

THE OPPORTUNITIES THAT DIGITAL ORTHOPHOTOS CAN SUPPLY IN URBAN PLANNING

H. Akdeniz

General Command of Mapping, Department of Photogrammetry, Ankara, Turkey - hakdeniz@hgk.mil.tr

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ABSTRACT:

The development level of the society and structural characteristics can be seen in urban structure and urbanization. Administration try to keep social justice and welfare by urban, regional and national plans. Now, urban planning tries to reach its economical, social and political goals by forming the structure. Because the storage and presentation of economical, social and geographic data and information which are necessary for planning, take too much time by traditional methods, urban settlement leaves behind planning and it becomes more expensive to take infrastructure to this kind of places.

Although the development in computer and communication technologies supply speed and productivity in data processing, sustainability of information systems depends on completeness and up to dateness of data. Photogrammetric methods, especially orthophotos are in such a form that they can meet the needs when there is a necessity for fast decisions.

With collecting the geographical information by means of digital orthophotos which can combine with geographical information systems, fast decisions will be able to be made because of the time shortage in data collection, on the other hand, there will be a passing from long-timed, traditional urban planning approach to process planning approach which brings solutions in short time.

1. INTRODUCTION

The development level of the society directly effects the economic, political, social and cultural structure and also the urban areas. On the other hand, the economic, technologic and cultural developments effect the speed and the structure of urbanization. As a result of the increasing urban population, both the total number of the cities increases, and the existing metropolises enlarge to bigger extend. It is only possible by means of planning to minimize the expenses of the urbanization and to form desired urban structure.

The nations, which don't let their future to coincidences but demand to give a shape to it, use planning as a device. Planning can be described as a continuing process, in which required data is collected and given to the administration units, and the administration decisions are applied to the areas. In this process, collection and the demonstration of the spatial data or the information about planning is made with the digital or hardcopy maps.

Planning process requires up to data geographical information and documentation in 1\1000 scaled base maps for development plans and 1\250.000 or 1\500.000 scaled maps for regional plans. Unfortunately, most of these products are not updated at present in Turkey. Updated spatial data and information can be collected and demonstrated in any periods from aerial photographs and satellite images. These orthophoto products could be used necessarily in the planning and the application phases.

2. CONCEPTUAL FRAME

Planning is the designation of methods and the style to reach the targets in the time that determined before. (Bozkurt, Ergun., 1998). The act of planning can be accepted as a rotation that includes the process of preparation, application, following and evaluation.

Urban planning is described as a connection to plan, suited to the region, environment and national plans, not only by means of the use of land, but also by means of the economic, social and population factors (Keles, 1998). Urban planning, which begins with the national plans and goes on with the regional and environmental plans and becomes practicable with the development plans, is a rotation that achieves the continuity of the process with the help of feedback.

In traditional method, planning and the application procedures are carried on with the use of hardcopy maps. Mapping with the traditional method is a long term study that includes field measurements and computations. Shortness of the process and the delivery time of the geographic data are the most important advantages of the orthophotos, which is a specific application of mapping with photogrammetric method.

Orthophoto image or photomap is a specific scaled photographic image produced from perspective images in which distortion errors originating from the attitude differences and the tilt of image are eliminated.

Orthophoto map is an orthophoto that has cartographic information on it (legend, grids, contours, labels, etc.). It is named photomosaic if two or more orthophotos joined each other on one base.

3. THE STRUCTURE OF THE URBANIZATION PROCESS IN TURKEY

We cannot find any legal arrangements about urbanization and urban planning in Ottoman Empire until the time of Administrative Reforms in which private ownerships were widespread. Due to the increase of construction areas, fires and difficulties in preventing them, the arrangements about settlement and construction in Istanbul had begun in the middle of 19th century. The obligation of planning for the cities was put in use with The Reconstruction Law numbered 2290_Municipality Construction and Highways Law, which was accepted in 1930. Then The Reconstruction Law numbered 6785 was put in use in 1956 and 3194 in 1985.

The urbanization in Turkey had begun to increase with the expansion of population to 2,2 % per year after World War II. (Table-1). And the population reached the highest ratio of 2,8% per year in 1960.

Years	Population	Annual Increase Rate(%)
1927	13,648,270	-
1935	16,158,018	21.10
1940	17,820,950	19.59
1945	18,790,174	10.59
1950	20,947,188	21.73
1955	24,064,763	27.75
1960	27,754,820	28.53
1965	31,391,421	24.63
1970	35,605,176	25.19
1975	40,347,719	25.01
1980	44,736,957	20.65
1985	50,664,458	24.88
1990	56,473,035	21.71
2000	67,803,927	18.28

Table 1. Population rates in Turkey for years of census (DIE, 2004)

In Europe, urbanization is caused by industrialization, but in Turkey, such an urbanization, which is caused by, factors that:

1. Take the population away from village life and agriculture,
2. The development in transportation sector and vehicles.

This urbanization period, which is not caused by fast industrialization, is described as movement of poverty and hidden unemployment in villages to cities. (Keles, 2002) Poor people, who can't be employed after migration to city, try to solve the problem of house by building shanties outside of planned area.

Although urbanization affects the whole cities generally, it can be said that it affects the fast growing cities differently. In the period of 1990-2000 populations in Istanbul increased by 2.306.005 and in Ankara by 703.720. In other words, in the metropolises like Istanbul, Ankara and Izmir, the places, which will provide residence to the increasing population, should be

planned. If it is taken into consideration that according to 2000 census, population of 61 cities are under 500.000, the importance of residential planning can be seen clearly. Because the appropriate planning is not carried out, reconstruction amnesty is applied in every two or three years since 1948 and de facto is tried to be legalized.

.It is estimated that average annual urbanisation rate between 1995-2000 is 4.7 percent. The urban population, which was estimated to be 34.4 million in 1995, is expected to reach 43.3 million at the end of 2000 and constitutes 66.4 percent of the total population. Urban population that was estimated to be 43.3 million in 2000 is expected to reach 54.7 million by the end of 2005 constituting 78 percent of the total population. In the 8th Plan period (2001-2005), it is expected that the rate of urbanisation will be realised by an average of 4.75 percent annually. The urbanisation phenomenon that started to accelerate in 1950s has led to accumulation of population crowds in big cities hampering a balanced urban distribution. This situation led to significant problems related to change in social and economic structures, and rapidly increasing urban investment needs. Unlike the case in developed countries, the urbanisation process in Turkey has occurred as a migration phenomenon in which urban poverty is preferred to rural. At the end of 2000, 44 percent of the urban population, 23 percent of which is in Istanbul is expected to be settled in cities whose population is over one million. In the 8th Plan period, additional housing requirement in settlements with a population of 20.000 or more, will be 2.714.000 due to demographic developments. Additionally, 72.200 houses per year, a total of 361.000 in five years, will be needed for some other reasons like renewals and natural disasters, including former needs caused by disasters. Consequently, the total housing requirement in the plan period, stemming from urbanisation, population growth, renewal and natural disasters, is 3.075.000 (LTSEFYD, 2004)

The problem is not only the deficiency of planning but also the deficiency of collecting geographic data and information related to determination of de facto needed in planning, fast and actually. Because of this problem, planning steps and connection between the plans can not be carried out adequately.

4. URBAN PLANNING PROCESS IN TURKEY

The legal part of urban planning includes legal arrangements, such as urban development law, which arrange urban, urban conservation, removing of unbalance between regions etc. Urban planning hierarchy in Turkey was arranged by urban development law numbered 3194. The connection between national plan which is important for economy, and development plans is tried to solve with regional plans and environmental plans.

- a) Regional Plans: Regional planning is arisen from urbanization, urban problems and the necessity of planning of cities and rural areas, which effect the cities or are effected by cities because of unbalance between regions, together. (Bozkurt, Ergun, 1998)

Region is described as; a united land in terms of geographic or social qualities, an administrative grade and a local management grade.

According to Art. 8 of urban development law numbered 3194, regional plans are prepared to determine the socio-economic development tendencies, development potential of settlements, sectoral targets and distribution of activities and substructures. It can be seen that the regional planning, which can be prepared on 1/100.000-1/250.000 scale maps is not common in Turkey and can't be put into use continuously over the country, but for some exceptions.

b) Environmental Plans: According to Art.5 of reconstruction law numbered 3194, Environmental Plan is a plan that determines the settlement, such as residence; industry, agriculture, tourism, transportation etc., and land use, convenient to country and regional plan. Despite the open rule of law; it can be said that environmental regularity plan is applied as independent plan without preparing regional plans in urban planning process. It can be prepared in 1/100.000, 1/50.000 and 1/25.000 and the authority for preparing it is The Ministry of Public Works and Housing. On the other hand, the authority for preparing ecological environmental plan is The Ministry of Environment and Forestry.

c) Development Plans: Development Plans include Master Plan and Application Development Plan that is prepared convenient with it.

Master Plans are prepared in 1/2.000 and 1/5.000 scales and are convenient with regional plans and environmental plan, if they exist. The authorities for preparing it are Metropolitan Municipalities.

Application Development Plans are prepared in 1/1.000 scale and are convenient with Master Plan. The authorities for preparing it are municipalities.

- d) Statistical Region Units: In the period of adaptation to European Union, country based Statistical Regional Units are described to collect and improve regional statistics, to make socio-economic analysis of regions, to describe regional policies and to prepare comparable statistical database which is convenient with European Union Regional Statistics System. According to this;
- There are 81 Statistical Region Units in “Level 3” and they are provinces.
 - There are 26 Statistical Region Units in “Level 2” and they were described by grouping the neighbour provinces in “Level 3”.
 - There are 12 Statistical Region Units in “Level 1” and they were described by grouping the Statistical Region Units in “Level 2”.

Whole public associations and institutions must use this structure. In this respect; the meaningfulness of collected attribute information is dependent on relation with collected geographic information in same levels. In other words; while preparing regional plans, environmental plans and Master plans, statistical region units should be taken into consideration.

In planning process, the most important problem is to obtain up to date geographical product. However much the appropriate production for this aim is digital vector products, they are not up to date, they don't cover whole Turkey and they cannot be updated. For this reason, in developing countries like Turkey, it is thought that the most appropriate geographical products to use in planning process are orthophoto maps.

5. USING ORTHOPHOTO MAPS IN PLANNING PERIOD

The orthophoto maps, which are produced by using aerial photographs and satellite images, can supply fast and economical map production. Especially the orthophoto maps that are produced by using satellite images, by means of developing technology, are advancing for being economical alternatives to classic maps.

Even the updating of digital vector products takes a short time, at first step the production takes too much time. For example; the production process of a 1/25.000 scaled map, which is used in environmental plan, last approximately 3 years, as it is seen in Table-2 (Özbalımcı, 2000). The production of a 1/50.000 scaled map, with the supposition of lasting 1 year for cartographic generation, photo-mechanic and printing processes, lasts at least 4 years. Similarly; it can be said that a 1/100.000 scaled map can be produced in approximately 5 years, a 1/250.000 scaled map can be produced in approximately 6 years. In other words, 1/25.000 scaled or smaller scaled maps become not up to date when they are presented to user. However, because the cities are always in a change, for dynamic planning, the maps must be prepared and updated in short times. So, it is appreciated that the optimum solution from the view of time and cost are orthophoto products.

Number	Executed Activity	Time (Year)
1	Establishing, liming, measuring and computing ground coordinate points and aerial photography	0.5
2	Map production with the photogrammetric stereo compilation method	1.0
3	Topographic completion on land	0.5
4	Printing processes with the cartographic and photo-mechanic works	1.0
	TOTAL	3.0

Table 2. 1/25 000 scaled digital vector map production phases and durations.

For an area containing approximate 300 maps, the cost of 1/5.000 scaled digital map production is 1652 US Dollars and it takes 102 hours (12.75 working days). In orthophoto production for an area in the same size, the cost of a sheet is 218 US Dollars and it can be produced in 14 hours. In other words, 1/5.000 scaled orthophoto map can be produced 7 times faster and 7 times cheaper than digital vector map.

Taking into consideration the components below and the aim and accuracy of orthophoto image that will be produced, it can be decided that the data source will be satellite image or aerial photograph.

- If aerial photographs of the interested area can not be taken because of the physical, legal e.g. reasons, the use of the satellite images will be necessary.
- The satellite images can be more economical for digital orthophoto mosaic production of small areas in high resolution and of wide areas in low resolution.
- It can be more economical to use aerial photographs for digital orthophoto mosaic production in wide areas with high resolution.

The source can be satellite image or aerial photograph depending on the scale of orthophoto map:

- In case of orthophoto production from aerial photographs, the scales of aerial photographs, which will be taken depending on the scale, are shown in Table-3.

Number	Scale of Orthophoto Map	Scale of Aerial Photograph
1	1/1.000	1/4.000-1/5.000
2	1/2.000-1/2.500	1/8.000-1/10.000
3	1/5.000	1/16.000-1/18.000
4	1/10.000	1/20.000
5	1/25.000	1/35.000-1/40.000

Table 3. The scales of aerial photographs needed for production of orthophoto map.

- In case of orthophoto producing from satellite images, satellite images and its specifications, which can be used depending on the scale, are shown in Table-4.

Number	Scale of Orthophoto Map	Type of Satellite Image
1	1/5.000	QUICKBIRD, IKONOS
2	1/10.000	IKONOS, KVR-1000
3	1/25.000	KVR-1000, SPOT5 (2.5m.)
4	1/50.000	SPOT5 (5m.), IRS
5	1/100.000	SPOT (1-4), TK-350
6	1/250.000	LANDSAT7, ASTER, RADARSAT

Table 4. The types of satellite image that can be used for production of orthophoto map.

As it is seen in Table-3 and Table-4;

- It is evaluated that base orthophoto maps, which are needed for Master plans and application reconstruction plans that contain 1 / 1 000 – 1 / 5 000 scales, can be produced from aerial photographs,
- Base orthophoto maps, which are necessary for regional plans and environmental arrangement plans in 1/10.000 and in smaller scales, are better to be produced from satellite images.

In this context, orthophoto example on which the cadastral boundaries drawn for development planning is given in Figure 1, enhanced orthophoto example for environmental plans or regional plans is shown in Figure 2.



Figure-1: Orthophoto for Development Planning (GEOINFO, 2004)



Figure-2: Enhanced Orthophoto for Environmental Planning (ABM, 2004)

6. CONCLUSION AND PROPOSALS

The development of the society directly affects the urban area and urbanization together with economic, political and cultural structure. Urbanization in developing countries like Turkey has many problems because of high population growth and push of the rural. But the urbanization is inevitable and positive development. The solution of the existing problems lies under urban planning and carrying out these plans.

The nations who don't want to live their future by chance plan development of their national, regional and urban areas. The data and information gathered in local level are transferred to administrative levels by generalization and evaluation and they help strategic decisions. These decisions in national level are reflected to the area by regional plan and urban plan.

Physical planning levels in Turkey are mentioned as regional plan, environmental plan and development plan in Urban Development Law numbered 3194. Also in the frame of adaptation to European Union, statistical regional units were formed and began to application. While the connection between the national plan prepared in economic level and the

development plans prepared in local level is supplied by regional plans and environmental plans according to Law numbered 3194, according to statistical regional units it is supplied by Level1 and Level2. But until now, this connection could not be supplied and regional planning could not be spread widely.

One of the important specialties of urbanization process that is highly rapid than the developed countries is growth of the population in urban more and more and uncontrolled growth of the urban. Although the population growth in Turkey decreased relatively according to 2000 population count, planning in metropolises like Istanbul, Ankara and Izmir is still a problem. The population in Istanbul increases 230.000 in every year, in other words; a city with a medium size is added and need planning for these areas. But the problem is not only the planning, but also absence of up-to-date geographic base for planning. Long period solution is the seamless vector maps, but the solutions in short and medium terms can be orthophoto maps.

The enhanced orthophoto maps produced from satellite images can be used as base for regional plans, environmental plan and the Level 1, Level 2 and Level 3. The orthophoto maps produced from aerial photographs can be used as a base for Master Plan, Application Development Plan and Level 3. So the vertical relationship between plans and some of the problems originated from rapid urbanization can be solved.

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