2

FUTURE SHOCK OR BRAVE NEW WORLD
TRANSPORT PLANNING TECHNOLOGY IN THE 1980's

J. Field
Network Manager
State Transport Study Group of NSW
North Sydney

Abstract:

The State Transport Study Group of NSW is implementing a completely new approach for all its data and technical processing.

The increasing problems of past technical and data handling methods together with changing administrative and computer conditions have lead to the development of a new technical philosophy and long term development plan.

The past problems are reviewed and the impact which the changed conditions have had upon the Study Group are discussed.

The three main thrusts behind the new approach are:

- *improved user interfaces*
- *a data base development*
- *appropriate equipment*

Four applications illustrating both the benefits achieved to date and the future potential are presented.

TRANSPORT PLANNING TECHNOLOGY IN THE 1980'S

INTRODUCTION

Transportation planning is a constantly changing and evolving process. Rational planning as we know it today is a relatively new and imperfect science. New techniques, theories and procedures are constantly being tried to overcome past problems and to cope with todays problems. Despite the many changes to transport planning methods over the years one element has remained constant. That element is the need for information about transport problems and the ability to analyse what that information means for decision makers and policy formulation.

The experiences of the State Transport Study Group of N.S.W. is indicative of the changes that have taken place in transport planning.

The group was first formed to carry out the Sydney Area Transportation Study. SATS was probably the last of the "Grand Plan" studies. Extensive data collection, model development and other technical procedures were carried out, all aimed towards developing the recommended transport plan.

Today the remnants of that group have become a permanent unit responsible for Statewide strategic transport analysis and evaluation. We are no longer working to a plan, our concerns have broadened tremendously and the demands for our information have never been greater. Coupled with this growth and change in function has been the development of new transport techniques (individual choice models etc.) and an almost revolutionary change in computer technology and costs.

This process of change introduced many problems for the technical requirements at the Study Group.

About two years ago a new technical philosophy began to evolve that will guide the Group's transport planning techniques into the 1980's.

This paper documents the changes and problems that lead to the new approach, sets out the progress that has been made to date, and discusses a number of applications of the new approach.

PAST TECHNICAL PROBLEMS

The following list of problems will be familiar to many. Increasingly the Study Group was finding its ability to respond, limited by these problems.

Study Group staff turnover has always been high. However it has become almost impossible to find new staff with the necessary knowledge and skills to use our computer system, models and data files. Some method was needed to allow non computer skilled staff to access the models and data.

Additionally it was becoming increasingly difficult to keep track of all our data and past work. The Group had over 300 tapes and several thousand individual data sets. With the high staff turnover, and the difficulty of getting people to properly document every data set a better method of data control was urgently required. Lack of control was resulting in good data being lost, unnecessary repitition of analysis and unsure knowledge on how certain data was created.

Over time the zoning systems and networks used had developed and changed. Every major project would try new techniques, develop special networks or data files. Maintaining compatibility between these different results and techniques caused great confusion. Much work was lost because the input into developing, say one particular network, was not necessarily carried over the next time a network was developed. The need thus arose for techniques to maintain a common data base, ease compatibility problems and allow ready maintenance.

The provision of basic data and other technical results to the wider planning community has become a significant function for the Group. However with the lack of staff and the problems of data control this task has become very difficult and our difficulty in responding is causing increasing embarassment for the Group.

An increasingly frustrating problem was the inability to use other valuable data sources. Such data as available from the Traffic Accident Research Unit, the Water Board, Department of Main Roads or the Department of Motor Transport could not be easily used because every group used a different "zoning" or location reference system. With the expanding needs for broader evaluation a method was desired to allow these other sources to be integrated into the planning process.

Overall it has been felt that too much time was being spent on maintaining data, accessing the data and running programs. Time spent on these tasks took away from evaluation and analysis of options and basic problems. A need has thus been seen to increase productivity, to ease the basic technical tasks and to expand the time spent on evaluation and problem solving.

Thus in summary the problems being faced by the Study Group included:

- lack of skilled technical staff
- inadequate data control and documentation
- need to eliminate duplication of data effort and analysis
- inflexibility and maintenance difficulties with basic data
- incompatibility with outside data sources
- information request overload
- need to increase productivity

CHANGED CONDITIONS

Together with the problems outlined above a number of the conditions under which the Study Group carries out its technical work have been changing.

No longer is our technical work purely project related. The technical support, and use of the Study Group have become integrated into a longer term administrative framework. Thus the Study Group could plan for a long term development program and it was recognised that its technical base had to support a broad and unknown range of needs and future tasks. These future tasks should be able to draw on past technical work and data and not have to embark upon major new data collection or development work. Nevertheless any data collected or new techniques developed should add to the overall store of information and not be lost.

The major computer bureau used by the Study Group indicated they would be closing by 1981. This announcement meant a major effort to find a replacement and what that might mean. Eventually a Government computer centre was located that could support our needs. This exercise necessitated a review of equipment and operating system available.

This review indicated the huge range of equipment and system options. The development of interactive operations, data base software, graphics hardware and micro-computer hardware indicated the direction in which the data processing industry was heading.

Together with these administrative and computing changes a number of new technical developments indicated the need for the Study Group to change its methods. Firstly the modelling future was unknown. The potential use of individual choice, and activity-based models and the continued development of UTPS indicated that a very flexible approach to data collection and format was needed. Secondly the Study Group's responsibilities now extend to all of New South Wales. The type of models, data and other technical requirements which Statewide planning may need were largely unknown. Thirdly it has been decided that a new home interview survey should be mounted to parallel the 1981 Census. Several opportunities were seen to make significant cost savings for the survey if the latest technology was used.

The technical problems discussed earlier together with these changed conditions resulted in the formulation of a new technical philosophy and a long term development plan.

DEVELOPMENT OF A SOLUTION

The new philosophy directed itself into three areas:

- the problem of interaction between user and machine
- the problem of data needs and control
- the problem of equipment needs and interconnection

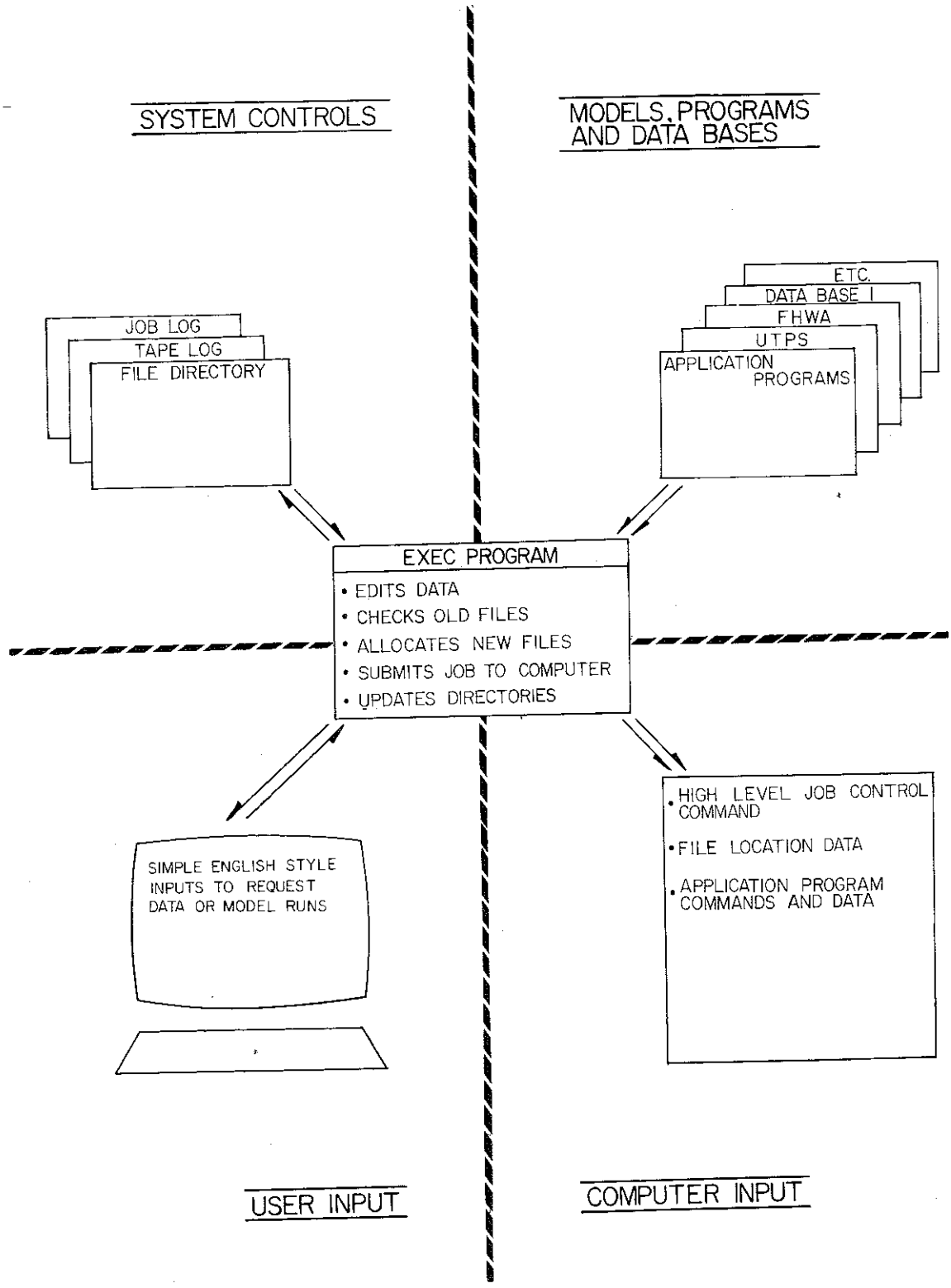

FIGURE 1. USER INTERFACE TO SYSTEM

Separate yet complementary solutions were devised for each of these areas. The following sections illustrate these solutions as they are presently seen. The approaches are being refined and adjusted as our experience with them grows.

User Interface to System

The desire here was to allow non computer people to access the system, to control all data flows and to provide automatic job and data documentation. Furthermore it was felt that some distance should be maintained between the models and application programs and the non skilled user.

The approach developed is shown in Figure 1.

The key has been the development of a program called EXEC which acts as a transport planning operating system. This program accepts simple english style inputs and generates the necessary computer job.

Complete information on files and tapes is obtained from central directories. EXEC updates these directories and creates job documentation.

Each function such as "Run Gravity Model" builds and edits the controls for the particular application program used. The application program itself is transparent to the user.

Data Base Development

The objectives behind the data base approach were to:

- collect and store data independantly of particular model needs and formats
- ensure that all data for a specific purpose was kept in one place
- use geo-coding as the means of allowing full compatibility between data sources
- create a system that could be easily updated and maintained from outside sources.

Figure 2 illustrates the main data-bases being developed and the general relationship between data and input/output areas.

All network, zoning and land-use elements will be geo-coded to Australian map grid (AMG) co-ordinates. The street index will allow any address oriented data to be converted to AMG co-ordinates. The street index will be our version of the American DIME file concept. Considerable co-operation between the Valuer Generals Department, the Sydney Water Board and the Study Group has been necessary for the street index to be developed. All three groups see significant benefits from the geo-coding of the Sydney street and address system.

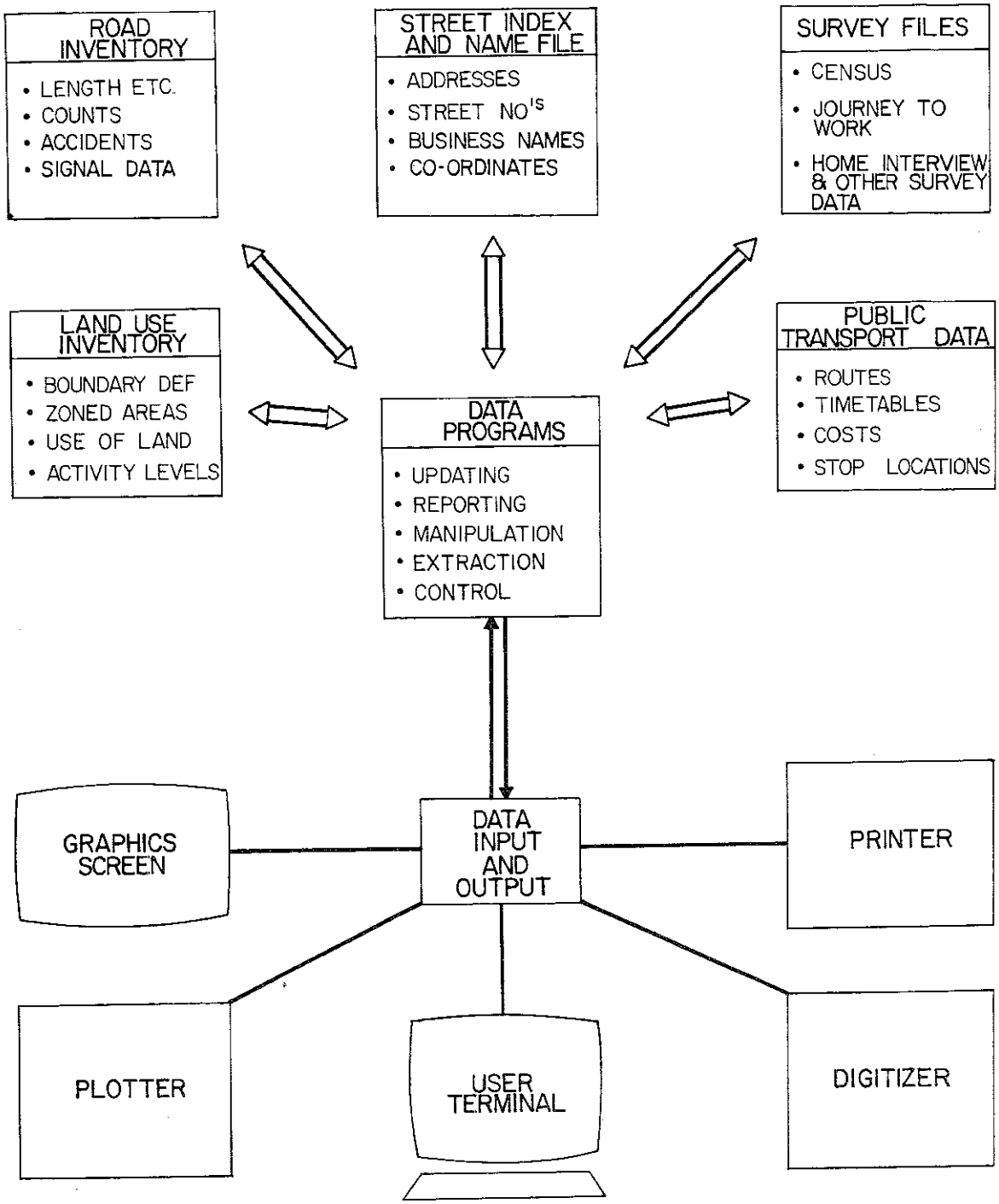

FIGURE 2 DATA BASE DEVELOPMENT

Road inventory and public transport data is in the longer term expected to be drawn from the responsible operating department files. They must collect and maintain this data as part of their day to day operations, and it is wasteful for this to be collected again by planning agencies. The geo-coding and street index will provide the means for data file transfer.

Equipment Network

To support both the user interface and data-base systems required some specialised equipment. Additionally the use of interactive techniques and computer graphics were seen as two highly desirable trends.

The specification and acquisition of appropriate equipment has been long, involved and frequently frustrating. A task not to be undertaken too frequently!

The resultant equipment network is shown in Figure 3. Maximum flexibility has been built in with several future options left open.

Considerable focus has been placed upon a micro-computer system for "off-line" control and storage for the plotter and digitizer, a connection to other computer systems and for word processing.

All input will be via interactive screens and the special graphics terminal.

Though not specifically shown in Figure 3 our operating environment is going completely away from tapes to a disk based situation. This alone will eliminate a number of problems.

The three broad solutions illustrated in Figures 1, 2 and 3 provide the framework for our longer term development plan. Some considerable progress has been made already.

SOME APPLICATIONS

Four applications are discussed. These applications indicate the benefits which are already being seen and on which there has been active progress. The complete development of our system will take some time.

Planning began in 1978 and the first applications under the new system started earlier this year, 1980. Considerable co-operation with other Departments has been necessary and will continue to be necessary in the future. The amount of time and resources which have been devoted to the development have been limited, for our major responsibility is still to provide transport planning analysis, research and policy advice.

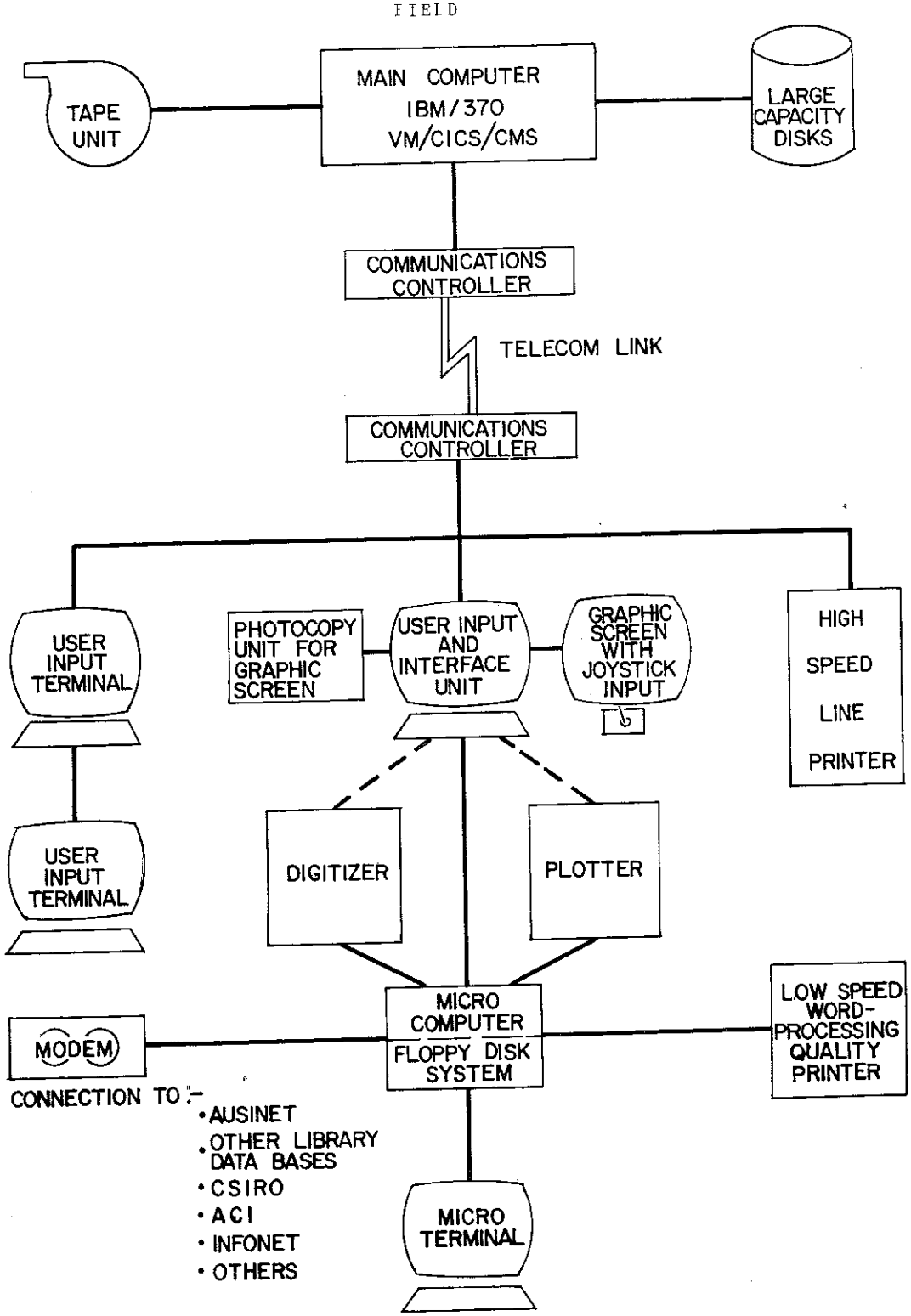

FIGURE 3 EQUIPMENT NETWORK

Model Applications

The running of the Sydney Grand Model has been a major technical task. The EXEC program has been developed to the point where the Grand Model is under its complete control.

The tape, and file directories are complete and allow for automatic data retrieval and updating.

The application of EXEC for the Grand Model is illustrated in Figure 4.

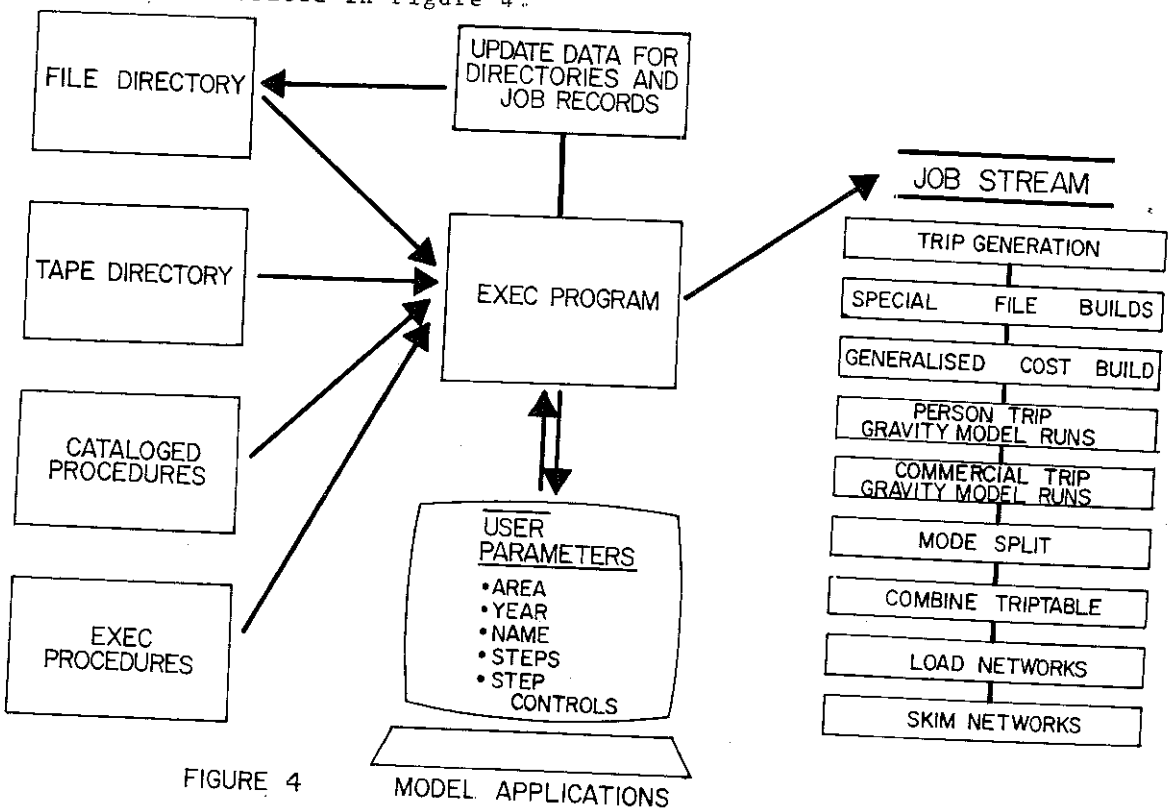

FIGURE 4

The input controls have been reduced to the absolute minimum. Standard names and formats have been established for all files.

The impact of this procedure upon the turn-around time from new parameter specification to final results has been dramatic. Previously it could take up to a week or more for all steps to be successfully run. Now the complete model run takes less than a day. This improvement makes it feasible to recycle through the model; an oft advocated but rarely performed procedure. Recently three recycled runs were carried out in less than four days.

Word and Text Processing

The information explosion is familiar to all of us. The difficulty of finding library material, old memos, data documentation and past work carried out on a particular issue is both frustrating and time consuming.

The Study Group has long been committed to a information storage and retrieval system. With the added capabilities of word processing and "interactive browsing" software this will be further developed.

The broad system envisaged is shown in Figure 5. Already substantial parts of this system are complete. Our filing system, library catalogue, data set documentation are already in the system.

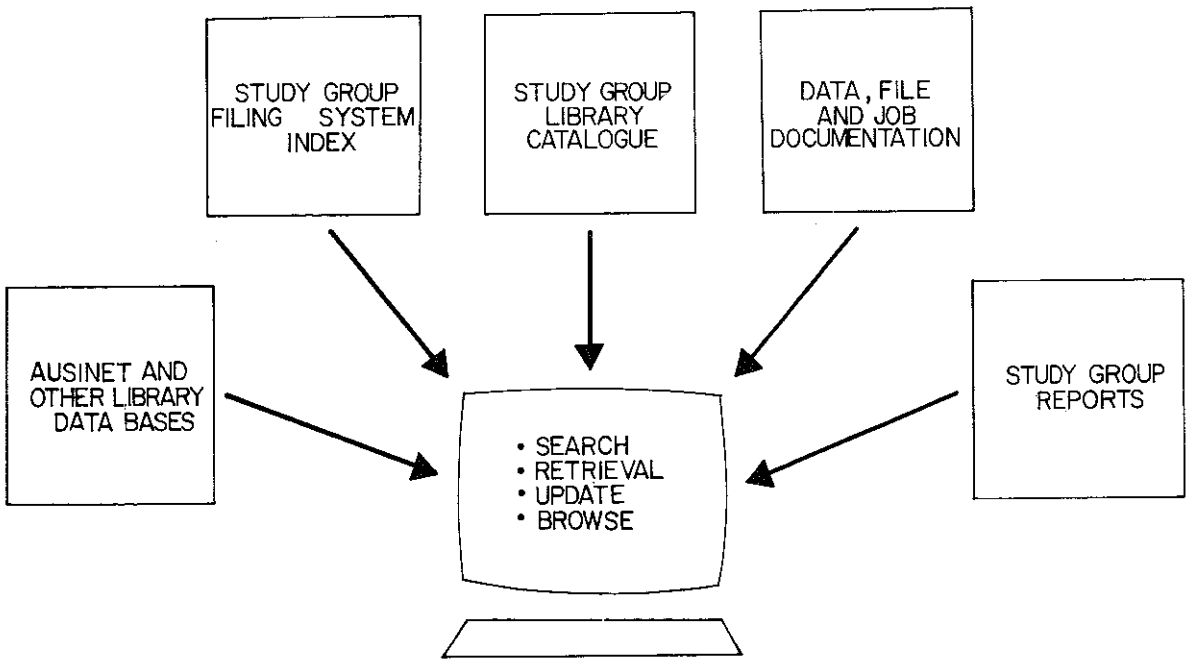

FIGURE 5 WORD AND TEXT PROCESSING

Any piece of information can be located by

- date of writing
- author
- reference number
- location
- and major keyword

Ihus all memos on say "Airport Study" can be located even if they are in different files and were written many months or even years apart.

With word processing our reports are now in a computer format and can be browsed for all references to say "accessibility". This is a very quick way for finding what work has been done in the past.

The ability to access AUSINET and other such information data-bases will further improve the ability of our researchers to review past efforts and thus save on repeating old errors or "reinventing the wheel".

Additionally the complete functioning of our library has been computerised. Ihe "automatic library" system has three components, the loans system, the circulation system, and the acquisition inter-library loans system. It has been working successfully for some time, and has greatly improved the utility of the library. Our librarian particularly appreciated the system because it has relieved her of many tedious tasks.

Survey Coding

As has been mentioned earlier a major new home interview survey is planned for 1981. One of the major tasks in any survey is the coding and editing of the raw data. In particular the task of converting locations or addresses to "zone numbers" has been particularly difficult, error prone and time consuming. Ihis zone system coding adds greatly to the inflexibility of the resultant data. The zoning system then determines the smallest level of geographical detail. Ihe system cannot be later changed to another system because the original addresses have either been lost or the effort required is enormous. New developments in modelling particularly the individual choice models do not depend on any zoning system and require far greater detail as to exact travel times, distances etc.

Ihus for the 1981 survey the Study Group plans to convert all trip origin and destination points to AMG co-ordinates. The zoning system can then be determined later and easily changed.

Additionally the plan is to use interactive data entry. Errors will be immediately corrected, there will be automatic conversion of such items as occupation to the standard ABS codes and vehicle characteristic data can be checked or expanded.

Figure 6 illustrates the process around which we are planning the 1981 survey coding.

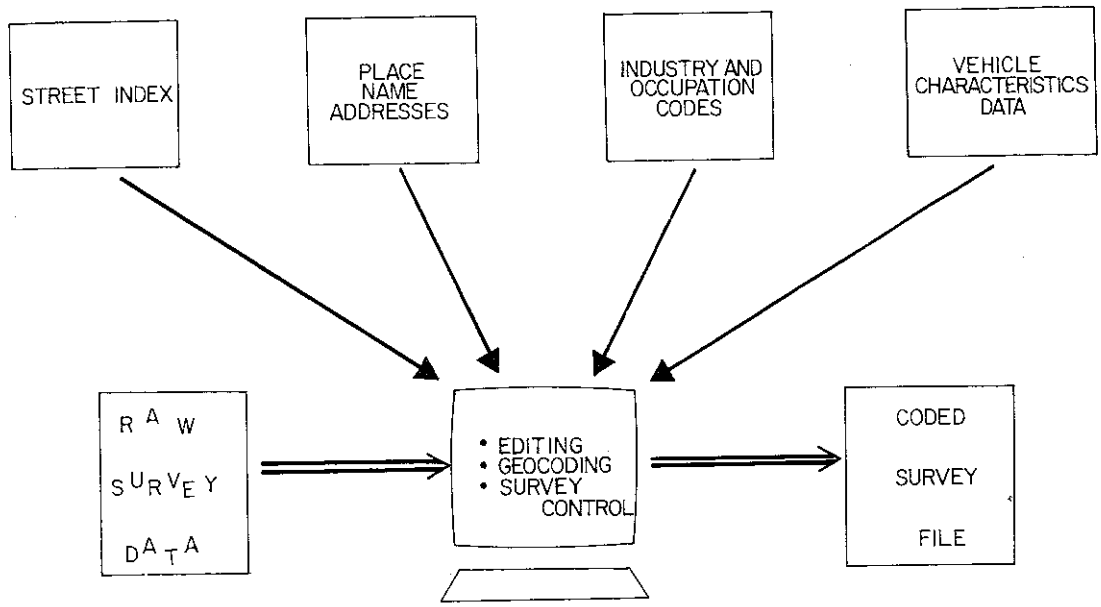

FIGURE 6

The core of this process is the street index and place name address files. Both these files are presently being created, largely from other sources (TELECOM, UBD Business Directories, Valuer Generals Department and Water Board).

The preliminary benefits calculated for this approach are substantial. It is expected that our 1981 survey will cost significantly less per completed interview than the 1971 survey. Recent U.S. experience with a similar approach using their DIME files reinforces our findings.(1)

The street index is being created jointly by three or four Departments. It will also be used by the Traffic Accident Research Unit of N.S.W. for locating accidents and will allow access by the Study Group to a wider range of data files.

---

1 Computer Geo-coding of Iravel Surveys : Iransportation Research Record 677, 1978. Ihey found that above 8000 addresses the savings of geo-coding over manual methods increased linearly with the number of addresses. Ihe 1981 survey may have 500,000 addresses to be coded.

Network Analysis

The final application considered is the use of the system for network analysis. Networks are the "bread and butter" of technical transport planning. Road networks, bus routes, traffic signal systems, bikeways and pedestrian paths have all been analysed using network type methods.

In this area a number of our concepts are being brought together.

- geo-coding : all network locations (nodes and links) are being co-ordinated for analysis (e.g. length), display and mapping onto other data (e.g. adjacent land-use or zones).

- data base : all network data will be maintained within a central data base. This data base will contain a wide range of data not normally used by traditional network models (e.g. number of houses on a link).

- interactive graphics : networks will be drawn on a screen, updated, and various features such as volumes, counts, speeds etc. displayed on simple user commands.

- EXEC control : all program operations and network functions will be via a interactive version of the EXEC program.

Presently this area is not well advanced. The networks have been digitised and much of the data base built. However the end result will expand enormously the analysis potential available to the Study Group researchers. This development parallels similar work in some U.S. universities and at UTPS.(1) Attempts are now being made to obtain this overseas work and use it or adapt it.

Figure 7 sets out the various functions and components planned within the network analysis area. The productivity gains from such a system is its greatest appeal. Network analysis will become a relatively simple and fast process.

---

1 Network Base System for Transportation Analysis : Transportation Research Record 677, 1978. This group use DIME files together with a commercial data base manager and interactive screen for creation, extraction, focussing and other typical functions. They eliminate totally the need for traditional network coding.

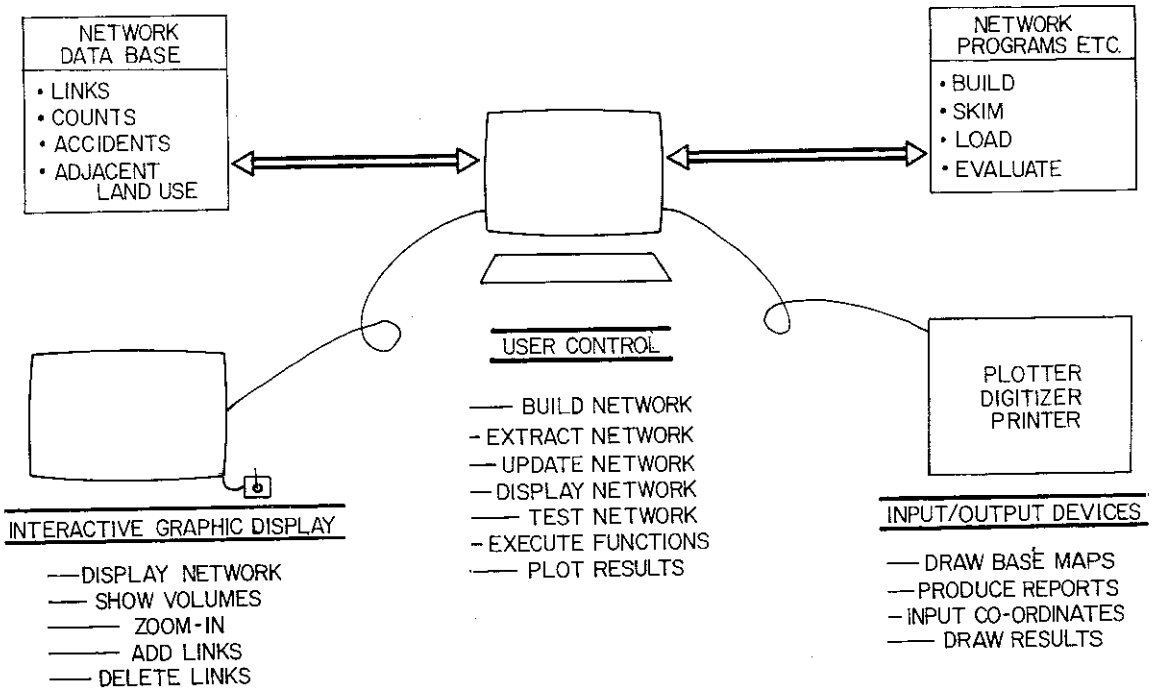

FIGURE 7 NETWORK ANALYSIS

CONCLUDING COMMENTS

The broad development plan outlined will not be achieved overnight. Nor will this plan proceed without numerous problems and difficulties. However even from the applications which have been implemented to date the eventual benefits and increased productivity are obvious.

The developments outlined have not been undertaken because of a new research fad or on an experimental basis. The complete development plan has been undertaken for cost saving, administrative and managerial reasons. The capability of using improved or completely different modelling techniques is an extra benefit.

The Study Group has always adopted the approach of developing staff expertise and building up an internal technical resource and background. Once it was recognised that transport planning was part of on-going Government planning not a series of one off studies the development of a stable internal technical resource was essential. That technical resource could only be developed from a skilled staff and an existing internal technical basis.

The next two years should be particularly exciting as more and more of the overall system is implemented.