Towards Area-Wide Local Transport Management

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Abstract:

Australian urban form is dominated by the continued growth of urban sprawl. Social inertia is likely to prevent rapid change to this form. Economic and environmental factors are reducing the desirability and affordability of second and subsequent cars potentially resulting in mobility changing at a faster pace than land use patterns can adapt. For the next ten to fifteen years there will be increased focus on the development of transport systems which can ease the transition to urban forms less dependent on the private car. The application of state of the art information technology to the management of existing public transport systems, particularly bus systems, hods the promise of substantially improved flexibility of service provision at economically sustainable costs. Such a system is being trialled in Shellharbour on the South Coast of NSW.

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1. INTRODUCTION

This case study provides an Australian example of the application of computer aided operations to local area public transport.

Structure of the Paper

The paper commences by giving a description of the urban, social and institutional context within which the research and demonstration project is taking place. This is followed by a brief description of the Shellharbour area and the transport network in place at the start of the project. Within this established context the paper then describes the system under development, paying particular attention to those features which point towards a more comprehensive solution to the urban transport problem. The paper closes by outlining the main research outcomes and lessons from the development of the project to date, and points towards possible and planned future developments.

2. THE URBAN CONTEXT

Australia is one of the most urbanised nations in the world with strong metropolitan primacy leading to over 60% of the Australian population living in the seven major cities. Unlike many first world countries, Australia is experiencing a steady and comparatively high growth rate (some 8% over the past five years) fuelled in large part by migration (ABS 1993)

Urban Sprawl

Growth is predominantly taking place as suburban sprawl on the periphery of the main urban areas and in favoured coastal locations. This means that many of the most pressing transport problems relate to the vast and growing low density housing areas.

The development and maintenance of suburban sprawl relies almost totally on the private car, yet there are a number of social trends which mean that Australian society is experiencing a rapidly growing group of people who are not able to gain access to a car. Australian family structure is changing - less than 30% of households consist of mother, father and children; the population is aging rapidly - the percentage of people over 65 is expected to double within the next 10 years; and the society is becoming more strongly stratified in income terms (ABS, 1993).

The problem is that land use habits and patterns may not be able to adapt fast enough to ensure that those with limited access to a car will be able to gain access to the exchange opportunities they need for a quality life (Engwicht, 1992).

Recent state government policy in New South Wales strongly supports the concept of urban consolidation. Increased densities are seen to provide for better use of urban infrastructure, one aspect of which is improved viability for public transport (Spiller, 1992). Whilst there has been some modest success in reversing population decline in some older established areas, at the urban fringe less than 5% of new housing could be described as medium density

Thus despite the efforts of government planning and changing social structures, future urban form is and will be dictated largely by a market which is still strongly committed to the detached house and which is yet to fully realise (and cost in) the impacts of the social and economic costs of sprawl, both in terms of land purchase and also in terms of transport (Graham and Purdon, 1992).

Thus in addressing questions of future urban form, and the transport required to serve it, it must be recognised that Australian society suffers from a high degree of social inertia acting against the social, environmental and economic imperatives of closer living.

3. THE PUBLIC TRANSPORT CONTEXT

Structure of the Industry

Australian public transport is split into the publicly owned and the privately owned sectors. Publicly owned public transport dominates rail and light rail, and generally provides bus transport in the more central areas of the major cities. In most cases, bus transport in the middle and outer areas is dominated by privately owned bus companies. The majority of publicly owned transport is owned and operated by the state governments, one notable exception being Brisbane, where a single local authority covers most of the city area. Local government involvement in 'main stream' public transport is comparatively rare.

Public Transport and Social Welfare

Public transport, whether publicly or privately owned, is not generally seen as a social welfare good - rather it is expected to be profitable - or at very least not be a major drain on the public purse.

The need for profit and the desire to reduce public transport spending has, however, meant that notwithstanding set minimum levels of service and the existence of community service obligation (CSO) payments, private (and to an extent public) owned bus operations still typically fail to provide an adequate degree of mobility for much of the population (Nairn and Harrington 1988).

Uptake of Technology and Industry Characteristics

The uptake of information technology as applied to public transport has been relatively slow in Australia. This is due to a number of characteristics associated with the industry.

Low profits have meant that public transport has had unusually long life-spans for capital assets compared to many other businesses. Over one-third of the Australian private bus fleet is over 10 years old (Gee and Hensher, 1992) and until recently twenty year old buses are not unusual in some Australian fleets. Government bus fleets have also been periodically starved of capital as public transport which makes a "loss" has not always been well received by the Australian electorate.

The private bus industry has the added characteristic of being dominated by very small companies (Gee and Hensher, 1992) often with conservative family management.

A final factor has been the general inflexibility of legislation surrounding public transport, particularly the bus industry. Although this is changing, historically it has provided little incentive for the application of new technologies as a means of meeting service objectives.

4. TOWARDS BETTER MANAGEMENT

The Need for Efficiency and the Role of Information Technology

Tight financial circumstances mean that improved industry efficiency is essential if more equitable public transport is to be provided at minimum costs to government. This efficiency, which will hopefully develop the cost savings necessary to pay for Community Service Obligations, needs to be on several levels:-

+ better management of individual modes at the "firm" level,
+ better integration within a mode between individual firms, and
+ better integration between modes

The use of information technology offers the possibility of bringing about efficiencies at all three levels. In some respects the problems may be viewed as analagous to those of integrating a variety of computer networks (Strobel and Ritschel, 1993) in that the problems of providing a seamless interface for packets of information bear a close conceptual similarity to those of providing a seamless interface for publci tranpsort passengers.

At the present time the focus of information technology in public transport is at the individual firm level - that of computer aided operations however to tap into the real benefits of information technology it is necessary to work towards multi-modal and area wide integration (Strobel and Ritschel, 1993). Achiving this higher level of integration will also require the capability of information technolgoy to provide individual, customised services, both in terms of trnsport provision and of information.

The promise is that with the careful application of information technology in the more effective management of existing capital assets and systems, efficiency gains can be made without the need to inject vast capital sums and without radical change to the industry structure.

In view of the inertia of both industry and the Australian public, however, reform needs to be approached cautiously.

5. THE SHELLHARBOUR AREA

Suburban Development in Shellharbour

Shellharbour Municipality is centred in the Wollongong Sub-Plain, a narrow coastal plain contained by a steep escarpment. The plain is located immediately south of Sydney, New South Wales (Fig 1). Physical constraints to growth coupled with a relatively high internal growth rate and significant "overspill" pressures from the adjacent Sydney conurbation suggest that the sub-plain may become the first urban area of Australia that will run out of developable land to support urban sprawl (NSW Department of Planning (1992).

The Municipality of Shellharbour is the focus of urban growth in the sub-plain for the short to medium term That growth will see the Municipality planning to accept an additional population of up to 40,000 people over the next 20 years (NSW Department of Planning 1992).

But Shellharbour's development contains a dichotomy Despite the known constraints to growth and despite medium density housing approvals now being in the order of 25 - 50% of total dwelling approvals, vast tracts of the Municipality are still being carved up for 700 m^2 blocks of land for detached housing (Witherby, 1992). In these new urban areas medium density housing only accounts for some 5% of total approvals.

Private Mobility and Car Ownership

With one of the highest unemployment rates in NSW, a growing mortgage belt and suffering the impact of a prolonged recession, Shellharbour still finds itself with one of the highest car ownership rates in the state (ABS, 1993). The problem faced in Shellharbour is that persistence of these factors means that ownership of the second and subsequent cars is now under real threat. This, combined with the social changes referenced earlier, will create a situation where mobility will still need to be provided for the population - large segments of whom may be increasingly unable to afford to provide it for themselves by way of private cars.

The Existing Public Transport Framework

The present public transport network in Shellharbour consists of three main elements:-

+ a State owned and run north/south rail line of marginal relevance to local transport needs,
+ two private bus operations orientated predominantly north-south, and
+ a taxi co-operative of 106 taxis (which serves the whole Wollongong sub-plain) (Fig 2).

The Local Response - Land Use and Transport Nexus

The local authority has already put in place a planning framework that provides for substantially greater diversity in housing choice and which provides for greater land use flexibility than that which the local market presently demands. It is recognised, however, that this framework will take some time to achieve a measurable change in land use (Simons and Black, 1992). The local authority has therefore focussed particularly on public transport as a means of increasing mobilty.

In 1987 Shellharbour Municipal Council in conjunction with the German Ministry for Research and Technology (BMFT) commissioned a $300,000 dollar feasibility study into the application of a computerised public transport management system to the efficient and equitable delivery of bus services to the population of Shellharbour. The focus of the study was on BMFT funded technology then being trialled in the semi-rural German County of Bodensee (Lake Constance).

Completed in 1990, the feasibility study suggested that a customised computerised public transport management system that would substantially increase access to the public transport system would not only be technically feasible, but had an excellent chance of covering its running costs and a good chance of recovering its capital costs (Nairn, 1991).

6. THE SHELLHARBOUR TRIAL

The Joint Trial

As with all feasibility studies the final proof can only come through an actual trial.

Shellharbour Municipal Council is currently coordinating a joint research pilot of the computerised public transport management system. Financial support has been made available from the Federal governments of Australia and Germany ($900,000 from each) and significant support and encouragement is also being received from the NSW Department of Transport

The pilot involves two private (and nominally competing) bus operators (who operate the vehicles); a German software and hardware company, Gesellschaft fuer Systemtechnik und Informatik mbH (GSI mbH), which is suppling vehicle equipment and specialist software as well as managing the control centre; and the local authority, Shellharbour Municipal Council, which is coordinating the project and administering the Australian funding on behalf of the Australian Federal and NSW State governments.

Monitoring and Review

The Shellharbour trial is a combination of research project and development exercise.

The development exercise is focussed on the adaptation of a system originally developed for essentially semi-rural operations in Germany to a suburban Australian context, and on the technical issues associated with data communication between on-board vehicle computers and the operations control centre (Gerland, 1990).

Research aspects of the proposal are focused on an independent external review of the pilot project. This review is being undertaken by the Institute of Transport Studies of Sydney University (under Professor David Hensher) and has four main aims. Firstly, to assess the operational aspects of the system on the way in which the local bus operators, John J Hill and Ruttys, run their day to day business - noting that the operators will be bearing the brunt of its implementation; secondly, to assess the financial impact of the system on the operators businesses; thirdly, to assess the wider societal economic cost/benefit aspects of the system; and fourthly, to provide a more sociological focus on the benefits in accessibility provided to households and to key disadvantaged transport users.

A key measure of effectiveness will obviously be the ability of the system to effect a mode shift from the private car to public transport. Whilst only modest shifts are expected in existing urban areas it is hoped that new urban areas will be able to achieve much better mode split, primarily through the ability to manage with only one car

7. THE SYSTEM UNDER TRIAL (after Gerland, 1990)

From a technical point of view, the system is designed as a comprehensive public transport management system potentially able to accommodate all forms of public transport including

- railway or light rail
- regular bus lines, feeder and distributor services
- dial-a-ride, call buses or other kind of on-demand services
- school specials and special charter services
- community transport services (e.g. frail and disabled services), and
- shared ride taxi services

into one uniform public transport management system. The ultimate aim is to create for the public a seamless interface to the total public transport system by providing, through one contact point, detailed, customised information about the public transport system and about particular travel requirements that a passenger may have.

Modes of System Operation

To achieve this, the system in its full implementation, potentially covers three different modes of operation (Fig. 3).

The first mode is the traditional fixed-route operation with a linear stop sequence whicyh forms the backbone of all public transport services. The main reasons for integrating fixed-route services into the system are to provide real-time system monitoring and passenger information, to synchronise transfers at risk and to link the system with functions for active traffic light activation at traffic bottle necks. An additional feature is the utilisation of the technology for on-board ticketing facilities.

The second mode is known as route deviation or corridor service The term "corridor" indicates that a timetable based operation is provided along a "trunk route" with demand-activated deviations according to actual passenger requests In this operation mode, elements of the fixed-route service and on-demand service are combined. This mode will be explored in more detail below

The third mode is a Dial-a-Ride or call bus service with random, on-demand stop sequences This purely demand-actuated, taxi-like operation mode is provided by either minibuses, vans or regular taxi cabs

The three operation modes need not be exclusive, but can be combined to complement each other in a uniform transport service network. A sample network is shown schematically in Fig. 4. The allocation of the three modes of operation to different sectors of the service area is not static, but can be flexibly adjusted according to requirements by area and time

Corridor Service

The majority of public interest in the system has been focused on the potential to provide and manage demand responsive transport services. Traditionally these have been associated in the public mind with the type of dial-a-ride systems initiated during the 1970's.

Computerised "free-demand" bus systems have not, however, had a great deal of success from an economic point of view, particularly in a rural or fringe urban context This is predominantly due to the number of vehicles required to provide an adequate level of service when vehicle routes are totally unpredictable

Taking the view that the "free demand" element was catered for by the existing taxi industry, the project focussed on the provision of the limited demand responsive system known as the corridor service (Fig 5)

The corridor service utilises a combination of "fixed" and "on demand" bus stops scattered throughout the urban area Based on a framework of line haul service patterns, buses have the capability to deviate from the line haul route, within pre-defined parameters, to service on-demand stops. Fixed stops are serviced on a timetabled basis although within a time "window" of 3-4 minutes rather than at a precise time On-demand stops are only be serviced on passenger request, usually by phone for one-off requests and by phone or mail for regular bookings.

Scope to introduce this on-demand service to existing operations is provided by the fact that most local access bus routes already adopt a fairly round about route. Generally this route is one that has evolved over time as a result of expressed trip requirements of the public as communicated to the bus companies. At best, however, these routes are a rough approximation of what the bus proprietor thinks the likely average demand may be over the week and throughout the day

Real Time Route Planning
The system under trial in Shellharbour can be seen as providing a real-time route planning service (within the constraints of the overall line haul structure) varying by time of day and by day of week, constantly optimising itself to the changing and evolving transport demands of the public.

Probably the key element of the system is that for a passenger who has made a regular booking, the system continues to "look like" a standard, line-haul system - the difference being it is now one which is customised to the individual's needs. The bus only services the on-demand stop when the passenger wishes to travel.

System Features
From a technical point of view the system has a number of major components (Fig. 6):

- A Passenger Communication System for
  - Trip booking and information requests via private or public telephone, and
  - Public transport information via the telephone operator.
- A Passenger Agency for
  - Timetable information, optionally compiled from nominal or real time operational data
  - Trip recommendation and vehicle diversion on individual passenger request, and
  - Transfer synchronisation, when and where transfers are at risk.
- A Management and Control System for
  - Analysis, and presentation of management data,
  - Display of nominal and actual operational status in the form of displays on monitor screens or hard copy outputs,
  - Operational management and intervention by reacting to operational messages with instructions or advice,
  - Statistical evaluation of operational data for documentation and planning purposes
- A Vehicle Communication System for
  - Transmission of operational instructions from the control room to the vehicle via digital or voice radio, and
  - Transmission of messages from the vehicle to the control room via digital or voice radio.

° Vehicle Devices or "On-board Computers" for

- Autonomous management of on-board facilities such as line number display, destination display, stop announcement system, ticket issuer, ticket validation unit, smartcard reading/writing unit,
- Autonomous nominal-actual timetable comparison for the measurement and recording of delays or runs ahead of schedule,
- Spontaneous messages of recorded timetable deviations to the management and control room for possible intervention by the manager, and
- Autonomous traffic light activation (bus priority).

Vehicle Autonomous Operation

In most of the public transport management systems currently being implemented in Germany, the provision of functions for "vehicle-autonomous" operation is playing an increasingly dominant role. This has the objective of increasing operational effectiveness whilst reducing the scope of data exchange between the control room and the vehicles, thus relieving the drivers of active collaboration with the control centre and allowing them to focus more of their attention on the public relations aspects of their role.

The major data transfer tasks are handled through portable driver "memory modules" for the storage of operational data (Fig 7). The memory modules provide an individual data base for each on-board computer and its associated vehicle. Radio communication is therefore only required to update this information throughout the day.

The on-board computer being trialled with this system (referred to in Germany as an IBIS unit - "Integrated on-Board Information System") has evolved to be the "core" of current and proposed transport management applications due to its ability to initiate both vehicle communication and vehicle equipment setting and monitoring including all forms of peripheral equipment. The IBIS units have been fully standardised.

The system technology - both hardware and software - is of completely modular design. Hardware standardisation plus the modular software character makes it possible to adapt the system to the specific requirements of any service area or public transport operator by modifying, adding or deleting certain functions. System versions or components are now in use or being implemented in six widely varying applications in Germany.

The introduction of fully vehicle-autonomous operational functions as well as the ability to integrate smartcards are driving the further development of existing operations and the implementation of additional applications in Germany. Of particular interest is the growth of smartcard usage combining the flexibility of an Electronic Funds Transfer at Point of Sale "Eftpos" terminal with the freedom of a fully mobile terminal. These developments have also created interest amongst various transport operators in Australia

Features Under Test

The pilot project is testing a wide (though not comprehensive) range of system functions and includes the following features:

- nominal and real-time passenger information
  - + phone based actual timetable information service
  - + stationary information displays
  - + bus information displays
- transfer synchronisation
  - + Bus - Bus
  - + Bus - Rail
- traffic light activation
- demand responsive service
  - + corridor deviation service
- fully autonomous on-board monitoring functions
  - + location
  - + timetable adherence
  - + fare information
- digital voice stop announcement

8. IMPLEMENTATION AND PREDICTED OUTCOMES

The Public Passenger Transport Act

Standards of service provision previously accepted within New South Wales suggested that 85% of persons within a residential area should be within 400 metres (direct distance) of a bus route. Measured on this accessibility criteria over 30% of Shellharbour's area was underserved by public transport until 1991.

Negotiations with the bus industry as part of the reforms introduced to New South Wales bus transport by the NSW Public Passenger Transport Act (1990) have achieved the development of far more sophisticated measures of accessibility which examine population characteristics, frequency of services, operating hours and accessibility. These criteria are negotiated individually with the operators who then obtain a contract to provide exclusive service to an area.

Additional services

In the case of Shellharbour, the new contract arrangements co-incided with the introduction of the system. Rather than be bound to the new minimum levels of service specified in the contract between the operators and the state government, the project participants decided to provide additional services, over and above contract requirements, designed specifically to cater for the intra-municipal movements of the population. These services would be the test bed for the demand responsive technology and would complement and supplement the services orientated externally to the local government area.

Phases of Implementation

The management technology was applied to all private buses operating within the Shellharbour Municipality (with the exception of school and charter services in the first instance) including both line haul and demand responsive services. For logistical reasons and because of the public service implications of failure, it was decided that a progressive, staged implementation path for the technology was required. This implementation path extend over a nine-month period and is being followed by a six to twelve month period of full operation in a stable operating environment.

Phase 1

The initial pattern of service provision under the new system is shown in Fig. 8. In phase 1 there is minimal alteration to line haul services operating in the area, with attention being focussed on the four corridor service routes, 72, 73, 74 and 76 (Figs. 8 and 9).

The four new routes are responsible for a 50% increase in bus stops from the 400 initially located within the local government area. 75% of the new stops are demand only stops.

To highlight the new services, distinctively painted mini buses (29 seat Mercedes) are being. Complementary colour and signage schemes were used in an information package (including brochure and map) circulated to every household in the local government area, for the public office/control centre and for the demand stop signage. As part of the image creation programme the name "TRANSLINK" was selected to describe the new services. Existing line haul buses were equipped with the "Translink" logo to assist in public identification that they were part of an integrated system.

Technical features included within phase 1 were:-

+ The establishment of the control centre with automated timetable information service (including routing algorithms for optimum route selection utilising all available services including demand responsive services),
+ The introduction of four corridor services with day before booking (no radio system to the vehicles),
+ Autonomous vehicle location by vehicles involved in demand responsive services (including nominal - actual timetable comparison for driver information, route determination for demand responsive stops and automated voice and digital stop announcement system).

The main reason for introducing day before booking was that as radio support from the control centre was initially unavailable, it was necessary to ensure that information could be provided to the driver at the beginning of the operational day. In addition, it ensured that all demand stop requests accepted could be serviced within the time windows available on each service during the calibration phase of the trip allocation software development.

Phase 2

Phase 2 consisted of a series of closely spaced implementational phases. This phase included a complete reworking of all line-haul and demand responsive services within the Municipality to maximise the "local service" function carried out by demand responsive services and focus line haul services on more direct, higher speed externally linked routes. Considerable expansion of the demand stop network occurred to a total of over 200 demand stops (approximately 30% of all stops).

Radio communication between the control centre and the vehicles was introduced with the route changes and has enabled the following technical functions to be implemented:-

+ Same-day booking of demand stops by phone or from drivers (up to 1 hour before the planned arrival time of the bus),
+ Real time timetable information (for public information by phone and from display panels at major interchanges and for operational monitoring by the control centre of both line haul and demand responsive services),
+ Guaranteed transfer between services (initially bus-bus but extending to bus-rail),
+ Automated traffic light activation where timetable adherence is at risk (to be trialled with both stand alone and networked traffic lights operating under the NSW Roads and Traffic Authority's SCATS system),

Phase 2 represents the full implementation currently programmed for Shellharbour, however planning is currently under way for integrating a cashless fare collection system as a Phase 3. The main technical features of the system would be based on the use of debit or credit "smartcards" incorporating a computer chip. Cards are inserted into a reader on entry and again on exit of the vehicle. This technology, when coupled with the vehicle computers already installed will provide the following features:-

+ The choice of a credit or debit facility (to suit customer needs and to cater for high credit risk passengers),
+ Automatic "best combination" fare selection (for instance regular use over a week would result in credit being given to equal a "weekly pass" price),
+ Avoidance of the need to purchase multiple tickets when using several routes for the one journey,
+ Faster boarding and deboarding at busy stops,
+ comprehensive loading/trip characteristics for the operator, and
+ automatic fare calculation.

9. CONCLUSIONS FROM THE TRIAL

The Shellharbour Project is an Australian, 'on the ground' example of the current 'state of the art' in bridging the gap from computer assisted operations systems to a more comprehensive approach to city transport and urban development. The system has allowed the canvassing of many of the issues raised by Strobel and Ritschel (1993). Of particular importance are the institutional and political environments within which the technology has to be implemented, but also of importance are the sheer technical barriers required to be overcome in implementing complex systems in an unfamiliar environment.

Technical Conclusions and Implementational Lessons

At the time of writing (June, 1993) the project has progressed sufficiently for a number of conclusions to be drawn on its functioning as a public transport system. More detailed figures and conclusions will be presented at the 18th Transport Research Forum in October, 1993, by which time some six months of stable operation will have been completed In brief, current conclusions are as follows:

+ The system has a proven capacity to attract additional patronage, albeit of modest dimensions,
+ The system has shown itself to be flexible and adaptable in meeting the needs of particular transport disadvantaged groups, and
+ It is possible and desirable to develop a 'bare bones' system for low-cost entry into the technology and to progressively upgrade such a system.

From a technical point of view there were several main implementational lessons.

Firstly, final development of software and hardware for technology transfer between countries must be performed in the target country. Sufficient resources must be developed to allow full on-shore support and development from the commencement of the implementational phase.

Secondly, the implementation requires both flexibility and adaptability of approach. System needs are often imperfectly understood until actual implementation takes place, thus new technical solutions may be required. In addition, new opportunities to utilise the technology will emerge and there must be provision to implement them into the system.

Thirdly, management of the implementation in the target country requires a combination of technical expertise with the system and local knowledge - a team approach is necessary.

Fourthly, the difficulties in educating the public to use a new system must not be underestimated. A concerted public education campaign is critical to the acceptance of new technology.

Organisational Lessons

Implementation of the technology has required a fundamental re-think of the relationship between the various levels government, the private bus industry, and the regulatory arms of government. Local government took on a prime coordinating role and was the catalyst for the system's development. In taking this role it became very evident that local government, through control over land use, plays a crucial role in ensuring the functioning of the urban area at a local level, and that this needs to be matched with equal attention to transport matters.

To undertake this role satisfactorily, however, requires the support of and coordination with higher levels of government, particularly the state. The state plays a critical role in ensuring that the regulatory environment is flexible enough to permit and encourage the application of new technologies in transport operations and management. This suggests that the current trend whereby the state sets desirable outcomes, in terms of service delivery, rather than specifying the methods by which those outcomes are to be achieved, should continue.

The federal role is also critical. The establishment of standards and protocols within which new technology can operate is essential, particularly in a small market such as Australia. This will permit multiple players to compete for the provision of technology thus ensuring a cost effective technical solution.

Co-operation with the private sector is also essential - and that co-operation needs to be active cooperation, as the private sector is a very significant player For government to exercise this cooperation effectively requires an intimate understanding of the problems and circumstances of the private sector. This must be matched by the ability to implement private sector style decision making structures and processes. Fast, accountable management response is essential. Also essential in dealing with the private sector is the need to ensure that the private sector does not feel dominated or threatened by government. Government needs to be seen as a partner in the transport process, but not as a manager of the firm

Implementation of new technologies also requires risk taking. Although in the case of the Shellharbour project the majority of this risk (in financial terms) was borne by Government, it is appropriate for the private sector to bear some of the risk As well as recognising that the private sector serves to benefit from successful technology, it also provides an added incentive for the private sector to make a project work.

Looking to the Future

The system is seen to be a catalyst for the development of inter-sectorial co-operation in transport in the Shellharbour area. It will hopefully form the core of a wider-based, integrated system covering bus, rail and taxi.

In a wider context, skills learned in the pilot project suggest applications for integrated, flexible systems across a variety of areas in Australia ranging from metropolitan areas to country towns Operational experience gained in Australia should be of considerable benefit in implementing such systems in low density urban areas worldwide.

APPENDIX 1 - FIGURES

List of Figures

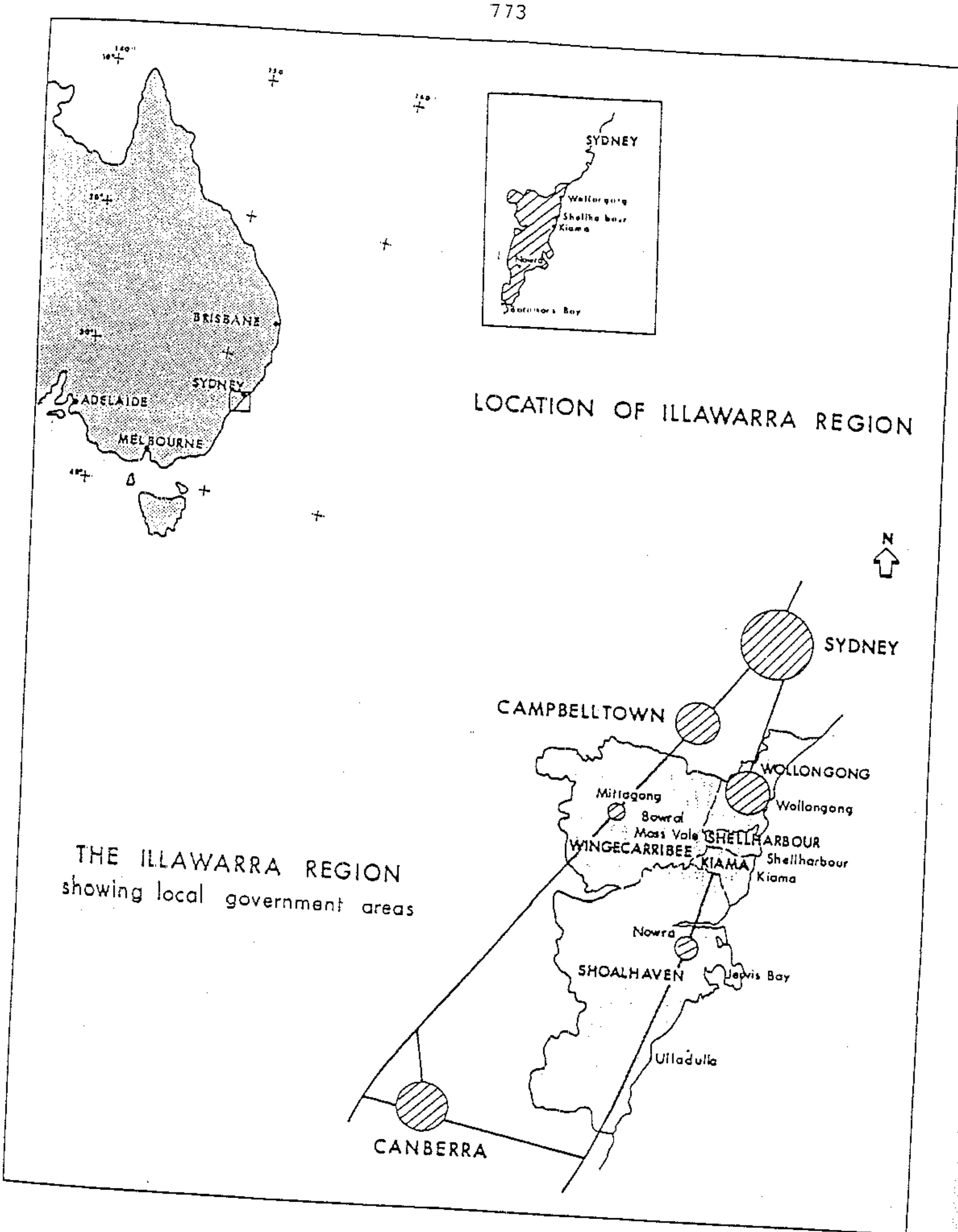
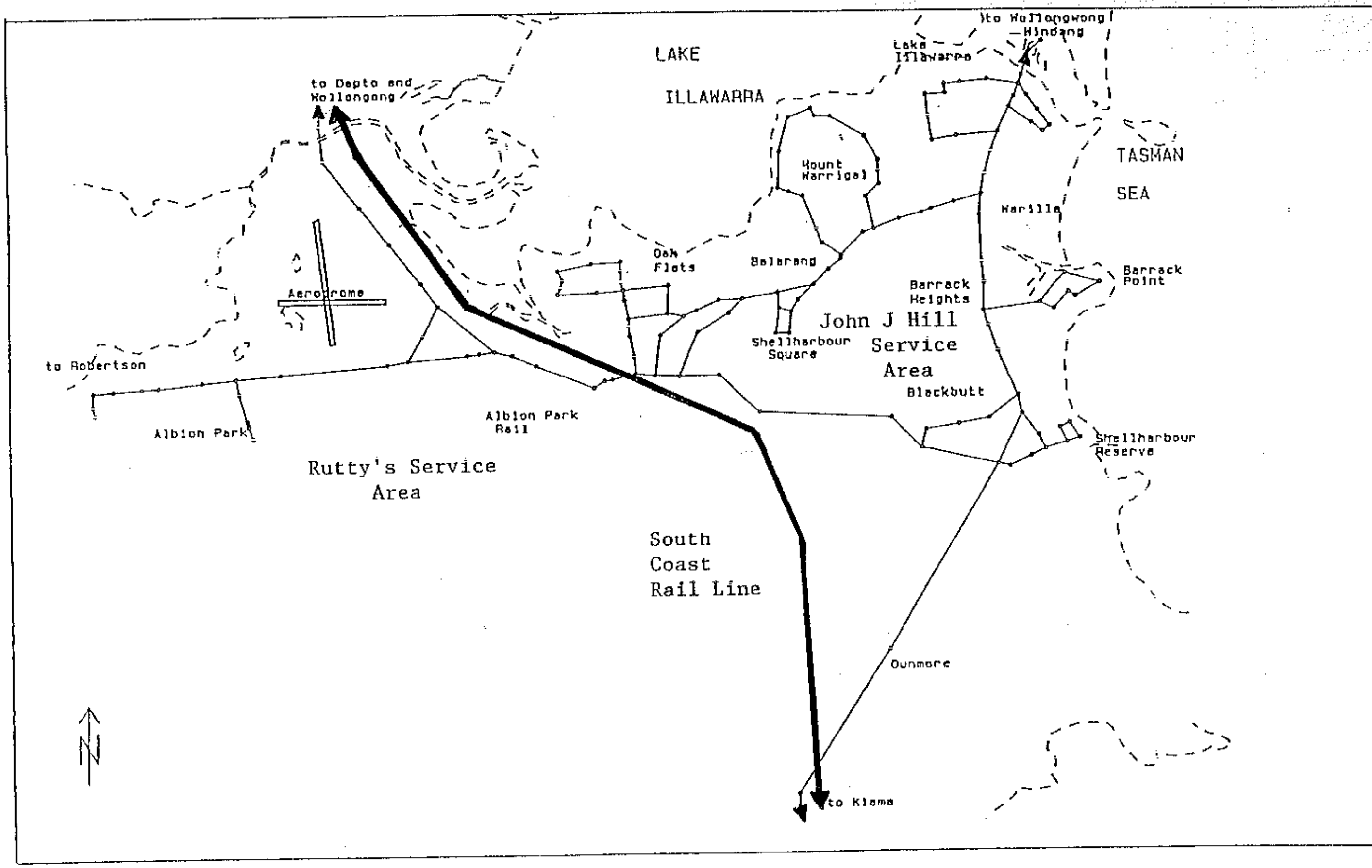

SYDNEY
BRISBANE
SYDNEY
ADELAIDE
MELBOURNE
LOCATION OF ILLAWARRA REGION
N
SYDNEY
CAMPBELLTOWN
WOLLONGONG
Wollongong
Mittagong
Bowral
Moss Vale
SHELLHARBOUR
WINGECARRIBEE
KIAMA
Shellharbour
Kiama
THE ILLAWARRA REGION
showing local government areas
Nowra
SHOALHAVEN
Jervis Bay
Ulladulla
CANBERRA

Fig. 1.


LAKE
ILLAWARRA
to Depto and
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to Wollongong
Windang
TASMAN
SEA
Mount
Warrigal
Warilla
Oak
Flats
Balarang
Barrack
Point
Barrack
Heights
Aerodrome
John J Hill
Service
Area
Shellharbour
Square
to Robertson
Blackbutt
Albion Park
Albion Park
Rail
Shellharbour
Reserve
Rutty's Service
Area
South
Coast
Rail Line
Dunmore
N
to Kiama

Fig. 2

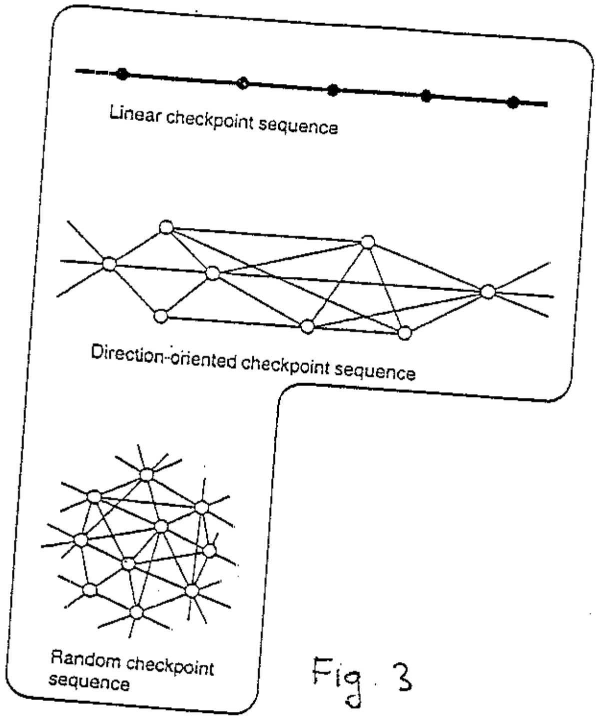
Linear checkpoint sequence
Direction-oriented checkpoint sequence
Random checkpoint sequence

Fig. 3

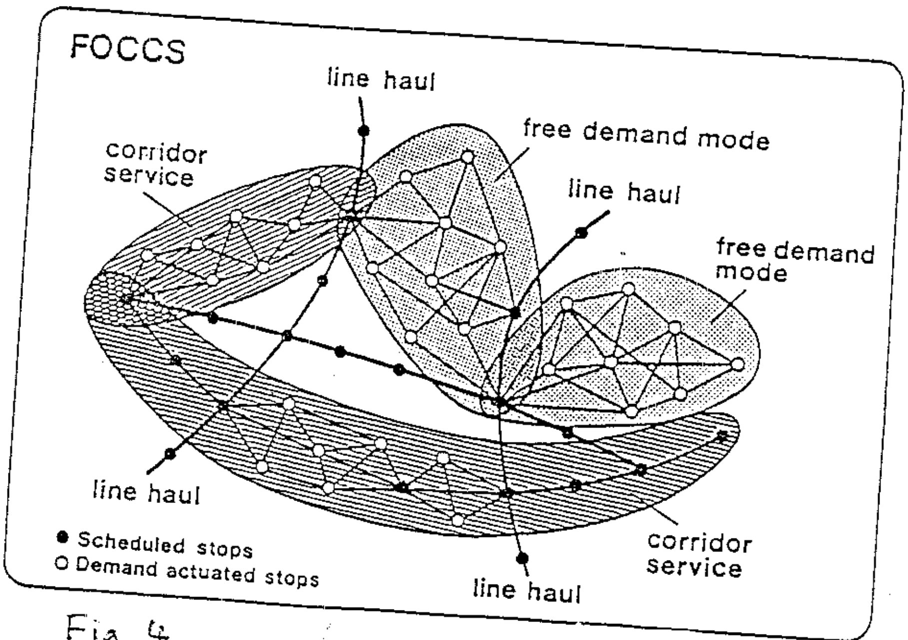
FOCCS
line haul
free demand mode
corridor service
line haul
free demand mode
line haul
corridor service
line haul
● Scheduled stops
○ Demand actuated stops

Fig. 4

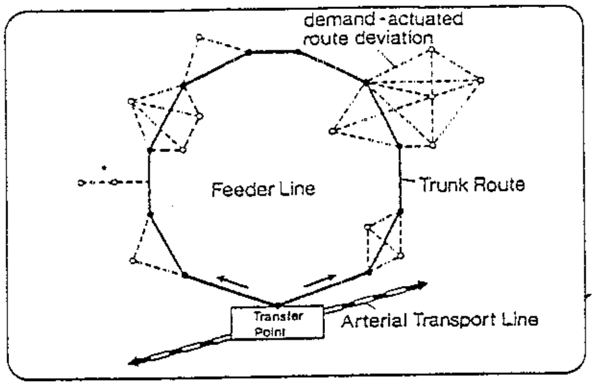

Fig. 5a.

Example of Corridor Service Using Route Deviation (Mini Version)

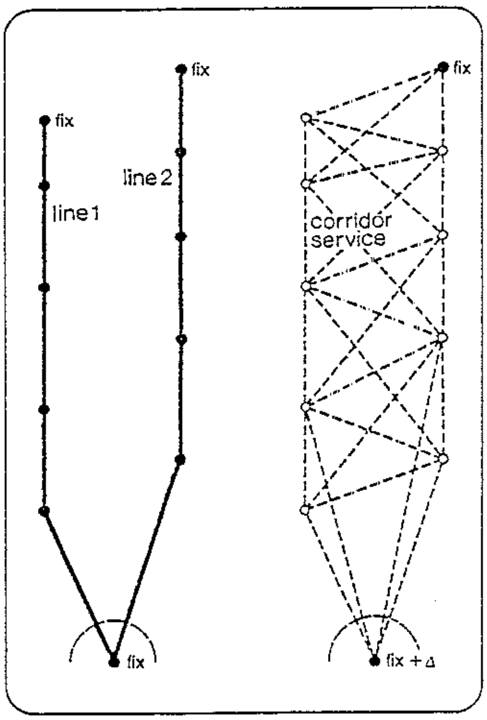

Fig. 5b.

Example of Corridor Service Using Direction Oriented Demand Responsive Mode (Maxi Version)

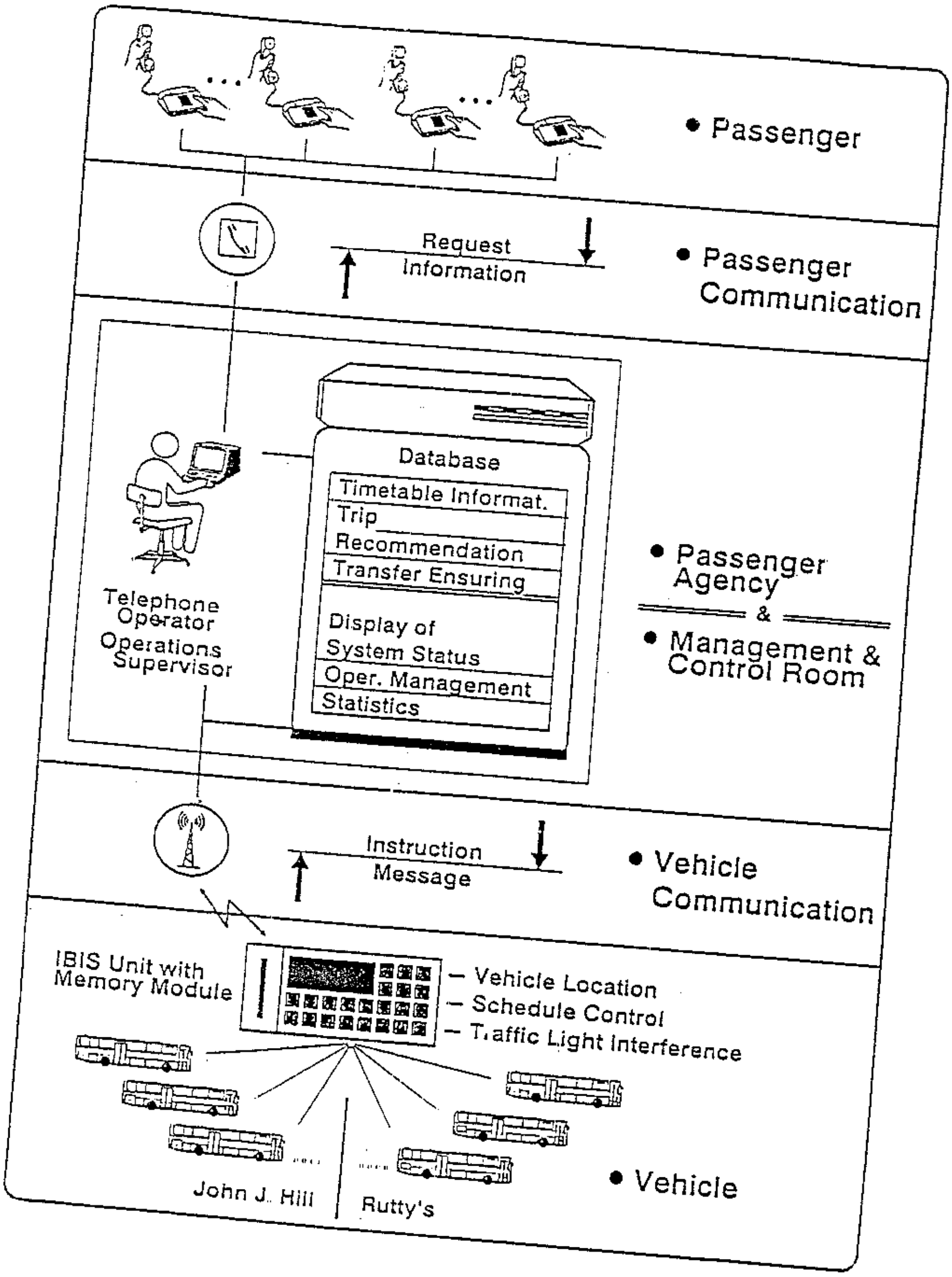
Passenger
Request
Information
Passenger Communication
Database
Timetable Informat.
Trip
Recommendation
Transfer Ensuring
Display of
System Status
Oper. Management
Statistics
Telephone Operator
Operations Supervisor
Passenger Agency
&
Management & Control Room
Instruction
Message
Vehicle Communication
IBIS Unit with Memory Module
– Vehicle Location
– Schedule Control
– Traffic Light Interference
John J. Hill
Rutty's
Vehicle

Fig. 6

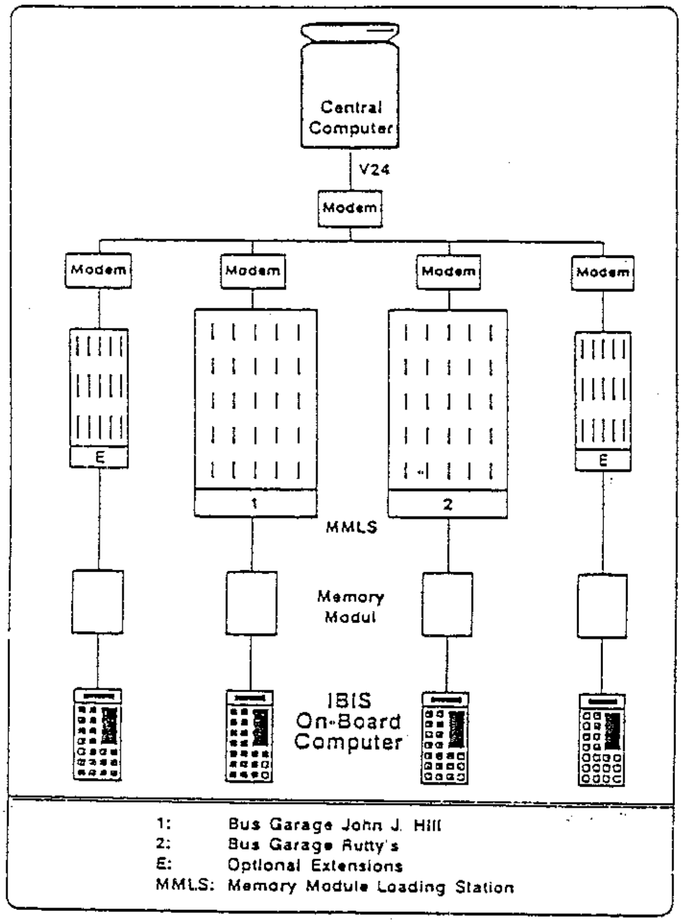
Central
Computer
V24
Modem
Modem
Modem
Modem
Modem
E
1
2
E
MMLS
Memory
Modul
IBIS
On-Board
Computer
1: Bus Garage John J. Hill
2: Bus Garage Rutty's
E: Optional Extensions
MMLS: Memory Module Loading Station

Fig. 7

779

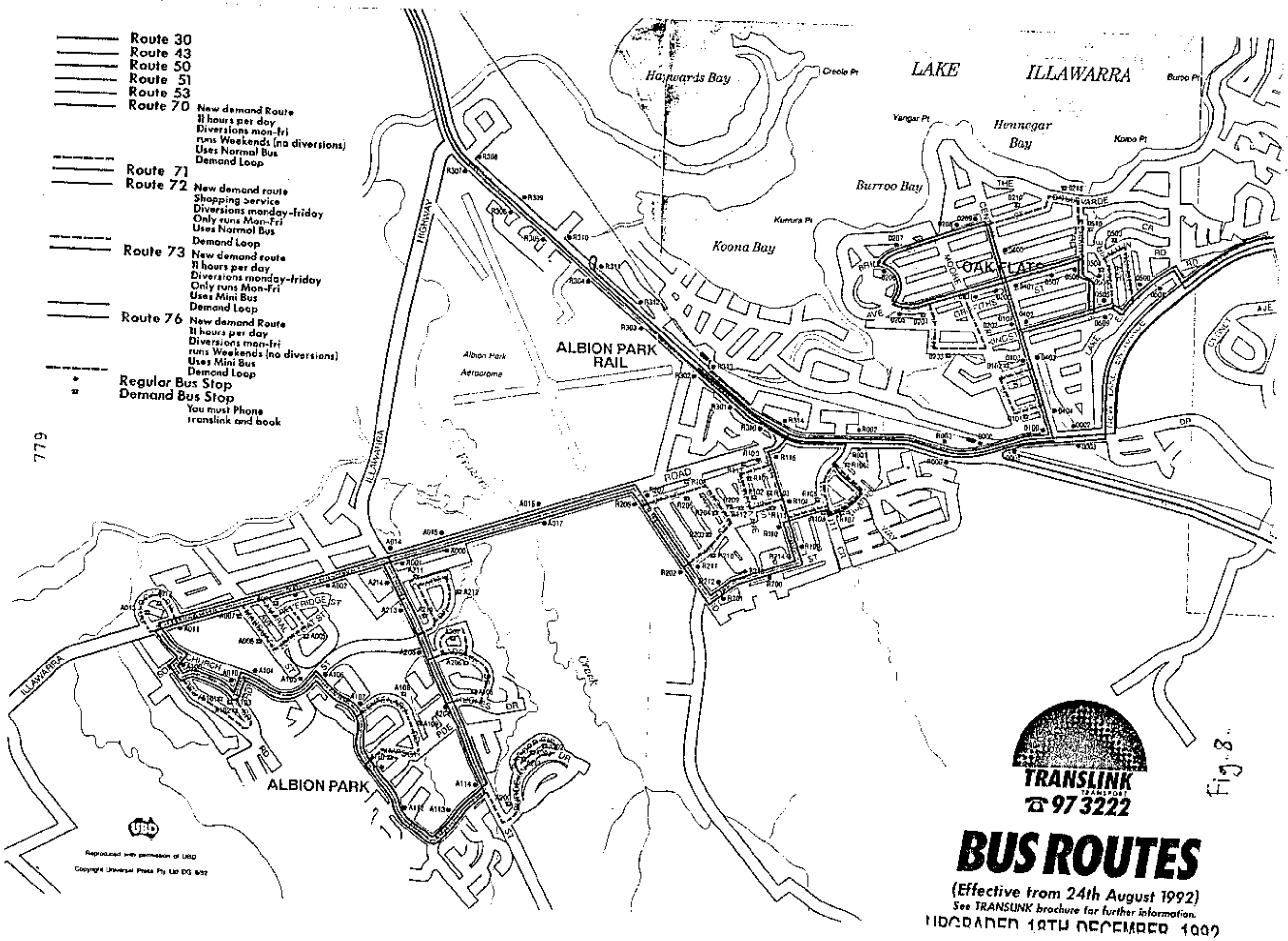
Route 30
Route 43
Route 50
Route 51
Route 53
Route 70 New demand Route
11 hours per day
Diversions mon-fri
runs Weekends (no diversions)
Uses Normal Bus
Demand Loop
Route 71
Route 72 New demand route
Shopping Service
Diversions monday-friday
Only runs Mon-Fri
Uses Normal Bus
Demand Loop
Route 73 New demand route
11 hours per day
Diversions monday-friday
Only runs Mon-Fri
Uses Mini Bus
Demand Loop
Route 76 New demand Route
11 hours per day
Diversions mon-fri
runs Weekends (no diversions)
Uses Mini Bus
Demand Loop
Regular Bus Stop
Demand Bus Stop
You must Phone
translink and book
LAKE ILLAWARRA
Haywards Bay
Hennegar Bay
Burroo Bay
Koona Bay
OAK FLATS
ALBION PARK RAIL
Albion Park Aerodrome
ALBION PARK
ILLAWARRA HIGHWAY
ROAD
Creek
TRANSLINK
TRANSPORT
☎ 97 3222
BUS ROUTES
(Effective from 24th August 1992)
See TRANSLINK brochure for further information.
UPGRADED 18TH DECEMBER 1992
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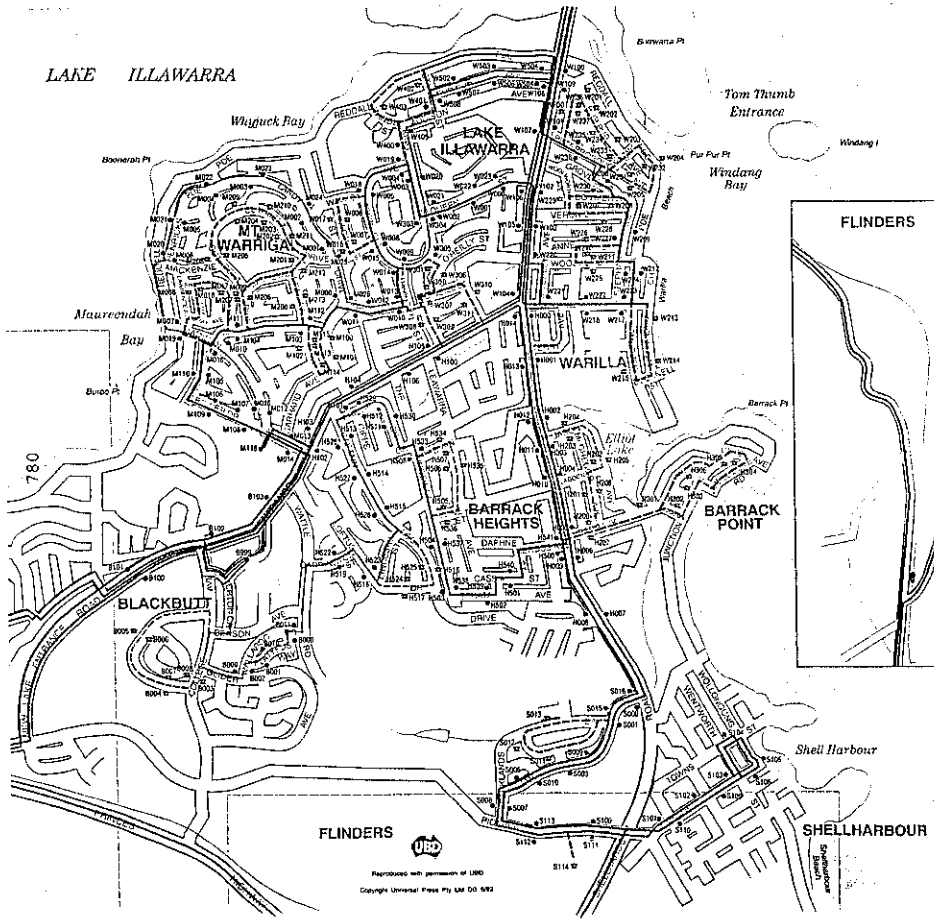
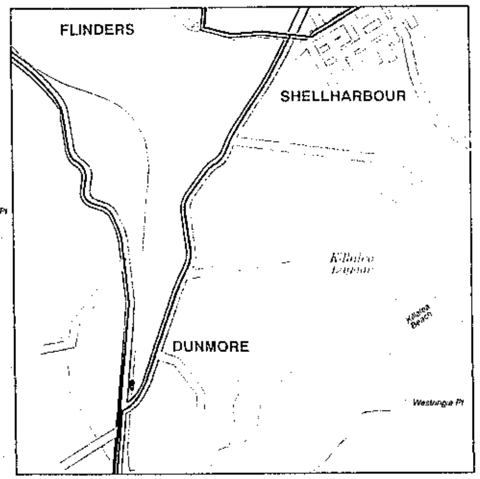
Fig 8.





TRANSLINK TRANSPORT
☎ 97 3222

BUS ROUTES

(Effective from 24th August 1992)
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Fig 2

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