INTEGRATION OF PRIMARY DATA ACQUISITION AND INTERPRETATION OF REMOTE SENSING DATA IN TOWN - PLANNING AND CITY - DISTRICT - RENEWAL ▪ APPLICATION AND EXAMPLES

Dr.-Ing. Peter Gerlach; Institute of Regional Development and Structural Planning - Berlin, Germany. ISPRS Technical Commission VII

OBJECTIVE

The aim of the studies is the development resp. application of an integral methodical instrument for planning in complete towns (areas) and city districts. The instrument is to combine the advantages of visual interpretation with the potentials of computer-aided classification of remote sensing data in compliance with adequate planning scales.
The elaboration of a special catalogue of branch criteria for data acquisition in town-planning and inner-city renewal (e.g. areal utilization, environmental qualitites) is an important basis of this method. Techniques of visual interpretation of remote sensing are adjusted in correspondence with the targets of stock-taking, planning targets and the adequate planning scale (e.g. 1:50.000/1:10.000). By using GIS and the potentialities of computer-aided data classification, we arrive at an original methodology for the creation of an application-dialogue. Initial examples for systematic data assemblage will be presented in the form of thematic maps and schemes within the given limits of planning human settlements.
KEY WORDS: Town Planning, City-District-Renewal, Human Settlement; Interpretation of Remote Sensing Data.

1. INTRODUCTION

A major objective of the studies carried out by the author during the past few years consisted in efforts to integrate methods and technologies of remote sensing into regional and town planning (5, 6, 7), and to turn them into an important aid for planning in the framework of space observation.

First, however, it was necessary to solve problems raised by practical requirements (e.g. for master planning and renewal development planning in medium and small towns), especially due to the increasing requirements for data collection in the new federal states of Germany. Second, the obligation to carry out research work in this field persisted. Thus, the starting-point of research into the integration of remote sensing and town planning was, in the first phase, chosen with a view of making possible and effective inventory by visual, instrument-aided interpretation of aerial photographs. In the second phase, this procedure was combined systematically with additional methods of producing and evaluating urban inventories. Because of the complex and complicated relationships within urban agglomerate spaces and inner cities, these types of structures were regarded to be suitable for investigations. Besides, we had commissions from district counties to work out master plans. The following presents a survey of the planning instruments used, and of a number of results achieved by the working group "airPLAN".

2. PLANNING INSTRUMENTS

- The planning target determines the selection and advanced processing of data made out by aerial and satellite photographs. This phase is closely connected with the probe for existing usable data and field comparisons.

- A hierarchically organized catalogue of criteria was used to arrive at a purposeful urban inventory and an effective assessment of conflict and potentiality areas within problem areas of regions, towns, and communities. With the help of this catalogue, the construction-relevant and spatial functional, natural, and social aspects were compiled and points of departure for arriving at solutions with respect to problem areas were revealed. The criteria were investigated with a view of the visibility by aerial photography depending on the planning and scale level (e.g. 1:10.000) and on the type (e.g. vertical photography) and material (e.g. CIR) of the aerial photograph as well as for the dependability of interpretation and effective compilation (3, 7).

Planning Methods for Carrying out of Ground - and Thematic Maps for Regional and Urban Development

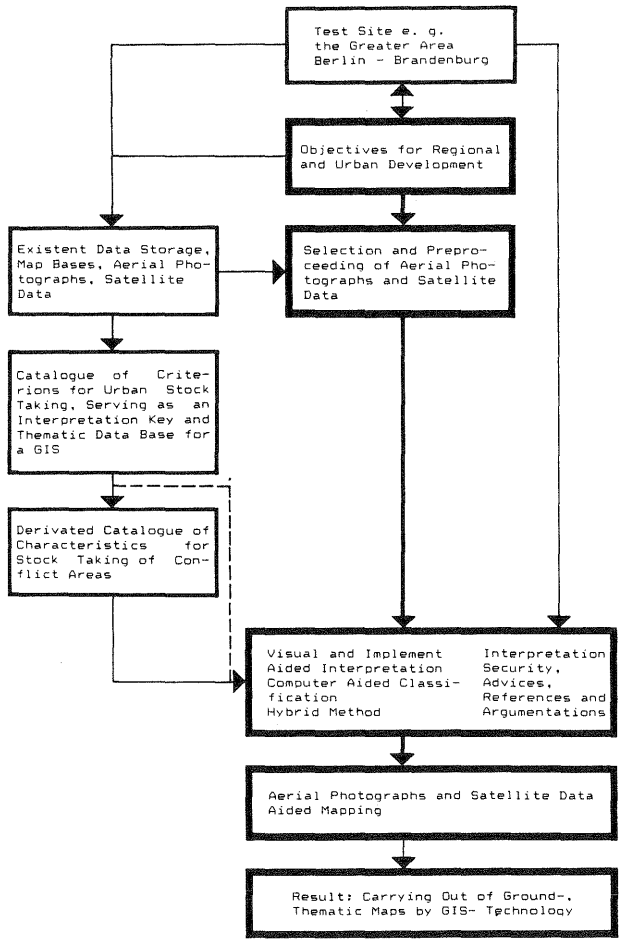


Figure 1: Approach for Integration of Methods of Remote Sensing and Spatial Information System (GIS) for Stock Taking and Inventory of Conflict Areas

■	I Regional Planning - Scale about 1:200.000 till 1:20.000 II General Urban Planning - Scale about 1: 10.000 till 1: 1.000		
e.g.	II General Urban Planning		
1. Fields of Urban Development		2. Categories of Fields of Urban Development	3. Characteristics, 1st-n Order for Particularing of Categories * a) Primary Characteristics b) Secondary Characteristics
1.1. Landuse		2.1. Categories of Landuse ▪ e.g. Business Building	3.1. Characteristics According to the Categories of Landuse ▪ e.g. Area of Business ▪ Business Park Areas of all Kind, including Storage Houses, Storage Places and Public Plants (if there are not any Disadvantages for the Environment) ▪ Commercial Buildings, Offices, Administration Buildings ▪ Filling Station
* Particularing of the characteristics follows this principle: - the primary characteristics are shared into a lot of secundary characteristics - the secondary characteristics of a scale will become primary characteristics of the next higher planning scale			▪ e.g. Area of Industry ▪ Business Park Areas of all Kind, including Storage Houses, Storage Places and Public Plants ▪ Filling Station
1.2. Technical Infrastructure Further Fields of Urban Development		2.2. Categories of Landuse Categories of Further Fields of Urban Development	3.2. Characteristics According to the Categories of Landuse Characteristics According to the Categories of Further Fields of Urban Development

Figure 1a: Catalogue of Criterions for Stock Taking in Urban Situations - Interpretation Key/Base for Thematik Data Base for a GIS

- Comprehensive experiences were acquired by the application on the methods of visual, instrument-aided interpretation. At present, investigations are being carried out into computer-aided classification, and the possibilities as well as limits of its integration into regional and town planning. A hybrid method of combining the advantages of visual interpretation and methods of photo analysis is being developed (fig. 1).

- Fig 1a shows by way of illustration a segment of the hierarchically organized catalogue of criteria for assembling urban inventories to be used as an interpretation guide. The data extracted by remote sensing constitute an important part of the data base of an information system for town planning. The structure of this information system is determined by the catalogue of criteria, and its purpose is to contribute towards the working out of qualified planning conceptions. An essential result is the computer-aided production of maps concerning the analysis and conflict areas for the planning unit (fig. 3).

- An important task of the potentiality area analysis is to determine where, in a given area, correspondence exists between the constructional-spatial frame and the required function within an area, and how to gradually adjust it to urban demands. A theoretical approach towards solving this problem could be to determine the conservation, redeveolpment, and conflict areas ascertained from the overlapping of values and deficiencies of town shapes on the one hand, and material values or deficiencies of a given planning area. The plan targets ensuing therefrom (e.g. the recommended preservation, development, or renewal of a district due to the accumulation of values and deficiencies) determine the requirements with respect to the struc-

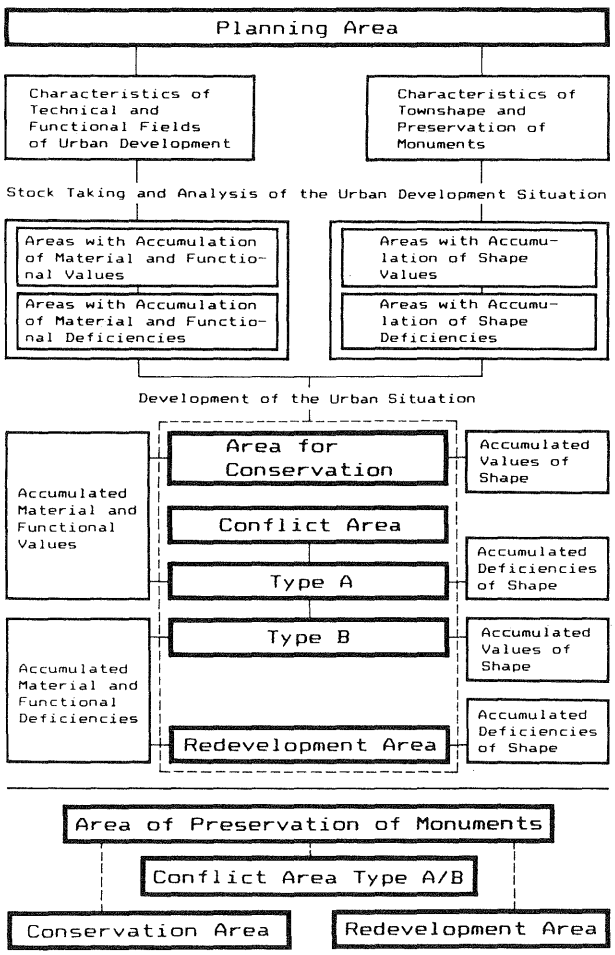


Figure 2: Stock Taking of Values and Deficiencies of Urban Situations - Theoretical Base

ture of the information system. A hitherto not widely developed field is the specification of criteria for planning a town shape as well as its integration into the assessment of its potentiality and conflict areas (2, 3, 6, 11). The advantage of using methods of interpretation aided by aerial photographs for the collection and storage of data in contrast to conventional methods consists in the rapid simultaneous resp. asynchronous data assemblage in large areas by the application of a uniform method. A further advantage consists in the objectivitiy of assessing the inventory and in lower costs of field tests. These advantages constitute the outset of integrating the interpretation of aerial photographs into planning practice (1, 4, 8, 10).

- A further planning instrument studied in this context is an application dialogue, i.e. the combination of exposure parameters by remote sensing and targets of urban inventory and planning on the basis of the system of criteria mentioned above and using computer-aided mapping. The application dialogue also serves to regulate special flights, should the routine flights produce insufficient results.

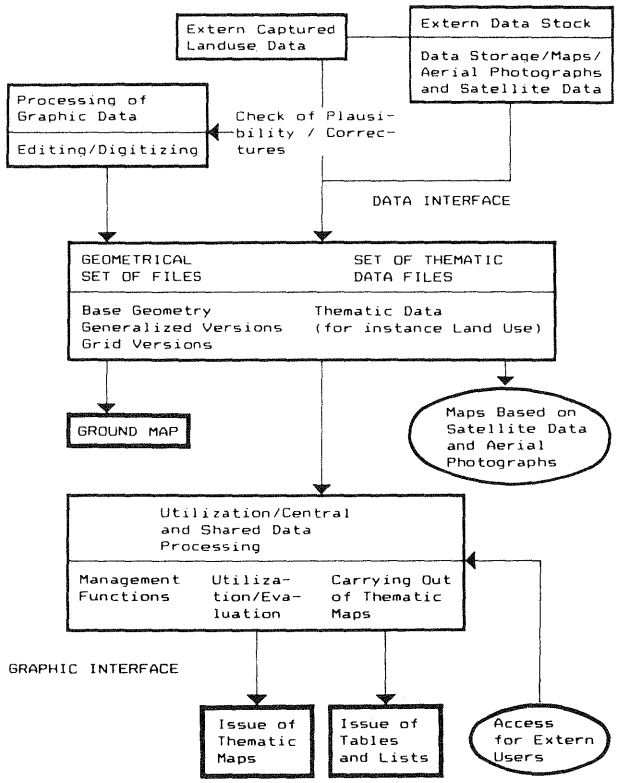


Figure 3: Description of the Principle Organization of GIS-Technology

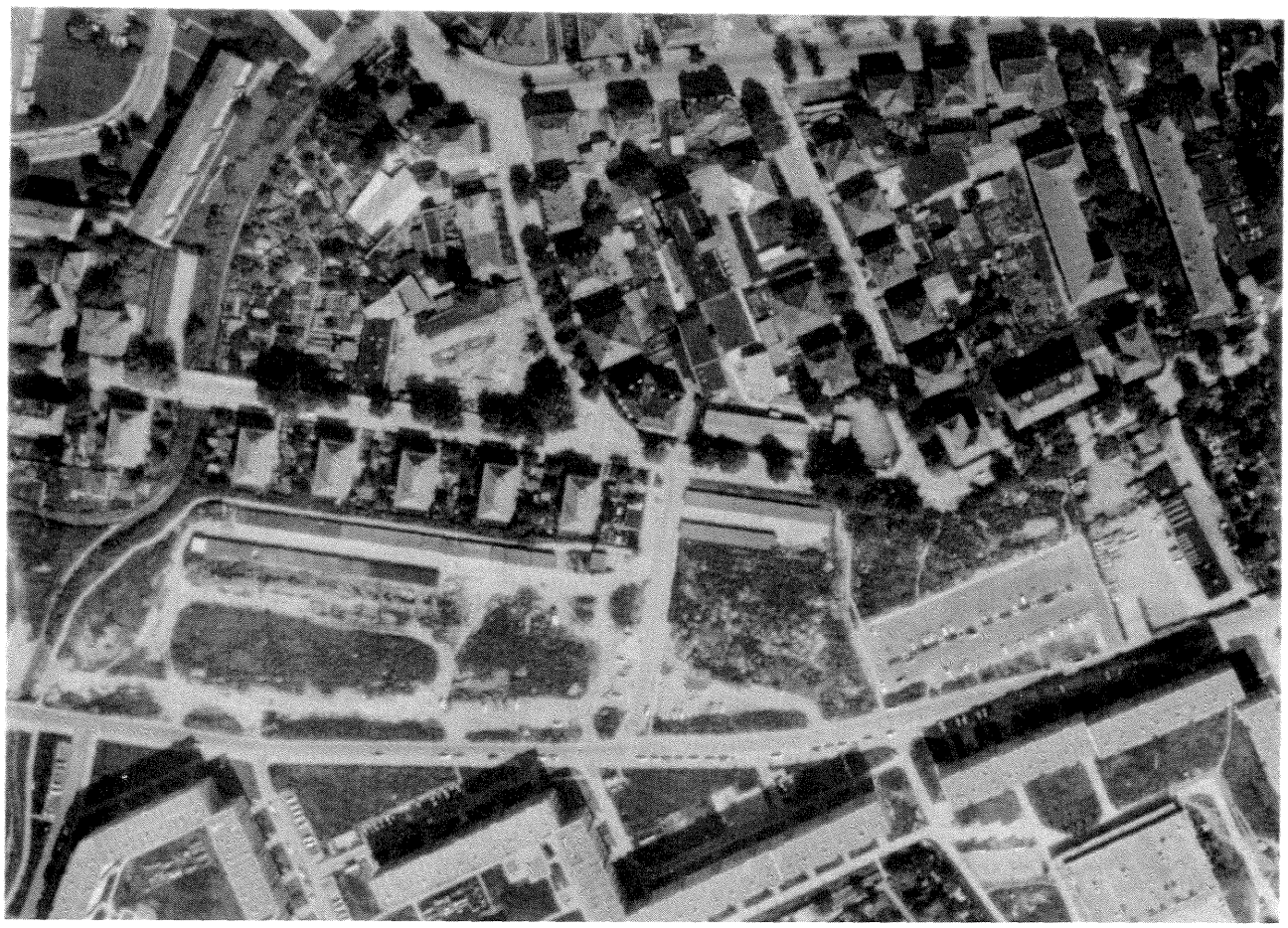


Figure 4: Dresden - Aerial Photographs (CIR, free for Publication/LFB-Nr. 073-89;8/22/87)

3.EXAMPLES AND RESULTS

Fig. 4 depicts a typical situation involving a task of planning land use. The multispectral aerial photograph at a scale of 1:36.000 shows, when enlarged to a scale of 1:13.000, the settlement encompassed by fields as an economic unit and part of the landscape.

Taking a segment of the city of Dresden as example, first, an investigation into the method of visually interpreting instrument-aided aerial photographing was carried out in the framework of the town development planning, second, the catalogue of criteria for inventories was tested systematically and third, starting from there, guides for interpretation were worked out. For instance, the following figures and maps (fig. 4-7)refer to the scales of master planning 1:5.000 and 1:2.000.

Fig. 5 illustrates the main elements of land use, whereby the new building blocks which had not yet been included in the town maps, were also recorded.

Further investigations referred to information on the sealing level of the partial area, on the physical and conservation situation of the sealing, on vegetation (fig. 6), on the vitality conditions of trees and lawn areas. By using these and other analytical maps, it was possible to work out differentiated starting-points for a discussion about urban development and planning approaches (e.g. fig. 7, wich depicts conflicts in the settlement environment).

It has become quite clear that the materials which were worked out produce initial points of departure for the creation of planning fundamentals for concrete ecological, town-shaping, and sociological situations. The utilization of conventional methods of data collection would have been by far too time consuming to solve an analogous task.

By integrating additional task-specific perception, it is feasible that interpretation and evaluation procedures can be advanced even further.

Merely unsophisticated technical equipment was applied, whereby existing , but antiquated maps, taken from the base map collection of the town, were made use of. A field test for special points was also carried out. The results thus gained are also being used for the observation of developments, i.e. of the current space observation, the changes taking place with respect to the town body, and the ecological situation.

A further example (fig. 8) shows an investigation into a potential urban redevelopment area, also carried out with the aid of visual instrument-aided interpretation of aerial photographs, in this case by a multi-spectral aerial photograph. By using aerial photographs, a swift preliminary investigation of the test site was possible, in order to assess the existing urban stock and to gain information on the structure and land utilization of the test site. This part of the city, characterized by very poor living conditions with an average building condition of grade 4 (inadequate) has certain town shape values. They can be

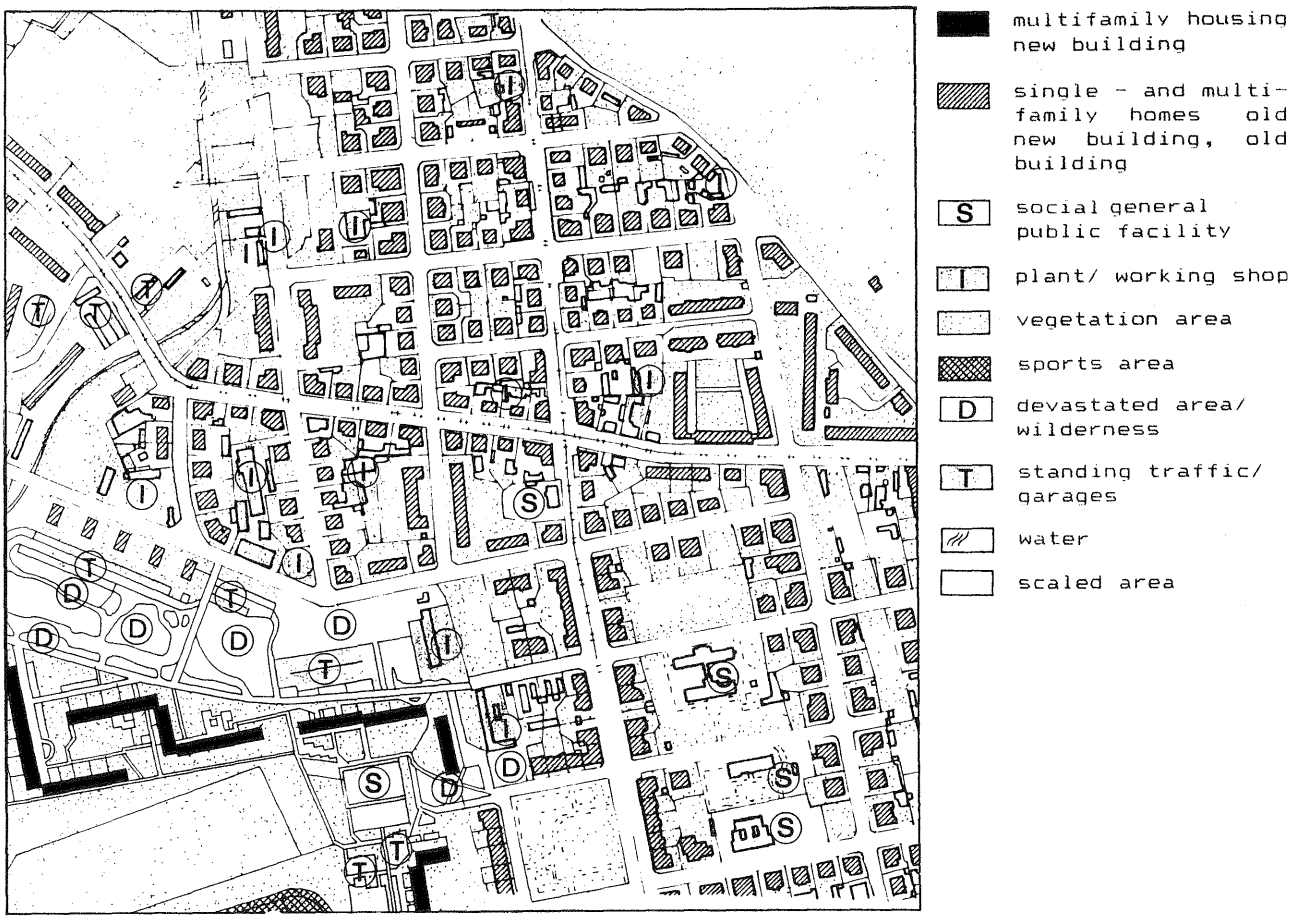
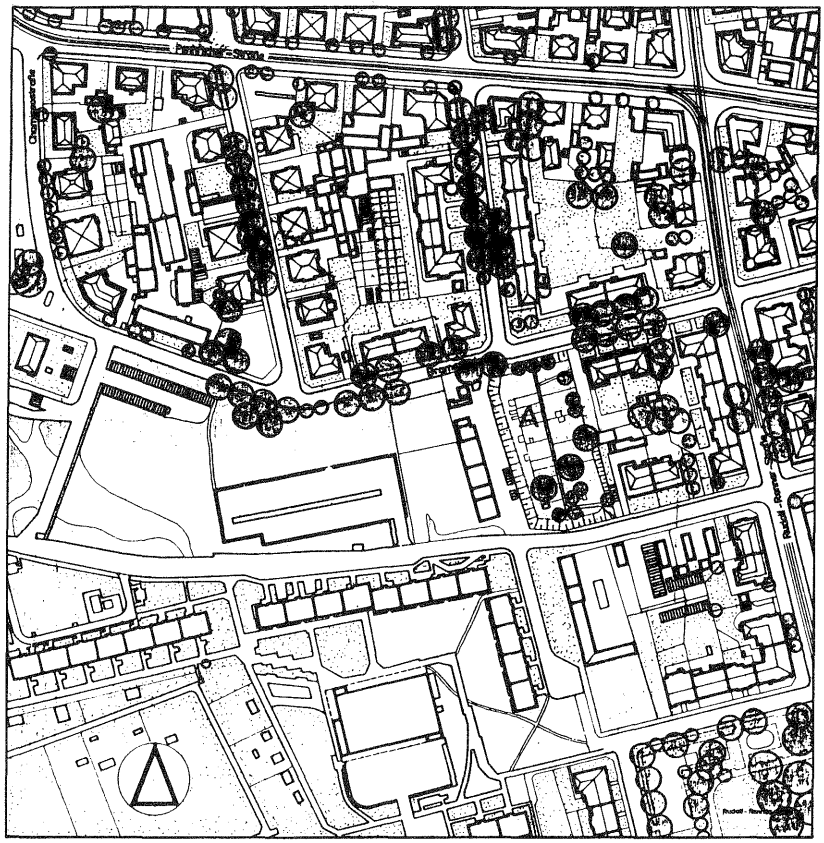


Figure 5: Dresden - Basic Map with Main Elements of Landuse



A allotments

tenant's back garden

lawn

ruderal areas

trees

Figure 6: Dresden - Map of Vegetation

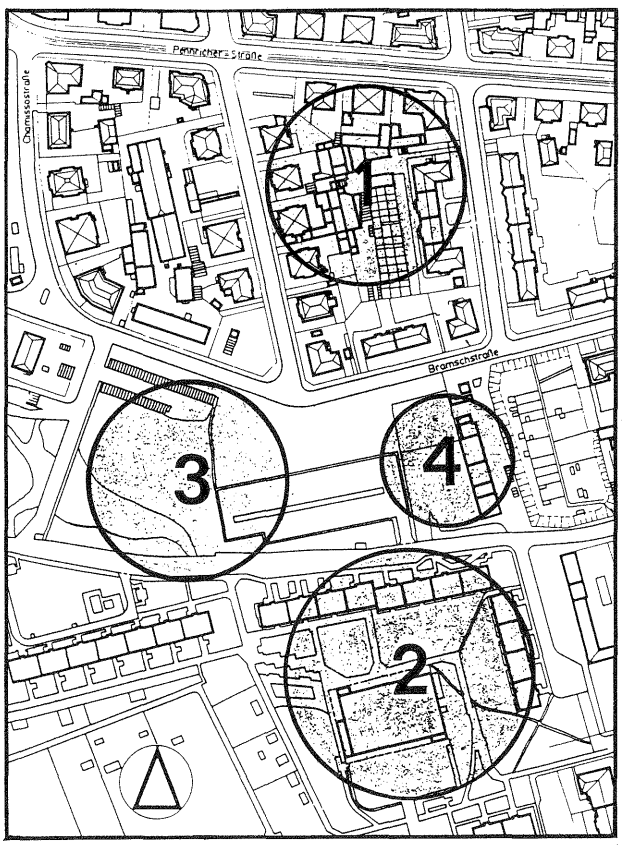


Figure 7: Dresden - Map of Environmental Conflicts with Housing Conditions

①
- mixed area with housing - percentige about 75
- construction level II till III (housing)
- type of structures 2 (2.30)
- facturies and working shops (joinery) surrounded by single situated residential buildings with private back gardens
- residential quarters with trees and grass

Conflicts:
- relative bad construction level of residential buildings
- annoyance of inhabitants caused by dust and house of the joinery
- free areas used as areas for storage
- no larger free areas (e.g. children's playground)

②
- new dwelling area with social and public facilities
- large spatial free areas, desolate
- a lot of little stamp pathes

Conflicts:
- only public free areas are existent
- larger areas are not existent because of suppleying
- existent free areas can not be used because of deficiercies of planning and shape
- no semipublic and private areas

③
large devastated areas are deviding the residential areas

Conflict:
- a lot of proper and unproper parking areas
- tree areas a not formed
- Ruderal Flora is growing
- special using by the inhabitants is impossible
- areas without any tree

④
car service station

Conflict:
- integration into the residential area is not so good
- large consumption of areas because of the existence of a car cemetry

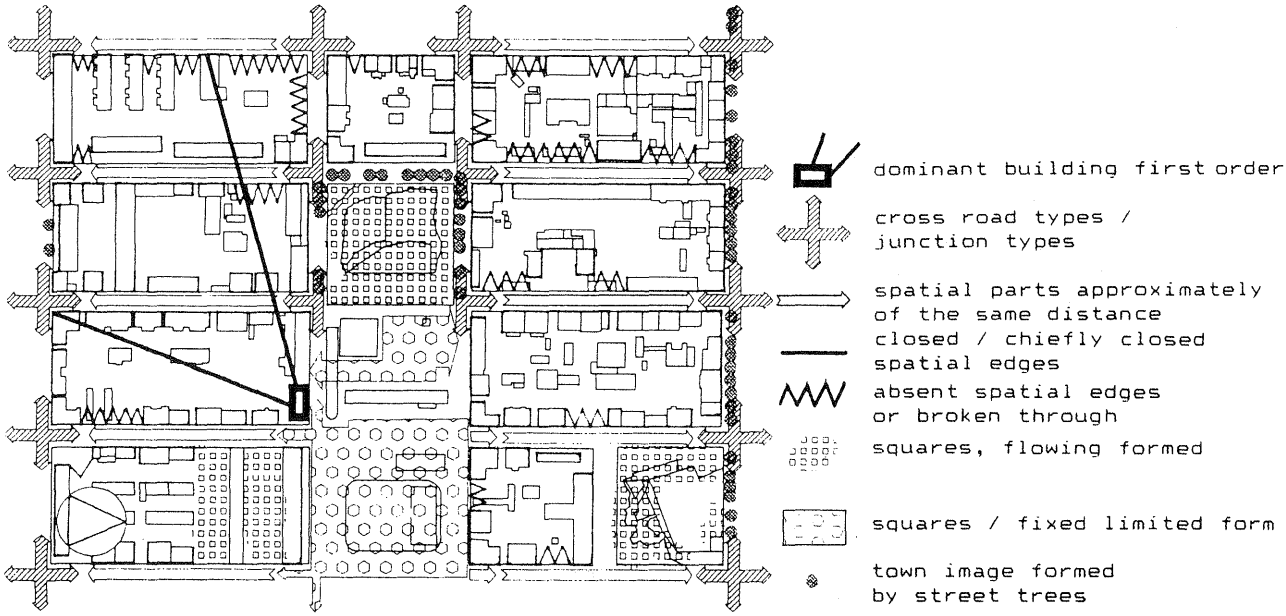


Figure 8: Leipzig - Map of Townscape, Computer Aided

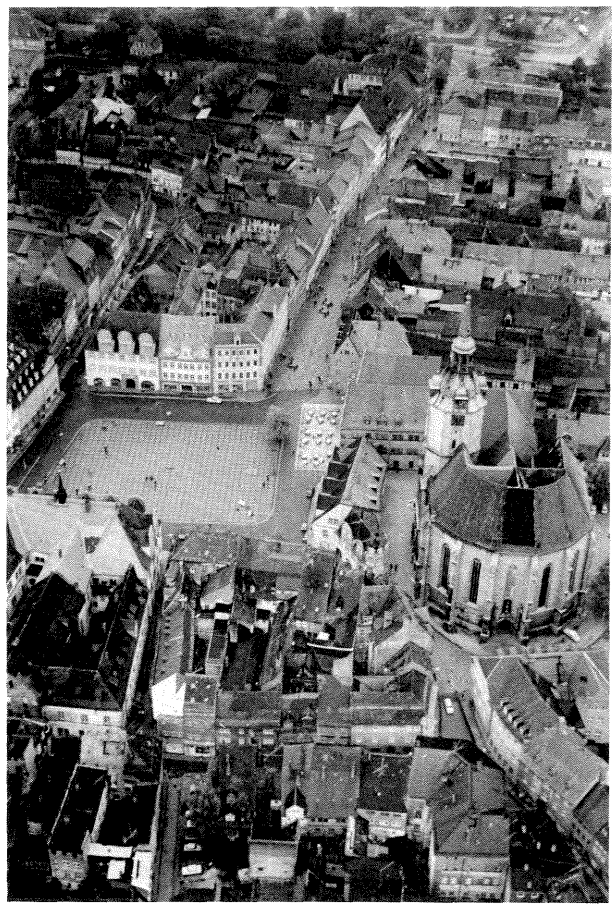


Figure 9:
Aerial Photograph (Bird's Eye View) - Traditional Historical Townscape

Figure 10 :
Bird's Eye View - Based on the Aerial Photograph with the Aim to plan Conservation in the Inner City District

seen in the mixed area structures and the rectangular space structure of building blocks erected in identical ways and at about the some time, typical for the period of 1870 to 1914. The shape characteristics inventory of this functionally worn-out area was set up by using analysis criteria for the ground plan order and composition principles (e.g. street running; space sequence, space sections according to length, width, breadth, height, facade construction, topographic and ground plastic conditions), street profiles (e.g. street and square cross-section in relation to the altitude of building within the limits of space), dimensioning of space-limiting elements and their typical arrangement rules (fig. 8). By using aerial photographs, the image (e.g. typical features already mentioned and visual relationships) and characteristics of historical development were assembled by the same method, in order to arrive at testimonies on conservation areas, redevelopment areas and conflict areas for the planning approach.

It is thus possible to hand over important planning fundamentals and other materials to planning bodies for a differentiated approach, appropriate to the given situation.

In order to arrive at more detailed testimonies with respect to the master and the allocation plan in the framework of town shape analysis, vertical photographs can conceivably be completed by oblique ones (fig. 9, 10). By using a set of oblique aerial photographs it is, for instance, possible to compile in a systematic and detailed manner the aforenamed typical features of the town shape. Thereby, changes with respect to the town shape can be included in the map on the basis of a correct scale, and different shaping targets concerning the conflict and renewal aeras can be simulated in test designs. Thus, fig. 9 depicts an urban area with values concerning the town shape, functional deficiencies, and wear symptoms on buildings and within the space structure. Fig. 10 depicts a test design carried out on the basis of aerial photographs which points out, as an objective of town-shaping, the preservation of original situations, the reconstruction of town and building types in their original forms or derived from similar historical models and their adaption (continued development of segments on the basis of historical models).

Contact Address:
Dr.-Ing. Peter Gerlach
Institute of Regional Development
and Structural Planning, Berlin
Postfach 241
Wallstr. 27
O - 1020 Berlin
Germany
Phone: 00372/27803 315/335

Literature/References

Literature - Books

/ 1/ Albertz, J.:
Grundlagen der Interpretation von Luft- und Satellitenbildern. Wissenschaftliche Buchgesellschaft, Darmstadt 1991

/ 2/ Finke, H.; M. v. Poswik:
Luftbildauswertung und Stadtplanung. Hrsg. Forschungsgemeinschaft Bauen und Wohnen -FBW- Stuttgart: Dt. Verl.-Anstalt 1981

Literature - Scientific Papers and Research Results

/ 3/ Gerlach, P.:
Stadtgestaltplanung im Rahmen der städtebaulichen Teilgebietsplanung.
In: Schriftenreihe der Sektion Architektur der TU Dresden, 1985, Heft 23, S. 90-94

/ 4/ Gerlach, P.:
Rechnerunterstützte Flächennutzungsplanung im Rahmen der städtebaulichen Leitplanung für Teilgebiete.
In: Landschaftsarchitektur, Berlin, 15 (1986) 2, S. 54-56

/ 5/ Gerlach, P.; Schmidt, I.:
Areal Photographs for Supervisory Planning of Municipal Partial Areas.
In: Trade Technical Review, Berlin, Volume 7, July/August 1988, 6 S. 40 f.

/ 6/ Gerlach, P.; Sassor, S.:
Visual Interpretation of Remote Sensing Data in GDR- Town- Planning - a Base for Creating a Geographical Information System.
In: International Archives for Photogrammetry and Remote Sensing. Vol. 28, Part 4, Tsukuba (Japan) 1990, S. 678-688

/ 7/ Gerlach, P.; u.a.:
Anwendung der visuellen Luftbildinterpretation in Stadt- und Landschaftsplanung, Architektur und Umweltschutz- Leitfaden Forschungsbericht, Institut für Städtebau und Architektur, Berlin 1990

/ 8/ Gerlach, P.; Brückner, A.:
Das Luftbild als Hilfsmittel für die Erfassung und Beurteilung von Grünflächen.
In: Landschaftsarchitektur; Berlin; Heft 1, 1991, S. 22-25

/ 9/ Gerlach, P.; u.a.:
Untersuchungen zum Einsatz von Methoden der Fernerkundung und computergestützter Informationssysteme im Rahmen von Stadtentwicklungs- und Bauleitplanung am Beispiel des Südostraumes Berlin.
Forschungsbericht; ISA, Berlin; 1991

/10/ Kenneweg,H.:
Remote Sensing approaches to assessment and diagnosis of forest decline. Proceedings of 15. International Meetings for Specialists in Pollution Effects on Forest Ecosystems. Interlaken, 1988

/11/ Kommunalverband Ruhrgebiet; Abt. "Karten-/Luftbildwesen und Stadtklimatologie" (Kellersmann, H. u.a.): Stadtbildanalyse durch Luftbildauswertung. Bergkamen, Gladbeck, Hagen. Hrsg.: KVR ESSEN, 1984