EXPLORING EXURBAN TRAVEL DEMAND IN THE USA AND NEW ZEALAND: ISSUES, CASE STUDIES AND A RESEARCH AGENDA

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ABSTRACT

The increasing popularity of exurban residence - i.e. beyond the traditional urban fringe - poses many issues for transportation and regional planners throughout the developed world. These issues include, but are not limited to, the economic and environmental externalities associated with long-distance commuting, - e.g. many persons retire to exurban areas, so that the mobility problems of the elderly are exurban as well.

This paper reports on case studies in northern California, USA and the Kapiti Coast in New Zealand. The USA case study focuses on long-distance commuters and illustrates the way in which quantitative data can be interwoven with qualitative approaches. The applicability of both findings and the research methods to transport and related issues in New Zealand is discussed. A comprehensive research agenda to integrate, interpret and augment available social, demographic and transport data on exurban travel demand in New Zealand is discussed and preliminary results form the Kapiti case-study are summarised.

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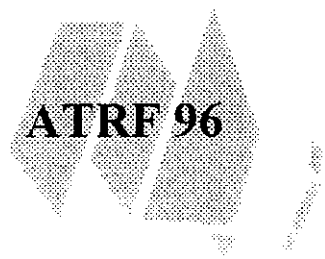

INTRODUCTION: EXURBIA AND TRAVEL BEHAVIOUR

Definitions

Urbanisation is the concentration of population into relatively dense living patterns. In an urban area, the vast majority of inhabitants engage in secondary, tertiary, or higher order economic activities. Cities, by virtue of their relative density, allow for both transport savings and agglomeration economies in the production of goods and services. However, they have also historically resulted in concentrations of economic externalities and environmental degradation, including pollution of ground, water and air with attendant effects on human health.

Thus for as long as there have been cities, there has been a desire by many residents for *suburban* living: residence in a lower density area with some rural amenities (open space, lower pollution levels) but directly adjacent and accessible to a city. Until a little over a century ago, suburban living was the privilege of the rich who could afford both high transport costs and shorter/more flexible work schedules. Two transport revolutions of the late nineteenth century -- the electric tram and the automobile -- opened the suburbs to progressively less-advantaged urbanites.

The tram and rubber-tired motor vehicles succeeded in democratising the suburbs to a large degree, particularly in Australia and New Zealand. But they also helped decentralise retail functions, personal services, and ultimately much basic employment. And the auto had some latent externalities of its own: in effect, it decentralised air and noise pollution, and brought vehicular congestion to the suburbs. In a sense, the car and the truck re-urbanised suburbia, although along a different pattern characterised by lower-density and greater separation of land uses.

Therefore, the post-World War 2 period saw the beginnings of *exurbanisation* as some sought to escape beyond the urbanising suburbs. The term "extra-urban" occurs in New Zealand's 1926 Town and Country Planning Act, which used the word to refer to territorial authorities with fewer than one thousand residents (Miller 1996). "Exurbia" was first used by Spectorsky in 1955 to describe long-distance commuters who commuted to Manhattan from essentially rural environs (Davis et al 1994). Other terms with similar, though distinguishable, meanings are counter- and peri-urbanisation. This paper will use the term exurbia; an exurban area is one that is considerably separated from, but dependent upon a core urban area. This dependence is for both employment as well as for other facilities and services (e.g. cultural and recreational activities). Exurbanites may be further characterised as persons leading essentially urban lifestyles

well beyond the traditional urban fringe.

The Need to Investigate Exurban Travel Behaviour

For decades urban transport planners have relied heavily and travel demand models. Such models were developed in an era when urban transport planning was dominated by concerns with the journey to work, frequently focusing on work journeys to a single Central Business District. Solutions typically tested with such models were large-scale mainline surface transport facilities such as urban motorways and high-capacity rail transit. However, recent national and local travel surveys indicate substantial increases in types of travel at the urban periphery that are not well explained by traditional travel demand models. Examples include long-distance commuting, the non-work travel of exurbanites and the travel patterns of the elderly who often retire to exurban areas.

A major premise of this paper is that understanding phenomena such as non-work travel, long-distance commuting, and the travel patterns of pre- and post-retirement households requires new basic research. Such basic research must be done if appropriate responses are to be made. This paper develops and reports on one promising approach that combines quantitative and qualitative research. Findings are presented from a study of long-distance interregional commuters in northern California. Preliminary results from a new study of the Kapiti Coast District, an exurban area centred 50 kilometres north of Wellington are also presented.

The US case study of interregional commuting explored these issues via analysis of Census and travel survey data as well as focus group interviews with commuters. This case illustrates ways in which quantitative data can be interwoven with qualitative approaches: Census data provided the basis for defining various types of commuter; the characteristics of these types were then elaborated via the focused interviews. The interviews illuminated important issues that could not have been discerned from conventional travel survey data alone.

The New Zealand case study, just under way, takes a broader view of transport in exurbia in that it is not limited to extended commuting. The study focuses on solving (or at least illuminating the complexities of solving) transport dilemmas posed by burgeoning exurban development. Although the focus is on a single case, the findings will be of broader interest, since exurbanisation is the most pronounced form of settlement growth throughout New Zealand. Examples abound in the Auckland Region, in the Western Bay of Plenty (Tauranga), in Canterbury and in the Kapiti Coast District of the Wellington Region. We need to better understand the identity and behaviour of

all travellers in exurbia. The evidence suggests that transport infrastructure limitations and rapid traffic growth are both endemic features of exurban localities. Exurban growth issues must be understood if economically viable and ecologically sound development is to be realized in Australasia in the 21st century.

LONG-DISTANCE INTERREGIONAL COMMUTING IN THE USA

Overview

This section of the paper examines an exurban case from the opposite corner of the Pacific Rim, i.e. Northern California. It focuses in particular on the special case of long-distance commuters who cross metropolitan boundaries. The discussion is informed by a detailed analysis of Census data for commuters living in California's Central Valley and working in the San Francisco Bay Area; it also incorporates the results of in-depth focus-group interviews with approximately three dozen commuters. Full study results are published elsewhere (Lee (1995); Lee (1996)).

Growth of Long-Distance and Interregional Commuting in the US

The US Census reveals that the average commute increased only marginally in terms of time, from just under to just over 22 minutes, a 3.2 percent increase (US DOT 1994). Though this average increase is modest, it does not reveal the distribution of commute times. Census data also indicate that in 1990 all but four of the 40 largest metropolitan areas had at least 10 percent of their workers commuting more than 40 minutes. Among the ten largest US metropolitan areas, the share of one-way commutes over 40 minutes ranged from 15.2 percent for Detroit to 31.6 percent for New York (US DOT (1993)).

The US 1990 National Personal Transport Survey indicates a substantial increase in average commute distances, from 13.4 kilometres (km) to 16.4 km since 1983. The smaller increase in commute time compared to commute distance reflects an increase in the solo driving (from 64 to 73 percent of all US workers, during the 1980s, with corresponding drops in other, slower modes - ridesharing, transit, walking and cycling (US DOT (1992)). The increase in average commute distance was due to a substantial increase in trip lengths over 13 km in length, and a substantial drop in commutes under 8 km between 1983 and 1990. Although only one in eight commute vehicle trips is over 32 km in length, such trips account for two-fifths of all commute vehicle km travelled (US DOT (1994)).

This trend towards longer commutes is partly a reflection of interregional commuters filling jobs located in metropolitan centres without locating or remaining there

themselves. Aggregate Census data compiled by Pisarski (1987, 1994) suggests that the number of interregional commuters (defined as those cross a metropolitan boundary as part of their normal commute) increased by 70 percent during the 1980s. Given recent rates of growth, it appears that interregional commuting in the US now rivals suburb-to-central city commuting in volume. Suburb-to-central-city commuting has been the focal point of much transport planning in the postwar era; such inter-jurisdictional commuting helped spur the US federal government's insistence on coordinated and comprehensive metropolitan transport planning as a condition for federal aid in the 1960s (Pas, (1995)). It appears that the geographic scope of surface transport planning must be enlarged again.

It must be emphasized that long duration commuting is not identical with long distance commuting, and long distance commuting is not identical with interregional commuting: a commuter who walks three miles to work may be a long duration commuter without being a long-distance commuter; a person who walks ten metres across a metropolitan boundary is an interregional commuter without falling into either of the other categories. This paper focuses on persons whose commutes fulfill all three criteria, since such extended multi-jurisdictional commutes pose the most difficult issues for transport and metropolitan planners.

Such issues include: *excess demands on transport capacity* (a 50 km one-way commute uses five times the road capacity of a more typical 10 km commute, all else equal); *environmental and energy impacts*, particularly air quality degradation, which is a major concern of both the US Intermodal Surface Transportation Efficiency Act of 1991 and the US Clean Air Act Amendments of 1990; *regional transport and land use planning issues*, and issues of metropolitan governance generally, as commute-sheds vastly outgrow the nominal boundaries of regional agencies; *potentially serious safety and economic issues* as households and exurban communities become dependent upon fatiguing commutes as the basis of their livelihood.

Fundamental to assessing the scope of all these issues is learning the identity of long-distance interregional commuters (LDIRC) and gaining an understanding of their motives. Who makes extended commutes and why? Are their non-work travel patterns similarly extended? Where are they in their life-cycle, and what are their long-term aspirations regarding home, workplace, and commute connecting these two sites? Answering these basic questions should also help us clarify and forecast trends in long-distance commuting. For example, if LDIRCs are mostly new households who are moving far from work for lifestyle reasons, the phenomenon may be long-term. If,

however, they are near retirement age, or commute only part-time, or are actively seeking local employment, (and have occupations that are relatively footloose), perhaps the problem will be resolved endogenously, with no need for major public intervention.

To date, few studies of long-distance interregional commuters have been made in any setting, though work by Davis (1993) found Portland, Oregon exurbanites to be a rather heterogeneous group with respect to both demographics and commuting, but that they generally spent more time commuting than closer-in suburbanites. Davis et al (1994) have explored the larger issue of exurban development, noting both the extent of exurbanisation (60 million populations in the US by their definition) and discerning several important distinctions between exurbanites and suburbanites. One key difference is an apparently greater willingness to trade long commutes for rural amenity. Davis, et al also observe that most exurbanites contribution to congestion is difficult to determine simply because most metropolitan travel demand models do not explicitly model externally generated traffic.

Northern California Long-Distance Interregional Commute Issues

Since the mid-1980s planners have noted an unprecedented increase in commuting from the San Joaquin Valley (the southern arm of California's great Central Valley) to its coastal metropolitan areas. From Stanislaus County, whose centre lies nearly 150 km inland of San Francisco (Figure 1), commuting to the nine counties that border San Francisco Bay increased by more than 1000 percent, from under 1,000 to more than 10,000. (The nine-county Bay Area had a 1990 population of just over six million, while Stanislaus County had a 1990 population of 365,000).

Many proposed solutions to "the problem" of long-distance commuting have been proposed including balanced new town development and expensive and extensive high-speed transport facilities (a "new transport" as proposed to a "new town" solution). What both the new town and new transport camps have in common is a belief that major planning and physical infrastructure initiatives need to be directed at a problem that is very poorly understood. Although anecdotes about long-distance commuters abound, no one has systematically studied long-distance commuting from the Valley to the Bay Area prior to the research reported here.

Does <u>force</u> or <u>choice</u> explain the growing number of Bay Area commuters in the northern San Joaquin Valley? Although the stress of a long commute intuitively suggests that LDIRCs are being forced out by high housing costs or urban problems, a number of types of "choice" LDC were postulated:

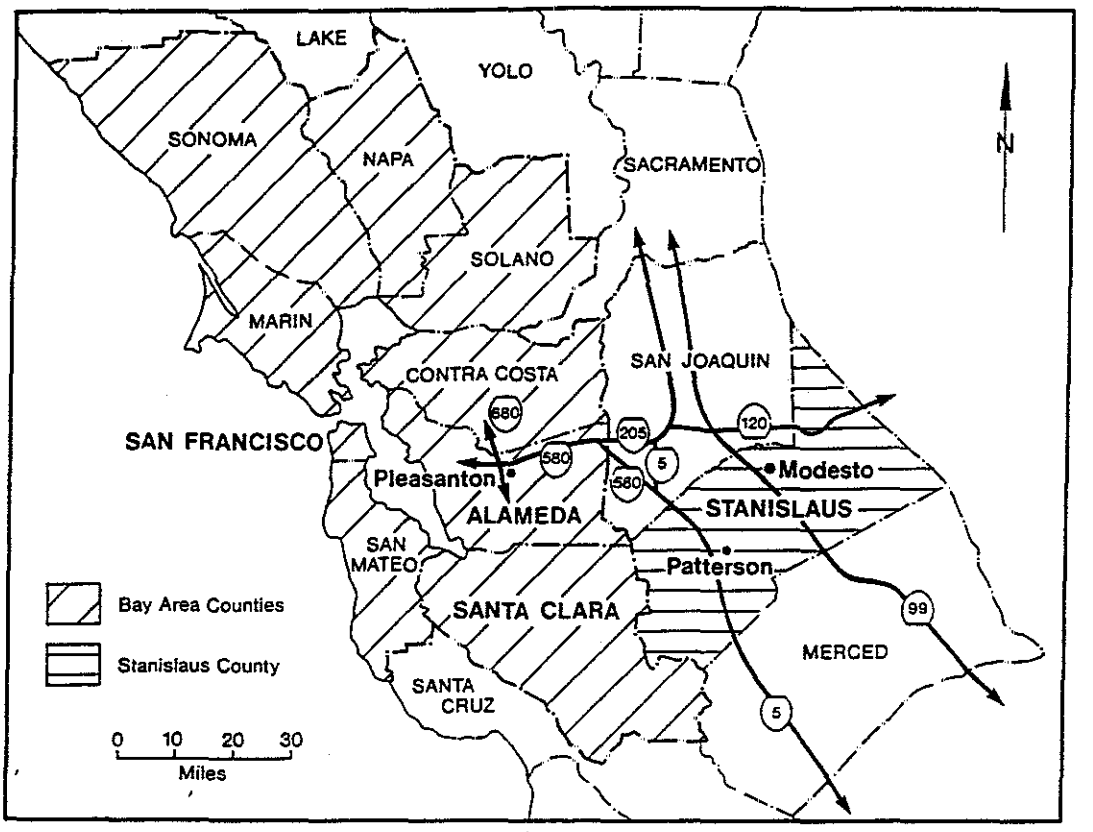

Figure 1: Relationship between the San Joaquin Valley and the San Francisco Bay Area, California

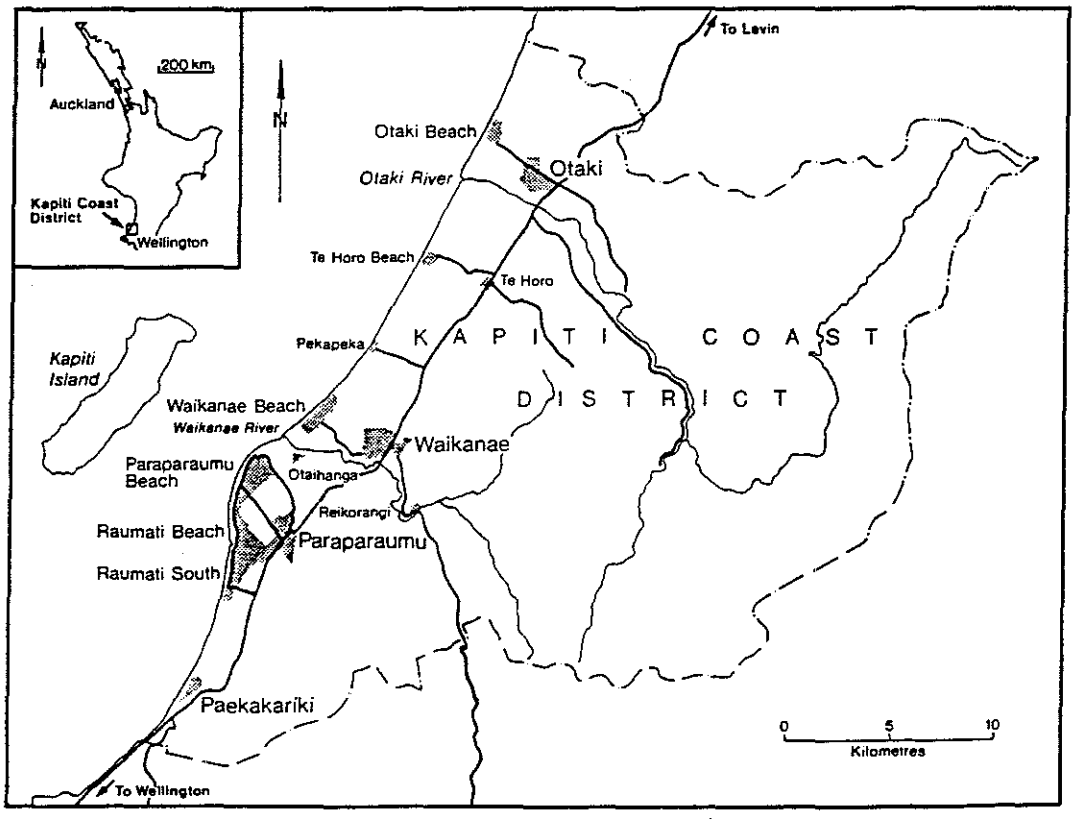

Figure 2: Kapiti Coast District, New Zealand

1. The part-time/seasonal LDC; semi-retired, or works both in Valley and in Bay. Likely scenarios include equity-rich home-owners from the coast who have "cashed out" and early retirees with pensions who still work part-time.

2. Space seekers. In Alonso's (1964) classic model, higher income groups prefer additional private living space over transport cost savings. These are households that are not priced out of Bay Area markets, but prefer to purchase a larger home in the Valley. A subcategory of this group could be dubbed "Equiteers" - households that mainly view housing as an investment.

3. The "traditional family", where one spouse makes the long commute, while the other does not work outside the home and does most household upkeep -- including making most non-work trips. In a sense, these LDC households have been forced out because of their lifestyle choice.

4. The supercommuter. A person who essentially does not mind commuting, and lives (part-time) in his/her car, perhaps having equipped the commute vehicle with all the comforts of home -- e.g. cruise control, tape/CD stereo, phone, fax -- to reduce the stress of the work trip. The supercommuter may be a heavy user of personal services for food, laundry, - possibly utilizing services along the commute route; alternately they may have a stay-at-home spouse or other household member, or a minimalist home life.

A Census Portrait of the Californian LDIRC

Table 1 summarizes cross-tabulations of US Census variables and generalized findings. The findings are couched as a comparison of LDIRCs (and LDIRC households) to the non-LDIRC Stanislaus Census sample, and with the 9-county San Francisco Bay Area. These comparison groups are appropriate, since the LDIRCs both literally and figuratively straddle the two regions. The data for Stanislaus County were analysed to create a demographic portrait of LDIRCs.

Based on the Census analysis, the typical Stanislaus interregional commuter 1990 is a white male aged 35, married with one or two children. His wife works, but probably part time, and commutes within the Valley. He may work as a precision technical worker, or perhaps as a policeman; he has some post-high school education, but not a four-year degree. Their household income is slightly higher than the typical Bay Area household, but their household -- and monthly housing cost -- is larger as well. The head of household works 44-45 hours per week; his commute requires another 15 hours

Table 1
Relevant 1990 Census Tabulations
for Stanislaus County Interregional Commuters

Information	Finding
Population by sex	IRCs 77% male (HoH, 93% male)
Ethnic Origin/Race	IRC 80.1% white, 5.6% Black; 18.6% Latino
HH type by presence of children	IRC HH 84% married; 65% w/ children < 18
Place of Work }	IRC predominantly work in Alameda (28.4%)
Place of Res, 1985 }	and Santa Clara Counties (26.5%); many formerly resided in these counties.
Commute mode	99% of IRCs in priv. veh; 1.32 AVO
Commute duration	Mean time one-way = 90 minutes
Departure time	65.4% of IRCs leave for work before 6 a.m.
Educ attainment, aged 25+	IRCs somewhat > Valley mean (AA degree)
Usual Hrs Worked/Week	IRCs mostly work more that 40 hrs
Industry	Many IRCs in "blue collar" industries IRC overrepresented in Const., Manufacturing. Utilities, and Public Administration
Occupation	IRCs over-represented in "blue collar" occupations; IRCs slightly under-represented as Exec/Managerial And Professional; over-represented in Technician, Precision Production and Protective Services occupations
HH income	Valley avg. =/> Bay Area
Workers in HH	30 % 1-worker, 70% 2+worker HHs 3:1 ratio 1st earner/2nd earner in IRC HHs.
Year structure built	63 % of IRC housing built 1985-1990
Housing tenure	IRC HH over 80% owner-occupied
Units in structure	IRC HH over 90% single-family detached
Lot size	5.2% of IRC HH lots > 1 acre.
No. of bedrooms	IRC > avg. of both Bay and Valley
Ownership costs	IRC w/ mortgages spend > on ownership costs compared to non-IRC for Bay
Gross rent	IRC > Valley avg; near Bay avg.
Housing Value	Non-IRC $123 K < IRC $143 K < Bay $256K

Key: IRC = interregional commuter; HoH = IRC Head of Household; HH = household.

per week. He works five days a week, 49-50 weeks per year. These figures hold true even for the relatively few LDIRCs age 45 and over; based on hours worked, "pre-retirement" does not look at all like retirement among these LDIRCs.

The family has a three-plus bedroom detached home less than five years old, and they moved into it from Alameda or Santa Clara County in the late 1980s; it cost a bit over $150,000 (US), compared to over $250,000 for a similar sized home in the Bay Area. Because of the newness of the home, and because they have two or three cars, they live in an auto-oriented subdivision on the fringe of Modesto (the County seat, 1995 pop. approx. 200,000) or Patterson (a farm town of 10,000 population that has one-third of its work force commute to the Bay Area). The bulge of LDIRC heads of household in early middle-age (over three-quarters are under 45), together with the high proportion of owner-occupied households suggests that most LDIRC households are at a point in their life-cycle where they are less apt to move.

Key Focus Group Interview Findings

Interviews with 40 commuters confirmed the existence of many hypothesized groups, notably supercommuters, pre-retirees and traditional nuclear family households. But this typology does not cover the full range of commuter characteristics. Moreover, each of the predicted types are somewhat different than initially expected. The supercommuters rely more upon a fixed routine, rather than upon any special commuting technology such as in car telephones or other technology aimed at easing the discomfort and increasing the usefulness of commute time; the pre-retirees appear to put in as many hours working and commuting as other interregional commuters; and (as indicated by the analysis of Census data) both spouses usually have jobs outside the home to make ends meet, though one spouse is usually closer to home physically and psychologically.

Almost all underestimate commute costs. One law enforcement officer stated that on the car he used every other day on an 85 km one-way commute (or about 1,700 km a month) his operating costs (gas and oil) were about $100. This same individual estimated his added wear and tear and tear cost at $20 per month. The estimate translates to under two cents a mile, compared to 10 cents a mile estimated by Newsom and Wegmann (1992) based on data compiled by the American Automobile Association. This underscores a phenomenon common among long-distance commuters (and is probably characteristic of all auto commuters): the perceived costs of auto commuting are less than the actual costs. The metaphor that best explains why they will endure the time cost of their long commutes (90 minutes each way on average) is that of moonlighting; by "working" a second "job" as a commuter, they can afford a larger or

cheaper home.

Overall, the interviews suggest that there are many types of LDC and interregional commuter. In general they do not fit the mould of frustrated Bay Areans (too anti-urban, too solace and home oriented). Nor are they Valley residents, eager to integrate themselves into what they see as a largely neutral or passive environment. If the number of "routine" jobs is predicted to decrease in the US, then LDIRCs numbers may diminish as well. On the other hand, they tend to be in early middle age, with children (a "settling" factor). Moreover, most of those interviewed indicated they expect their commute to be as long if not longer in two years time. Follow up surveys in early 1996 confirmed that most were indeed continuing their long commute. Given these facts and recent trends towards exurbanisation, it appears likely that extended commuting will persist. Plans for managing such interregional flows would appear to be prudent.

Other evidence gathered during this study suggests that LDIRCs are typically not extraordinary consumers of transport services outside their commute. Moreover, most are relatively content with home-based leisure activities. Most would welcome shared ride transport for their journey to work. Most desire clustered services to reduce travel for shopping and other household sustaining activities (church, health, other personal services). The average vehicle occupancy (AVO) among Stanislaus LDIRCs in 1990 was 1.32, well above figures for suburban Bay Area centres, which are generally below 1.1. Thus, somewhat ironically, LDIRCs are not necessarily a significant source of demand for major new transport facilities.

Conclusions and Observations on the Californian Study

The commuters interviewed exhibited a strong affinity for both natural amenities and convenient services. Therefore, pedestrian-oriented design that provides more local services seems appropriate for the residential end. For the commute itself "evolutionary" high speed links for shared-ride vehicles appear to make theoretic sense. Moreover, many commuters are eager for improvements in both their commute and their living situation. Most (though not all) commuters would consider ridesharing because of the very real economic and stress reduction benefits afforded on such a long commute. Thus, new commuter neighbourhoods would appropriately be centred on new or existing retail centres that supply local needs. Such centres would be "natural" assembly points for shared ride vehicles. (Indeed, both Modesto vanpools interviewed for this study depart from shopping centres).

There are many additional transport infrastructure and environmental advantages

accruing to ridesharing by long-distance interregional commuters beyond costs associated with the commute. It does appear that long-distance commuters expend the vast majority of their travel budgets on the commute; the interviewees did not report any significant non-work travel on work days, and most consolidated many purposes onto a single trip chain on their days off. If a commuter does not drive, all work-based travel will be by non-motorised, public, or shared-ride modes. Thus, placing a long-distance commuter in a shared ride mode for the work trip eliminates many of the congestion and air pollution externalities attributable to the commuter over the course of a day.

The preliminary, yet potentially transferable lessons from this study for other areas experiencing growth in long-distance interregional commuting are two: first, accommodate the long work trip via relatively environmentally benign modes; and second, accommodate the already compressed non-work trip patterns via land use planning (mainly clustering of essential goods and services) at both residential and work sites to facilitate the accomplishment of non-work activities via relatively short and efficient trips.

ENHANCING EXURBAN TRANSPORT CAPACITY IN NEW ZEALAND

Overview

The broad goal of this ongoing research is to identify and quantify existing and emergent travel demand patterns associated with exurban demographic types. Using an expert panel, it will also devise and test appropriate responses to future patterns of demand. "Appropriate responses" is not being limited to a narrow definition of transport infrastructure. Travel demand management, urban form solutions and telecommunications/delivery systems will also be examined for their efficacy in satisfying revealed and potential demands. An in-depth *case-study* of the Kapiti District is centrepiece of the research (see Figure 2 above).

The Kapiti District was chosen for in-depth study for several reasons:

1. It contains a high proportion of long-distance commuters to Central Wellington: over a fifth of employed residents and a quarter of full-time workers.

2. It contains a high and growing proportion of pre-retirees and retirees (in 1991 26 percent of Kapiti District residents were over 60 -- twice the percentage found in Auckland City). The travel patterns and requirements of the elderly are quite different from, and sometimes even in conflict with, those of commuters.

3. It has been one of New Zealand's fastest growing local authorities since 1981; it accounted for nearly all the Wellington Region's net population growth over the decade 1981-1991. Growth has since slowed slightly, but is still well above the national average (Statistics New Zealand (1996)).

4. Transport and traffic are pressing current issues. State Highway 1 (SH 1) has recurring congestion south of Kapiti (i.e. at the two lane Plimmerton Bridge). Two major roading projects (with a combined cost of over NZ$200 million) have recently been tabled as means of facilitating traffic flows to and through the Kapiti District. The distance from Wellington from seems to be encouraging ridesharing for trips to the central city: the average number of people per car on southbound SH 1 just south of the Kapiti District was 1.39 during the a.m. peak period, according to a March, 1996 survey by the Wellington Regional Council.

5. Unlike many exurban areas, the Kapiti District has viable public transport service, including considerable commuter rail service that uses the North Island's Main Trunk Railway. Despite the need for enhancements to both stations and rolling stock, fragmentary evidence suggests that rail commutation among those working in Wellington has increased in recent years. Congestion on SH 1 appears to be an important factor in this turnaround.

The Kapiti District emerges as an archetypal exurban area with some unique opportunities, e.g. the rail services and a high degree of ridesharing. The large population of retired and pre-retired residents entails special needs but also promises transport system benefits, since such residents generally have lower overall travel demands (especially during commuting times). A growing elderly population may also press for both accessible development and cost-effective local public transport services.

The District also has typical exurban problems, foremost of which is the unfunded "wish list" of roading and public transport projects to serve transport demand between Kapiti and central Wellington. In total this amounts to several hundred million dollars. There is also an acute shortage of funds for purely local transport.

For the moment, peak period congestion on the main artery (SH 1) still dominates transport debates in Kapiti. Proposed solutions focus on relieving current or impending congestion on this route either directly or through building parallel arterial roads. But local transport service levels are also a focus of concern for existing and new residents, drivers and non-drivers alike. Specific concerns include congestion, travel time, and the

creation of barriers to local movement. Overarching all of these is a general concern with the physical transformation of the locality.

There is conflict between local traffic and traffic using the arterial road, with significant impacts on safety, lifestyle and community coherence. Access to social and economic infrastructure, including health, education, and community service activities, is a key concern in an environment in which low-density development, and a limited local road network impede access. Local access is constrained by the heavily trafficked through route on which many local trips must also be made and many more trips must cross. These matters are of particular concern for elderly persons, who may not wish -- or be physically able -- to use an auto to attain all their needs and wants.

The degree and pattern of dependence of Kapiti on the central city of Wellington - for employment, shopping, leisure activities - seems likely to decline, especially with respect to commuting. The number of Wellington commuters was essentially unchanged between 1986 and 1991 at approximately 2,700, even as the number of employed Kapiti residents increased from just under 10,000 to just under 13,000 (Statistics New Zealand (1986, 1991)). On the other hand, the wider and higher-paying range of jobs in central Wellington suggests that long-distance commuting is likely to continue, and Wellington's wide variety of shopping and leisure activities will also remain formidable. Travel to Wellington varies for different demographic groups and will change as the area grows and its composition alters.

A comprehensive information base is being developed which integrates and interprets social, demographic and transport data on exurban New Zealand, including the Kapiti District. This information base will include census data, travel surveys from several regions, and national traffic safety statistics. This information will be used to create a quantitative portrait of long-distance commuters, retirees, and other groups which populate exurban areas. The Kapiti case-study will be built upon this base.

Kapiti Case Study: Methodological Steps

Step 1 is to delineate the current transport system and identify current travel demand as expressed in both passenger and vehicular traffic flows in the case study area. This is being developed from existing data already collected by the local and regional councils and Transit New Zealand, Statistics New Zealand, and the investigator.

The current road and rail system and their utilisation will be described in terms of the following attributes at key locations:

Vehicle movements by type of trips
Vehicle movements by type of vehicle
Passenger movement by type of trip
Timing of movements
Public transport provision and use
Non-motorised transport provision and use
Key generators of demand (nodes)
Current system capacities
Key points of congestion and volume-to-capacity ratios
Proposed transport network and service responses
Potential transport network and service changes

Currently available forecasts of changes in travel demand will be summarised and analysed according to shifts in the preceding variables. The underlying land use/spatial activity patterns and changes will be traced.

Step 2 is to formulate and describe a broader array of transport and para-transport solutions than currently exists. The focus will be on transport technology and policies with strong potential for application in the Kapiti Coast and Wellington region context. This step will entail the following sub-tasks:

- Updating recent reviews of national and international literature dealing with exurban traffic problems and solutions.
- Analysing and delineating land use/spatial activity strategies (urban form policies, urban design measures) with strong potential for ameliorating exurban travel flows. This will be accomplished in part by the literature review, but will be supplemented with a site visit and key informant interviews in areas of Australia where innovative land use transport planning have been undertaken in response to global initiatives to reduce greenhouse gas emissions.
- Identification of technical and policy innovations in travel demand management, including telecommunications options with demonstrated potential for ameliorating exurban travel demand (operational improvements and travel substitutes).
- Consideration of issues beyond transport, e.g. social service delivery, environmental and institutional issues. This will include efficacy of alternate means of delivery for enhancing the service capacity of the following public and private services for which transport is frequently, but not inevitably, an intermediary:

Public: health, education, welfare, local government services

Private: employment, retailing, recreation, leisure, private health and education facilities

Step 3 is to develop a composite future transport scenario. A scenario will then be developed and described (in the same terms as indicated above for the existing conditions description in Step 1) comprising both a demand forecast and an integrated set of transport solutions. This scenario will represent the investigator's judgement, based on the current theory and experience elsewhere.

Four types of transport/para-transport strategy will be interwoven into the scenario for evaluation by a Delphi Panel of local transport experts. These four types correspond to specific transport or para-transport modes:

1. A Roading/Private Vehicle Strategy
2. A Public Transport Strategy
3. A Spatial Activity Concentration (Compact Urban Form) Strategy
4. A Travel Demand Management Strategy emphasizing telecommunications and information technologies

The appropriateness of the transport/para-transport scenario for the initial round will be established by the investigator through analysis of: local area statistics; local documentation (plans and proposals); and community perceptions of issues and options gleaned from a variety of sources. Order of magnitude unit-costs will be developed for each of these strategy areas, based on the literature review and available information, including information supplied by an expert panel.

Step 4 entails a Delphi Panel evaluation and refinement of the forecast scenario. The Delphi, or expert method of forecasting generally consists of a panel of experts giving their opinions regarding a future scenario (Linstone & Turoff. (1975)). In this application, 15 to 20 experts will critique the transport/para-transport scenario.

The forecast scenario is being formatted using succinct text and graphics for consideration by a Delphi panel. This panel will consist of managers of key transport agencies, both public and private, as well as public and private entities in the case study area which generate significant traffic.

After an initial round of comments on the scenario is received, these will be aggregated and returned to the panel. In this manner, the responses by individual panel members will be controlled; each can make his or her response without group or individual pressure, since the responses of the panel are reported anonymously. Panel members can then modify their responses considering the aggregate group views.

With the Delphi method, a consensus generally emerges after a few cycles, although the consensus is never complete nor unanimous. Convergence of opinion usually begins after the second round. For this research project, three rounds (two following the initial round) are planned. Three rounds, together with a well-crafted initial scenario and in-person follow-up are expected to facilitate the formation of consensus by October, 1996.

Potential solutions will be evaluated (by both the investigator and an expert or Delphi Panel) in terms of: 1) their efficacy in obtaining economic goals, (including fiscal limits); 2) the degree to which they enhance environmental goals) the degree to which they appeal to and are acceptable to communities of interest (residents and other stakeholders, e.g. transport providers); and 4) the degree to which they appear likely to be used (an efficiency measure).

Expected Benefits

The final report, comprising both a current compilation of potentially effective exurban strategies and a multi-expert critique in a New Zealand context, should be of immediate interest and use to many in the transport industry. At present, no one agency in New Zealand has responsibility for identifying the conditions of exurban development which are placing extraordinary demands on transport infrastructure and services. No coherent body of knowledge exists to enable transport planners to identify and anticipate the demands that will be made upon them by the rate and nature of exurban development.

In essence, developing an understanding of, and formulating responses to travel demand and related issues in exurbia has been confounded by fragmented institutional responsibilities, i.e.,

- The traditional responsibility for funding and advancing transport (and particularly highway) projects lies with Transit New Zealand and Transfund
- The policy role in this area rests with the Ministry of Transport
- The concerns of the New Zealand Land Transport Safety Authority, entailing highly specific concerns regarding driving conditions and behaviour on the high speed roads which typically dissect exurban communities, communities with a disproportionate

and growing number of ageing people

- Local district councils, responsible for land use consents
- Regional; councils with their responsibilities for land and water quality and regional land transport planning
- Various social agencies with their increasingly circumscribed concern for community public health and welfare.
- Perhaps most important and most disparate, the Private Sector, which depends upon transport to fulfill vital economic and personal needs and desires. Prominent here is Tranz Rail, a former State-owned Enterprise, and the operator of all rail services in the Wellington region.

In addition to divided responsibilities, the short-term exigencies of most operational agencies tend to divert resources away from long-term concerns -- even when agencies acknowledge the importance of long-term trends.

The final report of this programme will help fill these institutional gaps and address the lack of long-range perspective concerning exurban transport and demand. It will also bring into focus areas of where prudent coordination across the transport sector is needed to ensure accessibility in exurban areas.

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