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THE INCREASING CONFLICT between the desire for movement and for a better environment has provoked considerable public interest in ways of resolving the situation. In particular there has been mounting public pressure to reduce the undesirable consequences of road construction.

The Greater London Council (GLC) has endeavoured to resolve the situation by combining Planning and Transportation functions within one Department to include professional officers who formerly worked in consultation but separately within the Departments of Architecture and Civic Design, Planning, and Highways and Transportation. The need for the professionals involved in road schemes to work closely together has been recognised by the creation of Area Teams consisting of architects, engineers and planners, based upon five geographical areas. The authors of this paper are the joint heads of the Central London Team.

The areas correspond to groups of London Boroughs. These boroughs (33 in all) are local planning authorities in their own right but governed by policies of the GLC. During the past three years these policies, contained in the Greater London Development Plan, have been examined by probably the largest public inquiry in history. This is not surprising since the GLC is the largest local government organisation in Britain, covering an area of 1,580 sq. Km. (610 sq. miles) and the home of over seven million people. Its Development Plan embraces most aspects of London life including homes, jobs, transport, recreation, education and public utilities. A concern for the environment is implicit in all the policies and the Area Teams are particularly well placed to influence them, being primarily concerned as they are with executive and practicable application of such policies.

Area Teams

The Teams are within a Branch of the Planning and Transportation Department headed by the Director of Development and Traffic Commissioner. The development and environmental aspects and the traffic aspects are coordinated respectively by the Chief Planning Architect and the Chief Traffic Engineer.

There are five teams: North East, North West, South East, South West and Central London. There is also an Environmental Studies Group, providing research and development support to the Teams; and a Management Services Group, providing general management and programming advice. This organisation has operated for four years, its tasks embracing everything from research to contract implementation.

The Central Area Team covers the eight London Boroughs north of the Thames, an area of 130 sq. Km (50 sq. miles) with resident population of 1.4 million people. This is only an administrative Central Area; the functional central Area is smaller and is partly south of the River Thames. It includes within its compass most of London's physical heritage; the nation's business centre and major institutions; also the poorer areas of the East End, heavily bombed during World War 2 and the obsolescent docklands; and to the north and west part of an enclosing ring of poor Victorian twilight housing. Places of such extreme variety call not only for the highest degree of care but also an equally varied approach to their individual problems. This makes great demands on the staff involved, they must be able to switch from matters of national importance to ones of local interest at a moments notice.

The Team is concerned with strategic aspects of urban design and transportation including: traffic and architectural design aspects of private development applications—(traffic generation, high buildings and environmental impact); special development schemes; pedestrian precincts; amenity aspects of the Thames and canals; the location, design, environmental effects and justification of road improvement schemes including evidence at public inquiries. It is also concerned with such details as street furniture, road trim and architectural design services to the road construction engineers, (recently an Architectural Design Group has been set up to handle this).

Team Organisation

As joint leaders we are in charge of and responsible for the quality of work of our respective professional staff. They work to section leaders, usually covering two Boroughs, and are also brought together in project teams as the need arises. The leadership of a project varies, according to whether engineering or environmental consideration predominate.

We have an establishment of 39 planning architects and 32 traffic engineers; this includes technicians and students in training. The Team has its own secretariat and administrative staff of eight, most of whom are graduates. Except for the senior staff, the team works in an open plan office, an arrangement which provides maximum opportunities for contact.

Traffic and Environment

The greatest scope we have for joint

Traffic and Environment: The Multi-Disciplinary Team and its Working Methods

by

*John Parker**
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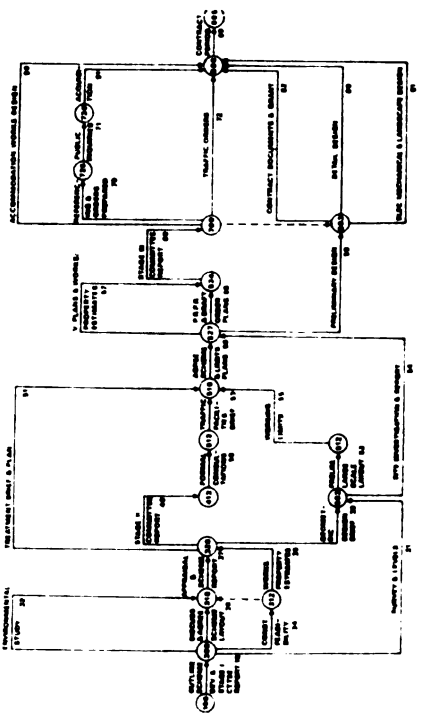
working has hitherto been on the Council's road improvement programme and traffic management schemes. About 80% of the engineers' total working time and 20% of the planning architects' time is taken by this aspect of the Team's work. The procedure followed in planning a road is shown on Figure 1, this illustrates the way that traffic engineering, town planning and environmental impact studies interlock and are reiterated before solutions are reached. This paper concentrates on the environmental and planning aspects of this procedure and presupposes familiarity on the part of the conference members, with normal traffic engineering studies.

Our procedure ensures that the Council's committees have all the relevant information they need to reach a balanced decision on any scheme. The planning architects are required to ensure that at a local environmental level the roads are designed to cause a minimum of disruption to their surroundings and to make the road fit into the urban scene. This includes the architectural design of bridges, joint development of roads and buildings and the design and execution of changes to buildings affected by the road, street furniture, lighting and landscaping. One particularly important aspect is to assess and monitor the environmental effects of traffic both on the immediate surroundings and the wider locality. The Council's Scientific Adviser's staff take all noise, pollution and vibration measurements and advise upon the suitability of remedial works.

At the strategic level the planning architects assist in selecting the routes and alignments of major roads to steer them clear of residential areas and other



Road Procedure
FIGURE 1

important features. Usually we seek natural alignments such as breaks in the urban fabric between communities, alongside existing railway lines or through areas ready for renewal.

In traffic management we have several objectives: to encourage the creation of environmental areas within which extraneous traffic is excluded; to ensure that management schemes do not create greater problems than they solve; to secure the provision of pedestrian shopping streets; and preventing the proliferation of road signs, markings and general traffic paraphernalia. The control of signing is an onerous and time consuming job but it is on such detailed matters that good townscape depends.

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The traffic and environment syndrome is a commonplace in Britain today, and has been the subject of a recent report to the government by its Urban Motorways Committee. This report—'New Roads in Towns'[1] resulted in a White Paper 'Development and Compensation—Putting People First'.[2] The GLC's political pressure, from as far back as 1960, was instrumental in the setting up of this Committee in 1969 and several of the Council's chief officers were appointed as members of the Steering Committee by the then Minister of Transport.

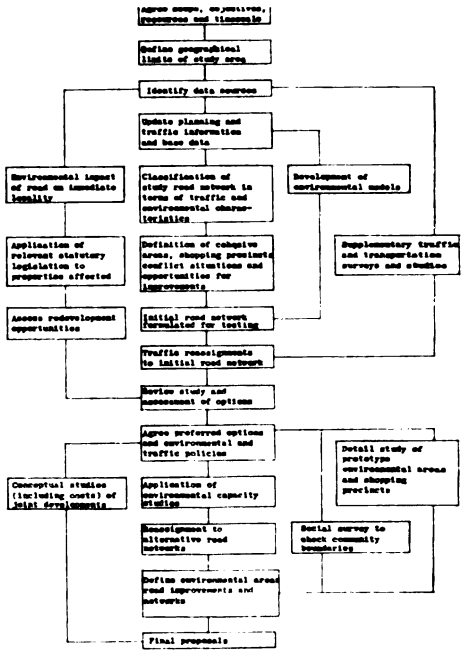
Until now highway and planning legislation in Britain has restricted what can be done to reduce the adverse effect of new roads upon people and property close to them. The Council's professional officers were leading advocates for a new approach and early exponents of the techniques which needed to be applied; it can justifiably be claimed that our work in this field played a fundamental part in the formulation of the new legislation. The resulting Land Compensation Bill was published in November 1972 and is now before Parliament.

Briefly, the aim of the new legislation is to reduce damage to the environment and to ensure fairer compensation for those who suffer. It applies not only to roads but to all public developments, and requires future proposals to consider both indirect and direct costs and benefits. On roads the principle has been firmly established that the design of the road and the treatment of the surroundings should be seen as a single planning task and tackled wherever practicable as one operation. It is recognised that adherence to these principles could put up the cost nationally of new roadworks, to the taxpayer and ratepayer, by as much as 15%-20%.

In its road planning in recent years the GLC has already gone a long way towards anticipating this new approach, especially with regard to route selection and the measurement of environmental impact.[3a,b]

Environmental Effects of Urban Roads

Major new roads and improvements can introduce a totally new scale of structure and traffic movement and completely change the quality of the spaces around them. Some of the effects are measurable and for these performance standards are becoming established. This applies in the case of traffic noise, interference with daylight and sunlight and to pollution. Other effects are less easily discernible and more subjective judgements are used, e.g., vibration, community severance and visual intrusion. We have adopted a range of techniques for these phenomena which are applied



Traffic and Environmental Study: Activity Chart
FIGURE 2

in all our road studies, they are covered in detail in various GLC publications (see references). Briefly they are:

Noise: For several years we have used the 1963 Wilson Committee L10 index defining the noise levels, expressed in decibels (dBA) which should not be exceeded for more than 10% of the time inside various types of buildings.[4] More recently the Noise Advisory Council has suggested a maximum acceptable external noise level at the face of houses of 70 dBA. This is at least 10 dBA higher than we have previously used, but is the standard the Government seems to be adopting for the new legislation mentioned earlier.[5]

Daylight and Sunlight: There are well-established and widely used codes of practice and by-laws which ensure interiors of buildings are adequately lit, but in practice the overshadowing of external spaces is less carefully protected.[6]

Pollution: Though measurable, the generation of fumes from vehicle exhaust and dust from road works and carriageways has not been accorded enough importance. This is because climatic inconsistencies and differences of site conditions together give wide variations in results. The GLC has however urged the Government to adopt the ECE recommendations on vehicle exhaust emissions.

Vibration: This can be an annoyance when it causes rattling of windows and ornaments due to airborne vibration but, according to the best scientific advice so far available, there is little evidence to support the widely held lay view that traffic vibration causes structural damage to buildings. There is obviously a good deal more research needed here, especially with regard to old and historic buildings.[7]

Severance: A new road can interrupt or make more tortuous well used pedestrian routes and create long delays in crossing roads. It can also cause physical or psychological separation of communities. The criteria we use to assess severance are discussed later under environmental capacity.

Visual Intrusion: This involves many issues: the changing of familiar and well loved views; the appearance of new structures; lighting columns, signs and the light from them; the traffic itself, both moving and parked and the glare from headlights; overlooking and reduction in privacy. Most of our assessments on these are made from experience and professional judgement. There has been an advance in measuring some of the effects, stemming from the work of the Urban Motorways Committee, but this is still an embryonic science.[8]

If the adverse effects cannot be minimized during route selection then some might be moderated by sensitive urban and architectural design, which of course is needed whatever the route. The 'view from the road' must not be forgotten for this is one of the ways we all experience our cities today, a pattern of sequential images. Traffic architecture requires excellent design standards, good quality materials, intensive landscaping and total integration of the road with its surroundings, all of which help the new structure to harmonise with its surroundings.

The Central Area Team has been conducting a special study during the past three years—"Motorways Environmental Reinstatement: Pilot Study into Remedial Treatment." The objective of the study has been to determine what can be done to improve living conditions in dwellings adversely affected by motorways. Three GLC housing estates were selected for this purpose alongside two recently open roads of motorway standard. Surveys were undertaken before, during and after construction.

Householders have been interviewed to find out how the presence of the motorway has affected their lives and the results have been compared with scientific measurements of noise, pollution, vibration, intrusion, accessibility, daylight and sunlight. The results have produced a close correlation between the views expressed in the interviews and the measurements. Noise is generally by far the most disturbing feature, although it is notable that those closest to the motorway considered dust as marginally more troublesome even than noise. The impact of the construction period figured prominently in many peoples views.

The studies have underlined the need for remedial works, which could range from simple acoustic treatment to windows to extensive internal conversions and external landscaping. If such works are carried out then a further series of social and scientific studies will measure the effectiveness of the work.

The study is only partially completed and will probably be published as a research memoranda in due course. Such studies provide an excellent basis for testing whether the environmental standards adopted are arbitrary or an accurate reflection of what those affected really feel.

Planning Studies

In proposing changes to a road network we normally study a wide area, to ensure that the total effects are understood and maximum traffic and environmental benefits are obtained. The studies involved, their relationship and sequence might be as shown in Figure 2. The study area must be of sufficient size to include the principal planning, environmental, traffic and transportation issues that may arise. Its exact determination at the outset is difficult, but one can for instance delineate a boundary based upon an arbitrary percentage of the reassigned traffic, i.e. what is the smallest change of traffic flow of measurable environmental significance.

The environmentalist's approach to studies of this kind is to seek, amongst other objectives, to maximise community benefits and minimise traffic intrusion, this can have internal conflicts because to improve the amenity of homes, shops, schools and community buildings may reduce local accessibility; it may also reroute traffic into neighbouring areas. We have no special key to unlock these problems, but in common with others we have used Buchanans' environmental models, updated by the more reliable of recent research findings, to measure environmental capacity and to define environmental areas.

Environmental capacity: Traffic redistribution means that some roads will be relieved of traffic and others will carry more. Therefore, some standard assessment must be devised for measuring the amount of traffic each street can accept without eroding its amenity and func-

tion—this is termed its 'environmental capacity'. A phrase invented by Buchanan in 'Traffic in Towns' (1963).

Traffic affects the environment in many ways only a few of which can be measured and of these fewer still can be compared with any commonly accepted standards. Most studies have relied upon two factors, noise and pedestrian delay. The former is a fair proxy for measuring the internal effect on occupants of buildings, the latter for measuring external effects on people moving between buildings.

Vibration and air pollution are not considered to be significant because, before they reach an unacceptable level, the acceptable limits of noise and delay criteria would already have been exceeded. Intrusion is a contributory factor but this is normally a value judgement arising from a subjective assessment. For the noise either the Wilson or the Noise Advisory Council's standards are used. The maximum internal noise levels we work to are: Houses 50 dBA (day), 35 dBA (night); Offices/schools 55 dBA; Shops 60 dBA.

The delay people experience when trying to cross a road can be measured and expressed in terms of average delay to all pedestrians, or of the proportion of all pedestrians who have to wait for a suitable gap in the traffic stream. Buchanan suggests that when the average delay reaches 4 seconds then the pedestrian's freedom to cross anywhere he pleases needs to be curtailed. Where the free movement of pedestrians is essential to the function of the street (shopping or residential) then 4 seconds becomes the acceptable limit. As a broad standard when more than 50% of pedestrians wishing to cross a street are delayed then the pedestrian function of the street is being disrupted.[9]

No commonly agreed figures exist for environmental capacity expressed in terms of traffic flow. Those available range from 150 vph to 950 vph based mainly upon noise and pedestrian delay.[3b] Obviously time of day is important, because homes are less sensitive to noise if largely empty during the day and pedestrian delay is more important when children are on the way to and from school or at peak shopping hours. Our current approach is to aim at a maximum traffic flow of 1,000 vph on local roads and preferably below 600 vph. A residential environmental area requires flows below 200 vph for satisfactory conditions.

The method has been criticised as inflexible, as not allowing the balancing of gains in one street against losses in another, nor for trading off one environmental impact against another, and not allowing the introduction of other factors such as traffic characteristics and economic evaluation. All this is true in a strictly academic sense, and certainly needs careful consideration; however, in practise in this field, the simpler the process the more likely it is to be used as one is really concerned with broad realities rather than high degrees of precision. The latter would be more appropriate where only a small range of streets are being assessed, such as for a pedestrianised street and diverting traffic to adjoining streets.

Many of the methods being developed involve complicated equations, so for practical use, we print a matrix of results by computer allowing the capacity to be read off, given the other variables (inch road width, vehicles speed). One can also introduce an assessment of the numbers of people affected to reach a decision on benefits and disbenefits. Whatever method is adopted, it should be remembered that these are purely tools providing a method for arriving at what are ultimately subjective values and as such only augment professional judgement. This may remain true even when more accurate results are achievable. The GLC and several universities, notably D. H. Compton at Imperial College, are pursuing various interesting developments.

Environmental Areas: This is defined as a unified area, having no extraneous traffic, and within which the needs of amenity and pedestrian movement predominate over vehicles; it can be either a residential or working area. The approach is to achieve a balance between restricting penetration by vehicles without making normal daily access for servicing unreasonable; Buchanan's 'rooms and corridors' provides a graphic analogy of this. In existing cities few schemes have been implemented and those that have often produce undesirable repercussions on access and peripheral streets which bear the brunt of diverted traffic, e.g., Barnsbury. The standard method we adopt is as follows:

1. Preliminary approach to traffic management options.

2. Planning Studies to identify: (a) Activity centres and uses: primary schools, hospitals/doctors, local shops, open spaces, community centres, entertainment. (b) Catchment areas—walking distances, e.g., primary schools: ⅓ mile, local shops: ¼ mile, open space: ¼ mile, railway station: ½ mile. (c) Barriers to movement and pedestrian routes. (d) Character, conservation areas, historic buildings.

3. Examine relationship to adjoining areas: (a) Community connections. (b)

Need for any special pedestrian provision.

4. Assess environmental capacities of peripheral and internal roads: (a) Based upon noise and pedestrian delay. (b) Subjective assessment of visual intrusion. (c) Existing parking provision. (d) Internal traffic generation.

5. Analysis (a) Identification of communities, possibly using a social survey to check previous empirical assumptions. (b) Definition of size (3,000 to 7,000 residents). (c) Optimum access and servicing. (d) Traffic feasibility.

6. Proposals (a) Delineate environmental boundaries. (b) Delineate pedestrian routes. (c) Detail proposals for road closures, improvement of peripheral roads and pedestrian access to adjoining areas, special parking measures, open space and play spaces, landscaping and street furniture.

To structure a whole district on the basis of environmental area planning will create tremendous pressures on the main road system to cope with increased traffic loads. The only alternatives are road improvements and/or traffic restraint, both of which will produce spare road capacity to absorb the extra traffic. It will also necessitate the redevelopment or the by-passing of the shopping centres which lay on these routes (most major shopping centres in London are on major roads, e.g., Oxford Street) and provision of special facilities for buses; these are but a few of the problems to be resolved before a theoretical ideal can be reached.

Case Studies: Westway.

As part of its evidence for the Greater London Development Plan, the GLC produced an environmental and traffic appraisal, carried out by the Central Area Team, of this road, which was opened in July 1970.[3c] The appraisal examines the development of the road in relation to its environment and identifies areas where changes in conditions have occurred as a result of the road, or where they may be anticipated on completion of longer term planning and further development of the primary and secondary road networks.

The environmental impact of the road had been anticipated before it was built, but only partly resolved due to lack of adequate powers. Benefits were also anticipated in the relief of local roads of extraneous traffic, both locally and over a wider area, but to be fully achieved they required other longer term road improvements and development. Landscaping needs time to grow and mature, and major development in the vicinity, as a consequence of opportunities afforded by the road, were only just starting. Local environmental area plans had not by then been prepared nor had plans for the use of the space under the road been formulated. There are now many schemes for the latter and the results of an architectural ideas competition will soon be announced.

Perhaps the most significant outcome of the appraisal was that it illustrated how far traffic planning and environmental study techniques have improved in recent years. Other conclusions are, however, of interest.

Local environmental effects were dominated by the issue of noise, but the combination of other factors—intrusion, daylight infringement and overshadowing were also significant for some properties, especially on the northern side. The noise effects when measured on site were generally as predicted by the Council's Scientific Adviser (within ± 2 dBA), which underlines the high degree of accuracy now being achieved in this field.

Redevelopment was an important factor in integrating the road with its surroundings. An ambulance station erected under the road by the Council and a railway maintenance depot are particularly successful examples in this respect.

The wider effects of the road are only now emerging as traffic flows become established. Surveys have shown extensive use of the new road with corresponding reductions on parallel roads, particularly inner east-west routes. This is important as it provides an opportunity for creating environmental areas; but it also needs swift management action to ensure that the capacity is not absorbed by traffic growth. This stresses the need to have plans prepared for such environmental improvements before the road is opened.

Traffic and Environmental Management

The alternative to road improvement is the maximum use of existing road space which is operating below its traffic capacity due to many reasons, i.e. obstruction due to waiting and loading, vehicle turning movements and uncontrolled pedestrian crossings. Added to this there are planning and environmental restrictions which are aimed at matching the traffic and environmental capacities of roads.

The GLC uses many techniques, parking and loading control, banned turns, urban clearways, lorry bans, one-way streets, bus only lanes and computer controlled signals; all of which have to be carefully monitored in planning terms to ensure there is not a loss of amenity and activities.

We try to ensure that such proposals are now embraced by 'Environmental

Traffic Management Schemes'. In the short term, without resorting to environmental areas, they can be achieved by limiting access, diverting traffic from 'rat-runs', closing minor streets at junctions with main roads, developing pedestrian networks, creating bus only lanes combined with pavement widenings and the pedestrianisation of shopping centres and places of congregation.

Perhaps the most promising, beneficial and easily implemented of the environmental improvements is pedestrianisation of busy streets, the GLC is therefore entering into a programme for implementing these.[10]

Central London has inherited a surprising number of narrow streets and alleys which have no vehicle access. These have become a natural and accepted part of City's fabric and are often forgotten when one is discussing improvements, e.g., The Temple, Shepherds Market and Burlington Arcade. They all have in common humanity of scale and a relaxed and dignified atmosphere.

There are several new projects which we have personally been involved with including: Oxford Street, Bond Street, Carnaby Street, Tower of London Precinct, Piccadilly Circus, Kings Road, Marylebone High Street and the Three Squares (Parliament Square, Trafalgar Square and Leicester Square). Some points on Oxford Street where we have early survey results available may be of interest.

Oxford Street

This is London's major shopping street, it is 2 Km (1.2 miles) in length from Hyde Park to St. Giles Circus. A mixture of shops, department stores, restaurants, offices and cinemas, with its side streets running into the conservation areas of Mayfair, Harley Street, Soho and the Portman Estate.

In recent years traffic and pedestrian conditions have become intolerable and it had achieved the unhappy distinction of having the highest accident rate of any street in Europe—over its length there was an average of 265 injury accidents per year, with a peak in excess of 300. This is ten times more than the average for similar roads in London.

The street has now been partially pedestrianised on an experimental basis since Christmas 1972 and is one of the most important projects of its kind attempted. Except on Sundays, traffic over a 1 Km long 20 metre average width section of the street is restricted to buses, taxis and service vehicles only, between the hours of 11 a.m. and 7 p.m. Some side streets have been closed, pavements widened and amenity features installed; this has improved visual quality and humanised the street.

Excluded traffic has been diverted to parallel already well used streets, which unfortunately are partly residential and partly in conservation areas, places which in themselves might be considered for environmental area planning. This neatly poses the dilemma inherent in such management schemes.

As it is an experiment, full before and after studies have been made, unfortunately, these have yet to be analysed. The studies include assessment of accidents, traffic and bus flows, pedestrian movement, noise and pollution measurements, accessibility, visual intrusion and an opinion survey of traders, pedestrians and residents.

Initial public reaction has been very favourable with a small sample survey showing over 85% in favour. Studies are now proceeding for an eastwards extension of the scheme and for modification and the possible permanency of the present scheme.

Conclusions

What has been achieved has not come easily, the difficulties that have arisen stem mainly from statutory legislation, administrative procedures and management aspects. This is particularly acute in our field where one is often uncovering problems that no one knew existed—and for which therefore established arrangements are not always helpful. Nevertheless work mushrooms in consequence and, unfortunately, selecting priorities on a basis of external pressure and statutory responsibilities conditions the direction of effort, this frequently relegates work of more professional interest to the back of the queue.

This can aggravate the problem of staff turnover, which may be considerable anyway, especially among younger design-oriented staff who wish to develop a career. This can only be partly satisfied by the architectural and planning aspects of road works and even the addition of large-scale urban design projects cannot completely answer the problem. Anyone setting up teams on our basis should note the need for a leavening of other quality projects if they are to recruit and retain creative and imaginative staff. Hopefully, such projects may well materialise from joint development schemes with buildings integrated with roadworks.[11]

We are lucky enough to have easy access to other specialists employed by the Council: landscape architects, valuers, estimators, scientists, economists, sociologists, lawyers and many others—it is seldom we need to venture outside our organisation for expertise. They are

all part of what might be termed the "extended team." A case could be made for some of these specialists to actually work within the team structure but continuity of work cannot always be guaranteed. Other organisations may however have a different emphasis in their work which would justify such a course.

Unless objectives are clearly defined at the outset of a project, disappointments will arise over what is achieved. Continuous and energetic control of implementation is necessary to ensure the right results not only occur but are used thereafter as a standard practice. This is very clearly seen on road trim and signing, where after the first flush of success at getting well-designed items accepted, there may not be impetus and opportunity for speedy implementation everywhere.

Many of the techniques and criteria used by the team are not yet developed to a state where they are given universal credence—much more research, development, feedback and analysis is needed. This applies especially to the importance that people attach to environmental improvements and the costs involved.

We both believe wholeheartedly in the principle of our kind of working arrangement and that this is seen in the results, particularly in the rejection of the easy but inferior options. Our staff also seem to be enthusiasts, proof of this can be seen in the traffic engineers, who are taking town planning courses and planners and architects studying transportation or computer applications.

Dr. Samuel Johnson once said: "Marriage has many pains but celibacy has no pleasures." He could have been describing a multi-disciplinary area team.

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