TRAFFIC PREDICTIONS IN REMOTE AREAS - THE STUART HIGHWAY STUDY

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ABSTRACT: *The prediction of traffic volumes for use in economic evaluation of a highway project normally involves the application of forecasting techniques to various factors influencing trip generation, and assignment of trips to a network in accordance with mathematical models. Where present traffic is extremely light, and the major influence on future traffic will be the project itself, such a method may be replaced by procedures which are sufficiently accurate but which are considerably cheaper and less time consuming.*

THE STUART HIGHWAY STUDY

INTRODUCTION

The Stuart Highway is the major road link between the settled area of South Australia and the Northern Territory. For much of its length within South Australia it is a graded earth road generally following the station tracks developed by the settlers of the region. In 1974 this road became a declared National Highway and following a request from the then Australian Minister for Transport a major study was commenced to define and evaluate alternative routes for an improved highway. The study was carried out by a Working Group formed within the South Australian Highways Department and under the direction of a Steering Committee which comprised one representative from the Australian Department of Transport, one from the Commonwealth Bureau of Roads and one from the Highways Department.

As the study progressed the Working Group was able to identify six major alternative alignments for detailed assessment. Each of these alternatives would cause significant changes to the existing road traffic pattern of the region and some trips would be benefited while others would not. An important part of the study was therefore to evaluate the economic benefits and disbenefits to traffic resulting from each alternative. To do this, one of the tasks of he Working Group was to develop realistic traffic predictions for each alternative. Because of the changes to the network roads this meant assessing future traffic volumes not just for the highway, but for the whole of the affected network. A knowledge of these volumes was also important for the social and environmental assessments of the alternatives where an indication of the number of people the improvement would introduce into the region was required.

From the outset of the traffic prediction phase it was realised that any approach taken would involve making a number of assumptions. For this reason the results of the economic analysis of the alternatives based on the "most likely" traffic predictions were tested using higher and lower traffic volumes. It can also be noted that as the purpose of the study was to compare alternative alignments, the absolute value may not be so critical provided a common approach is adopted in the development of volumes for each alternative.

THE TRAFFIC PREDICTION PROCESS

As with the majority of transport planning projects the prediction of traffic volumes on the Stuart Highway involved five basic phases; data collection and analysis, trip generation analysis, modal split, trip distribution, and traffic assignment. However the constraints of the study and the practicability (or indeed the need) to use refined analytical tools led to a simple approach being adopted for the study. It is the purpose of this paper to outline the practical problems encountered in applying more complicated models to a project such as the Stuart Highway and to show that less sophisticated and cheaper methods are adequate in such cases.

Most published data on transport planning has been presented for urban situations where procedures are well established and documented and where the approach is becoming increasingly comprehensive. While generalisations can be misleading most major studies utilise the following basic pattern.

The area to be studied is first defined and an inventory made of existing travel patterns. This essentially involves a collection of origins and destinations of journeys.

Household interviews gather data from survey area residents and provide information for trips within the area. Further roadside and public transport interviews gather data for trips entering or leaving the area and other surveys may be required for commercial vehicle trips. Investigations are made into the economic structure of the community, population characteristics, and land use, to provide information on journey behaviour.

A transport model can then be developed to synthesise these travel characteristics. The decision to make a journey, or trip generation, stage of the analysis examines the relationship between the number of trips made and selected socio-economic and land use parameters. Future trips can then be derived employing these relationships with forecast values of the chosen parameters. The future travel patterns are then found in the trip distribution stage of the study, for which a mathematical model, the most commonly used being the gravity model, is employed. Forecasting of the modal split of traffic, e.g. between road and rail, follows, on the basis of minimisation of travel time and cost, and finally road trips are assigned to a specific route on the basis of a minimum time or a minimum cost routing, or some combination of each. Data from the survey stage together with forecast socio-economic and land use parameters are used to establish future proportions of trips made on the various modes of transport available.

A similar approach can be used for rural roads when the zones of the origins and destinations of the trips using the road can be defined and can be examined in sufficient detail within the constraints of the study time and money budgets. This would apply, for example, with a major rural arterial road connecting two centres or regions where the greatest proportion of the trips on the particular road have the origins

and destinations in those centres or regions.

A more general approach can be developed in larger rural areas (but again having the constraint that the origins and destinations of most trips on the roads being considered lie within the overall study area) using theoretical procedures[1][2] which allow predictions of size and spatial distribution of population within a region. These methods can take account of the fluid nature of social, demographic and economic environment of rural regions.

For the Stuart Highway it was not possible to utilise these methods. Most trips, both now and in the future, are not generated within the region of the study. (refer Page 12). Many are interstate trips with origins and destinations in places as far apart as Sydney, Melbourne or Darwin. To survey these areas was inconceivable. An origin/destination survey on the few trips that now take place would help little with future projections, and to extrapolate past trends in traffic growth would be meaningless when the dramatic change to travel which will follow sealing of the road is considered. The change that is about to occur to transport in the corridor with the construction of the new Tarcoola - Alice Springs Railway (refer Page 13) also means any analysis of past or existing road traffic can be used as only one input. With the uncertain economic bases of the major communities of the area (refer Page 6), no rational model could possibly be produced to predict their

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(1) Foldvary, L.A. "Distribution of towns, networks of roads, and structures of traffic" Proc. 3rd Conf. A.R.R.B. 1966.

(2) Vance J.H. and Patel, P.M. "A method of predicting future population and motor vehicle numbers in local authority areas and regions for economic evaluation of road projects" Proc. 6th Conf. A.R.R.B. 1972

future growth or decline to assist in predictions for local traffic volumes. The whole predictive procedure therefore had to be developed around what information was available and what could be collected. The time and effort involved in the collection had to be carefully weighed against the degree of accuracy which could be expected from analysis together with the degree of accuracy which the study required.

DATA COLLECTION FOR THE STUART HIGHWAY STUDY

General Description of Study Area

Before describing the traffic investigations undertaken for the Stuart Highway Corridor Study it is necessary to briefly describe the study area (shown on Figure 1), making particular reference to those features of the region which are relevant to the traffic forecasting procedure.

The area may be considered to be bordered by the Trans Australia Railway in the south, the Great Victoria Desert, the Everard and Musgrave Ranges in the west, and the Flinders Ranges, Lake Eyre and the Simpson Desert in the east. The region comprises the eastern margins of the Great Western Plateau, a large part of the Lake Eyre Basin, several island ranges, and extensive low lying salt plains. The country is essentially arid receiving low erratic rainfall ranging from 250 mm per year to 100 mm per year. The summers are hot with the mean monthly maxima for December and January ranging from 32^{o} to 38^{o}C.

The region is remote and isolated. Only 12 500 people (0.9% of South Australia's population) live in an area of 350 000 sq. km (73% of the State's area). Approximately

75% of this population is located in the towns of Woomera (4 000), Coober Pedy (3 500), Andamooka (800), Marree (350), Leigh Creek (1 000) and Oodnadatta (200). A further 1 500 persons (or 12% of the total) are Aborigines living on the reserves and settlements of the far north west of the State. The remaining population of approximately 1 000 is scattered throughout the region on pastoral properties. Approximately 40% of the population is employed, with the concentration of employment being in mining, primary industry, transport and services.

The future population of the region is difficult to predict. The major towns of Woomera, Coober Pedy and Andamooka (65% of region's population) have uncertain futures. Woomera is dependent on future Government proposals for the W.R.E. Range area, and the size of Coober Pedy and Andamooka fluctuate with the availability and prevailing world price for opal. Further problems arise from the difficulties in estimating the actual existing population. The problems facing census collectors in this region with a large floating population (with some not wishing to be counted) are many, and available data is only a guide at best.

The major mining activity in the area at present is opal mining at Coober Pedy and Andamooka. The total value of rough opal sold in 1973 was estimated at $30 million, most of which came from Coober Pedy where over 60 per cent of the work force is engaged in the industry. A State owned and operated coalfield exists at Leigh Creek and coal production of about 1.6 million tonnes is railed annually to Port Augusta for use in supplying much of the State's electric power requirements. The only other major mining activity is the copper mine at Mt. Gunson, south east of Woomera where present

value of production is approximately $2 million annually. The only known possible future mining development is at Lake Phillipson, approximately 60 kilometres south west of Coober Pedy where an extensive deposit of low grade coal has been discovered.

Pastoral leases cover the greater portion of the study area. In some cases several leases have been combined under the one management to form a single "station", and the stations under consideration range in size from approximately 750 km^2 to 30 000 km^2. A vermin proof fence running through the area forms the boundary between cattle and sheep grazing. The number of stock on each station is strictly controlled by the lease and stocking rates vary significantly between stations and from year to year. The maximum permissible and average rates indicate a low productivity per unit area of land. Research into the carrying capacity of the existing leases is continuing but is is unlikely that the permissible maximum stocking rates will change significantly. Little expansion can be expected in the future in this industry.

The other significant industry in the region is tourism. The remarkable diversity of the landscapes and their specific unique attractions constitute an excellent resource for tourist development. However, the existing activities are restricted by remoteness, road conditions, prolonged travelling times and climatic extremes, and existing facilities for tourists are not extensive. Available accommodation is limited with only 120 hotel/motel rooms and 32 cabins serving the whole study area. The present number of visitors (excluding through travellers) is difficult to assess accurately with so many tourists on private camping trips. During 1975 there were 55 tours by scheduled four wheel drive operators and approximately 200 bus tour groups sought overnight accommodation in Coober

Pedy. As a broad indicator of the extent of private visitor traffic it was estimated that approximately 50% of the cars on the road network were involved in holiday trips.

In summarising this general description of the area, several issues which relate to traffic forecasting are evident. Firstly the paucity of the data base for the predictions presents a problem. Also existing population figures are only estimates and future population growth is difficult to predict. It is also evident that the low population and the nature of the industries in the region will generate only small volumes of traffic. Detailed home interview studies would be expensive and would provide data on only a small number of trips. A further problem with this approach is that a high proportion of the population is itinerant and views expressed may not represent the views of the inhabitants in a few years' time. The difficulties in developing anything but the simplest of models to synthesise the existing trips and to predict future trips are obvious. Many of the usual parameters appear to defy rational mathematical modelling.

Existing Transport Facilities

The other important data base in traffic prediction studies is a study of existing transport facilities. For this study, past and current traffic to or through the area was examined to provide a greater understanding of travel in the region and to ascertain whether past trends may be suitable for making future predictions.

Air Transportation

Australia's two major airlines (T.A.A. and Ansett)

both service Alice Springs on the Adelaide to Darwin route. At the present time there are 15 flights north and southbound each week. The number of passengers carried between Adelaide and Alice Springs (one way trips) has increased dramatically in recent years from 10 990 in 1963 to 60 100 in 1974, a 15% p.a. increase.

Airlines operating scheduled services within South Australia include Ansett Airlines of South Australia to Woomera (five per week), Opal Air to Andamooka (three per week) and Coober Pedy (seven per week) and PAGAS to Oodnadatta (one per week) and Leigh Creek (four per week). Opal Air provide services to Amata, Ernabella, Everard Park and Ayers Rock as demand arises. Statistics available from the Department of Transport provide some indication of past air travel but do not give trip numbers to each town served.

Rail Transportation

In the southern part of the region, rail services are provided by the standard gauge Trans Australia Railway travelling westwards from Port Augusta via Pimba, Kingoonya and Tarcoola. On this line there are one passenger train and two or three freight trains travelling in each direction every day.

To the north a 350 km long standard gauge line links Stirling North (Port Augusta) and Marree, and an 870 km narrow gauge line links Marree and Alice Springs. At the present time there are two passenger trains per week (the "Ghan") to Alice Springs and an average of three goods trains. The existing service is hampered by the condition of the narrow gauge track, the change of rail gauge, and flooding of the line north of

Marree. Figures of traffic on this line were obtained from Commonwealth Railways for the seven year period 1963 - 1974 and may be summarised as follows:

- The number of through passengers has been growing at approximately 6% p.a. there being 19 500 in 1973 (1973 figures are more representative due to the significant interruptions to rail services which occurred in 1974, the last year for which figures were available).

- The number of through passengers' motor vehicles handled has been growing at the same rate and amounted to 4 240 in 1973.

- Northbound through freight has been increasing at approximately 7½% p.a. while southbound has remained fairly constant. The total quantity shipped in 1973 was 145 740 tonnes northbound and 51 730 tonnes southbound.

- Rail freight and passengers to or from stations within the study area is light, amounting to approximately 6 000 tonnes of freight and 700 passengers in 1973.

- Figures for the number of head of cattle carried on the line were obtained for the years 1972 - 1974. This gave a three year average of 65 000 head with the average number carried from stations within the study area being 15 000 head.

Road Transportation

The Stuart Highway is the major road within the study area. From Port Augusta its route connects Pimba, Kingoonya,

Coober Pedy and Kulgera, a small township approximately 25 km north of the N.T. Border (refer Figure 1). The total distance between Port Augusta and the Border is 1 073 km.

The road network has developed to serve the existing needs of the region. It connects the outlying population to their service centres, and in the northern part of the study area it is oriented towards providing west-east connections to the railway. Principal roads are the Port Augusta - Marree - Oodnadatta - Granite Downs Road, the Pimba - Andamooka Road, the Oodnadatta - Mt. Willoughby Road, and the Kingoonya - Tarcoola Road. With the exception of part of the Port Augusta to Marree section, all roads are open surface. These roads are also shown on Figure 1 together with the minor roads of the network.

Only limited data was available on road traffic volumes within the study area. Over the past five years, one-day 12 hour counts have been taken twice yearly (February and August) at various locations. However, due to the wide fluctuations of the recorded volumes, which have resulted primarily from the influences of weather conditions on road trafficability, these figures were of little value in assessing past or future trends.

For the Stuart Highway more meaningful data was obtained from permanent meters located just north of Port Augusta (installed in 1973) and on the Northern Territory side of the Border. From these counts averages could be taken to minimise the effects of traffic interruptions. The results also showed the considerable seasonal variations with peak volumes occurring in the May and September holiday periods. From these records and from the few earlier counts available for the Stuart Highway, a 12% p.a. growth rate of through car

traffic and through freight traffic has occurred since 1966.

Further data for the Stuart Highway was obtained from Origin and Destination Surveys carried out by the Department of Northern Territory at Mt. Cavenagh near the South Australian Border. The counts were taken over four one-week periods in the years 1971 to 1973. They showed that during that period the average car occupancy was 2.5 persons, the average freight truck loading was 12 tonnes, and the average bus loading was 22 persons. They also provided useful information on trip purpose and showed that 70% of car trips were holiday trips, 15% were business trips and 5% were social or shopping trips. In addition, these surveys together with another Origin and Destination Survey carried out between Port Augusta and Pimba in 1972, showed that 74% of the vehicles on the road were cars, 6% were buses, 8% were two axle trucks, and 12% were heavy trucks.

The traffic composition on the various roads in the network was determined from the 12 hour counts, from field inspections, and from discussions held with the inhabitants of the region. The percentage of heavy trucks was relatively low. Most stock transported from the area is walked or trucked to the nearest rail siding and shipped by rail. Of the mining industries only Mt. Gunson, at the southern end of the study area, generates any road freight traffic. Some freight trips are, of course, generated by the towns of the region, especially Coober Pedy.

Two surveys were carried out, however, to obtain further data on existing traffic. As it was recognised that a significant number of persons were transported through the corridor by bus, a questionnaire survey of bus companies operating in the region was undertaken. The information

obtained supplemented data from the Department of Northern Territory surveys. Questionnaires were also forwarded to major freight carriers operating in the region to seek information on magnitude and nature of freight carried.

From all available data it was possible to develop, for 1974, figures for traffic volumes, traffic composition, total numbers of passengers carried, and total freight carried on various sections of the road network. The traffic volumes are shown in Figure 2. This Figure clearly shows the low road traffic volumes which exist in the area and that a high proportion of the total traffic is concentrated on one road, the Stuart Highway.

Summary

Travel through the corridor increased significantly in recent years. Passenger numbers have been growing at approximately 13% p.a. and freight tonneage at 8½% p.a. An overall increase can be expected to continue but the proportion of travel by each mode is likely to change with proposed improvements to the transport system. For this reason it is not practical to extrapolate past trends of road traffic to obtain future road volumes. In any case the concept of extrapolating the small and somewhat suspect past traffic figures would be questionable.

TRAFFIC PREDICTIONS

Influence of Future Transport Changes on Travel

The transportation pattern of the region is about to undergo a major change with the construction of the new standard gauge railway line from Tarcoola to Alice Springs

(refer Figure 1) and the closure of the existing narrow gauge line north of Marree. Towns in the eastern areas of the Corridor will decline and new traffic desires will be to the west. Coober Pedy and Indulkana will be served by the rail whereas all land transport to Oodnadatta will be by road. Although information received from Australian National Railways indicates that passenger fares on the new line are expected to be slightly higher than on the existing, the marked change in trip times (in the order of 24 hours instead of 45 between Adelaide and Alice Springs) will attract trips from road to rail. In addition the more reliable rail service is certain to attract a greater proportion of freight traffic.

A further change in transportation will occur with the construction of the Stuart Highway itself. A sealed road between Adelaide and Alice Springs is certain to attract some trips from other modes and to induce new trips which would not otherwise have taken place.

The problem therefore arises of how to predict the effect on road traffic volumes of these changes in the transport system. For the study it was fortunate that the results were available of Passenger and Freight Surveys carried out for the Adelaide - Alice Springs Corridor in 1969. These surveys were carried out by P.G. Pak Poy and Associates under the technical supervision of the Commonwealth Bureau of Roads and the then Department of Shipping and Transport. The passenger survey was the first long distance, simultaneous, all mode, survey in Australia, and the survey of freight consignees in Alice Springs and Darwin was similarly unique.

Field work for the earlier survey was carried out over a one-week period. Roadside interviews were conducted

with the drivers of all vehicles which passed through an interview station located north of Port Augusta and another south of Alice Springs; all adult passengers (15 years and over) travelling on the 'Ghan" between Maree and Alice Springs were requested to complete a questionnaire distributed and collected by sleeping car conductors; a questionnaire was distributed to and collected from all passengers travelling by air between Adelaide and Alice Springs; and bus drivers gave a questionnaire to all passengers travelling north from Port Augusta and south from Alice Springs. For the freight survey, interviews were conducted with representatives of major firms in Alice Springs and Darwin to determine the major characteristics of inwards and outwards goods movements generated by each firm. From these surveys the volume and composition of passenger traffic by all modes and factors influencing persons' modal choice was found. Also found were the volume and composition of freight traffic by all modes with particular reference to the factors influencing modal choice and the effect of transport interruptions on commercial and industrial operations.

In the present Corridor Study consideration was given to undertaking a similar study to examine modal choice, and also to carry out an attitude survey of residents of the region and of Alice Springs to provide data on traffic generation following the road improvements. It was however, decided for the following reasons to accept the modal split values determined by the 1969 study and not to proceed with these new surveys.

(a) The high cost involved

(b) With information being available from the 1969

survey a new survey for modal split data was not so essential (it can be noted that during the period 1969-1975, air and rail fares, and motor vehicle operating costs for trips through the corridor have increased by almost exactly the same percentage).

(c) The origin/destination data obtained for existing road traffic would be of little benefit because of the low volumes involved (most future traffic will be generated traffic).

(d) A survey of residents of the region would account for only a small proportion of future trips on the highway. Further, preliminary data indicated that Alice Springs residents' trips would also make up only a small percentage of expected trips. To obtain a meaningful assessment of trips undertaken by N.T. residents, it would be necessary to survey Tennant Creek, Katherine and especially Darwin. This was impractical to achieve in the time available and, in any case, no meaningful results could have been expected at that time from post-cyclone Darwin.

During the course of the study a search through available data provided no satisfactory Australian research or statistical information on volumes of induced traffic which follow road improvements where towns of relatively small size are separated by great distances. An attempt to draw a parallel with other roads in Australia was also unsuccessful. The forecasts were therefore based on some limited U.S. and British experience and it was concluded that an estimate of induced through car traffic amounting

to 50% of the existing traffic should be adopted for this study. (It can be noted that for cars the new highway will reduce average trip time by 35% and trip cost by up to 45%.) The improved road would also induce additional intrastate trips and accordingly an assessment of these volumes was also made.

Further work was undertaken on the timing of generated trips (i.e. those converted from other modes and those induced by the road improvements). Based on an analysis of traffic volumes on the Eyre Highway it was concluded that the full amount of generation of through trips should be applied in the first year the road is fully sealed. It was also concluded that generated traffic from the towns of the region should be introduced when the sealed road reached the town, and similarly generated holiday trips within South Australia should be applied when the road improvements were completed on the highway sections used for the trip.

Trip Forecasts

The method finally selected for the calculation of trip forecasts was to break road traffic down into various components by trip purpose and to apply simple growth factors to each component based on the knowledge built up of the transport factors operating in the region. The various components identified for interstate (i.e. through) traffic were tourist trips, N.T. residents' trips, and freight trips, and for intrastate traffic were tourist trips, trips generated from towns and settlements, and trips generated by the stations. A discussion of each follows:

Through Tourist Trips

Central Australia is one of the prime tourist areas

in Australia and boasts many famous attractions including Ayers Rock and the MacDonnell Ranges. The Survey of Australian Tourism 1973/74 Report[1] indicates that 62% of all interstate trips to Central Australia are holiday trips and a further 9% are combined business and holiday. A high percentage of trips in the Port Augusta - Alice Springs Corridor are holiday based and forecasts of future tourism are pertinent to the future traffic on the road, both directly as visitors' trips and indirectly as a determinant of population growth of the region.

The total visitor forecasts to the region were derived from a study of published reports on tourism to the Central Australian Region [2][3] and from advice received from the Department of Northern Territory who have analysed data supplied by the Australian Tourist Commission and the Northern Territory Tourist Bureau. As most overseas tourists travel to the region by air and this is expected to continue, the number of through tourist trips by road was predicted to grow at the same rate as interstate visitor numbers.

N.T. Resident Based Trips

A significant proportion of through traffic using the Stuart Highway consists of trips by, or generated by, N.T. residents. These would include business trips, social trips and holiday trips out of the Territory. The total number of residents' trips were assumed to grow in direct proportion to the population of the Territory. The most recent population predictions available were prepared by the Department of Northern

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(1) Australian Travel Research Conference
Survey of Australian Tourism 1973/74

(2) Kinnaird Hill DeRohan & Young
Ayers Rock - Mt. Olga National Park Economic evaluation 1972

(3) Harris Kerr Forster and Company et al
Ayers Rock - Mt. Olga National Park development plan 1969

Territory in 1974. The future of Darwin would obviously effect these predictions but as no other information was available the figures were adopted with the growth trend of Darwin, shifted five years forward to allow for the delay in development caused by the cyclone of December 1974.

Through Freight Trips

At present much of the freight carried through the corridor has its origin or destination in the Central Australia region, although the proportion destined for the northern areas of the Territory is increasing. Most of the freight is transported by rail. Air freight accounts for a very small proportion of the total, and only 20% is currently carried on the Stuart Highway. However, figures available for 1965 show this proportion is approximately twice that of ten years ago.

For the purpose of the study the total freight through the corridor was assumed to grow at the same rate as the population of Alice Springs (which is found to be similar to overall expected population growth of the Territory). Although freight per head of population could be expected to increase in the future due to general increases in living standards, this effect is considered to be offset by an increase in the average load per trip.

Tourist Trips within the Corridor

The Far North of South Australia is considered to contain numerous unique and major scenic attractions, but to date the difficulties in reaching most destinations have been a barrier to any substantial tourist activity. Even with the construction of a new Stuart Highway, any large scale development

of tourism centred on the region is not expected to occur as access to the widely scattered attractions would still be difficult.

To determine the existing tourist trip numbers in the region, consideration was given to carrying out road-user surveys. However, due to the number of checkpoints which would be required, the low volumes which would be recorded and the wide fluctuations in traffic volumes, the accuracy of the results obtained would be suspect unless an extended and therefore very expensive survey was undertaken. This did not appear warranted and the number and distribution of trips was estimated from enquiries and observations made in the region (refer Page 8).

For the purposes of traffic prediction, the growth of tourism in the region has been assumed to increase at the same rate as for interstate holidays to Central Australia. Due to the low volumes involved, errors in this assumption would not be significant in the overall study assessment.

Towns and Settlements Traffic

The trips considered in this component of total traffic included those business, social or holiday trips undertaken by the residents of the towns and settlements, and those trips required for the town to assume its central service role to the surrounding community dependent on the town. The trips are predominantly out of the region to Adelaide, and to a lesser extent to Port Augusta.

As surveys of the number of these trips were not available, the number of trips associated with each town was

calculated by considering existing trips by all modes to Coober Pedy and Oodnadatta. Forecasts of this component of total traffic were made by assuming that traffic from each town varied in direct proportion with population changes predicted for each town. With road volumes dependent upon town location in relation to the railway, the effects of the rail relocation were accounted for in the traffic estimation procedures.

Station Traffic

Station traffic was considered to include all trips associated with the operation of the station, that is, visits by government officials and stock agents, delivery of stores, fuel and fertilizers etc., travel by the station owner or manager and other employees on business, and the private travel of the station community and its visitors. Only a few of these trips are taken outside of the region each year (e.g. to Adelaide), the total number being insignificant for the purposes of assessing daily traffic volumes. Although aircraft are being increasingly used on the stations, most station trips continue to be made on the road network.

Once again, without surveys of local trips being available it was necessary to estimate the existing numbers of these trips. Drawing on the advice of people familiar with the area and on discussions held with station residents, an average sized station can be assumed to undertake one one-way trip per day, usually to the central service town. For the study it was considered that the number of trips generated by each station is proportional to the average stock turnout of each station. Although little growth can be expected in the Pastoral Industry during the analysis period, some increase in station traffic can be expected to occur resulting primarily from general

long-term maintenance improvements to the roads of the region.

Transport of Stock

Figures of average stocking rates and total annual stock turnout (10 year average) from all stations in the corridor were found. As no significant changes are foreseen in the pastoral industry of the region the future transport requirements have been assessed from the average turnout figures without growth rate.

Most stock transported from the region is currently carried by rail, and an analysis of the expected rates for cartage of livestock on the new Tarcoola - Alice Springs Railway shows a considerable economic advantage of rail over road haulage. For the purposes of road traffic volume predictions it was therefore assumed that all stock would be carried out of the region by rail.

The existing pattern of road stock haulage will change dramatically with the relocation of the railway. During the course of the study, discussions were held with station managers and the Australian National Railways, and the new rail sidings likely to be used by each station were known.

Assignment of Trip Forecasts

The current traffic volumes for each of the links of the alternative highway routes and their associated road networks were determined by assigning separately the various components of total traffic and summing. The total traffic volumes on the existing road network for 1974 derived in this manner were found to compare closely with the volumes found

from count data. Predicted traffic volumes were then determined by applying the factors for trip conversion, the induced volumes, and the growth rates for each separate component of traffic. This forecasting method directly showed the numbers of cars, buses and commercial vehicles in the predicted volumes.

For information the predicted volumes (AADT) on the road network for one of the alternative improvement options are shown on Figure 3. As can be seen, even in thirty years' time the traffic volumes are not expected to be high.

The future traffic predictions, together with other collected and derived data relating to construction, road-user and community costs, were used in an economic analysis of the alternative routes, which enabled the latter to be ranked in order of economic desirability. Other concurrent investigations led to ranking by other criteria such as environmental impact, social effect, etc.

It was realised that the paucity of data and the randomness of some of the assumptions made rendered the traffic predictions questionable, at least in absolute terms. The sensitivity of the economic analysis to variations in the assumptions made was therefore tested by applying the maximum conceivable percentage variation to predictions of population, travel desire, and trip inducement. Not only did no change result in the ranking of the alternative routes, but the changes in calculated benefit/cost ratios were only marginal.

CONCLUSIONS

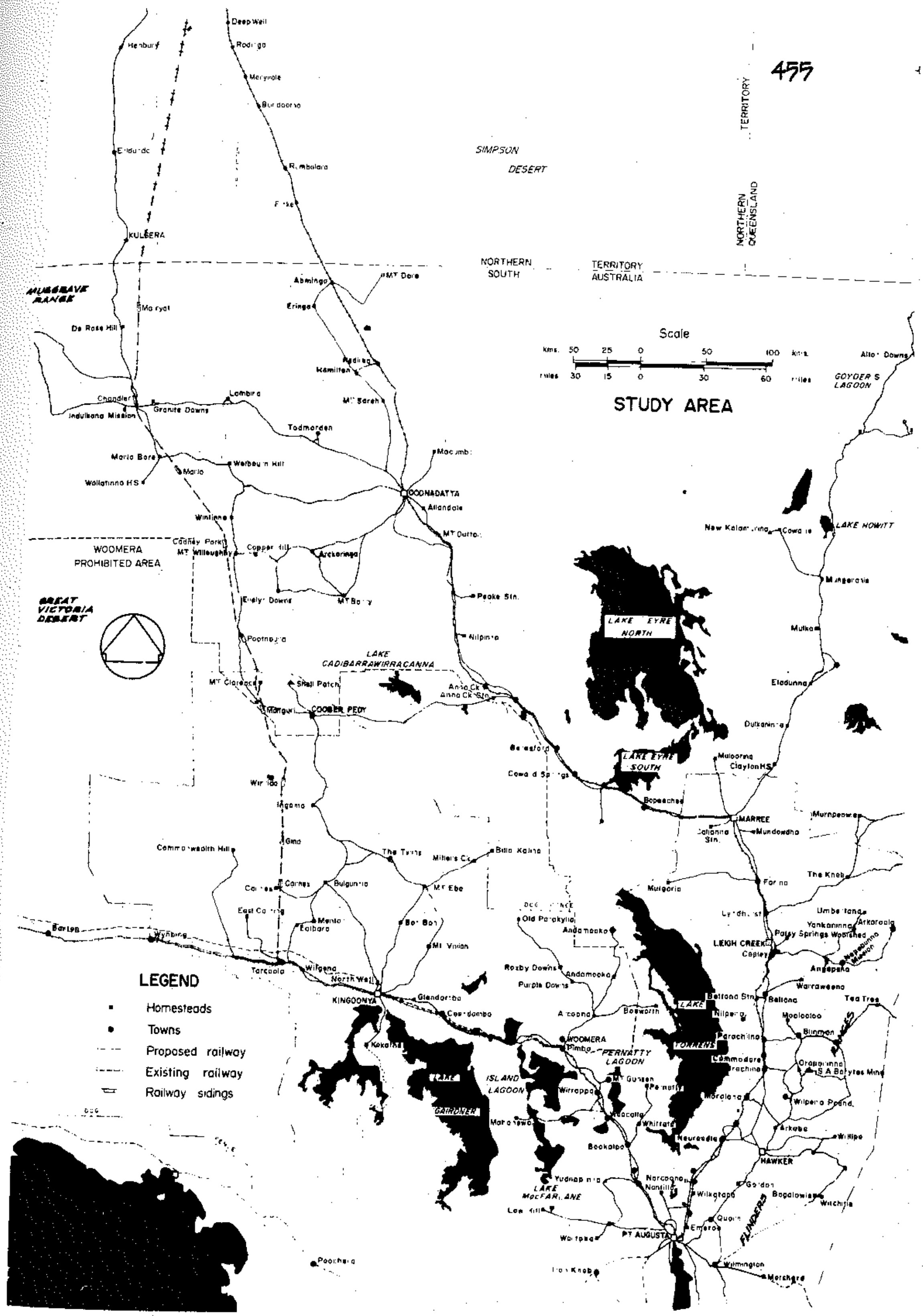
It was concluded that in projects of this type, where:

- Existing traffic is very light;

- The proposed improvement is such that resulting increase in traffic is likely to exceed by far any probable increase if the improvement were not effected;

- It is not desired to compare the economic feasibility of the project with that of projects in other areas,

detailed traffic surveys and sophisticated analysis are not warranted, and adequately reliable predictions of future traffic can be made by applying almost arbitrary growth factors to the various components of existing traffic. These factors can be estimated from questionnaire and personal enquiry amongst those involved in the generation of the traffic, seeking subjective opinion on possible future traffic generation.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Proposed railway
Existing railway
Railway sidings
LAKE
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RANGES

FIGURE 1

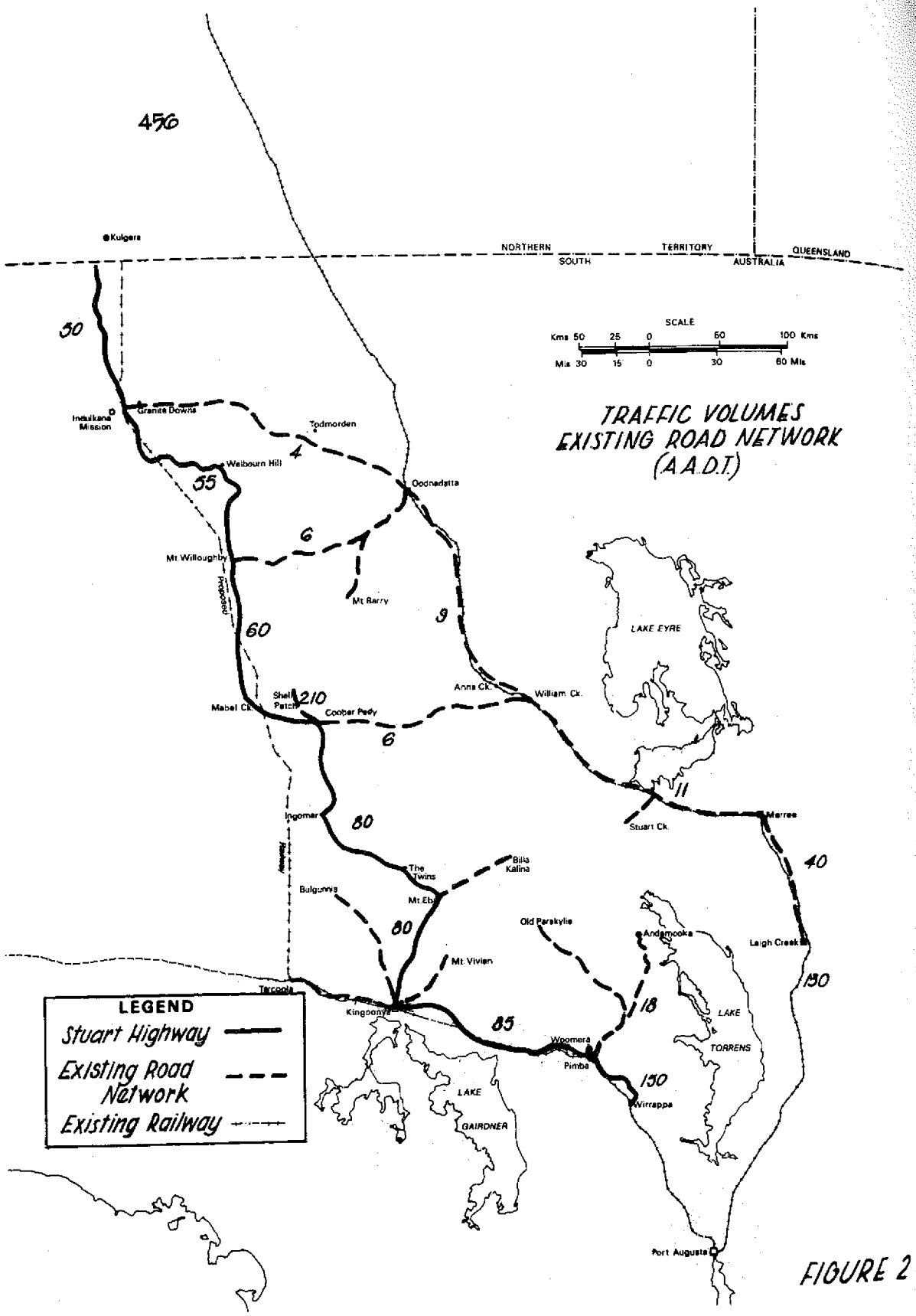
456
Kulgera
NORTHERN TERRITORY
SOUTH AUSTRALIA
QUEENSLAND
SCALE
Kms 50 25 0 50 100 Kms
Mls 30 15 0 30 60 Mls
TRAFFIC VOLUMES
EXISTING ROAD NETWORK
(A.A.D.T.)
50
Ineulkana Mission
Granite Downs
Todmorden
4
Welbourn Hill
55
Oodnadatta
6
Mt Willoughby
Mt Barry
9
60
LAKE EYRE
Shell Patch
210
Anna Ck
William Ck
Mabel Ck
Coober Pedy
6
11
Marree
Stuart Ck
Ingomar
80
40
The Twins
Billa Kalina
Bulgunnia
Mt Eba
80
Old Paralkylia
Andamooka
Leigh Creek
130
Mt Vivian
Tarcoola
Kingoonya
85
18
LAKE TORRENS
Woomera
Pimba
130
Wirrappa
LAKE GAIRDNER
Port Augusta
LEGEND
Stuart Highway
Existing Road Network
Existing Railway

FIGURE 2

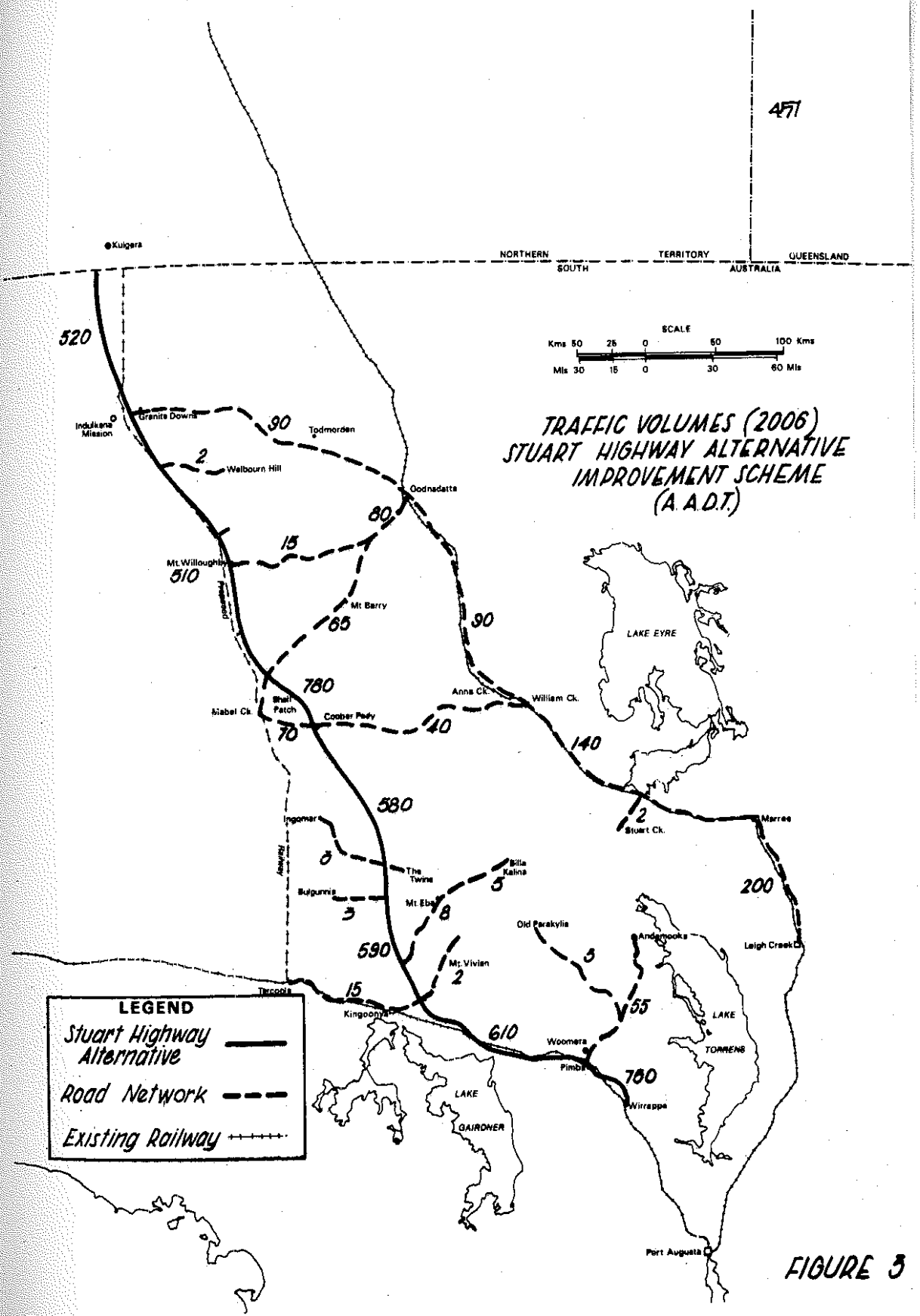
4771
Kulgera
NORTHERN TERRITORY
SOUTH AUSTRALIA
QUEENSLAND
SCALE
Kms 50 25 0 50 100 Kms
Mls 30 15 0 30 60 Mls
TRAFFIC VOLUMES (2006)
STUART HIGHWAY ALTERNATIVE
IMPROVEMENT SCHEME
(A.A.D.T.)
520
Indulkana Mission
Granite Downs
90
Todmorden
2
Welbourn Hill
Oodnadatta
80
15
Mt Willoughby
510
Mt Barry
65
780
Shell Patch
Mabel Ck
Coober Pedy
70
40
Anna Ck
William Ck
90
LAKE EYRE
140
580
2
Stuart Ck
Marree
Ingomar
3
The Twins
Bulgunnia
3
Mt Ebor
8
Billa Kalina
5
200
Old Parakylia
3
Andamooka
Leigh Creek
590
Mt Vivian
2
Tarcoola
15
Kingoonya
55
LAKE TORRENS
610
Woomera
Pimba
760
Wirrappa
LAKE GAIRDNER
Port Augusta
LEGEND
Stuart Highway Alternative
Road Network
Existing Railway

FIGURE 3