

Vehicle Occupancy Rates

In Canberra the peak car occupancy rate is 1.2 persons per vehicle, the average daily occupancy is 1.38. If car occupancy rates could be doubled then a 20% fuel saving would be possible, however, there is no obvious way in which this could be achieved. For a variety of socio-economic reasons 'car pooling' is unlikely to offer a solution in this regard.

Cycleways

Of the minor transport modes Canberra has a very extensive metropolitan cycle path system which is used primarily by students and for recreational trips. It is expected that ultimately its existence might reduce annual fuel consumption by about 2%. Currently there are 85km of cycleways and the completed network will total 180km.

Non-Transport Energy Consumption

Although the greatest scope for energy savings resides with the transport sector because it consumes roughly 60% of all energy used in Canberra, there are nonetheless worthwhile economies to be had in relation to domestic, commercial and industrial usage.

Canberra by virtue of its altitude has a cold climate by Australian standards but with high hours of sunshine per day and a clear atmosphere. Domestic utilisation of energy comprises

. Space heating	61%
. Water heating	20%
. Cooking, lighting etc	19%

Insulation

Initial efforts at conserving domestic energy have been directed since 1976 at improving the insulation of houses on the basis of estimates showing that approximately 65% of all houses were poorly insulated. The capital cost of insulation improvements for the average house is in the range \$700-\$1000 and would produce savings in energy costs of \$125-\$175 per annum. This represents a pay-back period of 7 years and a return on investment of 18%. For the individual householder this is a cost-effective investment where many other energy conservation measures are not.

Sub-Division Design

Domestic energy savings might also be achieved in the case of future urban development through improved land subdivision design so that a high proportion of houses have a northerly orientation. The NCDC has developed computer techniques which assist in the optimisation of orientation, views, and land servicing costs, but is too early to know whether these will lead to significant improvements in energy utilisation. Both house orientation and improved house insulation have been the subject of education campaigns aimed at developers and consumers. These are having some beneficial effects.

Public Buildings

With regard to public buildings, such as government offices, hospitals, schools etc, a programme of changeover from fuel oil to natural gas is under way. This coupled with a general reduction of 2-3°C in thermostat settings is expected to yield an overall energy-cost saving of about 10% per annum and is a fairly direct consequence of national energy conservation and petroleum replacement policies.

Energy audits are currently being prepared for government buildings and facilities in order to draw conclusions as to revised energy and insulation standards. It is proposed that subsequently 'prescriptive energy targets' for offices, schools, hospitals, etc will be set.

Solar Energy

Canberra's climate favours the use of solar energy, particularly to meet part of the high winter space heating load. At the present time, however, the use of solar energy is not cost-effective because not only is the capital cost of equipment relatively high but also, because of limitations in heat storage technology, it is necessary to have supplementary mechanical plant relying on conventional fuels. To date small scale solar plants have been mainly confined to situations requiring low temperatures, such as municipal swimming pools and domestic hot water supply. Reverse cycle heat pump

systems have been installed in several schools on an experimental basis in order to discover the most economical way of cooling and heating.

District Plant

District heating and cooling stations have been designed for inclusion in the town centres to service primarily commercial buildings, however, the lack of a diversified consumer demand, low urban densities, and winter-summer temperature extremes, render such centralised plants uneconomic at the present time.

Water and Environment

Turning now to questions of water and the physical environment. Canberra lies within the larger area of the Australian Capital Territory (ACT) covering 2356 sq. km. Of this approximately 50% is reserved as proclaimed water catchments in which only a limited amount of farming and recreational activity is allowed so as to avoid contamination of the reservoirs. The urban area of Canberra itself currently occupies just under 300 sq km and is situated at the extreme northern end of the A.C.T. downstream from the catchment areas.

Water Consumption

Canberra is planned as a 'garden city' and accordingly makes lavish use of water. In a climate of relatively low rainfall (6,000 mm per year) and high summer evaporation, the daily average consumption is 670 litres per head per day of which 51% is used for watering domestic gardens and public parks. This is one of the inevitable consequences of low density development. The quality of the urban water supply is high largely because of restrictions applying to activity in the catchment areas and the reservoirs. The increasing use of native plants and trees in large scale landscape programmes is helping to curb the growth of water consumption.

High Cost of Environmental Protection

During the past decade as Canberra's population has risen to 223,000 it has become apparent that the inland waterways - particularly the Murrumbidgee River system - are in danger of being degraded due to the discharge of treated sewage and stormwater runoff. With regard to sewage disposal

a major sewage treatment plant has recently been completed at a cost of \$50 million designed to eliminate virtually all solids, nitrogen and phosphorous but with consequent high annual operating and maintenance costs. With conventional urban water supply and sewerage systems high capital and operating costs are virtually unavoidable. High density development tends to reduce the demand for water but otherwise pricing policies seem to offer the only mechanism for economising on water usage.

Environmental Planning

In order to understand the nature of the physical environment of the A.C.T. and the extent to which it is being subjected to adverse impacts as a result of urbanisation, the NCDC has adopted two basic procedures one concerned with research the other with planning standards. A series of scientific programmes is concerned with the nature of air, water, flora and fauna ecosystems and monitors the way in which these systems are responding to urban impacts. Water quality monitoring stations have been established in a limited manner sufficient to provide data for research on 'model' catchments and to observe environmental changes in the urban lakes system. Similarly there is a limited air quality monitoring programme.

Complementary programmes are concerned with the formulation of performance standards and design and development practices so that planners and engineers can minimise adverse impacts of urban development.

Stormwater Drainage

The principal objective of urban drainage networks has traditionally been to remove surface runoff as quickly and as economically as possible, with not much concern for its impact on the receiving waters, which in Canberra's case is the Murrumbidgee River having highly variable seasonal flows. Stormwater systems are now being designed to increase assimilative capacity in the network and hence reduce turbidity and pollutants in the river itself. Within each town special measures are taken to regulate urban run-off, one of the most effective being the construction of artificial lakes and stormwater ponds designed to trap pollutants

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and sediments before reaching the main streams and minor watercourses.

Environmental
Impact
Assessments

Major planning proposals and urban development projects of significant size require an environmental impact assessment to be carried out in order that reasonable steps can be taken to minimise adverse impacts on the natural environment. This requirement exists under federal government legislation, state government requirements in this regard being less stringent.

National
Policies
likely to
exert only
a marginal
influence

In terms of the necessarily brief discussion offered so far it may be observed that on the basis of Canberra's experience national policies relating to energy, water and environment are likely to exert only a marginal influence on both the functioning and future development of the city. On the other hand urban management and urban planning appear to be much more significant in this regard. It is probable that cities elsewhere will find that national policies are, generally speaking, not very helpful in achieving conservation objectives at the level of the city itself.

Linear Plan
Advantages

Canberra's linear plan (Y Plan) lends itself to energy efficient public transport, particularly in relation to the inter-town line-haul services which allow uniformly high speed and satisfactory levels of patronage. The concentration of employment and tertiary services along the linear spine tends to produce an introverted trip pattern due to gravity distribution within the corridor and this is the type of movement pattern that public transport can most readily service.

Value of
sharp urban
boundaries

The linear plan bounded at the periphery by a parkway system produces a sharp distinction between 'town and country'. Inhabitants of urban areas have typically short travel distances before reaching rural areas and open spaces in the non-urban areas outside the parkways. For these reasons environmental protection is facilitated and there is an absence of the urban sprawl that occurs at the fringe of most other cities whose town planning controls are relatively weak.

Transport
Planning and
Management
are critical
to the efficient
use of energy

Because urban transport systems, including the private motor car, are major users of petroleum cities everywhere will need to find ways and means of influencing travel patterns with the aim of reducing the frequency and length of trips. Canberra's experience demonstrates the value of a town planning and urban management policy which links together the three essential elements of the overall transport system, namely, road space, parking space and public transport capacity. Unless a balance is maintained between each of these factors then no effective regulation can be exerted and thus average vehicle speeds in urban areas will continue to decline because of congestion. Other consequences are that congestion will cause further air pollution, public transport will not provide an attractive alternative transport mode and operating deficits will accordingly worsen.

Lessons for
Developing
Nations

Canberra is increasingly being recognised as one of the world's outstanding examples of planned urban development providing as it does an attractive 'garden city' environment and an efficient urban structure. Canberra has managed to avoid most of the adverse effects of urbanisation that characterise the modern metropolis because of its town planning methods and its highly co-ordinated development programme. For this reason a growing number of developing nations in Asia and Africa have sought assistance from the Australian Government in order to help solve problems arising out of the rapid growth of their cities and towns, particularly in relation to the planning of 'new towns'.

New Capital City
of Tanzania

The NCDC has been involved in a variety of overseas-aid programmes concerned with urban development. The greatest effort since 1975 has been the provision of assistance to the Government of Tanzania to develop a new capital city at Dodoma situated 500 km inland from the East African coast. Although Canberra is a very different city to that which Dodoma is likely to become nonetheless it has been found that many of the town planning and development methods which have been used in Canberra are readily applicable to Tanzania.

Following the decision to establish Dodoma as the new capital in 1973 work commenced almost immediately on the Capital Master Plan which was completed by Canadian consultants in 1976. Progress on the subsequent implementation of the Plan has been slow given that the initial programme was to transfer the principal government agencies to Dodoma over a 10-year period commencing in 1975. By 1979 roughly 10% of government and party employees had been transferred and some 600 houses completed. None of the principal government buildings have yet been finished save for a residence for the President.

Weakness of
the Master
Plan
Approach

As a general rule European and North American town planners tend to favour the use of detailed master plans drawn up on the basis of sophisticated economic analysis and complex computer programmes. These master plans usually define land use zones, the location of key urban functions and the road and utilities networks as a setpiece for target populations often 20-30 years in advance. In the circumstances that usually prevail in many developing nations, where physical resources and skilled personnel are scarce, such master plans often prove to be inflexible and thus unable to meet changing circumstances as the initial development stages occur.

The Master Plan for Dodoma is a typical 'western' plan which lays down a precise pattern of land use zones and complex road network whose capacity is unlikely to be fully utilised for many years. The location of retail, commercial and service industry are scattered at well beyond walking distances in a city where pedestrians and cyclists are prevalent. The residential areas bear little or no relationship to the philosophy of small, mutually supporting, housing cells of ten dwellings centred on small outdoor meeting places, a physical and social concept strongly espoused by the government.

NCDC Advice
tries to be
adaptive

In its advice to the Capital Development Authority the NCDC has suggested that the Master Plan should be re-defined so that it serves as a generalised concept plan setting out the overall form and structure of the

city, together with the underlying planning principles, in a manner similar to Canberra's Y-Plan. Detailed land use planning should be confined to local development areas and should reflect the actual scale of houses and other buildings, as well as the predominant movement system which for the most part is likely to be pedestrian.

Implementation
more
important than
planning

The NCDC has also stressed the importance of co-ordinated development programmes, particularly in relation to civil engineering works and housing. The greatest difficulty faced by the Capital Development Authority has been in the realm of implementation and where the initial emphasis was placed on master planning it might have been more appropriate to concentrate on the programming of construction. Unfortunately most of the advice and assistance offered by western nations to countries like Tanzania tends to focus mainly on policies and plans in economic and social realms, rather than on the implementation of physical development programmes which are properly related to the skills and resources of the indigenous population.

Landscape
Planning

Canberra's emphasis on the importance of large scale landscape works as a means of modifying micro-climate and as an embellishment, is being followed in Dodoma by the establishment of a plant nursery by Tanzanian staff trained in Australia coupled with the implementation of mass planting programmes.

Staff
Training

Rather than assigning experts to Dodoma in the same manner as the United Nations aid agencies, staff from the Capital Development Authority and NCDC are being exchanged periodically so that a combination of advice and education is generated.

Planning more
important
than
Policies

In Dodoma issues of energy, water and environment are crucial. Canberra's planning methods can assist the Tanzanians to find at least some of the solutions even though they won't always be similar to those applicable to Canberra itself. In the realm of national policies Tanzania and Australia have a similar

experience in that national policies tend to be statements of governmental aspirations but other means must be found if there is to be effective implementation of such policies. To the extent that national policies are concerned with contemporary problems of energy, water and the natural environment, then effective town planning methods provide the best basis for development implementation.

Conclusions

The reduced availability and increased cost of petroleum-based fuels is having a significant impact on all categories of transport. Government policies are likely to be effective only at the margin. Already in some countries there are signs of a slowing down in the annual growth of consumption and growing investment in the development of alternative fuels. Cities by their very nature will, however, adjust more slowly. There are bound to be significant locational shifts of economic activity in metropolitan areas in order to reduce the need for travel. This will in turn have implications for public transport and thus highlight the need for co-ordinated land use/transport planning. Relatively small, planned cities, such as Canberra, might offer useful lessons in this regard.

Rapid urbanisation in developing countries has caused a pressing need for massive improvements to water supply and sewerage systems in most cities. The engineering solutions available from conventional practice in North America, Western Europe or Australia, usually involve costly and complex technology which can have significant adverse impacts on the natural environment. There is a need for engineers to develop new methods better suited to the limited resources of developing countries. Similarly town planners must devise urban forms and structures for 'new community' development which will inherently reduce demands for water and drainage.

Methods for understanding and protecting the natural environment are probably more advanced in the case of planned new communities than in most metropolitan areas

throughout the world. Canberra offers at least one example where monitoring of air, water, flora and fauna eco-systems is being progressively established and influencing the form and pattern of future urban development in the city. Whether such methods can be applied elsewhere in situations of rapid urbanisation and limited resources remains to be seen.

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