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COLLEGE D' EUROPE

TRANSPORTATION RESEARCH FORUM

"What makes business? The roads!
"How do they move the food they eat? The roads!
"How do thye get to work? The roads!
"How do they get home to their wives? The roads!

Robert A. Heinlein

DEVELOPMENTS over the last ten to fifteen years have suggested that, particularly in urban areas, there is an urgent need to consider other solutions to the movement of people and goods than the conventional highway system. Such alternative solutions may require new technologies, new forms of transport infrastructure and above all new approaches to understanding the implications of transport investment.

Historically transport planning in the UK has largely been the responsibility of people drawn from a limited range of disciplines. Civil and highway engineers have until recently tended to dominate the field, and they have developed their own branch of specialism, traffic engineering, to help them cope with their responsibilities. Public transport planning in its turn has been very much determined by the operators of the systems, subject to constraints imposed by regional or central government, while freight transport appears to a large extent to be hardly planned at all.

There would seem to be a great deal of evidence that the situation in the UK is by no means unique. Increasing contact between transport specialists particularly in Europe and North America has forced upon us the realisation that the transport problems, certainly of developed countries, are fundamentally similar, and that with a very few exceptions traditional and segmented approaches to their solution are still very much the order of the day.

Education in transport studies has naturally tended to follow the same pattern, with the approach to a career in transport being generally by way of highway engineering, transport operations or, to a limited degree, urban and regional planning. Undergraduate courses in civil and highway engineering are common in the UK and successful graduates go on to specialise on Masters' programmes or acquire professional qualifications while working. Training in transport operations has been stimulated by the activities of the Chartered Institute of Transport, and a variety of undergraduate planning courses exist which are recognised by the Royal Town Planning Institute. These latter courses usually contain elements of transport studies generally with a highway and urban bias.

In addition to these more formal processes of education, a number of small groups within a variety of disciplines have developed interests in transport. These include transport economists, transport engineers, vehicle and system designers, sociologists, psychologists and land-use planners. This involvement of people with widely differing skills, coupled with a growing awareness of the need for new styles of approach to transport problems, have promoted questions concerning the need for transport planning and the nature of the education required for the people who will undertake the job. These questions are becoming increasingly important in the UK with the formation of the so-called two-tier local government system which will give much greater powers to the county authorities to control and plan for transport in their regions.

THE NEED FOR TRANSPORT EDUCATION

That a need for properly educated manpower would arise in the field of transport planning in the UK, particularly for urban areas, was foreseen as long ago as in 1967 by Mrs. Barbara Castle, the then Minister of Transport. She invited Lady Sharp to undertake a special enquiry (Ref. 1).

Lady Sharp described her terms of reference as: "To examine the manpower implications of likely developments in the next 25 years in urban transport planning, including highway planning, traffic management, public transport and allied fields; to consider the needs of manpower, its calibre, qualifications, training and organization, with particular reference to local government; and to suggest what needs to be done."

Early on in the enquiry Lady Sharp widened her terms of reference and was able to state that: "The whole dimension of the job is changing. Traffic and transport can no longer, in the cities, be dealt with by providing more roads and making the best use of them. What is needed is a total transport policy for each major town, or inter-connected group of towns, and its hinterlands, related to the land-use of that area."

Lady Sharp goes on to discuss the inseparable nature of land-use and transport planning at the highest level and concludes that "what is really in issue is the development of a corps of people with a wide variety of education, training and experience to work in the whole spectrum of environmental planning, and to be members of a single society in which all can meet to discuss their common problems."

The report involved the determination of the numbers of such people that would be required and presents recommendations as to the type of education needed

An Approach to Post-Experience Education in Transport Studies

by

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at both post-experience as well as direct postgraduate levels. The problems in setting up suitable courses arise from the wide range of staff required to span the range of disciplines which must be covered. Furthermore centres offering advanced courses must be actively involved in research across the whole field to be studied.

RECENT DEVELOPMENTS

The report had a considerable impact on the thinking in universities and, to a lesser extent, local authorities concerning transport planning, and fairly general agreement emerged regarding the need for education of the type described. At about the same time that the report was presented (1970), the Science Research Council announced its intention to increase substantially its support of transport research in universities and to concentrate a major part of this increased support in four or five centres. The intention of this concentration was to encourage the formation of large multi-disciplinary teams who could thus take a coherent and wide-ranging approach to transport problems, and hence provide a first step away from traditional fragmented styles of study.

One of these major grants was awarded to the Centre for Transport Studies at Cranfield. The Cranfield Institute of Technology is an entirely postgraduate/post-experience institution concerned with advanced studies of technology and management. Transport studies already formed part of Cranfield's activities and the Centre for Transport Studies was in 1971 offering short courses and one year research courses, and undertaking transport research. The injection of Science Research Council support has enabled a rapid expansion of staff and activities, and has stimulated the development of other sponsored research in related fields of study. The Centre is now in a position to offer a range of teaching programmes and these have developed very much on the lines described by Lady Sharp. It is worthy of note that no explicit intention existed to follow the framework proposed by Lady Sharp, and that in fact the Centre she recommended has in fact just been established at Bristol under the direction of Professor Colin Buchanan.

The following sections describe in more detail the rationale behind the development of transport studies at Cranfield, and indicate how these programmes are being realised in practice.

RATIONALE FOR EDUCATION IN TRANSPORT STUDIES

The aim of the teaching programme is to take students from a previous discipline or background and show them how to apply their experience and training to problems in transport and planning. The intention is not to produce people of equal aptitude and interest—a sort of standard transport specialist. This is neither practicable nor desirable. Rather we expect to produce people with particular skills but with a clear understanding of how their skills can be applied, in conjunction with people of diverse backgrounds and interests, to transport situations. Furthermore, we suggest that the type of person required will not only be a problem solver, but be capable of recognising and formulating problems as well.

Behind this argument lies the recognition that transport and planning have so far failed to develop the coherent philosophy which enables so many other fields of study to teach at undergraduate level. We are doubtful if it is wise to consider undergraduate teaching until such a stage has been reached, since the lack of coherence may well be detrimental to the intellectual development of the student. It is also felt that the strong element of research in transport studies at the moment must be used to provide a basis for teaching, in the manner of the classical function of a university.

This rationale applies to all forms of teaching in transport at Cranfield, and we recognise a great many forms. One form of teaching is concerned with the in-job education of research staff, a second with short courses of varying duration and a third with full time Masters

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and Doctoral programmes. We shall not here discuss the in-job education of research staff, other than to comment that their problems and requirements are frequently analagous to those of formal students; we make use of our own short and long courses to assist in their education. Historically the development of short courses has tended to precede that of long courses, and the experience gained on the former has been used to define the detailed structure of the latter.

The Centre has been running a series of one week intensive short courses for about 2½ years. On the whole they have been very successful in attracting a very wide range of people to each course and we have been particularly pleased with the number of participants from planning authorities, national government and transport operation, and the growing number of visitors from abroad, particularly from Europe. The basis of this course is less to teach techniques, but more to present up to date information and views of contemporary problems and to place participants in a situation where they can discuss these with a wide range of people.

Our original series of short courses on "The Assessment of Transport Systems" has been used to define the nature and scope of the Masters programme in transport studies which we describe in more detail below. We are now recognising a need for short courses on specific aspects of planning and assessment, where particular techniques and areas of study can be dealt with in detail. A number of such courses are being planned for the next twelve months on topics including "The Application of Cost-Benefit Analysis to Transport" and "The Planning and Design of Airports."

FROM THEORY TO PRACTICE: THE MASTERS PROGRAMME

Factors Affecting the Style and Nature of the Course

While suggesting that no generally agreed philosophy of transport and planning is available, individual organizations must develop some approach to the problem in order to organize and implement a coherent programme of research and teaching. For our purpose it has been important to establish the general principles involved in transport assessment exercises. Such assessment exercises may be seen as an extension of technology assessment as derived from the defence and weapons field. The argument is that any transport plan or strategy is ultimately implemented by innovations in, modifications to, or extensions of transport technology. The word technology does, of course, include not only the obvious technical and engineering aspects, but also the methods of operation. Thus the objective of transport assessment is to evaluate the various impacts of changes in transport technology. Modern transport technology assessment differs from previous technology assessment in that a particularly wide range of potential technology options is available, the levels of resource allocation are very high and the social and economic implications are frequently both profound and complicated. Resource allocation is in fact the key to technology assessment provided that the range of resources used is not confined to those normally used but includes money, time, manpower, materials, energy, physical environment and many others. The intention of transport assessment is to ensure that the allocation of the resources is made in an acceptable and efficient fashion where the acceptability is determined in any particular situation by the appropriate set of social, political and economic criteria.

It is important to recognize that such an approach is no more than an aid to working in the difficult field of transport planning in that it provides a focal point for discussion and disagreement. The approach has the advantage that technology changes can be comparatively well defined so that the development of ideas and research is firmly anchored. It is for these reasons that despite the problems of quantification, forecasting and evaluation we regard transport technology assessment as one of the most coherent and useful approaches to transport planning currently available. A full description of this approach may be found in Ref. 2.

We have already suggested that a teaching programme should draw heavily on the research carried on in the organization. An additional constraint arises out of diverse backgrounds of the students and the nature of the course which requires a higher level of contact between staff and students than a wholly lectured and examined course and thus requires a higher staff-student ratio. Similarly if a genuinely multi-disciplinary course is to be run the range of topics and disciplines required by the teaching team is much wider than could be dealt with in a conventional academic organization.

This problem has been dealt with in the Centre by eliminating many of the distinctions between so-called academic and research staff. The result is a "core" teaching team composed of academics and research staff who are responsible for the seminars, essays, tutorials, projects and thesis supervision while the remainder of the staff provide specialist courses in such topics as statistics, com-

puting and economics. (See Appendix for further details).

The "core" teaching team is seven in number and provides expertise in mathematical modelling, economics, psychology, urban planning, civil engineering, operations research and transport engineering. We feel that this represents a reasonably good cross-section of the disciplines involved in transport studies, and enables the students to consider a wide range of topics for their dissertation.

An essential factor in considering a course of this nature is the type of student who will be most suitable. An obvious basic requirement is that the candidate be academically well qualified. The Institute takes considerable trouble to determine the equivalence of academic qualifications from other countries and a number of foreign nationals attend courses at Cranfield each year. It should be remembered, however, that the Institute has a special responsibility for post-experience teaching and thus is less restrictive in its view of qualifications than conventional universities, although by no means less emphatic about the quality of candidates. Thus it is possible for the Institute to accept suitable working experience or professional qualifications as a substitute for formal academic achievements.

The above are minimum qualifications and the candidate must still attend a personal interview at which time we attempt to discover the motivation of the potential student. There is some evidence over the last few years that many graduates are seeking what might be termed a conversion course. These are people seeking to move from their first discipline or vocation and to apply their knowledge in a new field. This appears to apply as much to the mature man as to the recent graduate.

This strengthens our opinion that the education system in the UK tends to force students into a vocational training at too early an age, and that this is responsible for the increasing number of younger applicants who wish to move into a multi-disciplinary field in order to broaden their education. An additional factor appears to be the strong motivation of many applicants to work in the public sector.

The final major factor that has affected the nature of the course is its duration. Lady Sharp suggested that this should be two years. It should be remembered however that two year courses frequently lose considerable time in vacations which is undesirable if the type and age of the student is considered. Most of our applicants would not have been able to consider a two year course either because of financial reasons or because of the disruption to their family or career, and appear to prefer the very intensive one year course presented at the Centre.

Thus the course of study over 50 weeks, with two one week vacations at Christmas and Easter should give something in the region of 2000 hours of work while a two year course of 30 weeks per year gives perhaps 2200 hours. The difference is marginal, particularly if one considers the enthusiasm and involvement of students on a one year course.

Content and Style of the Course

The case for a course of this type has been made and the general aims disclosed. Although the factors affecting the style and content of the course have been discussed the result of this thinking has not been detailed. To some extent the course has developed from research and short course teaching although we now have experience of the Masters course over two years.

We do not think that conventional lecture programmes and examinations are at all suitable for this type of course because they do not allow the student sufficient freedom to develop his own abilities, nor to make an original contribution to transport studies.

Our experience over the last two years has led to the following specification of the Master's programme.

The majority of incoming students have a limited knowledge of transport; even those coming from working experience in some branch of transport tend to have a narrow viewpoint. Thus the first element of the course must be to present the students with a wide range of information in as interesting and varied fashion as possible. We have chosen, for reasons given previously, to use as the core of this element of the programme a series of seminars on a very wide range of topics. These topics in themselves tend to be multi-disciplinary and are run by one or more members of the core teaching team. This programme is supported by a series of essays which deal with more philosophic or abstract problems. (See Appendix item 2 for details of this element).

In addition other members of staff run a series of courses in specialist topics such as transport economics, statistics, computing etc. The emphasis of these is the individual development of the student and the classes are frequently run by two or three staff simultaneously. Finally each student has a personal tutorial with one of two members of the core teaching team each week lasting about an hour. This goes on throughout the

first two terms and allows the student some opportunity to sort out his individual problems, whether these be personal or academic.

The student will be expected to be able to apply his previous experience and the new information within a multi-disciplinary group facing common problems. Thus the second element of the course should be to put the student into a situation which will provide the problems of group collaboration and communication. This is done by means of a group project involving teams of 7-10 people. The details of such projects may be found in Appendix item 3. It is sufficient to mention here that these projects are always real problems, usually those of a local authority and that our observations suggest that they are highly successful both from our and the students' point of view.

Finally the student will be expected in the working situation to be able not only to solve problems suitable to his training but also to recognise and formulate problems himself. Thus the third main element of the course is an attempt to reproduce this situation. The technique used is for the student, with considerable discussion with his supervisors and other members of the staff, to define an area of study (or "problem") in sufficient detail as to allow him to make an original contribution to the chosen study area within the five months allotted to this course element. The emphasis is on useful work and students are not encouraged to define trivial though original areas of study. Appendix item 4 gives further details.

CONCLUSION

This paper has attempted a brief explanation of why and how a multi-disciplinary course may be run in transport studies. One of the measures of the success of a course in fulfilling a demand for education is the number of enquiries and applications, which for the 1973-74 course are running at about 250 and 60 respectively. The second measure is what the students end up doing and how successfully. Unfortunately we have only the evidence of the first year of the course, (the second year does not finish until September) but from this and the job applications being made this year it appears that 40-50% will go into planning authorities or national government, the remainder being split between universities, consultants, transport operators and, increasingly, private industry. The range of background of applicants is also encouraging and includes sociologists, physical planners, mathematicians, physicists, geographers, marine transport operators etc. It is anticipated that the course numbers will continue to grow for another two or three years about which time we anticipate running similar courses with different biases.

Cranfield, with its special responsibility for post-experience teaching has created an excellent environment in which to run short courses. We regard such courses as a particularly useful forum for teaching and discussion for people in working situations who wish to expand their knowledge and meet people with a range of transport problems and interests. It is expected that six one week courses will be run in 1974 on a variety of topics. The participants in such courses display a similar range of background and experience as the one year students, with a greater bias towards local authority planners, transport operators and national government employees.

Finally having gained experience in short course teaching and the one year course, we think, as does Lady Sharp, that there is a demand for an intensive ten or eleven week course based on the first term of the Master's degree programme. This would be aimed at local authorities and the government departments, although we expect interest from a wide range of people. It will be remembered from previous discussion that the first term of the one year course is an intensive mixture of seminars, essays, lectures and tutorials over about an eleven week period. This could be used as an induction course for new employees of organizations involved in transport problems or as a refresher course for those already in post. This form of education is increasing in other areas of work, particularly management training and is slowly being encouraged by many organizations as a most efficient way of informing and training their staff.

Whatever the future holds we feel, that with the broad range of staff at the Centre and their enthusiasm, it must be interesting and rewarding.

REFERENCES

1. HMSO, London. "Transport Planning: The Men for the Job," Report to the Ministry of Transport by Lady Sharp, January 1970.

2. J. M. Clark, "The objectives and methodology of transport assessment Proc. Fourth Annual Conference of British Section of Regional Science Association 1971. Published in Patterns and Processes in Urban and Regional Systems (ed. A. G. Wilson) Pion Publications 1972.

APPENDIX
MSC SYLLABUS

1. INTRODUCTION

The course may conveniently be considered in three parts; a formal teaching programme comprising; seminars, technical essays and background lectures:

group project work and individual dissertations.

The content of these three parts is described in the following sections. Section 5 shows how the work of the students is assessed.

2. FORMAL TEACHING PROGRAMME

Seminars

The core of the formal teaching programme is a series of 40 seminar sessions held during the autumn and spring terms. These seminars can be grouped into three categories: Methods and techniques of transport assessment; a framework for transport assessment, relationship between transport and land-use planning, structure of urban transportation studies, principles of economics, investment appraisal techniques, models used in forecasting travel demand, quantification of the attributes of transport systems, social survey techniques, cost-benefit analysis and alternatives to cost-benefit analysis.

Properties of existing and innovatory transport technology. Descriptions of the costs, engineering principles, performance, capacities and associated facilities of: conventional urban transport modes (car, bus, taxi, suburban rail etc.), novel urban transport modes (dial-a-ride, cabtrack, minitram, high speed moving pavements etc.), terminals and interchanges, intercity ground modes (rail, APT, tracked hovercraft, magnetically suspended systems etc.), air transport modes (conventional short and long range aircraft, V/STOL aircraft, supersonic aircraft, third level services etc.), freight transport modes (truck, rail, inland waterways, pipelines etc.) and physical distribution management etc.

Applications of Assessment

These sessions are largely drawn from research studies active or recently completed in the Centre. Some specific case studies carried out by external bodies are also included, for example: third London Airport, Greater London Development Plan and Public Transport in Stevenage, etc.

Each seminar session involves the student in approximately ten hours work over some three or four days. The topic is introduced in a one hour lecture designed to highlight the basic elements of the topic and elucidate any conceptual problems. The student is then given 6 hours to prepare a seminar paper on an aspect of the topic in preparation for a three hour seminar at which the topic is discussed in detail. During the seminar some of the students present their papers and other students criticise these papers. The discussion is guided by at least two members of staff in such a way as to ensure that the whole breadth of the topic is covered.

This style of teaching places great reliance on the students' own work and on discussion. The intention is to give students a good understanding of the techniques, concepts and information involved and to develop an awareness of the current literature. The opportunity to apply this knowledge is provided by the technical essays, group project and individual thesis work.

Technical Essays

During the same first two terms, the students are required to prepare 10 technical essays. The topics are chosen so as to give the students an opportunity to apply the knowledge derived from the seminar programme and to consider in some depth the implications of the process of transport assessment. The students are expected to spend some 20 hours on the preparation of each essay, and after the essay has been submitted the topic is discussed in an essay class with the members of the teaching staff. The objectives of these classes are: to encourage students to discuss the topics and to ensure that all students are aware of the complete breadth and implications of the topic.

Finally each student discusses his essay in an individual tutorial with his supervisor.

In addition the students are required to prepare three major essays (at around Christmas and Easter) on aspects of: the methodology of transport assessment, the current state of and development in transport technology and the application of assessment techniques.

These essays are designed to test the students' understanding of the material presented in the seminar programme, and as such are given special weight in the students' course assessment.

Background Lectures

Since the students are drawn from a range of backgrounds, it is important to ensure that all have some familiarity with important background disciplines. Accordingly courses are offered in: elementary mathematics and statistics, transport economics, computing and languages.

These courses are compulsory, except in special circumstances where it is clear from the student's background and experience that he has an extensive understanding of the subject.

The language courses are taught in the Institute's language laboratory by experienced language lecturers. Students may opt for French or German, and the courses are designed specifically

with transport application in mind. With Britain's entry to the EEC it is clear that it will be a great advantage to professionals in transport to have a working knowledge of at least one European language.

3. GROUP PROJECT WORK

During the Spring term the students work in groups on a project. These projects are designed to give the students experience of working in a multidisciplinary team. The topics are usually chosen in consultation with a neighbouring Local Authority or Development Corporation, and involve the use of real transport and socio-economic data in the context of a specific location.

The specification is usually fairly vague since the process of defining a coherent and achievable work programme is seen as a necessary element in the students' training. Each individual student is required at the outset to provide in writing his own interpretation of the plan for the programme. On the basis of these papers, a detailed programme is prepared following group discussions which are guided by the staff. In defining the programme and structure of the report, each student is allocated his own tasks and required to write his contribution to the final report.

A draft report is prepared by Easter, and each student is then required to write an individual criticism of that draft report. On the basis of these criticisms, a final report is prepared and submitted to the Local Authority or Development Corporation which has provided the data and their co-operation. It is intended that in addition to their value as a teaching exercise, these reports shall be of direct use to the organisation involved.

Throughout the progress of the project, frequent meetings are held by the group. These meetings are given just sufficient guidance by the teaching staff to prevent individuals dominating the study and to ensure that the programme is adhered to and a coherent report produced.

4. INDIVIDUAL DISSERTATION

During the Spring term students are guided in the choice of a thesis topic, and aided in planning a work programme. The main effort in preparing the dissertation is put in during the last five months of the course. The topics selected may be either in the area of developing aspects of the methodology of assessment, or concern the application of assessment techniques to real transport situations. These topics must offer scope for research of some originality. Students are encouraged to work in areas related to the main body of research of the Centre, and particularly to the SRC supported programme on the Assessment and Development of Transport Technology.

5. ASSESSMENT OF STUDENTS

The work of the students is continually assessed throughout the year on the basis of the written papers they are required to produce. No examinations of the work undertaken in the background courses are taken. This is because, unless the students complete these courses successfully, their performance in the other assessable elements of the course will be impaired.