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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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(R) PREPARATORY ASSISTANCE FOR THE RESEARCH AND DEVELOPMENT INSTITUTE FOR THE CONSTRUCTION INDUSTRY*.

YUGOSLAVIA.

DP/YUG/76/001.

Technical report: Construction information.

Prepared for the Government of Yugoslavia
by the United Nations Industrial Development Organization
acting as Executing Agency for
the United Nations Development Programme

Based on the work of Herbert Stoecher,
expert in construction information

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Explanatory notes

The following abbreviations have been used in this report:

ATURBA	Ateliers d'Urbanisme et d'Architecture French sub-contracting firm for the design of a new building system
CIB	Conseil International du Batiment
COM	Computer Output on Microfilm
COMICS	Component Management Information and Control System
EDP	electronic data processing
GIK	Gradjevinsko-industrijski kombinat (building materials and component manufacturer and construction enterprice)
IGV	Institut za gradjevinarstvo SAPV (building and civil engineering institute) duty station (in Subotica SAPV) for UNIDO experts
IMS	Institute of Management Science of Novi Sad university in Subotica
MIS	management information system
nbs	new building system
SAPV	Socijalisticka Autonomna Pokrajina Vojvodina (Socialistic autonomous province of Vojvodina) province in north-eastern Yugoslavia
SFRJ	Socijalisticka Federativna Republika Jugoslavija (Socialistic federal republic of Yugoslavia)
SFB	Samarbetskomittén för Bygqnadsfragor (Coordinating Comitee for Building Information, Sweden)
UDC	Universal Decimal Classification

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SUMMARY

A rough survey of the situation of construction information in SAP Vojvodina, and particularly in IGV, showed - besides the general problem of language barriers, which might be approached by other projects - a number of local characteristics and shortcomings.

The desirable organizational framework, already designed by a previous expert, should be implemented with special attention to the dynamic role of information flow. Furthermore, improvement of all kinds of information and documentation methods and of the corresponding skills of the personnel will be a prerequisite for a successful introduction of the new building system.

On-the-job advice had been given for the organization of retrieval and exchange of scientific information, for building - design and project documentation, and for the pertinent methodology, including classification and codification.

An outline of a feasibility study about a computerized management information and control system for the construction industry of SAP Vojvodina had been drafted and, for its first step of realization, a 3-phase model project "COMICS".

Study tours are suggested to upgrade professional knowledge of team members in the fields of industrialized building design and documentation.

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INTRODUCTION[1/]

1.1. General Background

The Five Year Economic Development Plan of SFR Yugoslavia (1976--1980) states under its main objectives an increase in volume and capacity of the construction industry by more than 20 per cent, in order to meet the demand of 820 000 housing units for this period.

Due to a lack of
- a Yugoslavian Modular Coordination standard and the concept of typified buildings,
- specialization of construction firms and manufacturers of building materials and components, and
- specialization of building design and research institutes

construction works and services cost very much and last rather long.

The Socialistic Autonomous Province of Vojvodina (SAPV) with its accelerated growth and its far developed construction sector has been choosen to experiment a construction industry development plan and its organizational set-up.

1.2. Project Background

At the beginning 1974 UNDP initiated the project assistance from SIS trust funds (SIS/YUG/74/023 - titled "Mission on Industrialised Construction") which had been executed by the French firm "ATURBA" in the construction enterprise GIK"Banat" in Zrenjanin.

The final report indicates that GIK"Banat" will be able to cope with the future demands of the building construction market provided that the following proposals will be implemented:
- A conceptual reconsideration of the role of GIK"Banat" to become essentially a builder.
- Technological changes by using concrete and leightweight concrete instead of brick masonry.
- Industrialization of production and construction techniques making large use of prefabricated standard components.

Furthermore it was suggested to
- install expanded clay production units,
- build-up a factory for standardised components,
- constitute a multidiscipline study group for investigations on architectural design and research on
  - the technology of the new building system,
  - the technology of the component production,
  - the specification of the construction process.

1/ quoting the terminal report of J.W.Kapalski, expert of UNIDO (DP/YUG/76/001/11-01) and the project document (DP/YUG/76/001/B).

The need for further studies had been stressed and as a final recommendation the installation of a multidiscipline conceptual group has been proposed.

The construction combine GIK"Banat" in Zrenjanin had been choosen to test the new building system on its construction sites. The building and civil engineering institute IGV in Subotica - the most potential and research-based design institute in SAP Vojvodina - has been selected to be the coordinating body for the process of industrialization of the construction industry in SAPV, being backed-up by new construction research teams and by new laboratory equipments for building materials and components testing.

1.3. Official Arrangements

In such a situation the Government of SFR Yugoslavia together with UNDP prepared a program for the improvement of the construction industry. It had been pointed out in detail in the Project Document (DP/YUG/76/001/B) titled "Industrialization of the Construction Sector in SAP Vojvodina" which was officially approved by the Yugoslavian Government, UNIDO and UNDP on 9 March 1977.

It was agreed that the project should last 3 years, starting from January 1977. The Yugoslavian counterpart and Government Implementing Agency was IGV (the Building and Civil Engineering Institute of SAP Vojvodina) in Subotica.

It was decided to organize the project on the basis of existing infrastructure of Vojvodina, besides serving as a pilot project for similar developments of the construction sector in other regions of Yugoslavia.

1.4. Contributions

The UNDP contribution budget totals US $ 500.000.- in more or less equal distribution to the years 1977/78/79.

The Government contribution budget includes
ND 5,058 658 for 1977, ND 6,533 823 for 1978,
ND 9,777 519 for 1979 with a total of ND 19,370 000 [1], approx. the half of it for project personnel.

1.5. Objectives

The project establishes three major long-term objectives:

(1) The introduction of a new building system based on modular coordination, typified schemes of dwellings and standardized prefabricated components.

[1] The present exchange rate is = 1 US $ = 18,30 ND.

(2) The extension of the production capacities of the building industry through modernisation, specialization and concentration of production, and through the installation of new industrialized units with the application of up-to-date technology.
(3) The introduction of new building materials, components and construction techniques through strengthening the existing research units and establishing new teams.

The immediate objective of the project - the industrialisation of the construction and building materials industries in Vojvodina - has to be achieved by the following sub-objectives:
(1) Preparation of a complete technical-technological and architectural study which will define a modular system of building construction using the components industrially produced in the factories of the new building system.
(2) Strengthening and improving the Building and Civil Engineering Institute (IGV) in Subotica to provide direct consultancy services to the construction industry, particularly in introducing industrialized methods, new materials and components into the construction process.

The main emphasis of the work plan has been placed on the practical implementation of the new building system.

1.6. Expert Missions and Tasks

The first of the immediate objectives has been commissioned by UNIDO to be elaborated in accordance with particular "Substantive Terms of Reference" (of 21 Febr. 1977) by the French subcontracting firm ATURBA with participation of local specialists.

To meet the second one, a particular programme of the assistance of UNIDO consultants to the national project management has been organised.

An expert in industrialised construction, Mr.J.W.Kapalski, was deputed by UNIDO to Subotica for a 5-months mission in February 1978. He designed a new functional scheme for IGV, gave advice in design methodology, prepared specifications for additional design equipment and a training programme for local specialists.

According to the output specification II.E.13 of the project document the writer was fielded by UNIDO to Subotica in summer 1978 in order to advise in the organisation of a modern system of construction information.

Two further experts - in construction physics and in building materials for prefabrication - are expected to be in Subotica in the subsequent period.

ACTIVITIES

2.1. Activities of the First Phase

In order to make efficient use of the two-month duration of the mission, it was divided into two phases of two and six weeks, respectively. The first phase of two weeks in June/July 1978 was used to make a general survey of the information problem in the construction sector in Vojvodina, with particular attention to the needs of the Building and Civil Engineering Institute in Subotica (IGV) in its development process towards a nucleus of information handling for industrialized construction. A set of questionnaires was prepared and distributed to the main departments of IGV, asking for detailled information process, in order to provide a valuable basis for consultancy in the second phase.

From discussions with counterpart personnel it turned out that IGV is right in the middle of a manifold development and evolution process, particularly as regards the information problem. Thus, as an outcome of these investigations, the writer could - at the end of the first phase - present a detailed list of tasks [3] which he considered to be useful for further development and which he offered to perform during the second phase of his mission, if desired by the counterpart.

2.2. Activities of the Second Phase

On the basis of a deeper understanding of the situation the writer presented his ideas and models for a solution of some of the indicated problems and for a general improvement of the information flow at IGV, when he returned to Subotica to the six weeks lasting second phase of his mission in September/October 1978.

In general, he showed alternative ways of tackling the problems, and by means of consecutive discussions with experienced and competent counterpart personnel and in close cooperation with them feasible and reasonable solutions had been elaborated as far as possible.

Close cooperation has also prevailed in the drafting of a schematic model of a computerized information and control system for the management of production, distribution and use of components of the new building system. Guidelines for further investigations and studies on this subject had been given in the form of checklists and graphs.

Visits to the component prefabrication plant of GIK"Banat" in Zrenjanin - the future manufacturer of the new building system components - gave complementary insight into the complex situation as well as occasions for discussions on the findings obtained so far.

3/ See the expert's interim report "Detailed list of tasks and questionnaires" dated 6 July 1978.

FINDINGS

3.1. Status of the Project

In general it can be maintained that the status of the project does not differ much from that described in the terminal report of UNIDO-expert J.W.Kapalski. Some facts, however, which affect the job of the writer, should be mentioned in the following.

3.1.1. Organisational Structure

As much time did not elapse since J.W. Kapalski proposed in his report to set up a new organisational scheme of IGV, the institute runs its daily business in the traditional structure. Moreover, a group of specialists from IGV and GIK"Ramat" forming a UNIDO-group to support the project is still waiting for a complete set of documents of the ATURBA - project component. Meanwhile they do not yet involve themselves in system research and development, and due to their high qualifications, they are fairly engaged with the current work.

The position of IGV personnel within multipartite working groups should be strengthened by including them into the fellowship programme and awarding study tours for upgrading their professional skills.

3.1.2. Status of ATURBA subcontract

In addition to "Phase I Final Report", a component catalogue for the new building system was delivered by ATURBA, just at the beginning of the mission of the writer. Neither a catalogue of joints and interfaces to subsystems nor a set of working drawings for a pilot project - a model building with 200 dwelling units was envisaged - had arrived during the time of the mission.

From a rough evaluation of the present ATURBA documents the writer fully agrees with the selected multimodules and the concept of joint profiles, but is rather apprehensive for the large quantity of different wall components and whether the problems of sound reverberation and thermal inertia can be solved by an adequate design of the interior surface layers.

3.1.3. Availability of EDP equipment

The main prerequisite for the computerization of component management, building design and information services: the computer itself arrived in Subotica at the end of the mission. The Univac 1100/11 counts among the upper middleclass of computer hardware and, in the configuration installed in the local computer center, can serve as a multipurpose tool for advanced data processing.

The available set of software packages, of course, needs major endeavours in development work in order to adapt it to the intended fields of application. This particularly concerns the use of EDP in building design and component management.

Not at least due to the fact that the computer center is being installed outside the premises of IGV, its engineers are less skilled in computer application and did not participate at software development work up to now.

3.2. The Information System

3.2.1. Major Differences to Conditions in Western Europe

A comparison of the information system prevailing in the building planning and construction sector in Vojvodina with those established in Western European countries shows a set of differences of the following nature:

- 1 The participants of the building process are grouped to few, but big enterprises with the well separated functions: developing and investing, planning, production, con - struction.

- 2 In general, planning is distinctly separated from production and construction; once that the planning phase of a project is completed, the project documents and the role of supervision of construction goes to a special institution which may be identical with the planning body or not; members of the planning team are much less engaged in the construction process as in other countries where part of the design work is done during and interfering with the construction phase.

  Thus, the information system is less complex; a good deal of exchange of building information takes place within the design institute itself; external information flow between different participants is more concentrated.

- 3 The quantity surveyor plays a minor role: cost estimating and the pertinent quantity surveying is done by the design institute, cost control and settlement is executed by the contractor's office.

- 4 As the construction works are more or less guided in one construction enterprise, the tendering process is simpler; therefore it is intelligible that standardized specification text is not applied; likewise there is only a small motive for computerization in this field.

- 5 The concept of functional performance specification, on the other hand, appears not to be used in Vojvodina as well; with regard to the trend towards open industrialized building systems an introduction of this methodical aid is fairly advantageous, as it allows to the competitors to offer an optimal solution to a building task by taking into account their own technological intensity as well as adequate and available resources.

3.2.2. A General Hindrance = The Language Barrier

In exchanging information, the use of a common language is a dominant factor. And in this case there was found a considerable and multiple shortcoming.

- 1 For an active participation in international exchange of information, a working knowledge of English turns out to be a must. Endeavours in this field will contribute to make advantage of technical literature, symposia and working groups, as well as to the use of the most developped reference services.

- [illegible]

- 3 And even at a smaller scale, as regards the industrialization of the construction sector in Vojvodina, there might arise a further language barrier with the introduction of computerization: the elabouration and development of a so-called building language - comparable with the German "Sprache des Bauwesens" - should enable all qualified participants in the building field: engineers, architects, economists, surveyors, as well as planners and investors, to make efficient use of computers and connected equipment without deep [illegible] into strange and misleading programming languages. It is obvious that it should be established in such a linguistic form that as many [illegible].

3.3. IGV and its situation

In addition to the comprehensive description provided by the report of J.W.Kapalski there will be given some comments on the situation at IGV as it has been selected to be the implementing agency for the project in discussion.

3.3.1. The Organizational Structure of IGV

As previously already stated, the proposed new organizational scheme has not yet been brought to reality. This fact might be used in a favourable way, guided by the following considerations: Information is not a task as any other task; the function of an information elabourating and processing section is to [illegible] communication between the various departments of an institution and its external counterparts and partners; it has to play a rather dynamic role in the total process. As a consequence it should keep close relationship to all departments and sections envolved, particularly to the management group; and to make it sure, why not organize a part-time participation of members of the specialized branches in the information and documentation work?

Quite a number of misunderstandings could be cleared away if planners and scientists would cooperate in information and documentation work under the guidance of an intelligent information officer.

3.3.2. The Personnel of IGV

There can be found high qualified personnel, well skilled in its professional duties. Post-graduate courses with remarkable curricula, provided by Belgrade's Technical University, are attended by younger collegues of IGV, which in most cases supports these efforts by special grants.

Nevertheless, some international experience might be fairly recommendable to members of the institute. The predominant role of IGV in the UNIDO project for industrialization of construction should be paid attention by sending qualified (in profession as well as in language) personnel to studytours and to include some of them in the fellowship programme. This particularly concerns members of the design department (industrialized construction department according to the report of J.W.Kapalski) and of the information unit (information elabouration section or library, respectively).

As regards the personnel for executing the increasing amount of information and documentation services, there might be followed two ways: the first one is described in the preceding chapter - the part-time collaboration of members of all engaged and interested departments; the second would be to expand the general information unit by supplying it with one or two assistent documentalists (with secondary school qualification); they should perform all the pile of ordinary information works and thus allow the head of that unit to keep closer contact with the contacted sections and their information needs.

Although there is still little knowledge of design software and small experience in EDP at IGV's members, there is a great hope that the situation will change as soon as one of the terminals will be installed within its premises. At that time directions for a step-by-step introduction of computerization into the relevant fields of IGV tasks should be at hand.

3.3.3. The Premises of IGV

Due to a rapid growth of IGV's turnover in planning, material testing and scientific research, the present premises at put Moshe Pijade in Subotica are rather insuffuoient. Moreover, an extension of the buildings towards the existing free space seems to result in an unlucky compromise. At least the design department, or industrialized construction department respectively, should be given a new home, in order to fit the lay-out of the rooms to a well organized scheme of sections and functions.

When developing the lay-out of new premises, the design should provide a fairly balanced scheme respecting information and documentation, in other words:

- a balance between community and privacy: a common room for each section with more or less visual and acoustic screening of the place of work of each member of the group, providing them to personally design their environment;

- a balance between central and decentral storage of information: central to each section there should be made available and easily accessable a central documentation comprising a complete set of all documents necessary for the work of the group; in addition to this, each collaborator should have those few documents directly at hand which he makes use of in every day business;

- a balance between overdoing and underdoing as regards the technical equipment : it will help to perform professional tasks with success in reasonable time and with moderate exertion and not be a burden; in this sense an intelligible reprographic equipment and handy files will rather support work than sophisticated microfilm and EDP-technology.

3.3.4. The Information System at IGV's Library

Wall-cupboards in a general meeting room of 21 m2 floor area contain a collection of approx. 2ooo books, an increasing number of volumes of more than 16o periodicals, a large quantity of standrads, some catalogues, records, tapes, etc, 9 editions of reference bulletins and a UDC-classified file with more than 5ooo entries.

At present most of the standards and about half of the books and periodical numbers are placed outside the library to be at hand to engineers and technicians of IGV. Nevertheless, the present accommodation of the library is insufficient in relation to its services, and in the near future there will be not even enough space for storage.

The UDC-system is used for filing reference cards taken from Yugoslavian reference bulletins, and for classification of the books of IGV in the title file. A coincidence card reference catalogue of Geodex International is held for the subject Geomechanics. For the great amount of periodicals a special file is run indicating the present location of any number.

Whereas searching for a book is a daily task, searching for articles in periodicals and for references takes place approximately once a week. It is understandable that most of the inquiries come from the Hydrotechnical Department which carries out a number of difficult projects.

The two librarians, however, spend approx. half of their time with translation work, particularly from English and German originals. The rest goes to filing, searching, registering, lending, classifying and ordering activities, ranked by consumed time.

There is an outlook towards a cooperation with other libraries in Subotica, especially with that at the Faculty of Engineering of Novi Sad University. Further steps in this directions might be taken when the IGV will move to new premises closer to the faculty.

There is a general feeling of lack of communication with other institutes in the country and with similar institutes abroad. Besides that, IGV is not member within CIB, an international association of building research institutes, and therefore does not use its channels of information flow.

3.3.5. The Information System at IGV's Design Office

In four main divisions (architectural, structural, electrical, mechanical and environmental) approx. 30 engineers with university diploma, 20 plain engineers and 45 technicians produce an output of 7000 m2 drawings/year, with an average number of 8 copies/original. All drawings are entire ink drawings.

Each drawing is classified by a 10-digit code indicating the the project number(3), the main part of the project (1), the responsible department(1) and section(1) within IGV, the project phase(1), the type of the drawing(1), and a running number within the previous class (2 digits). Supplementary documents bear the project number and a page number.

Catalogues and pamphlets of building products and commodities are kept in cupboards without any deeper classification. No codification like SfB is in use at the product files. Each of the four divisions keeps its own collection.

There is a distinct interest of the architectural design section for an intelligible classification of the product file, and even more for a handy file of building design examples. The main demand, however, was expressed for a methodical advice for easy retrieval of particular documents of former projects of IGV, as well as to keep the general project documentation in good order as to make advantageous use of existing details of building construction in current design works. This project file should, if possible, be realized without using the microfilm technology.

3.3.6. The Information Equipment at IGV

At present, project documentation suffers much from the fact that hudge quantities of drawings, lists and specifications are produced and stored on a narrow space and are hard to retrieve. The introduction of microfilm technology seems to be obvious, besides the fact that it might be useful for the reduction of bulky computer outputs of the planned "Component Management Information and Control System" to be installed at IGV for the new building system.

An alternative method of project documents filing and retrieval could, indeed, be developed by making use of standardized drawing forms and a copying apparatus which allows to reduce A 1 - size drawings (840/594 mm) to half-scale A 3 - size prints (297 mm). The reduction factor of 1 : 2 still allows excellent reading of the half-scale prints if the drawing techniques of microfilm technology will be used here,too. A 3 - size project documentation files (or A 4 - size, if the larger prints are once folded to A 4) can easily be stored in existing cupboards and handled on the desk during design work.

If an extended project document code is used - as e.g. used in the CI/SfB and in the BRD/SfB classification system - documents of former projects could be collected to design manuals for special interests, e.g. by filing an additional copy of all window details in a "window"-folder.

Moreover, there are several long-term advantages from this medium size documentation system: drawer boxes are only needed for the original drawings of current projects, drawings of finished projects can be collected in tube batteries. Other participants in the project can more easily be supplied with copies for their information. The catalogue of standard components and standard details for the new building system could be draughted in more precision at double-scale and handled conveniently in book-size.

The product file as well as the design examples file need a random access storage system with easy compilation of documents of different size and stiffness what could be best provided by a suspended folders registry (four rows of telescope frames from bottom up to eye-hight) supplemented by three upper shelves.

3.4. Advice Provided and Achievements

During the stay at IGV in Subotica, the writer had the opportunity to give some on-the-job advice and to attend to the realization of some of his recommendations:

- A basis for a product file and a file of design examples was set up as a tool for the design purposes as well as for the building system development work to come.
- Reference files in the central library had been given a foundation by the introduction of the method of concept coordination in connection with the compilation of a set of key-words fitting to the institute's information needs.
- A feasibility study for a computerized component management information and control system had been outlined in close cooperation with counterpart personnel of the university institute for management sciences.

RECOMMENDATIONS

4.1 Organizational Structure

(1) For a successful realization of the project the cooperation of the main contributors (IGV, GIK Banat, IMS) has to be intensified towards joint efforts in analyzing the information system of the construction industry in SAP Vojvodina (cf. app. 10), in the application and further development of the new building system (cf. annex VIII) and in improving the drawing and documentation techniques (cf. annexes VI and VII).

(2) The organizational structure of IGV itself should be reorganized according to the scheme recommended by UNIDO-expert J.W.Kapalski, at which particular attention should be payed to a qualified system research team, whose members should possess or acquire at the earliest possible an outstanding knowledge of up-to-date building system design and documentation, or else they and IGV would fail to remain an equivalent partner in the multidiscipline group. Further study tours and fellowships should primarily be awarded to this team.

(3) The dynamic role of communication should be taken into consideration when setting up the new organization of IGV - one of the means might be a regular part-time collaboration of building design professionals in the various documentation tasks - as well as in the adaptation of the existing premises or in the lay-out design of new ones: a reasonable balance between community and privacy, between central and decentral storage of documents and in the choice of technical equipment should be taken into consideration.

4.2 Building Design and Documentation

(4) As a prerequisite for systematic building design and further investigations of building systems, the design departments have to collect and systemize a multi-facetted documentation, covering:

- the new building system catalogue
- a general documentation of building materials and products
- a compilation of exemplary building designs
- an easy accessable documentation of IGV's own projects

(5) For classification and codification in this field the internationally used SfB-System is recommended in its German version (BRD/SfB). The main chapters, lists and registers of R.Piel's book (cf. literature) should be translated into Serbocroatic to make best use of the comprehensive possibilities of the system in the various fields of application (cf. also annex VI Study tour 2).

(6) Product information material should be ordered in duplicate in order to have a complete set in a central file besides those distributed copies which the members of the design teams have to have ready at hand at their desks for daily work. A circular letter to manufacturers and suppliers and the mediation of building products information services may facilitate the collection work. The tables 1,2,3 of BRD/SfB should be used for classification and codification.

(7) A compilation of design examples, methods and solutions to design problems should be gathered from periodicals and reports. Besides the possibility of making use of a new copying machine, it is recommended to tear the periodicals after their regular circulation into pieces, and to file only those articles for which a particular interest had been expressed on a circulation label by staff members during circulation of the journals. The use of table O of BRD/SfB is recommended, eventually supplemented by the other tables (1,2,3,4).

(8) As a reasonable alternative to microfilm-technology it is suggested to make use of modern copying equipment in a half-scale documentation. All documents of the new building system and of any building project should be reduced in scale by copying so that they can be collected in a A 4 - size folder without folding in the vertical (cf. [illegible]).

(9) A copying machine has to be ordered, which permits scale reduction to A 3 or A 4 - size copies on standard papers from originals up to A 1 - size. (cf. [illegible]. [illegible], this recommendations differs from that of UNIDO-expert J.W.Kapalski.

(10) The introduction of microfilm - compatible drawing technique in the building design and industrialized construction department is recommended. First it will support the introduction of the a.m. half-scale project documentation, later on it may be useful as a prerequisite for the application of the microfilm-technology.

(11) A system research team has to continue the work done by ATURBA by starting a series of investigations for the further development and an optimal application of the new building system:
- a compatibility study
- a suitability study
- a study on the organization of feed-back of information from research laboratories, building site, building use and maintenance to the design (of the building system and of particular buildings (cf. [illegible]).

(12) Study tours and fellowships should aim at modern methods of design and drawing techniques for industrialized building construction with attention to residential buildings and to documentation techniques, too. (cf. [illegible], [illegible] tours 1 and 2).

4.3 General Documentation and Exchange of Information

(13) The central library of IGV primarily has to support the scientific activities in the institute, secondly to give guidance and assistance in other information and documentation activities of the institute's departments. A step-by-step extension of the cooperation and coordination with other institutes is highly recommended (faculty of Novi Sad university in Subotica, building centres in Belgrad, Zagreb, etc.), particularly as regards the subscription to the expensive international data bases.

(14) The documentation system to be applied in the library should follow the concept of coordination. That means that documents are kept on shelves in chronological order of acquisition (except handbooks, dictionaries, directories, atlases, etc, which are set up separately).

Thus, the most recent books are to be found at the end and retrieval can be performed by several means. Furthermore, it correspondens to the international trend in scientific information.

(15) The retrieval system and the corresponding files should be as elabourate as there is a demand within IGV. Therefore it should start with a simple subject file, compiled from multiple copies of the access cards and filed under the relevant entries of a mini-thesaurus. Later, a coincidence card system might be used in context with an improved thesaurus of engineering terms, which leads in its most developed stage to a computerized retrieval system by making use of a data base and its accompanying software system. A study tour on this subject should be taken into consideration, too. (cf. [illegible].

(16) External exchange of information should be executed in three ways:
- A collection of addresses of participants in symposia, congress and CIB-meetings, and their home institutes, by an address-file (a A 6 - size format with hole-tabs for easy retrieval is suggested, as e.g. "AZ-Kartei").
- Contacts to other, similar institutes in Yugoslavia and abroad should be established by the periodical exchange of information on current projects, (the use of CIB-format for the exchange of building research projects is suggested; the membership within CIB should be taken into consideration).
- Cooperation with other building research and information institutes in the country in the participation at international data bases (RECON, NASA, ESRA, INPADOC, LOCKHEED, FIS 8, etc.).

4.4 Industrialized Construction Management Information

(17) In the starting phase of setting up a computerized management information and control system for the construction industry of SAP Vojvodina, a thorough investigation of the information system prevailing in the country, the development of needs, interests and possibilities, should be made in connection with a survey of international realizations in similar fields of application (a similarity in the size of the system and in the structure of the participants is more important for an effective transfer of methodology than the question of the right branch), forming the main body of a feasibility study (cf. [illegible].

(18) The most urgent and - at the moment - most promising part of such system will be a management information and control system for the components of the new building system. A 3-phase implementation of computerization and expansion is suggested and presented in the outlines of a model study "COMICS" (cf. [illegible]. Further stages of development might involve a management information and control system for other products, for whole building projects and for the allocation of resources (manpower, equipment, material).

(19) As regards classification and codification of the items in the data base, free coding is recommended for the components of the new building system. If in later stages whole buildings and a wide range of products will be managed by the data base, the SfB-system is recommended for the classification, and if necessary, with

supplements from the CIB-master list of properties. Particularly as regards cost control and specification, the Scandinavian variants of the SfB-system (BDC, CBC) and their variety of codification should be considered for application, as they are well developed in computerization.
(Appropriate documents are marked in the list of literature).

ACKNOWLEDGEMENTS

The writer wants to express his acknowledgements with thanks to the contacted staff members of IGV, the "Institut za Gradevinarstvo SAP Vojvodine" in Subotica, particularly to Mr.Sandor Bači, its General Director. He furthermore wants to manifest his appreciation to the co-directors, Mr.Savanja and Mr.Stipić, who spent considerable time for guidance and discussions on this project.

The writer also feels obliged to Mr.Bogdanović, General Director of GIK"Banat" and his staff in Zrenjanin, and to the staff of the Institute of Management Sciences of Novi Sad university in Subotica, particularly to Mr.Mamužić, for all their supports towards a better insight into the problem situation.

He gratefully acknowledge the guidance and help provided by Mr.Jaime Renart, the UNDP Resident Representative in Belgrade, and Mr.Rada Janjetov, the national project director of "Industrialization of the Construction Sector in SAP Vojvodina" and thanks to Mrs.Palenčar of IGV for all assistance in carrying out his mission.

Annex I

JOB DESCRIPTION
DP/YUG/76/001/11-02/32.1.Z

POST TITLE	Expert in Construction Information
DURATION	Two months; in split missions of two weeks and six weeks
DATE REQUIRED	As soon as possible - Two weeks September 1978 - Six weeks
DUTY STATION	Subotica, Zrenjanin
DUTIES	The expert will be attached to the UNIDO project: Industrialization of the Construction Sector in SAP Vojvodina and will in cooperation with the Project Director and counterpart personnel assist and advise in the development and improvement of the project. Specifically, the expert will be expected to:

1. Prepare a questionnaire in order to collect the data necessary for the organization of a modern information system in the Institute.

2. Introduce international coding of construction information.

3. Organize exchange of information within the country and with similar institutes abroad.

4. Advise on the introduction of computerization for construction needs.

5. Draw up a list of equipment needed for organization of modern testing of new materials and components.

6. Prepare a new functional scheme for the Institute, in order to meet the requirements of the project's actual implementation.

7. Advise the National Director of the project on the preparation of training programmes for local specialists, who will be involved in the elaboration and further improvement of the standard building system.

8. Be responsible for the preparation of the specifications for additional equipment needed to upgrade design processes.

The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Government on further action which might be taken.

QUALIFICATIONS

Extensive experience in the organization of information services particularly for construction sector. Experience in the field of introduction and use of computers on information technology in building industry.

LANGUAGE

English

BACKGROUND INFORMATION

The construction industry during the last twenty years of its development reached significant results and now plays a very important role in the general development of the economy.

For the next plan period, inclusive 1980, it is foreseen to build 820,000 housing units in the country.

Among the other Republics, Serbia and especially SAP Vojvodina, possess one of the more developed construction sectors. Construction activities represent approximately fifty one per cent of the total investment in SAP Vojvodina for the past five - six years. The general orientation of the long term development programme for SAP Vojvodina, covering the period 1976 to 1985, lays particular emphasis on the construction industry. It is foreseen, among other tasks to build 200,000 housing units during this period.

Realization of the project will start with the elaboration of the main principles of construction design standardization thereby creating a new standard building system based on unique modular co-ordination.

For this purpose, it is envisaged to organize it at the Construction Combine "Banat" located in Zrenjanin, with use of existing capacity of the Construction Industry Institute in Subotica. The introduction of new systems will be organized at the construction sites of the Construction Combine "Banat".

For further development of the construction research it is foreseen to provide assistance to the Construction Industry Institute in Subotica, specifically in the field of testing of new building materials and in organization of construction physics investigations of structures.

The Institute has sufficient professional staff (approximately 170) and very good scientific relations with the Civil Engineering and Faculty of Novi Sad University which is also located in Subotica.

The main purpose of the work carried out during the period of assistance by UNDP will be to establish a base for further uninterrupted development. Particular attention will be paid to the creation of a strong organizational set-up and of teams of professionals able to assume full responsibility for the project's activities and continuation of work following the completion of the project.

For the realization of the immediate objectives the project has engaged a consulting firm which will elaborate the principles of the new prefabrication system and formulate the development of a system suitable for industrialized building (Model1).

The individual experts will implement the following tasks:

1. Elaborate a more practically oriented structural scheme of the Construction Industry Institute in Subotica, in order to meet the requirements of further development and application of industrialized methods in construction practice of the Vojvodina region.

2. Establish the new research teams mainly oriented towards the development of a new prefabricated system.

3. Prepare a programme on construction physics investigations in order to organize the test of new structural elements and components on the basis of modern methods, instruments and equipment.

4. Improve the construction investigations with the main emphasis on:

   - use of locally available raw materials and execution of their extraction.

   - large application of plastics and other new materials in construction.

   - elaboration and testing of new building materials.

5. Organize a modern system of construction information with the:

- introduction of international coding of construction information.
- use of computerization for information.
- organization of exchange of information.

6. Elaborate the project of new settlement, on the basis of new prefabrication system, as a prototype for introduction of industrialized construction.

7. Organize the training programme for local staff in order to fulfil the requirements of immediate objectives of the project.

8. Ensure equipment needed for organization of modern testing of new materials and components.

NO CANDIDATES REQUIRED AT THIS TIME

Annex II

LIST OF CONTACTED PERSONNEL

1. UNIDO, UNDP

- 1 Jaime RENART, Res.Repr. of UNDP
- 2 Rada JANJETOV, architect, project director

2. Institut za Gradevinarstvo SAPV, Subotica (IGV)(Construction Industry Institute)

- 1 Šandor BAČI, director
- 2 Stevan ŠAVANJA, co-director
- 3 Lajčo ŠTIPIĆ, co-director
- 4 Aladar GULJAŠ, architect
- 5 Laslo DJARMATI, engineer
- 6 Julijana PALENČAR, philologist
- 7 Josipa RUDINSKI, architect

3. (Institute of Management Sciences, Subotica)

- 1 Ivan MAMUŽIĆ, M.Econ.
- 2 Imre ANTUNOVICS, dipl.eng.
- 3 István KISIMRE, M.Math.

4. GIK "Banat" (building construction enterprise), Zrenjanin

- 1 Petar BOGDANOVIĆ, general director
- 2 Dušan MILANOV, director
- 3 Miodrag MOŠORINSKI, architect
- 4 Slobodan RACKOV, architect
- 5 Sredoje MIHAJLOV, mathematician

Annex III

ADDRESSES

1. Classification and Codification

1.1 (SfB)
SfB Bureau
Svensk Byggtjänst
POB 1403
S - 11184 Stockholm
(Swedish building centre)

1.2 (BRD/SfB)
Institut für Baukonstruktion
Universität Stuttgart
Keplerstr. 11
D - 7000 Stuttgart 1, Pf. 560

1.3
Technische Akademie Esslingen
Rotenackerstrasse 71
D - 7300 Esslingen, Pf. 748
Telex 7-256475 akes d
(courses on codification systems in industry, application of microfilm technology, etc)

1.4 (BSAB)
Byggandets Samordning AB
Fleminggatan 77
S - 11232 Stockholm

1.5 (NENK)
The Nenk Development Group
Directorate General of Research and Development
Ministry of Public Buildings and Works
Millbank
GB - London SW 1

1.6
Materialamt der Bundeswehr
S3/Dv - Stelle
Niederpleiser Strasse 50/52
D - 5204 Hangelar
(Handbuch der Versorgungsartikelkatalogisierung)
(Handbook of codification and supply commodities)

1.7
IBM - Deutschland
D - 7031 Sindelfingen
(various "IBM - forms" on codification)

1.8
Institut für Bauökonomie
Kienestrasse 41
D - 7000 Stuttgart 1, Pf 560

1.9 (CBC)
Björn Bindslev
CBC Byggeadministration AS
Kokkedal Industripark 28
DK - 2980 Kokkedal

1.10 (SfB)
Information Centre of Building
c/o Nándor Kékesi
Hárosa utca 21
H - Budapest VII

1.11 (CI/SfB) — Royal Institute of British Architects
c/o Mr.Alan Ray-Jones
66, Portland Place
GB - London WIN 4AD

2. Cost Estimation and Cost Control

2.1 — cf. 1.8

2.2 — Mr.Urien (Service Economique) CSTB
Centre Scientifique et Technique du Bâtiment
4, av. Recteur Poincaré
F - Paris XVI eme

2.3 — Mrs.Klara Szöke (EGSZI)
Építésgazdasági és Szervezési Intézet
Csalogány u. 9
H - 1027 Budapest

2.4 — Institut für Hochbauforschung
ETH - Zürich
Hönggerberg
CH - 8093 Zürich

3. Design Technology, Documentation, etc.

3.1 — Gesellschaft zur Systemförderung für Zeichen-, Druck- und Reprotechnik mbH
POB 100801
D - 5900 Siegen 1
(editor of periodical "tb-report", covering problems of design offices, organization, reprographics)

3.2 — cf. 1.3

3.3 — Dr.Hatz
Institut für Industrialisierung des Bauwesens
c/o Hugo Mischek KG
Dorotheergasse 7
A - 1010 Wien
(NC process in large-panel design and production)

3.4 — Informationsverbundzentrum Raum und Bau (IRB)
der Fraunhofergesellschaft für Angewandte Forschung
Silberburgstrasse 119
D - 7000 Stuttgart
(scientific documentation centre)

3.5 — Institut für Technische Bauwissenschaft
Mozartstrasse 26
A - 2500 Baden bei Wien
(research institute dealing particularly with modular coordination, building information)

3.6 — Conseil International du Bâtiment (CIB)
General Secretariat
Weena 700/POB 299
NL - Rotterdam

Annex IV

LITERATURE

1	CAT	Piel,R. Ordnen, Suchen, Finden Bauinformation mit dem BRD/SfB-System Köln-Braunsfeld: Müller, 1978
2	C	Bindslev, B. Project management by means of the CBC-System Dänemark:Vedback, 197o
3	CA	A master list of properties for building materials and products CIB report 18 Rotterdam: CIB 1972
4	CA	The SfB-System CIB report 22 Rotterdam:CIB 1973
5	C	Büchin, K. et al. Die Anwendung des Klassifikations- und Codierungssystems BRD/SfB in der Projektbearbeitung Deutsches Architektenblatt (1974)19,2o,21
6	C	Eisenblätter, A. Produktinformation - Entscheidungshilfen des Architekten Hannover : Diss. TU Hannover, 1974
7	C	Ray-Jones,A./Clegg,D. CI/SfB Construction indexing manual London: RIBA, 1976
8	C	Ray-Jones,A./McCann, W. CI/SfB Project Manual, organizing building project information London: Architectural Press, 1971
9	C	Gemeinsamer Ausschuss "Elektronik im Bauwesen" in DIN (Deutsches Institut für Normung eV),edit. Das Standardleistungsbuch für das Bauwesen Berlin/Köln: Beuth
1o	CA	Nigel Gough/Lenz Planen + Beraten GmbH Klassifizierung und Codierung von Bauelementen Berichte aus der Bauforschung, Heft 78 Berlin/München/Düsseldorf: W.Ernst & Sohn, 1972

A ... an acquisition of the so-marked literature is recommended
T ... a translation of the so-marked literature is recommended
C ... the so-marked literature particularly deals with classification and codification in the building field

11 C
The National Computing Centre, edit.
Commodity Coding
Manchester: Quay House, 1968

12 C
Ausschuss für Wirtschaftliche Verwaltung eV,edit.
Warenkatalogisierung und Kommunikation über Waren
Frankfurt/M.: AWV, 1970

13
Pfeiffer,K.K./Schmidt,G.
Eine Datenbank für den Entwicklungsbereich
VDI-Z 119/1977/15/16, p.745-752

14
Hoffmann,M.J.A.
Gestaltungsparameter und Vorgehensweise bei der Systemkonzeption komplexer betrieblicher Datenverarbeitung
Berlin: Diss. TU Berlin, 1975

15
Bindslev, B.
Computers in Contract Control
Building Research and Practice 1(1973)2, p.75-82

16 C
Department of the Environment,edit.
Structuring Project Information
A report on the arrangement and presentation of information for building projects
London:DOE, 1972

17 CA
Construction Specification Institute,edit.
First International Congress on Construction Communications (Rotterdam, Sept. 24-28,1972)
Washington: CSI, undated

18 A
Murray, D.
A Reference Guide to Information Services
Industrialization Forum, Montreal 3(1972)5,p.19-22

19 C
Hagenbrock,T./Küsgen,H./Sulzer,P.
Die Funktionale Leistungsbeschreibung im Bauwesen
Kurze Anleitung für Aufstellung und Gebrauch
Schriftenreihe des Instituts für Baukonstruktion der Universität Stuttgart, Heft 9
Stuttgart, IfB, 1975

20 C
Ministry of Public Buildings and Works, edit.
A commodity identification code for the construction industry
London: MPBW, 1970

21+ C
Wahlin, Erik
Comprehensible design documents for buildings
Statens institut för byggnadsforskning
Report R4: 1971
Stockholm: SIB, 1971
(report in Swedish, with English summary)

22+ CA
Wahlin, Ejnar
Uniform classification in the building sector
Part I: Classification of products
Guidelines for a general product system and for a building product system adapted to the requirements of the trade
Statens rad för byggnadsforskning
Report R 47: 1976
Stockholm : SRB, 1976
(report in Swedish, English summary separate)

23 C
Institut für Bauökonomie der Universität Stuttgart
Bauelementgliederung
Berichte aus der Bauforschung
Berlin/München/Düsseldorf:Wilhelm Ernst & Sohn

24 C
DIN 1356, Teil 1o: Bewehrungszeichnungen
in: Beton- und Stahlbetonbau 73(1978)5, p.1o9-116
(classification and codification of reinforcements)

25 C
ISO/DIS 4o66: Bar Scheduling
Stockholm: ISO/TC 1o/SC 8 - Secretariat, 1976

26
von Bosse, J.
Zeichnungserstellung durch Montage und Reprografie
tb-report (1974)1, p.15 ff.

27 C
ISO/draft proposal: N79E
Building and Civil Engineering Drawings - Coding and Referencing Systems for Drawings and Associated Documents
Stockholm:ISO/TC 1o/SC 8 - Secretariat, 1977

28 C
CBC Management Information System
CBC publ. no. 1o1
Kokkedal: CBC, 1972

+) : distribution by : Svensk Byggtjänst
POB 14o3
S - 11184 Stockholm

Annex V

EQUIPMENT SPECIFICATION

To facilitate project documentation at IGV and to provide means for the compilation of multivariant design manuals and easy distribution and storage of project and design documents, the aquisition of a special copying machine is recommended with the following specification:

size of original	: A 1 (594/841 mm)
size of copy	: A 4 (297/210 mm) and A 3 (297/420 mm)
reduction factor in length	: 2 and 1 (obligatory) $V\bar{2}$ (optional) $2V\bar{2}$ (optional)
paper quality of copy	: standard paper (obligatory) tracing paper (optional) transparent film (optional)

This specification differs from that given in appendix of final report of Mr.J.W.Kapalski, particularly as regards the size of the original.

Annex VI

STUDY TOURS

Study Tour 1 : Industrialized System Planning

The further development of the new building system and its application in housing and similar buildings will be executed - according to the organizational scheme suggested by Mr.J.W.Kapalski - by a group of specialists mainly employed at IGV in Subotica. In order to upgrade their skills in industrialized systems design and in an advantageous application of modular coordination, the organization of a study tour is suggested.

subject	: Development of and design with industrialized building systems
function	: Upgrading the skills of members of the Industrialized Construction Department, especially of the Information Elabouration Section and the Industrialized Design Section
location	: Vienna and environs
language	: German or English
duration	: 1 week
period	: not in December, July, August
counterpart	: Dr.D.Hatz H.Mischek KG
features	: (enterprise for large-panel production and construction of residential buildings) numerical control for automatic production of panels, slabs, 3 D - modules
counterpart	: Dr.F.Maderthaner Institut für Techn.Bauwissenschaft
features	: former system designer at Interconstruct, (manufacturer of CAMUS-like large-panel system), expert in component interface and joint design, tolerances control
counterpart	: H.Fürst Academy of Applied Arts, Vienna
features	: former system designer at Universale HT (manufacturer of Larsen & Nielson-like large-panel system), expert in modular coordination and modular drawing of large-panel building systems

participants	: L.Stipić, IGV J.Rudinski, IGV S.Rackov, GIK Banat
supplements	: INPADOC (International Patents Documentation Centre) Visit of large-panel building systems factories and building sites Performance of data base retrieval with RECON (Remote Control Data Base System) Thesaurus development work

Study Tour 2 : Building Information and Documentation

Advanced methods and techniques for exchange of scientific information, project documentation and product documentation obtain an important role in industrialized building. Stuttgart as the new German centre for building information and documentation at IRB is also the place of far advanced development and application of building classification and codification practice. Therefore a study tour to Stuttgart seems to be a useful means to improve the efforts of IGV in this field.

subject	: Information and documentation in building with particular respect to classification and codification
function	: Demonstration of modern information and documentation methods and techniques to members of the Information Elabouration Section and of the library of IGV
location	: Stuttgart
language	: German or English
duration	: 1 week
period	: not in August, September
counterpart	: Dr.W.Wissmann Informationsverbundzentrum Raum und Bau der Fraunhofergesellschaft für Angewandte Forschung eV (IRB)
features	: German centre for building documentation and information, mainly in scientific information, EDP of data bases

counterpart	: Prof.P.Sulzer Institut für Baukonstruktion, Universität Stuttgart
features	: medium-size scientific library and files, introduction of SfB in Germany (BRD/SfB), introduction of functional performance specification in Germany, development and systematization of building systems
counterpart	: Prof.H.Küsgen Institut für Bauökonomie, Universität Stuttgart
features	: systematic approach to cost estimation and cost control, adaptation of SfB-system for cost control
participants	: J.Rudinski (IGV) J.Palenčar (IGV) L.Stipić (IGV)
supplements	: Technische Akademie Esslingen: courses on microfilm-technology, on drawing classification, etc. Architect design office Weidle, with application of SfB-system by R.Piel and K.Büchin

Study tour 3 : Cost Estimation and Control

The introduction of a computerized component management information and control system for the new building system, in cooperation of IGV, GIK Banat and the Institute of Management Sciences (IMS) of Novi Sad university is a challange towards an integration of a comprehensive cost estimation and cost control system. A study tour to institutes dealing with the relevant methodology and to users of that system is recommended for envolved people.

subject	: EDP - compatible methods of cost estimation and cost control, with particular respect to residential buildings
function	: Assistance to members of IMS and IGV at the introduction of a cost estimation and control system into the computerized component management information and control system (COMICS, stage 3) for the new building system
location	: Paris
language	: French or English
duration	: 2 weeks
period	: not in August

counterpart	: R.Urien or M.Sultana CSTB, Paris, Service Economique
features	: Methode ARC (comprehensive cost estimation system for the various stages of the design and building process)
supplements	: visit to the hudge building laboratories campus of CSTB in the outskirts of Paris
location	: Stuttgart
language	: German or English
duration	: 1 week
period	: not in August, September
counterpart	: Prof.H.Küsgen Institut für Bauökonomie Universität Stuttgart
features	: systematic approach to cost estimation and cost control, adaptation of SfB-system for cost control
supplements	: cf. study tour 2

Further addresses for studies in cost control are:

Prof. Heinrich Kunz
Institut für Hochbauforschung
ETH - Zürich/Hönggerberg

Mrs.Klara Szöke
Institut for Building Economics and Organization
(EGSZI)
Csalogány u. 9
H - 1027 Budapest

Mr.Kent Juvèn
REPAB
Mor&ngatan 5B
S - 41671 Göteborg

participants	: I.Mamužić, IMS L.Stipić, IGV

All study tours should be well organized, prepared according to the suggestions in appendix 4 of the final report of J.W.Kapalski. In addition to this it is recommended to ask for introductory literature when arranging the study tour programme with the counterparts. The naming of participants is based on the rough insight of an outsider and should, of course, be subject of further considerations.

Annex VII

PROJECT DOCUMENTATION CONCEPT

A reasonable alternative to microfilm-technology for setting up a project and design documentation is based on modern copying equipment. As it fits well to the tasks, experience and size of IGV, it is highly recommended and will be described in the following. For the absolutely necessary machinery cf. to appendix 6.

The Concept

Provided that drawings and other large design documents are produced according to the drafting techniques which are necessary for the microfilm technique, they can be read and understood even if their size is reduced by a factor of 2 V 2, or 3 respectively, in length. That means that by applying an appropriate reproduction technique, documents with sizes of up to A 1 (594/841 mm) can be collected in a A 4 - size folder, and thus easily handled, sorted and stored. In general, one central copying machine is sufficient.

The Method

The sizes of original drawings should be multiples of A 4 or A 2 (upright position is recommended) in the case of A 4 - size documentation, and of A 3 or A 1 in the case of A 3 - size documentation. A horizontal as well as a vertical accumulation of the basic is possible.

The drawing technique applied should be according to the standards for microfilm drawing. This concerns

- the graduation of line thicknesses
- the minimum line thickness
- the minimum line distance
- the necessary contrast
- the repetition of the drawing number on the drawing
- the lay-out of the drawing
- the use of adequate form of letters and stencils
- the choice of a suiting scale
- the intelligent decomposition of the content
- the best use of references to standard details

As far as these rules are not yet subject of Yugoslavian standard, reference should be made to e.g. the German standards.

The reduction factor should be either 2 (half size in length) or 1 (full size), thus providing a considerable reserve in clarity at reading.

The classification and codification of the drawing should be as comprehensive as needed for storage, distribution and retrieval. A classification system similar to that shown by Diel (in : Ordnen, Suchen, Finden - - page 42) is recommended. It comprises a

- project classification : project-number, parts of the project according to the decomposition of the building as far as needed in the documentation. e.g. down to the room number, if a considerable amount of documents deal only with information about a specific room. (e.g. furniture, equipment, interiour design, etc.)

- subject classification : a functional code is reasonable to indicate the building element under consideration; cf. to BRD/SfB table 1; a classification of construction types and materials and resources - according to BRD/SfB tables 2 and 3 - is not necessary; it might be an additional aid of the documentation is primarily intended to become a design manual.

- source classification : a code referring to the body or person who produced the document or planned the represented object, resp.; it helps to find out the responsible person, an advantage particularly in the case of vaguenesses or necessary amendments; the classification of this topic should conform to the relevant organizational scheme of planning.

- user classification : a code which indicates the presumable users of the document might assist at the distribution of the documents; a suitable classification for this topic, however, seems not to be available at the moment.

- identification : in addition to the above mentioned classifications, further codes should indicate the type of document (drawings according to a typology of drawings, as e.g. given in the BRD/SfB project documentation system), a consecutive number and an index showing the status of corrections.

Although it might not be reasonable at the moment to fill in all of the a.m. codes in the classification field of a document, sufficient space, however, should be provided for all codes which might be used in future project documentation. Furthermore it is recommended to integrate all those codes which are already being used and understood now.

The storage of originals, if larger than A 3 - size, could be in a drawer box during the planning phase of a project, later on the drawings may be stored away in tube batteries, clearly labelled on the lid and on the tube.

The delivery of copies will be in full-scale size to all main users, i.e. to counterparts who either want the full size copy as a basis for their own drawings (e.g. specialists for electrical or HVAC installations); copies in reduced (half-scale) size will be given to all participants in the project who merely use the drawing as a vehicle of information.

The documentation can be in A 4 or A 3 folders or files; depending on how the documents will be used further on, they can be compiled according the various codes mentioned above, thus providing a variety of manuals, e.g.

- project manual
- a design manual, covering a selected group of drawings/documents from several projects
- a component catalogue, as e.g. for the new building system
- a specialist's partly project documentation
- a cost-control documentation

In any case, the documentations should be supplemented by a set of lists, leading the searcher to the right document in shortest time.

The Prerequisites:

Obligatory is a copying apparatus for up to A 1 - size originals and A 3 and A 4 - size copies, on standard paper (tracing or transparency paper optional), with reduction factors of 2 and 1 in length scale ($\sqrt{2}$ and $2\sqrt{2}$ optional).

Recommended is the application of a drawing technique according to microfilm - standards.

Recommended is also the use of standardized modular sizes of drawings.

Optional is the use of a facetted classification and codification system (as BRD/SfB, e.g.) for multipurpose storage, distribution and retrieval.

Annex VIII

BUILDING SYSTEM DEVELOPMENT

The multidiscipline group for the development of the new building system should start investigations in the following fields

A Compatibility Study

The new building system, although it comprises as a large-panel system most of the functional elements and subsystems of a building, will to some extent need supplementary subsystems. Furthermore, with the increasing expansion of the building market, more and more variations of subsystems, non-system components and commodities might be offered for use in the context of the building system. In both cases, it will be useful to study the compatibiliy of the interfacing subsystems. This concerns

- The fitting of dimensions and sizes, to be best carried out
- the matching of joint configuration and joint profile
- the harmonizing of physical and chemical performance.

Some of the correlations are obligatory, some are optional, the latter fact depending on different solutions of building design.

Suitability Study

Prefabricated building components can be produced at lower cost if they are produced in greater quantities. A promising way to achieve this is to develop open building systems, i.e. to increase the possibilities of application of the existing components by using them in other buildings or building systems than that for which they were designed originally.
In some cases this might bi possible without any changes in form, size and composition of the respective component, in many cases one or more of the constituent parametres have to be varied.

Organization of Feedback of Performance

As the development of a building system includes a lot of detail improvement, adjustments in production and construction process, learning from previous experince is an essential requisite; feedback of experience from production halls and building sites, of performance tests from laboratories and of performance in use from the used buildings therefore should be systematically collected, classified, processed and stored.
The design of the respective forms and the use of a general classification and codification system (e.g. the tables 1 and 4 of the BRD/SfB system) is highly recommended.

Table 1 : General compatibility pattern of the new building system

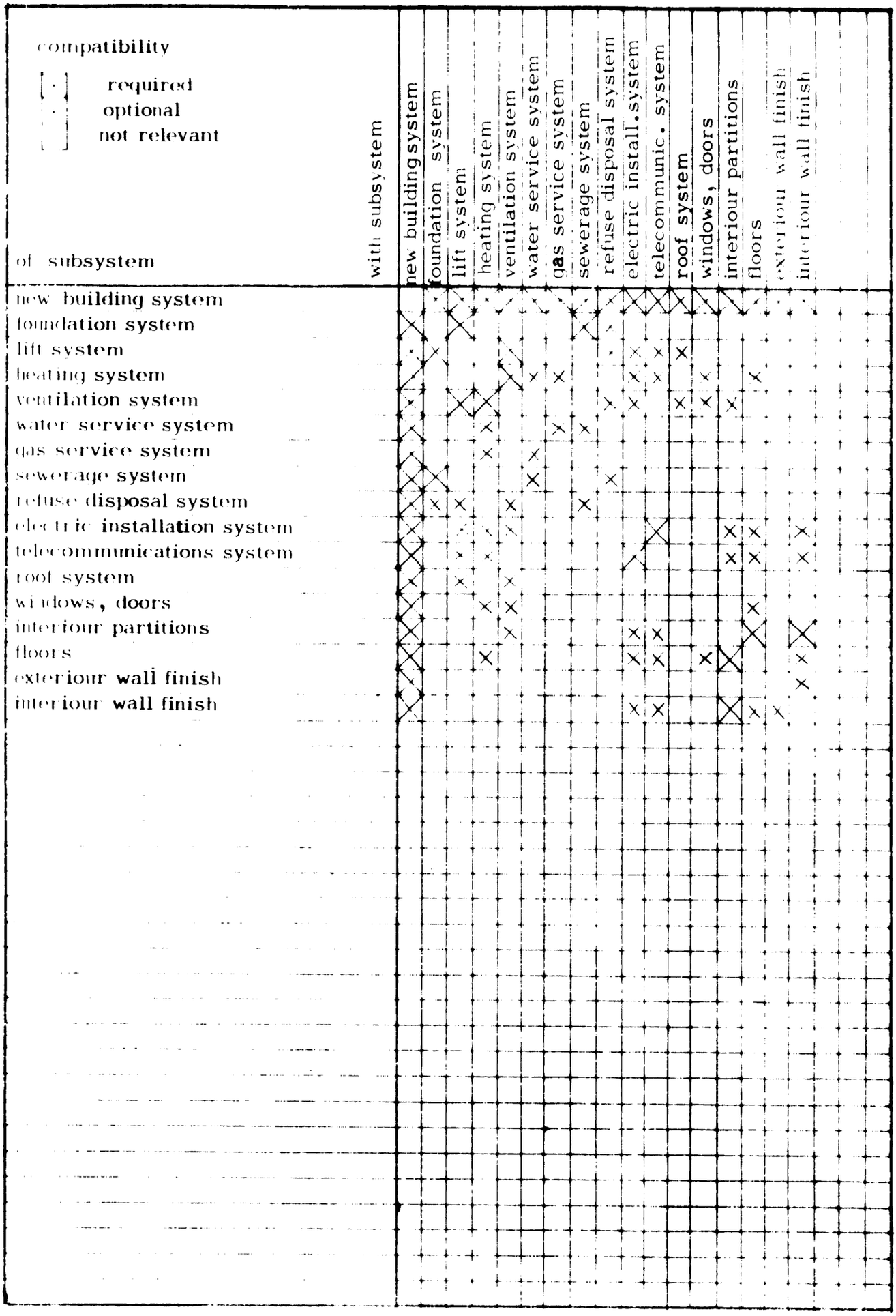


Table 2 : Compatibility evaluation form

compatibility
required
not required
unknown
not existing=incompatible
indicated by left system
indicated by right system
indicated by both systems
approved=compatible

of subsystem

	new building system A	B	C	foundation system A	B	lift system A	B	heating system A	B	C	D	ventilation system A	B	C	water services system A	B	gas services system	sewerage system A	B	etc.
new building system, type A																				
" B																				
" C																				
foundation system A																				
" B																				
lift system A																				
" B																				
heating system A																				
" B																				
" C																				
" D																				
ventilation system A																				
" B																				
" C																				
water services system A																				
" B																				
gas services system																				
sewerage system A																				
" B																				
refuse disposal system A																				
" B																				
electric installation system A																				
" B																				
" C																				
telecommunisations system																				
roof system A																				
" B																				
" C																				
windows																				
doors																				
etc.																				

Supplement to Compatibility Study

Catalogue of the New Building System

St andard components	drawings
	specification of generic typ
	size , dimensions
	composition, quantities
	finish
	performance, incl.tests
	production, transport
	maintenance
Standard joints	drawings
	specification of construction
	performance , inc. tests
Subsystems interfaces	drawings
	specification of construction
	performance, incl. tests

Catalogue of Subsystems used in context with the New Building System

Product information	drawings
	specification of generic type
	size, dimensions, etc.
Standard joints	drawings
	specification of construction
	performance, incl. tests
Commercial information	address of manufacturer or supplier
	telephone nr. of contact or responsible person
	specification of conditions of procurement
	prices, costs, consumptions

As far as possible, the catalogues should be compiled in form of tables and structured lists using the same format for all catalogue versions following the CIB-report 18 (Master list for structuring documents relating to buildings, building elements, components, materials and services. Rotterdam, 1972).

Table 3 : Suitability evaluation

suitability
- ☒ suitable = no modification necessary
- [•] modification of compos. and performance nec.
- [ ] modification of size and dimension nec.
- ☐ not suitable

of building system components	for use in building syst.: residential A	B	C	hostel A	B	office	school A	B	hospital A	B	research	agricultural	industrial A	B	C	D	commercial	storage	miscellaneous
basement walls																			
exteriour wall, variant 1																			
" 2																			
interiour wall, variant 1																			
" 2																			
floor slab, variant 1																			
" 2																			
loggia slab																			
staircase wall																			
stair flight																			
landing																			
whole staircase																			
lift wall																			
installation wall/sanitary																			
" /HVAC																			
other supplem.components																			
beam																			
girder																			
column																			
slab																			
ext.wall																			
int. wall																			
window																			
door																			
roof slab																			
partition wall																			
ventilation duct unit																			
sanitary unit																			
solar collector																			
etc.																			
other supplementary works																			
in-situ concrete walls																			
floors																			
beams																			
columns																			
foundations																			
etc.																			

Annex IX

INFORMATION SYSTEM FEASIBILITY STUDY

In the following some studies are rendered which might be useful as a starting line for setting up a computerized information system for the construction industry of SAP Vojvodina.

The adjacent lists and tables are based on the rather scarce insight of the writer into the structure and the habits of the information flow in this country and therefore should be improved and detailled by further multilateral discussions and investigations.

Contents :

FEASIBILITY STUDY
About the installation of a computerized information system for the construction industry of SAP Vojvodina

1 Introduction

.1 problems : changes, shortcomings, deficiences, wants

.2 goals : housing demand forecast, industrialization, acceleration, quality

.3 legal basis : 5-year plan, funds, instituional framework, responsibilities

2 Problem Analysis

.1 potential participants, scope of the project

.2 their role, location, capability

.3 their mutual communication

.4 their data production, inside use of data, receiving of data

.5 constraints : standards, codes of practice, legal and local constraints

3 Status report

General survey of solutions of the industrial information problem,
in SAPV/SFRJ/world
with particular atten tion payed to

.1 documents/vehicles of information flow (incl. informal/private ways)

.2 standardization, unification, classification, codification of data

.3 computerization : hardware, software, operation system

4 Model Synthesis

Conception of a model of amore or less computerized information system outlining - if appropriate, in several variants -

.1 the participants and their special function in the information system

.2 the amount of data computerization

.3 data bases , data packages, data sets, data items

.4 the computerized part of the information system
- operation and access: on/off line, (de)centralization, privacy/security
- the software package
- the hardware configuration : data bases, terminals, network

.5 the non-computerized part of the information system

.6 auxiliary means : standardization, classification, codific.,forms,

.7 supplements : microfilm technique , etc.

.8 consequences : organizational , formation of participants

5 Evaluation

Analysis of cost / time / benefit

Distribution of cost/benefit, participation in development work

6 Continuation

Work plan and program for the further investigations and activities

7 Conclusion

Recommendations for decision

Table • : Project-independent building information flow

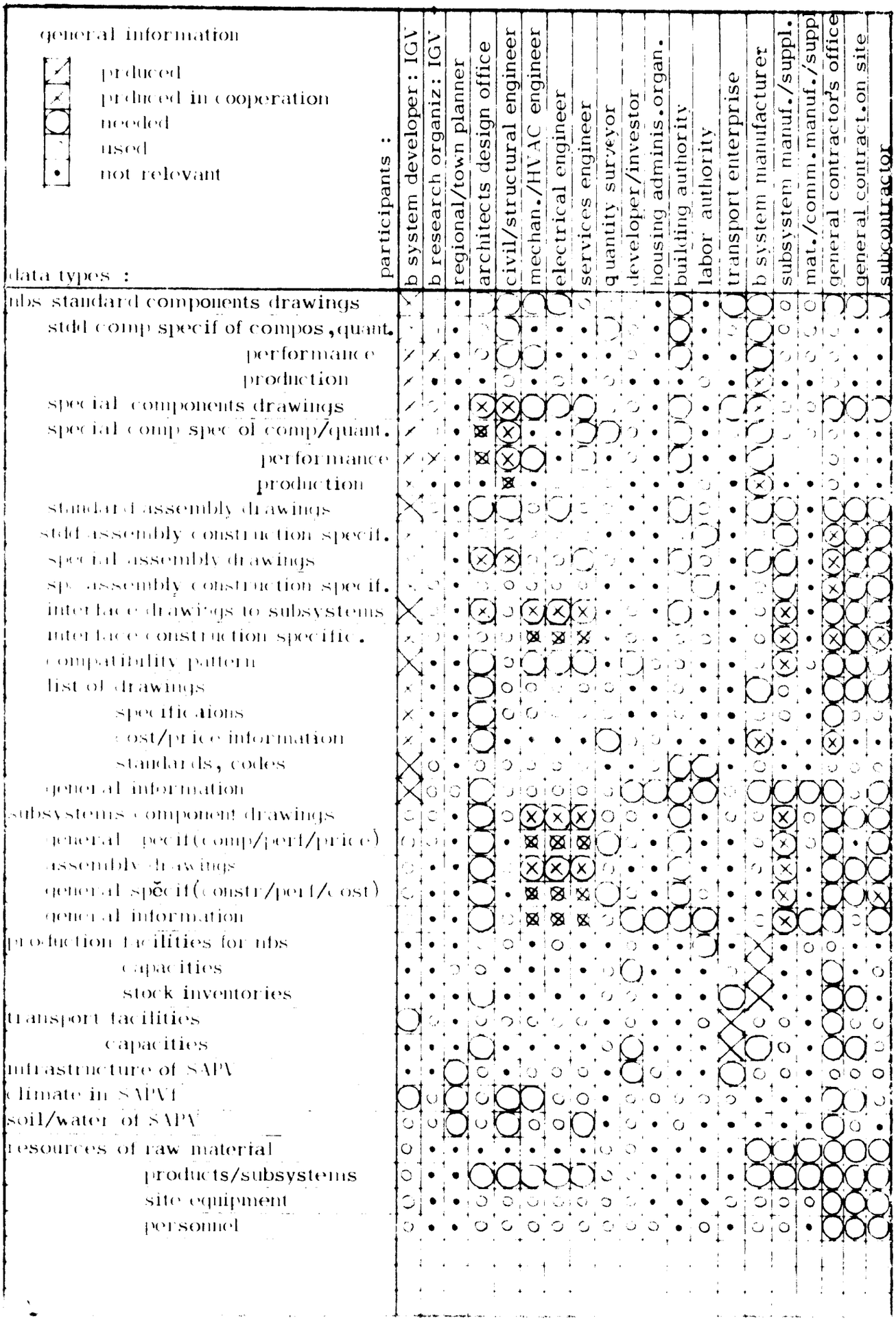


Table . : Project information flow

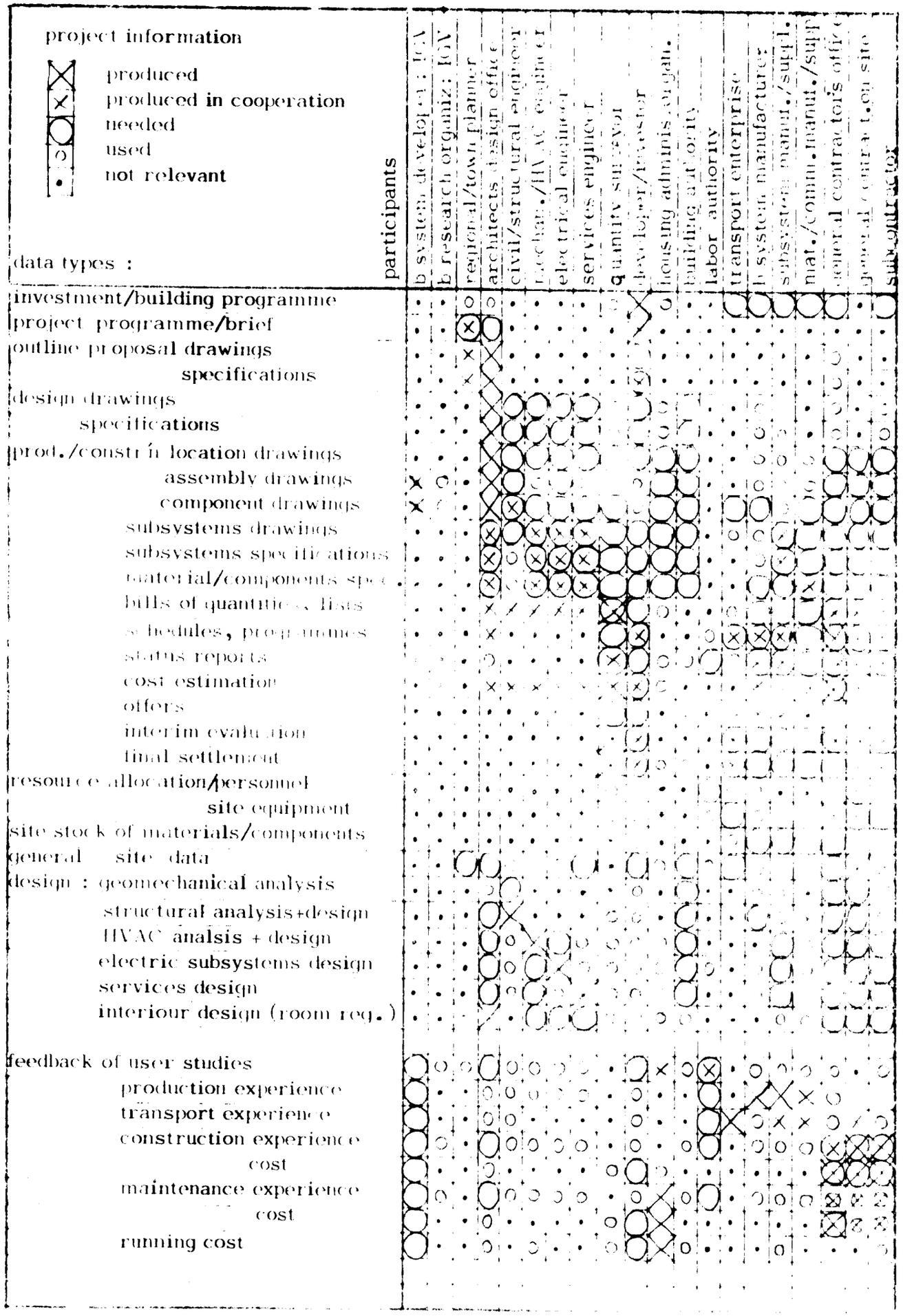
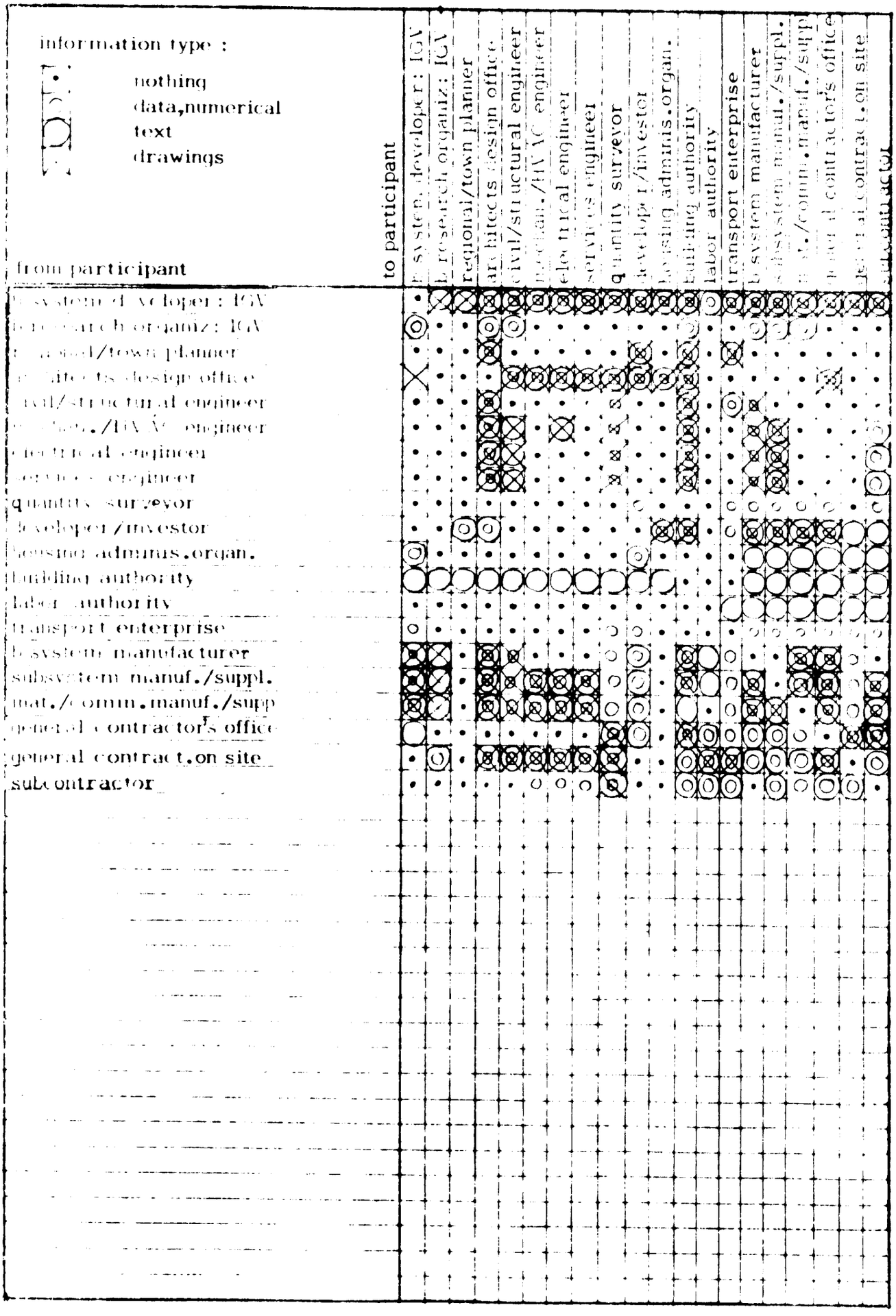


Table . : Information types in project communication



PROCEDURES FOR COMPUTERIZATION

IN DESIGN	
Structural Design	Standardized structural design of the new building system
	Structural design fo substructure, framework, etc
	Structural analysis of irregular parts by special methods
Installation Design	Thermal Analysis of heating/cooling load of buildings
	Pipe network analysis and design
	Optimization of operation of installation systems
Design Documents	Specification writing with standardized text
	Registration of project documents
	Quantitiy surveying and cost estimation/cost control
IN PRODUCTION	
Stock control	Stockcontrol and ordering of raw materials
	Stock control of building components
Production control	Development of production capacities
	Production programme and schedule
Fiancial control	Accounting, taxation
	Personnel control, wages and salaries
	General dispositions
IN TRANSPORT	
Transport control	Transport optimization and scheduling
Financial control	Accounting, taxation
IN CONSTRUCTION	
Construction control	Network planning and scheduling
	Eqipment allocation
	Personnel allocation
	Material handling
Financial control	Accounting
	Personnel control, wages and salaries
	General dispositions
	Cost calculations, settlements
IN LABORATORIES	
	Evaluation of test results
AT INVESTOR	
	Housing planning and scheduling
	Housing administration
	Accounting

Table [illegible] : Software availability

software is
- at hand
- needed
- relevant, interest
- to transformed

program types / at participants	b system developer: ICA	b research organiz: ICA	regional/town planner	architects design office	civil/structural engineer	mechan./HVAC engineer	electrical engineer	services engineer	quantity surveyor	developer/investor	housing adminis. organ.	building authority	labor authority	transport enterprise	b system manufacturer	subsystem manuf./suppl.	mat./comm. manuf./supp	general contractor's office	general contract. on site	subcontractor
data base managem.: nbs components	•			•	•	•	•	•	•	•		•			•	•	•	•	•	•
nbs/subsystems compatibility	•			•	•	•	•	•		•					•	•	•	•	•	•
nbs assembly stdd specific.	•			•	•	•	•	•	•	•					•	•	•	•	•	•
commodities, materials	•			•	•	•	•	•	•	•					•	•	•	•	•	•
project bills of quantities				•	•	•	•	•	•	•			•	•	•	•	•	•	•	•
project documents registry	•			•	•	•	•	•	•	•	•	•			•	•		•	•	•
components prod'n/stock cont				•					•	•				•	•	•	•	•	•	
raw materials stock/ordering									•	•				•	•	•	•	•	•	•
personnel	•			•							•	•	•	•	•	•	•	•	•	•
site equipment				•	•				•					•				•	•	•
analysis + design: structural for nbs					•							•								
special structural a + d					•							•								
thermal						•						•								
pipe network								•												
ventilation ducts						•														
network analysis/scheduling: prod'n															•	•	•			
transport, with optimization														•		•	•			
construction, with allocation																		•	•	•
commercial: accounting, taxation	•			•						•	•			•	•	•	•	•	•	•
personnel control, wages	•			•						•	•			•	•	•	•	•		•
cost estimation and control	•			•					•	•	•				•	•	•	•		•
analysis of test results		•																		

Annex X

C O M I C S - Component Mangement Information and Control System

As a first stage in setting up a computerized information system for the construction industry in SAP Vojvodina, a 3-phase model is planned for the new building system components production and distribution control.
A central data base in Subotica will be installed in close cooperation of the

- Institute of Management Sciences of Novi Sad university in Subotica (responsible for hardware maintenance, software development and - at least in the first phase - also for input and output operations),
- Building and Civil Engineering Institute (IGV) in Subotica (responsible for building design and components performance information),
- Building Construction Enterprise GIK Banat in Zrenjanin (responsible for components description and management information).

As the development will take place in several branches, it asks for a network of activities :

- The preparation of the building system components catalogue, including drawings, specifications, sizes , compositions, etc.
- The specification of participants (institutes, enterprises, persons, locations, functions, etc.)
- The classification and codification of
  - components and component properties
  - drawings and other design documents
  - participants and their locations and functions.
- The design of forms and formats for data presentation, input and output
- The development of data base mangement software and the adaptation of additional programs
- The institutional , financial and legislative coordination
- The formation and up-grading of participants
- The general coordination and scheduling.

The following pages present some introductory ideas and show

- the development of the model in 3 phases
- a closer description of the first phase
- an approximate estimation of the data quantities.

Table • : 3-phase model of a component management information+control system

	C O M I C S 1	C O M I C S 2	C O M I C S 3
participants	4	8	20
locations	4	8	20
participants	IGV, Subotica GIK Banat, Zrenjanin Neimar, 3 sites transport enterprise	IGV, incl. design office GIK Banat Neimar, 5 sites 3 transport enterprises 2 subsystem manufact.	IGV+other des. offices GIK Banat Neimar, 5 sites 2 other contractors with 8 sites 5 subsystem manufact. 2 investors
input	forms → IGV → IMS - tape cassette → DB	forms → IGV → IMS tape cassette → DB	remote terminals displayed inputformat
updating intervals	2 weeks	1 week	daily or permanent
updating dates	Monday	Thursday	daily
output	at computer centre	at computer centre	at computer centre
print	-	-	at remote terminals
display	-	at remote terminals	at remote terminals
delivery	mailing of output	mailing of output	mailing of output
retrieval	by hand from computer output	at remote terminal from data base (DB)	at remote terminal from data base (DB)
standard features	stock control : at manufacturer, at sites production schedule and control transport schedule and control damage, destroy, repair and delay control description of components		checklists input-forms input-control invoices
additional + special features		statistics component decompos. price information quality information use in building types	capacity of prod'n capacity of transport accessories control raw material control transport optimization capacity of constr'n extended plausibility c.

C O M I C S 1

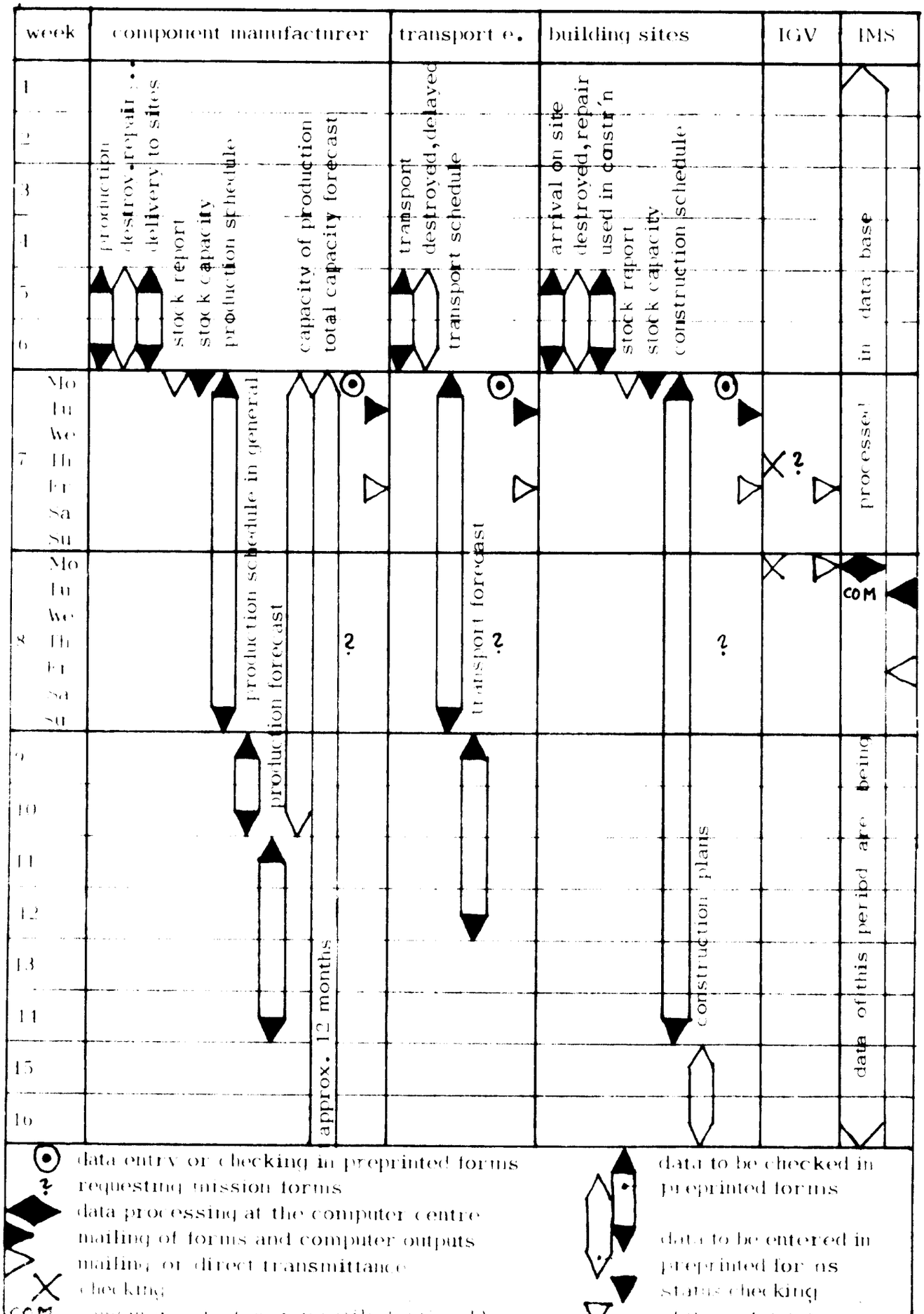
Generalities : cycle time : 2 weeks
input/updating : every second Monday, at IMS
output : every second Monday, at IMS
batch mode

Schedule :

Monday	: stock report
	production/transport/sonstruction report
	damage/repair/destroy/delay report
	delivery/arrival report
	checking of needs/schedules
	entering of amendments
	entering of new preplanned needs in preprinted forms
Tuesday	revision, mailing
Wednesday	on mail
Thursday	arrival at IGV
Friday	checking at IGV
	urgent request of missing forms
Monday	input/processing/output in computer center
Tuesday	computer output on microfilm (optional)
	mailing to participants
Wednesday	on mail
Thursday	arrival at duty station
	request of missing forms

participants : IGV, system research team
component manufacturer in Zrenjanin
transport enterprise in cooperation with Zrenjanin
some building sites of Neimar, Novi Sad

Table • COMICS I , demonstration of information flow in weeks 7 and 8



MM7-reports to the data base

on Monday morning of week 7 (W7), based on FF6-output

from building site(s)

- .stock report MM7 ; incl.damages of components,
- . checked free stock capacity MM3
- . checked need for W7 - W14
- . new planned need for W15, W16
- . checked component arrival list for W5,W6, incl.damages
- . report of damaged/destroyed/repaired components during W5,W6
- . checked construction report for W5,W6

from component manufacturer

- . stock report MM7, separate for reservations for b sites A,B,C...
  free available components
- . checked free stock capacity MM7
- . checked production schedule for W7-W8: urgent items/duty/voluntary items
- .checked production schedule for W9-W1 -general
- . checked production forecast for W11-W14
- . checked production report for W5,W6
- . checked components delivery list for W5,W6 incl.damages
- . report damaged/destroyed/repaired components during W5,W6
- . report of free production capacity for W7-W10
- . report of total production capacity forecast for 12 months, in periods of 2 or 4 weeks

from transport enterprise

- . checked transport execution for W5,W6
- . transport report for W5,W6 concerning damages
  destructions/losses
  stop overs at report term
- . checked transport schedule for W7,W8
- . checked transport forecast for W9-W12

from all participants

- . answers to clarifying questions in preprints for W1-W4

FF8 - reports from the data base

on Friday - Forenoon of week 8 (W8) to be at the duty stations

to building site (s)

- form for report of stock MM9
- check list of probable free stock capacity MM9
- check list for arrivals in W7,W8
- form for report of damaged/destroyed/repaired components in W7,W8
- check list for components used in W7,W8
- check list of need for W7-W14
- form for new need for W15,W16
- copy of invoice from manufacturer X for settled weeks (W1,W2)
- copy of invoice from transport enterprise for settled weeks (W1,W2)
- report of component manufacturer's production, production capacity and stock

to component manufacturer

- check list for production in W7,W8
- form for report of damaged/destroyed/repaired components in W7,W8
- check list for components delivered in W7,W8
- form for report of stock MM9 = for components reserved for b site A,B,C ...
  for free available components
- check list of probable free stock capacity MM9
- check schedule for component produtction in W9-W10= urgent items
  duty items
  voluntaty items
- check schedule for component production in W11,W12; general
- check forecast for component production in W13-W16
- copy of invoice to b contractor for b sites A,B,C... for W1,W2
- form for report of free production capacity in W9-W12
- form for report of total production capacity forecast for 12 months

to transport enterprise

- check list for transport report of W7,W8
- form for report of transport damages/destructions and losses/delays in W7,W8
- check schedule for transport in W9-W10; incl.urgencies

- check forecast for transport in W11-W14
- copy of invoice to building contractor for sites A,B,C; for W1,W2
- report of component manufacturer's production, production capacity and stock

to all participants

- questions on open problems of weeks W3-W6

to design institutes

- general status of new building system
- report of component manufacturer's production, prod uction capacity and stock

C O M I C S 2

Generalities : cycle time : 1 week
input : updating : every Thursday, at IMS or IGV
output : every Thursday at IMS

terminals with input format at IGV
terminals with output format at participants
batch mode processing
on line retrieval

Schedule :

Monday	: last arrival of forms at participants entering to the forms, amendments checking of stock, lists entering of new needs, plans in proprinted lists mailing to IGV
Tuesday	on mail
Wednesday	arrival at IGV, checking
Thursday	input/processing/output/COM/mailing at IMS
Friday	on mail
Saturday	arrival of outputs at duty stations

Participants as in COMICS 1, plus :
more building sites
more manufacturers, also for other components
more transport enterprises

Special Features : remote display/ retrieval/slow printer
monthly balance sheet
statistics
decomposition of components
accessories listing
cost/price information about components

C O M I C S 3

Generalities : remote data entry
daily or permanent updating
remote data retrieval/remote printer at main participants
central documentation by COM (computer output on microfilm)

Participants: as in COMICS 2, plus :
more manufactureres
all sites of the new building system
investor

Special Features : raw materila and accessories control
transport optimization
capacity of production/transport/construction
cost/price information about building projects
extended specification of components, plausibility control

Table 10. : Data sets and data items for the identifaction and description of the components of the new building system

Identification :

Identifaction number
name
generic type
identification number at the participant
participant(producer)

Description :

form
length
height / thickness
weight

position of windows, doors
type of windows, doors

concrete class, steel classes
surface treatment front / rear
composition : concrete / steel / polystyrene / accessories

performance : load carrying capacity
thermal transmittance

pertinent drawings / specifications
prices of components in various periods
cost of transport, transport class

use in buildings of typified design : A,B,C,..

identification number of substituting component

Table 11. : Data sets and data items for the management of the components of the new building system

from manufacturer : report	
production in weeks W1 - W6	6 items/comp.
delivery to building sites W1 - W6	6
delivery to other sites in W1 - W6	6
damaged during W1 - W6	6
repaired during W1 - W6	6
destroyed during W1 - W6	6
on stock on Monday morning, ok	1
on stock on MM7, damaged	1
free stock capacity on MM7	1
from manufacturer : schedule of production	
production in W7 and W8, urgent/duty/free	6
production in W9, W10, total	2
production forcast for W11-W14	4
free production capacity in weeks W7 -W10	4
forecast of total production capacity for 12 months	12
	67
from transport enterprise : report	
transport from 1 manufacturer to 1 building site, W1-W6	6
dto, damaged/destroyed/delay	18
from transport enterprise : schedule of transport	
transport from 1 manuf. to 1 building site in W7, W8	2
transport forecast for W9-W12	4
	30
from building site : report	
use for construction in W1 - W6	6
arrival on site in W1 -W6, ok	6
arrival on site in W1 -W6, damaged	6
repaired/destroyed during W1 - W6	12
on stock on Monday morning 7, ok/damaged	2
free stock capacity on MM7	1
from building site : schedule of construction	
use for construction in weeks W7 - W14	8
forecast for construction for W15 - W16	2
	43

If 1 building site is being supplied by only 1 manufacturer and 1 transport enterprise, the total data/component type will amount to : $67\ n_i + (30+43)b$
(m ... number of manufacterers)
(b ... number of building sites)

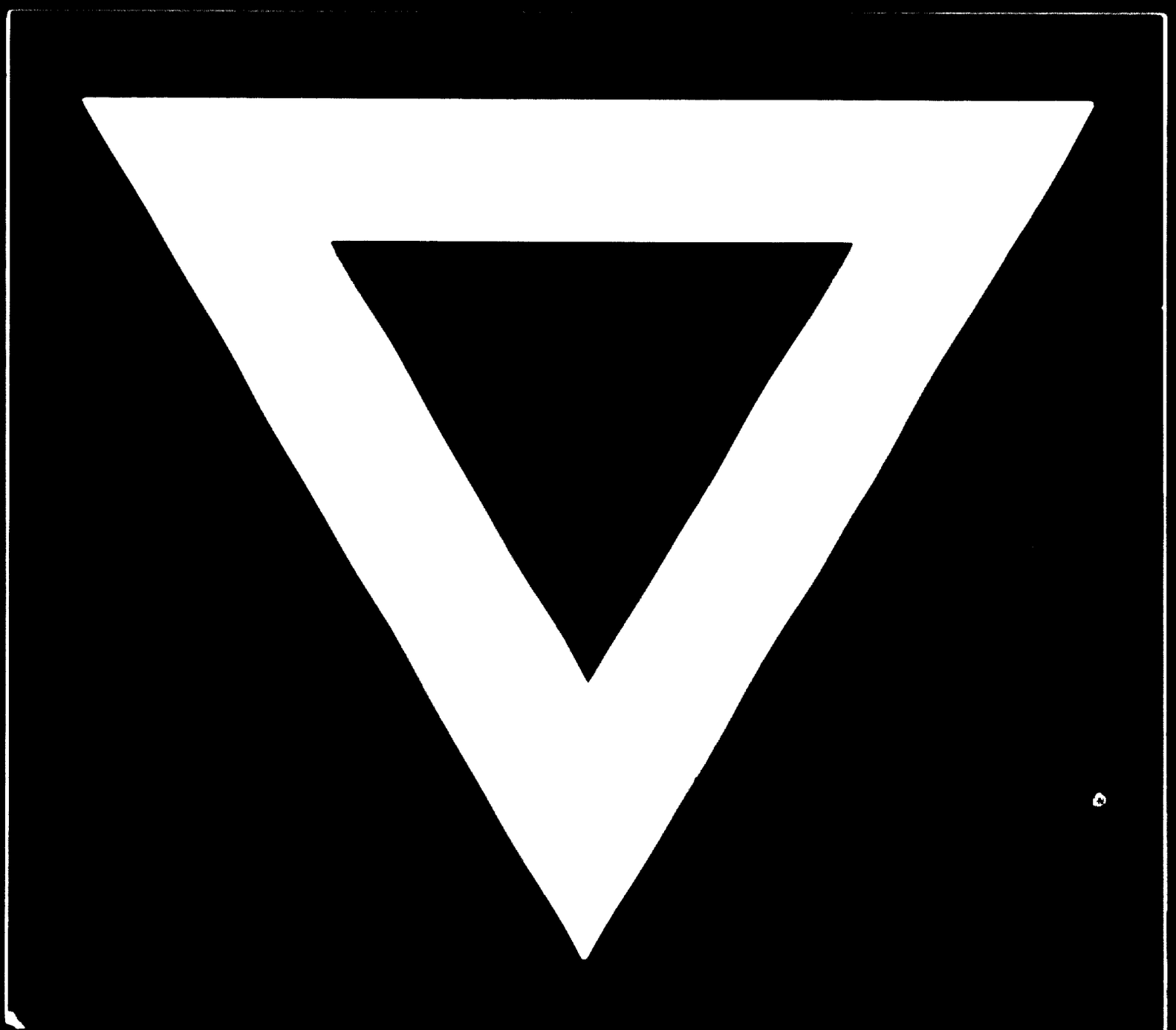
Table 1 . Types of data output to participants in the information system

retrieval

- inadmissable
- automatic printout at computer center
- printout on request
- information by telephone or terminal

by participants :	IGV : nbsystem developer	IGV, design office	investor	transport enterprise	manufacturer of nbs	manuf./supplier other co.	contractor, central office	contractor, building site				
general discription of single components												
group of components												
list of components with substitutes												
comp. with form , dimensions, weight												
composition												
performance specification												
cost and price												
drawing number												
specification numbers												
indication of use in typified buildings												
components available on stocks (manuf., b.sites)												
comp. to be produced , per week												
to be transferred, per week												
to be used on building sites, per week												
lists of typified buildings and nbs components + price												
demand for accessories												
demand for raw materials												
demand for site equipment												
lists of site equipment , specification, allocation												
lists of specialized construction teams, allocation												

B-81



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