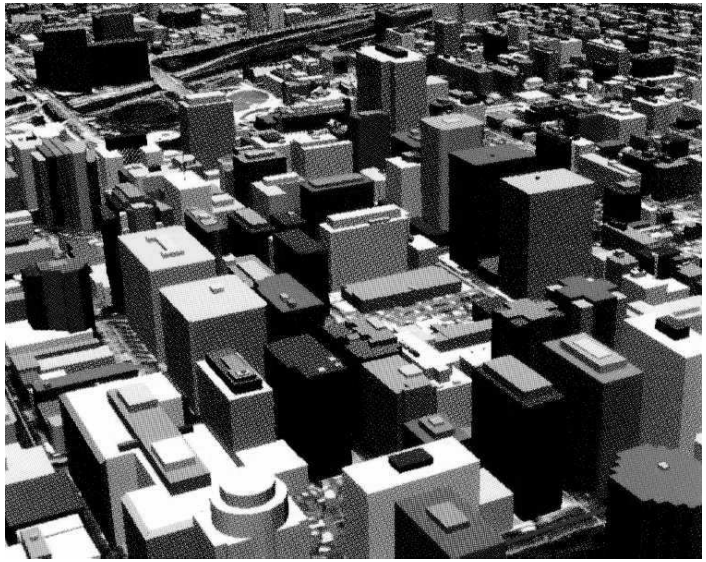
IN BRIEF

- Users of 3D maps
- 3D map – definition and content (main, secondary and additional cont.)
- "From Paper to Virtual Map" – a cheap technology for easy creation of 3D maps
- 3D cartographic symbol system
- Animation of 3D maps

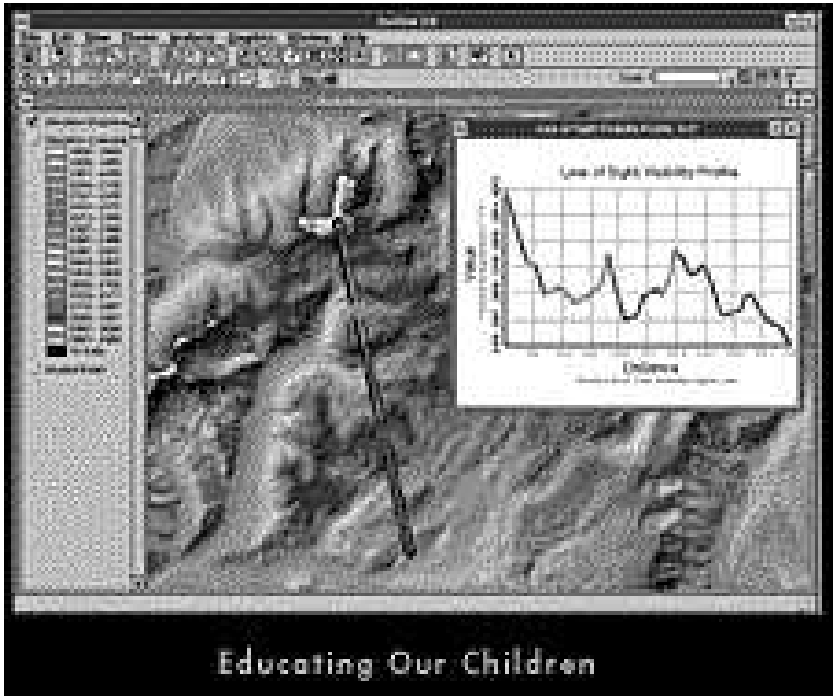


3D maps – USERS

- City planning and architecture

3D modelling of a part of Varna city in Bulgaria by DavGeo Ltd.

3D maps – created for different usage



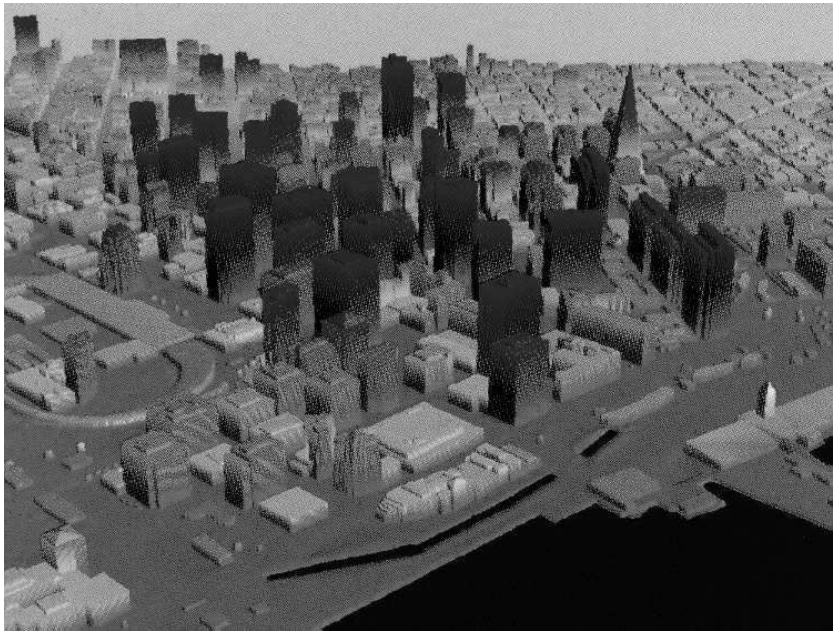
- Education in schools and universities

3D maps – created for different usage

- Land use

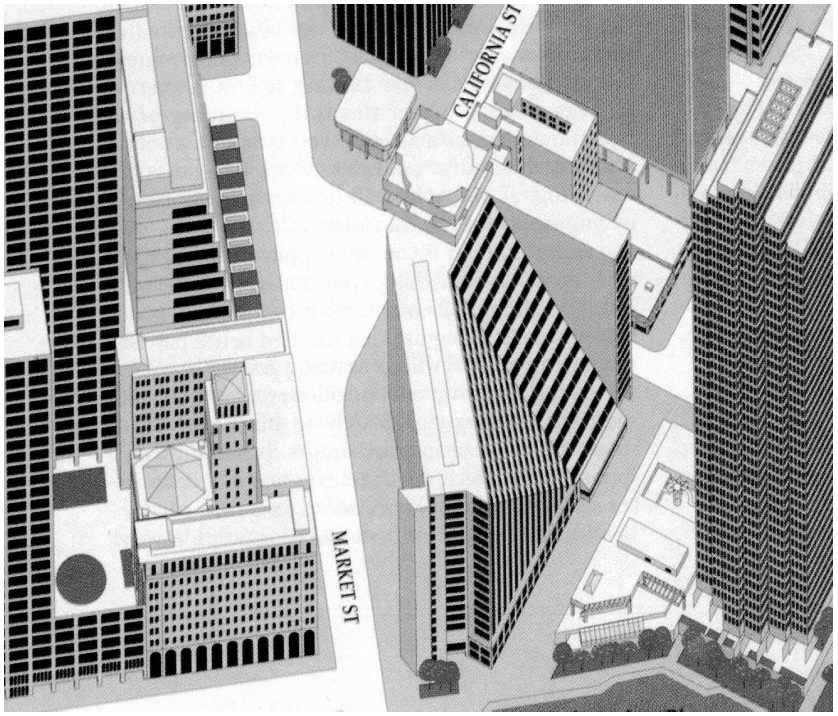
3D modelling of a part of Varna city in Bulgaria by DavGeo Ltd.

3D maps – created for different usage



- Land management and cadastre

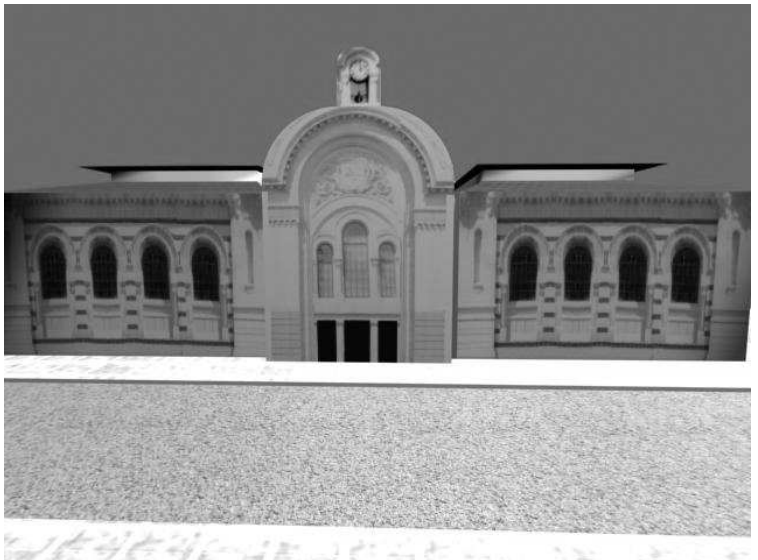
3D maps – created for different usage



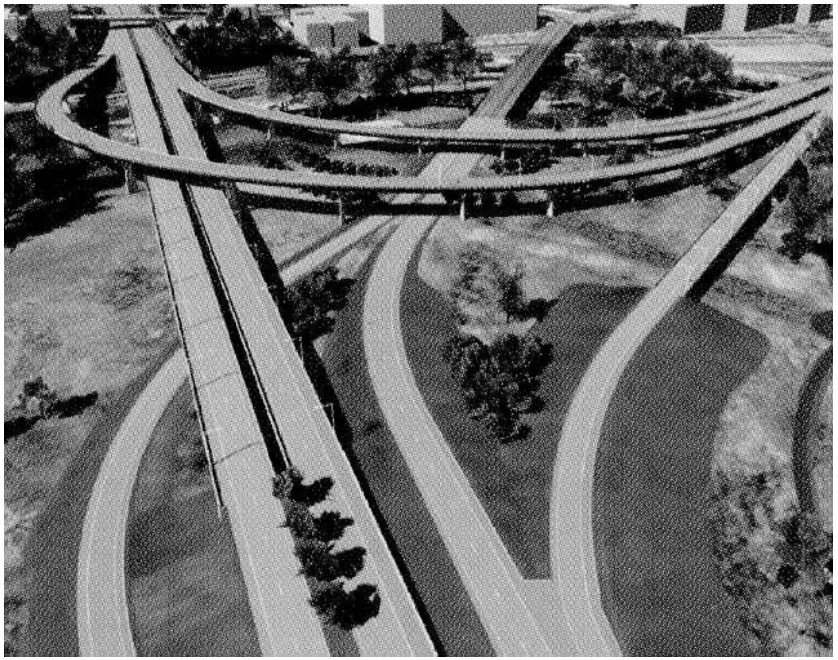
- Telecommunications
- Design and advertisement

3D maps – created for different usage

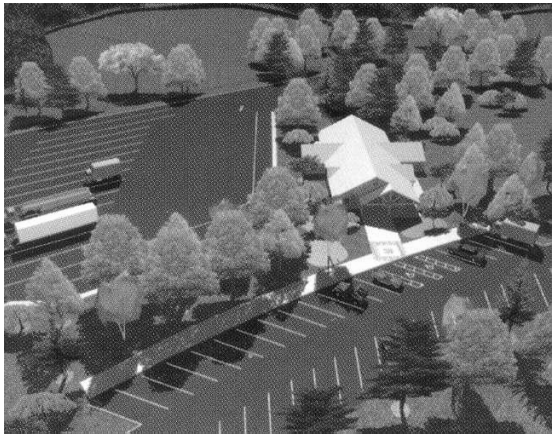
- Tourist offices
- Archives of City Architecture



3D maps – created for different usage



- Transport services



3D maps – created for different usage

9-11 Damage Report - Lower Manhattan

- Crises management

3D model of New York (http://www.metroblocks.com)

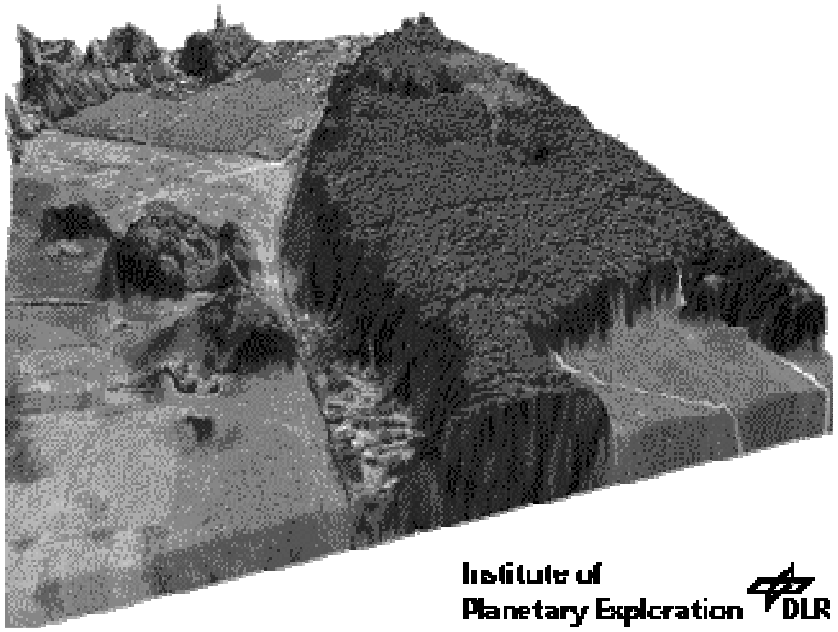
3D maps – created for different usage

- Police
- Military
- fire management

3D maps – created for different usage

- Meteorology

3D maps – created for different usage



- Environment pollution
- Water resources
- Flood mapping
- Crises management
- Risks Prevention Plans
- Long-term Monitoring
- Flood early warning

3D model created by Institute of Planetary Exploration, DLR

map - definition

- Maps – cartographic products represent the spatial variety of the natural and socio-economic phenomena.
- 2 aspects:

- mathematical – scale, map projections, co-ordinate system
- geographical – visualize geo-information

3D map - definition

- Digital, mathematical defined, three-dimensional virtual representation of the Earth surface, objects and phenomena in nature and society.

  Represented objects and phenomena are classified, designed and visualised according to a particular purpose.

Disadvantages of 3D maps

- Higher hardware and software requirements
- Difficulties in 3rd coordinate collection
- Large amounts of data and complex visualization
- Lack of standardized symbol system
- High 3D production price

Advantages of 3D maps

- Multiple geometric representation
- High realistic representation of the real world
- Photo-realistic buildings and objects representation
- User friendly and easy for understanding models
- Attractive and more informatively products
- More applications and users

Contents of 3D maps

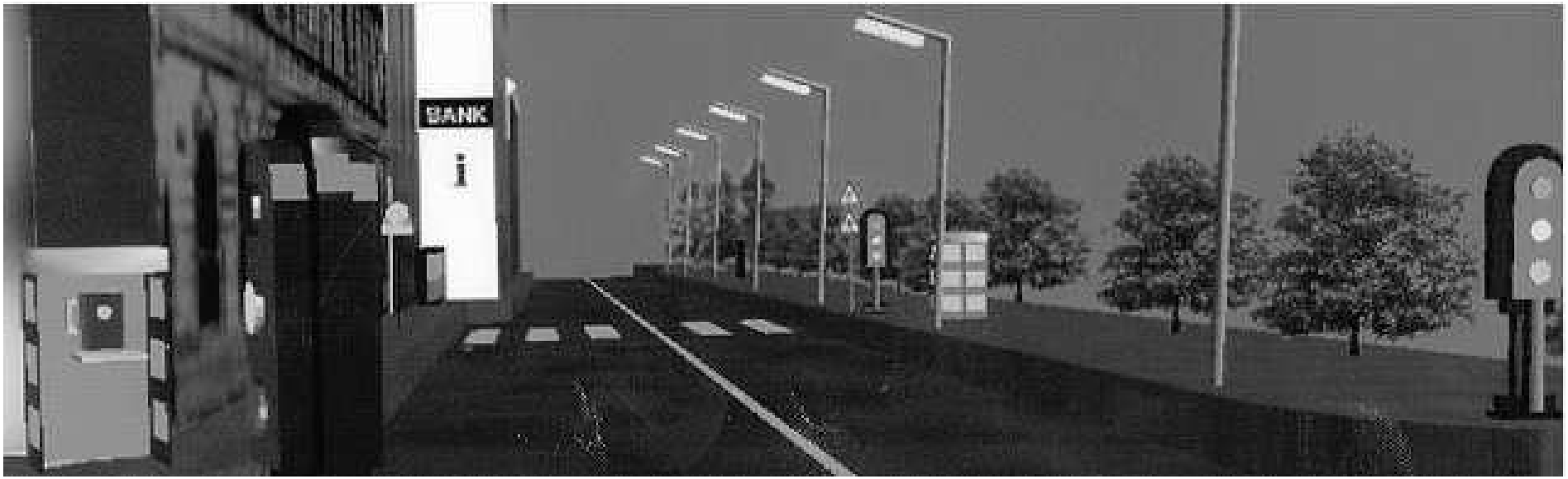
- Main content
- Secondary content
- Additional content

Main content

- large topographic or landscape objects – relief bodies
- roads
- buildings

Secondary content

- traffic signs
- facilities
- transport elements
- information signs
- trees
- geodetic points

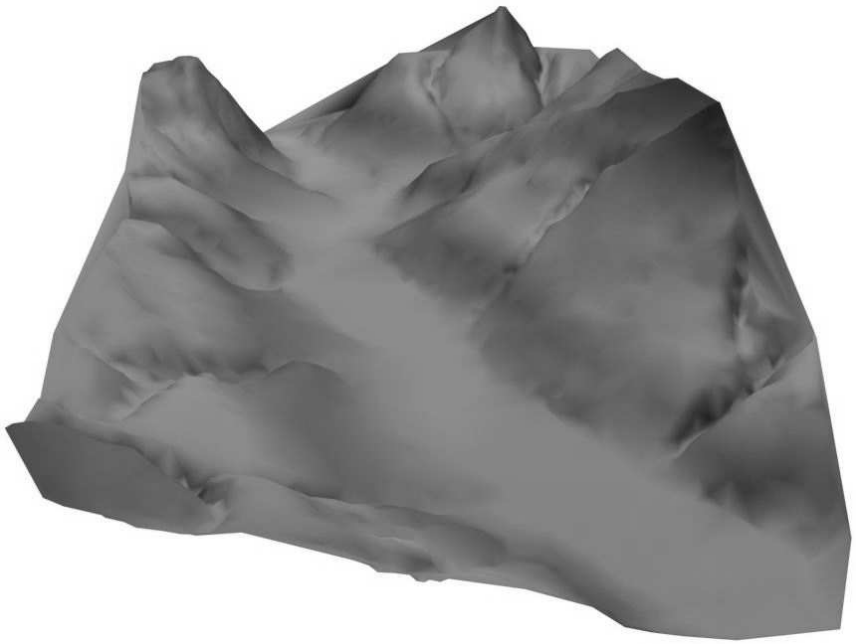


3D map “a street in Vienna”, created by ICG, TUGraz and 3D symbols created by T. Bandrova

Additional content

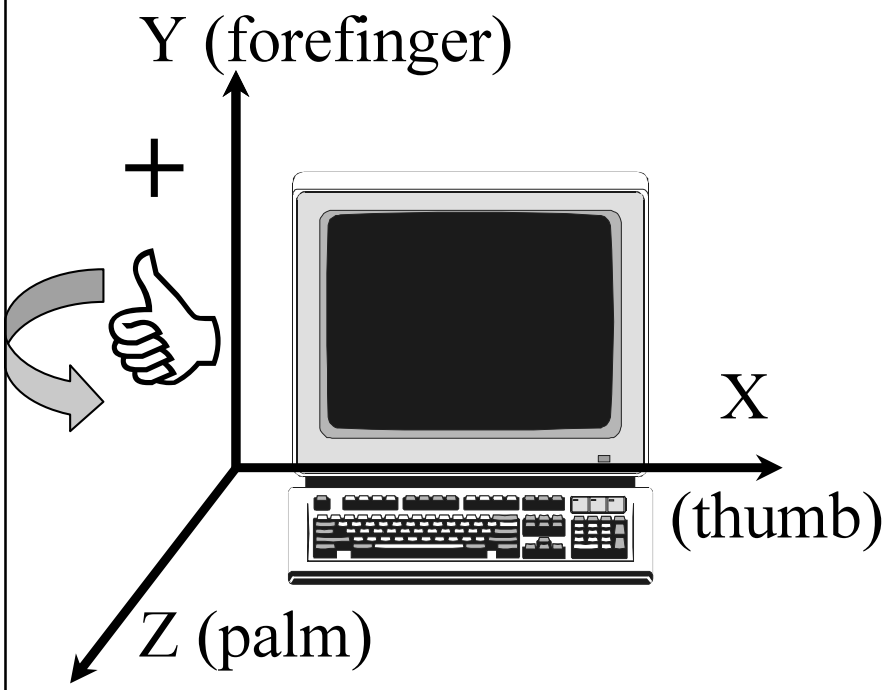
- quality and quantity information about objects
  – fence, roof, street, parcel
- created as a textural database

Sources for 3D map

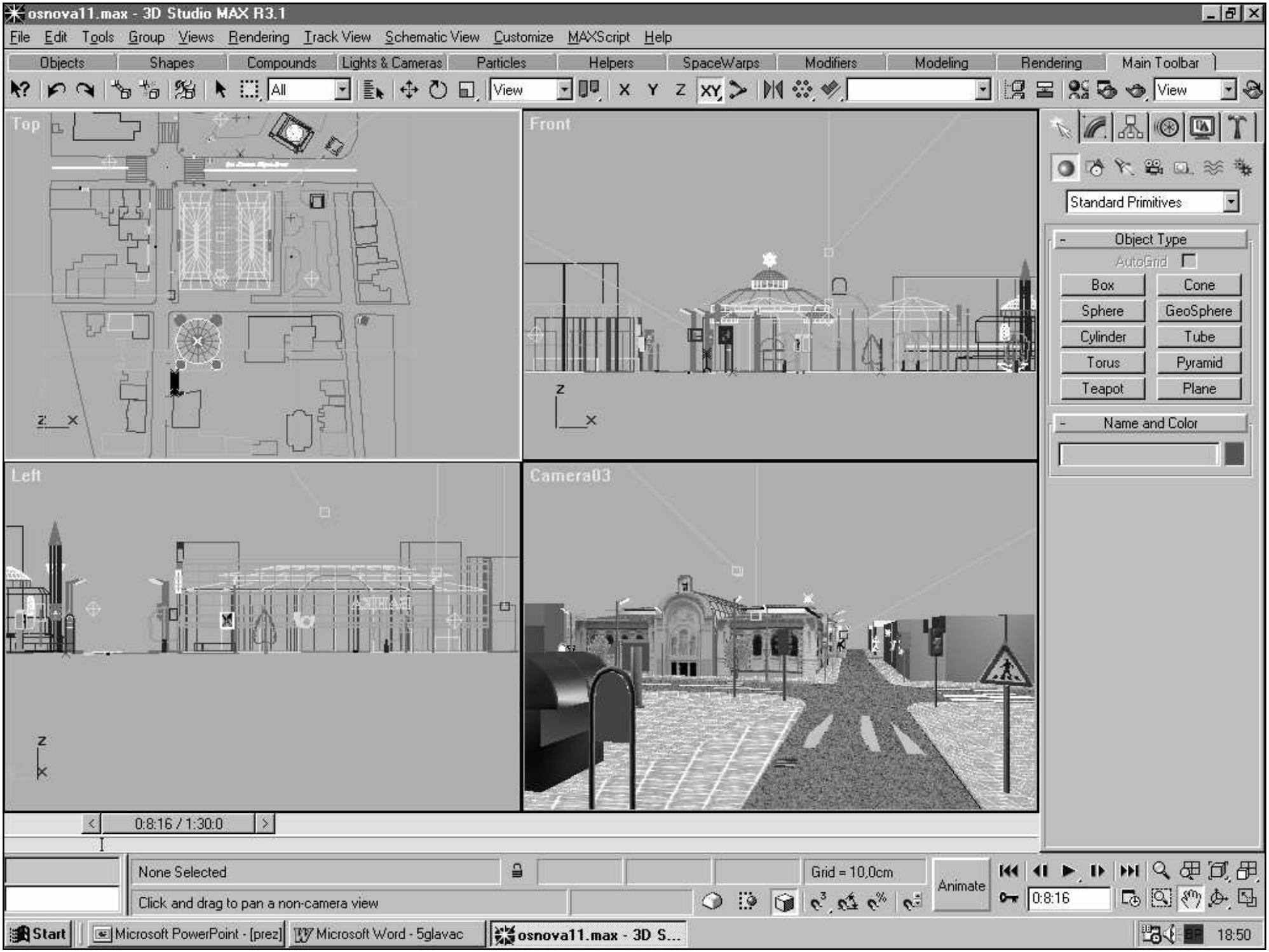


- paper topographic or cadastral maps
- photogrammetric or surveying data
- digital 2D map
- topographic information, measurements, architecture drawings etc.
- digital or paper photos
- 3D symbol system

Mathematical basis



- Scale – source 2D paper or digital map
- 2D view in “top”, “front”, “left”, ….
- Perspective projection
- Spatial orthogonal 3D co-ordinate system XYZ (local)


osnova11.max - 3D Studio MAX R3.1
File Edit Tools Group Views Rendering Track View Schematic View Customize MAXScript Help
Objects Shapes Compounds Lights & Cameras Particles Helpers SpaceWarps Modifiers Modeling Rendering Main Toolbar
Top
Front
Left
Camera03
Standard Primitives
Object Type
AutoGrid
Box Cone
Sphere GeoSphere
Cylinder Tube
Torus Pyramid
Teapot Plane
Name and Color
0:8:16 / 1:30:0
None Selected
Click and drag to pan a non-camera view
Grid = 10,0cm
Animate
0:8:16
Start
Microsoft PowerPoint - [prez]
Microsoft Word - 5glavac
osnova11.max - 3D S...
18:50

Code	Name of type object object
1000	Situation
1100	Geodetic base
1110	Astronomic point
1120	Triangulation point
1130	Polygon point (PP)
1131	PP, stabilized by a wooden picket
1132	PP, stabilized by a concrete block
1133	PP, stabilized by an iron tube
1140	Axis point

1500	Transport objects
1510	Railway
1520	Roads
1521	Highway

1527	Shaped pathway

2000	Hydrographic objects

3000	Relief

4000	Pipelines
---	…

Classification of mapping objects

The basic types, kinds and sub-kinds objects - hierarchy-code presentation

European standards for exchange of information

Generalization

Automatic – formal selection, smooth and filtration, according formal criteria

Dynamic – for animation presentation and track out the development of the phenomena in the space and time

Interactive – complex of the traditional, automatic and time generalization

Accuracy in objects representation

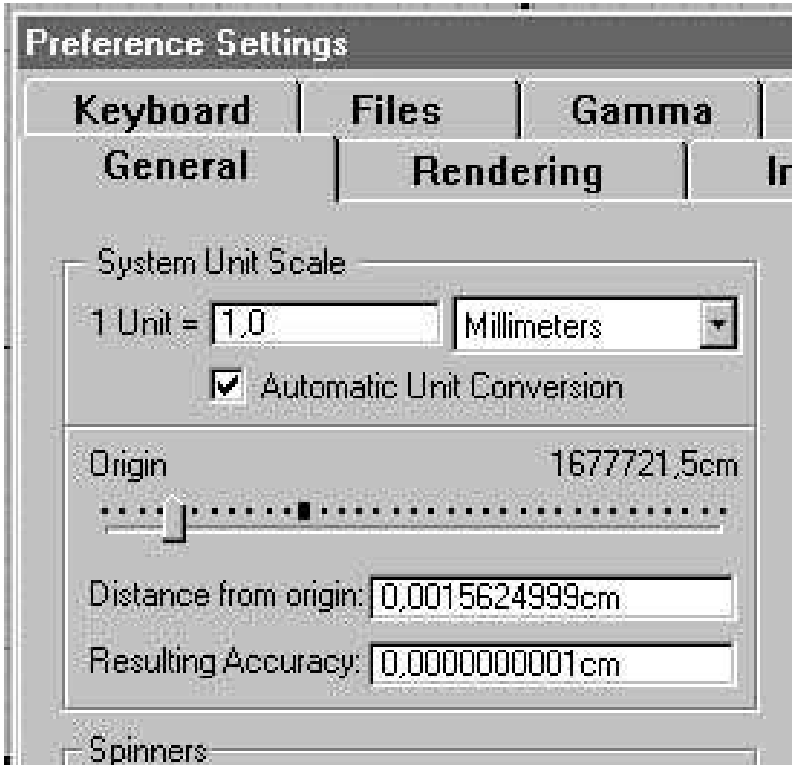
Accuracy in reference (location)

Thematic accuracy

Semantic accuracy

Accuracy in object location

- accuracy of measurements and data capture
- scale of 2D map
- method of sources processing



Thematic accuracy

- data base – quality of statistical data, methods of capture and processing
- data transformation – selection, classification and data references

Semantic accuracy

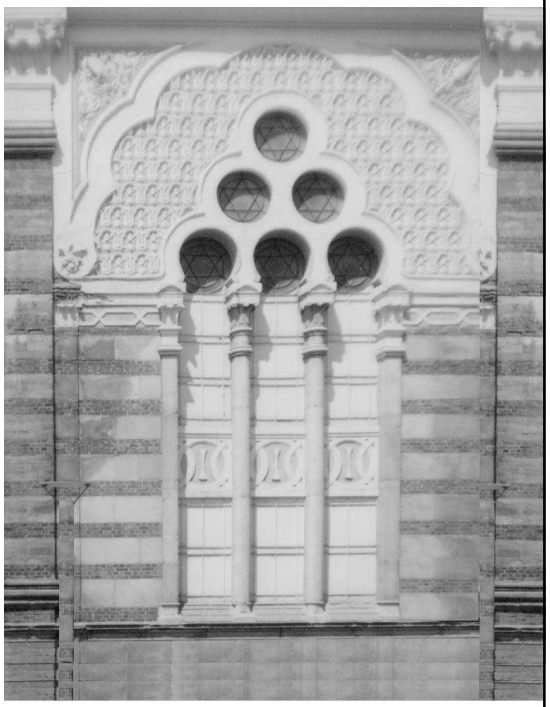
- symbols define the objects
- realistic and informatively representations

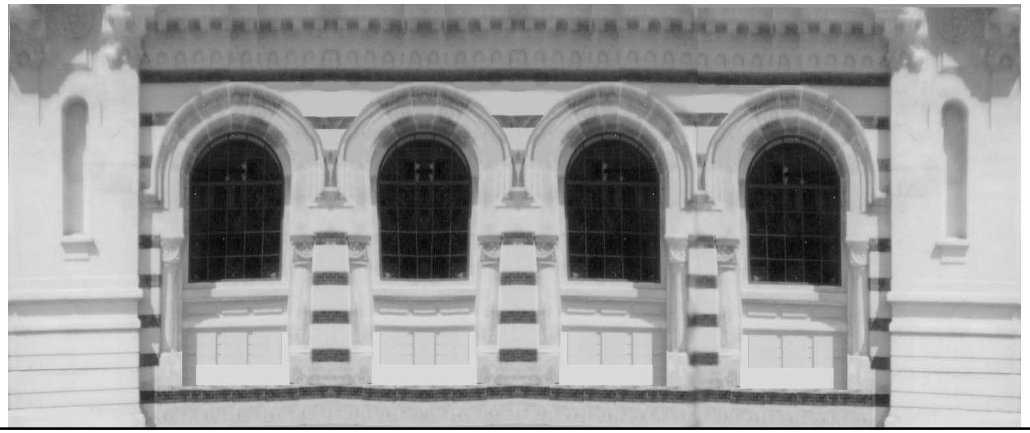
Photo-texturing

Photos from street level – for buildings facades

Photo-texturing

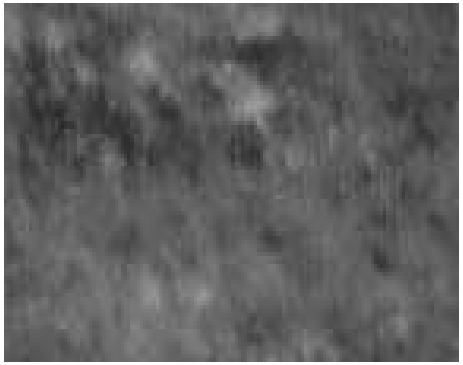
textures after image processing



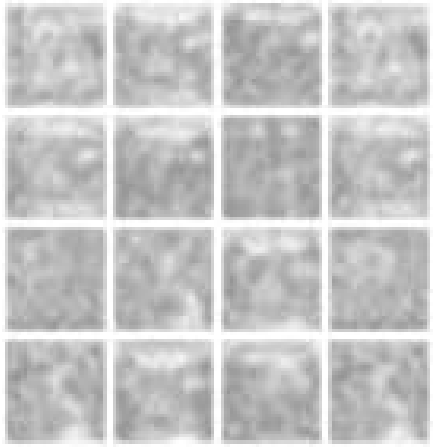


Texturing

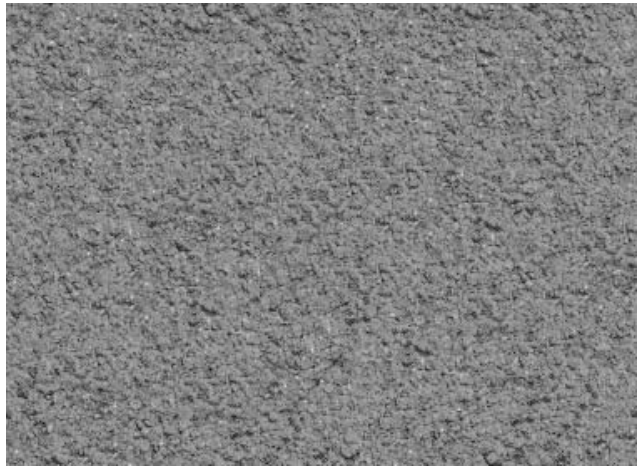
Software library texturing - areas symbols



Grass

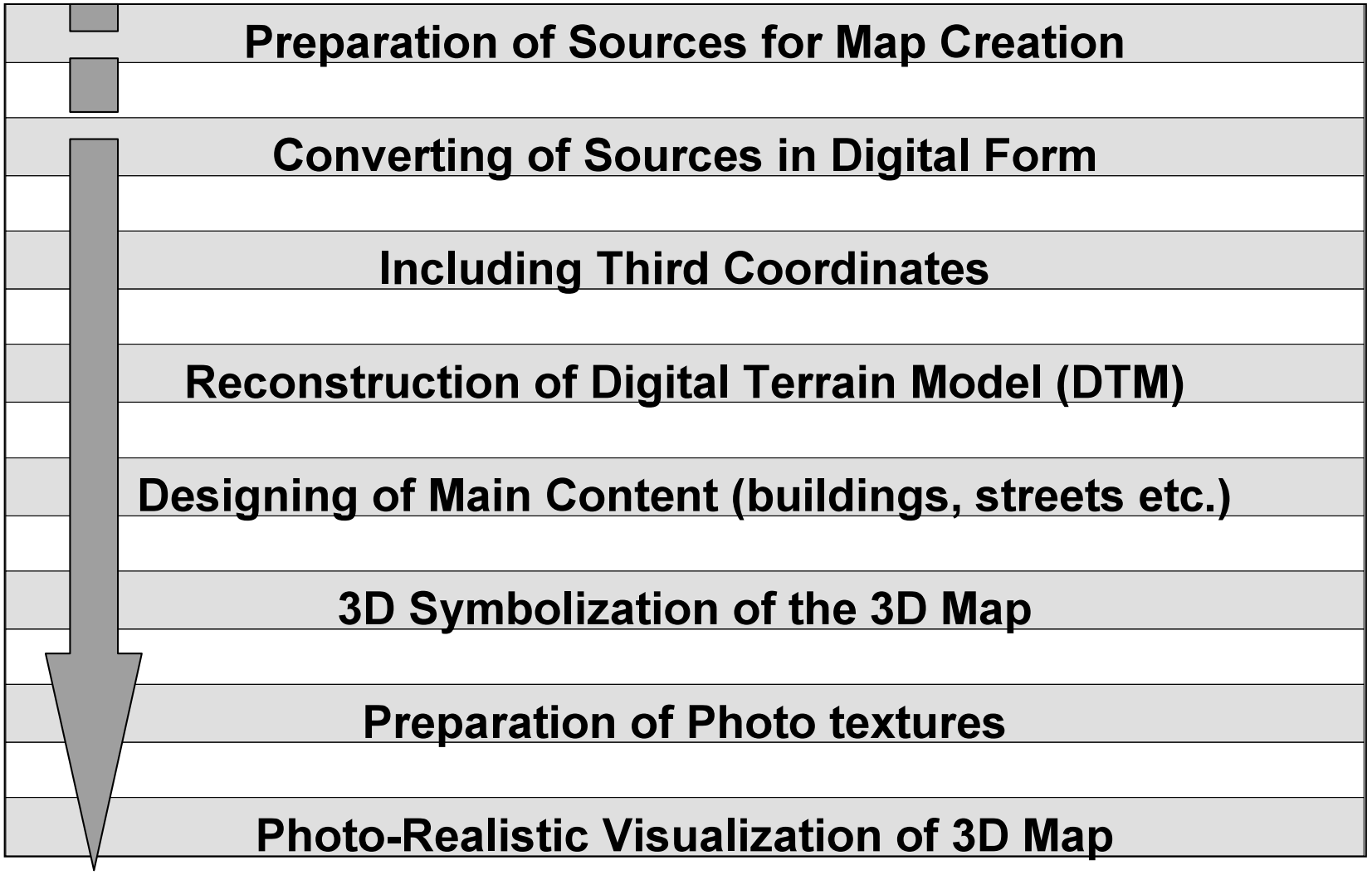


Pavements



Roads

A technology for designing of 3D maps



3D maps on 2D monitor?

This disadvantage is overtaken by applying of various “tricks” just in order to leave the user with no doubt that it is rally a 3D model. This can be enriched by assigning to the objects of properties of the real objects and materials, such as luminosity, roughness, transparency, lighting, shadow. 3D maps become more realistic like in the real world.

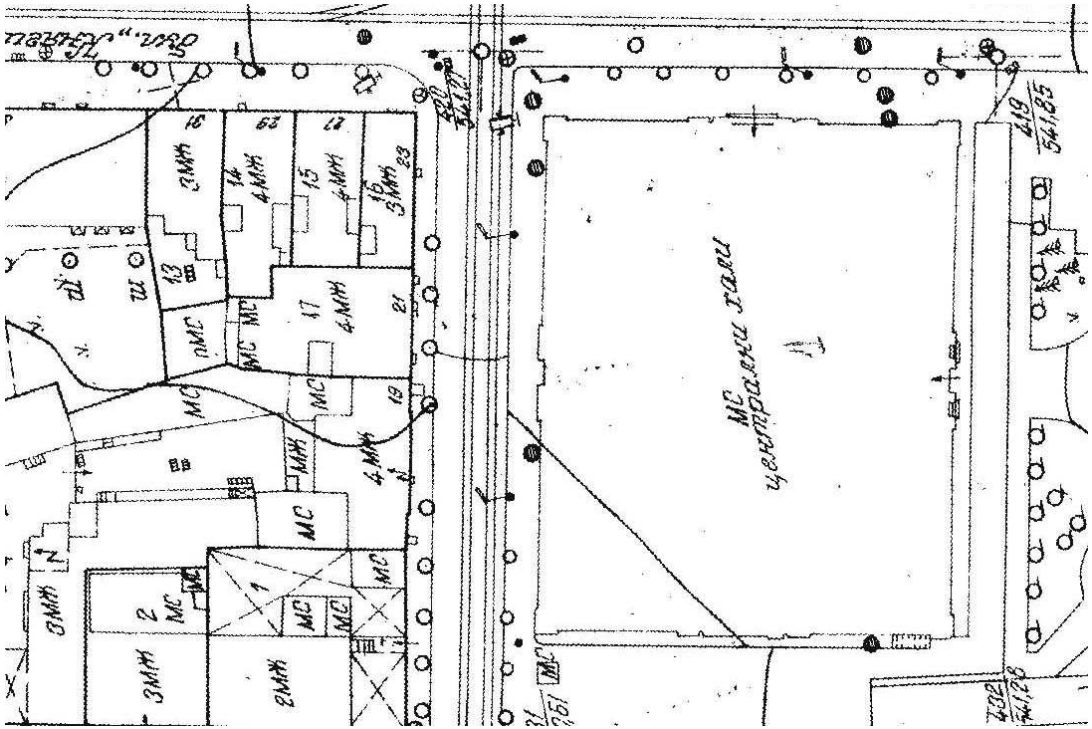
Quality of visualizing of 3D maps

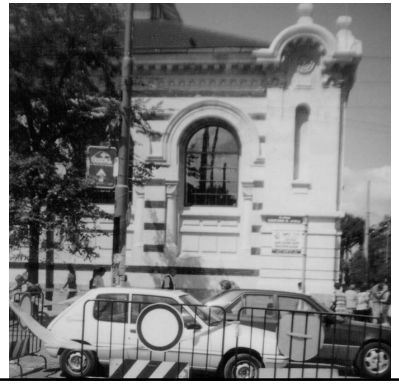
1. Real color tone of screen points
2. Good contrast and focus
3. Maximum possibility for brightness usage and keeping of good contrast
4. Grey linear scale (proportional brightness levels)
5. Quality of the white color
6. Monitor’s flicker and twinkle

Steps for symbol creation

1. gathering information for an object;
2. analyzing information and collecting data for each object;
3. designing symbols by visual and metric analysis applying computer graphics techniques;
4. visualizing symbols in virtual environment;
5. obtaining synthesized information for an object.

3D map Central Sofia





43 buildings, streets, pavements, grass areas, symbol system;

24 photos, scanning with 300 dpi, в RGB (Type: Sharp Millions of Color, Brightness: 125, Contrast: 132)

5 photo-textured buildings

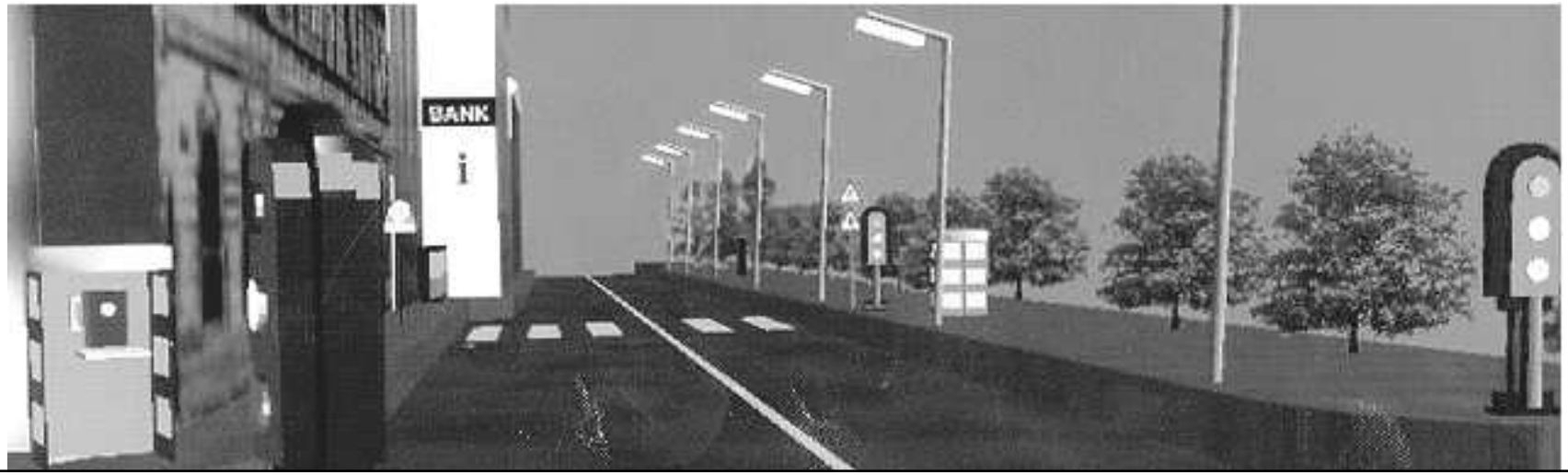
3D map - Vienna

3D model of 28 buildings

GIS data

Aero-photos and photos of buildings' facades, made from street level

Scanning of 200 traffic signs for texture processing



Conclusions

- Creation of a symbol system will facilitate the compilers as well as users of 3D maps.
- Their existing will legalize the 3D maps and this is the task of cartography in nowadays.
- The next step - researches of the qualitative and quantitative features of the map by 3D GIS, extraction of the data for it and solving of different kind of tasks.

Thank you very much for your attention!

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