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**A SUCCESSFUL TOD WILL REINFORCE BOTH THE COMMUNITY & THE
TRANSIT SYSTEM?**

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ABSTRACT

The three cases of transit-oriented development (TOD) were selected either because they represent comparable rail station types (and/or physical settings) or because certain types of implementation tools were used to make transit-oriented development happen.

In looking for comparable examples of TOD in Perth City, specific station area characteristics were evaluated:

- *whether the station is underground, at-grade or elevated*
- *how many people use the station*
- *surrounding urban form and land use, and,*
- *other transportation connections that are provided*

This paper presents detailed case studies of representative TOD projects throughout Perth.

The experiences of transit operators, and local authorities, with TOD will help Perth establish a planning framework and to take action toward station-area development. This paper provides background for the case studies by defining transit-oriented development, describing the methodology for choosing the specific case study areas and establishing the framework for analysing individual station areas.

This analysis of TOD case studies looks at a variety of transit operators and suburban station types throughout Perth. Although the case studies make reference to many exemplary station-area projects within the transit corridors served the following stations are reviewed in the most detail:

1. *Esplanade*
2. *Murdoch*
3. *Cockburn Central*

The selected stations are located in dense urban areas, with limited provision for parking and ride, consistent with the proposed characteristics of Perth's transit system.

INTRODUCTION

Transit-oriented development (TOD) has become the dominant urban growth planning paradigm in Australia and is recognised as a way to encourage economic revitalisation, community diversity, and travel alternatives.

The Federal Government in Australia established an \$850 million fund to build model transit-oriented urban villages in all major cities as a way of demonstrating this new and important way of coping with the automobile. The program, called 'Better Cities' has several very successful demonstrations in Perth. Such developments have been shown to save Australian cities very large amounts of money from less expenditure on new infrastructure and transportation, compared to development at the urban fringe, as well as a much improved environment (Kenworthy and Newman, 1992; Diver and Newman, 1996).

Western Australia encourages sustainable urban environments through the employment of TOD

Transit-oriented development (TOD) — compact, mixed-use, and pedestrian friendly precincts around transit stations — is an increasingly popular strategy for encouraging smart growth in Australia. Western Australia has implemented policies and programs that facilitate intra- and inter-governmental cooperation to promote TODs.

Western Australia has won the National Urban Planning Achievement Award for the State's Transit Oriented Development program “Reconnecting Perth”. The program provides a framework for making places near rail and bus stations more attractive and liveable through the provision of a variety of housing choices. It promotes maximising access to mass transit by fostering mixed-use development that is compact, pedestrian friendly, socially diverse, and inter-connected with other places via public transport.

The Department for Planning and Infrastructure, the Public Transport Authority (PTA) Transperth, Department of Housing and Works, Main Roads W.A., Midland Redevelopment Authority, East Perth Redevelopment Authority, LandCorp, and the Western Australian Local Government Association have spent several years planning a mixed-use TOD adjacent to a rail station on the agency's property (LandCorp) and are currently developing further TOD opportunities at various locations in the greater Perth area such as; the new Murdoch and Cockburn Central stations on the new Southern Suburbs Railway, Burswood and Belmont Park rail stations and Mirrabooka Regional Centre and bus station.

Perth, the capital of Western Australia is best described as a low density city in contrast to California as the most populated state with in the USA, with 18 times as many people as Western Australia. It also has the largest rail network in the USA.

The urban densities of major metropolitan statistical areas in California range from 3,369 people per square mile in San Diego to 4,717 people per square mile in the San Francisco. The New York/Northern New Jersey urban population density is 4,203 people per square mile while Perth experiences the lowest population density for any major Australian city with 2,754 people per square mile.

Although Perth has low population and employment densities accompanied by high levels of car ownership and use, it also has a relatively high proportion of its total workforce located within the Central Business District (CBD) and a relatively high proportion of public transport usage per capita on rail (See Table 1).

		<i>Los Angeles</i>	<i>San Francisco</i>	<i>San Diego</i>	<i>New York</i>	<i>Perth</i>
Urban density	persons/ha	24.1	20.5	14.5	18.0	10.9
Job density	jobs/ha	11.2	8.9	6.6	9.5	4.6
Proportion of jobs in CBD	%	4.1%	13.9%	5.8%	20.7%	19.2%
Metropolitan gross domestic product per capita	USD	\$28,243	\$37,154	\$26,508	\$34,395	\$21,995
Length of road per person	m/ person	3.7	4.5	5.3	4.9	9.1
Parking spaces per 1,000 CBD jobs	spaces/1,000 jobs	627	157	767	66	630
Total length of reserved public transport routes per 1,000 persons	m/1,000 persons	39.5	53.1	44.9	92.4	82.0
Passenger cars per 1,000 persons	units/1,000 persons	527.4	599.6	555.1	444.0	658.1
Daily public transport trips per capita	trips/person	0.09	0.21	0.05	0.29	0.14
<i>Mode split of all trips</i>						
Nonmotorized modes	%	9.5%	11.6%	5.8%	16.1%	9.1%
Motorized public modes	%	2.3%	5.4%	1.5%	8.6%	3.7%
Motorized private modes	%	88.2%	83.0%	92.8%	75.2%	87.2%
Total public transport boardings per capita	boardings/person	49.1	93.6	27.0	131.5	59.5

Source: Kenworthy and Laube's and the International Association of Public Transport's Millennium Cities database (data represents 1995).

The problem for TOD today is the same as that identified by Curtis in 1999: "There appears to be a misalignment between strategies and actions, with little evidence of implementation that achieves balanced transport outcomes" (p. 349).

The successes of redevelopment authorities in places like Midland and Subiaco unfortunately affect only a small percentage of new development, most of which is low density and automobile dependent. While Perth has an established history of planning, much of it has perpetuated a car-based culture.

OVERVIEW

The increasing number of rail passengers traveling has led to an increased demand for car parking at stations. In order to manage this demand, more sustainable ways of getting to and from the stations need to be found, rather than relying on cars.

The primary aims of this work have been to determine the best ways to reduce out-of-vehicle travel burden and improve transit users' experience at stops, stations, and transfer facilities. In order to achieve this it has been essential to consider the development of various improvements at stops, stations, and transfer facilities and to understand how these improvements affect people's travel behavior. In gaining and understanding of this it is important to recognize that transit systems' primary focus is clearly their passengers and the perceptions and needs of these passengers.

Over the years Perth City continues to grow more dispersed and automobile-oriented. In an effort to accommodate increasingly dispersed patterns of trip-making many transit systems, including the Perth metropolitan areas, now require transit users to make frequent transfers among lines, modes, and operators. As such, transit stops and stations are integral parts of transit networks, playing an important role in connecting multiple transportation modes and systems. The effectiveness of these connections governs waiting and walking times at transit stops and stations and, in turn, travelers' choices (ie whether or not to take a particular transit trip). Given the effect of travel time on travel choices, good connectivity at transit stops and stations is critical to overall transportation network effectiveness.

The increasing number of train passengers traveling has led to an increased demand for car parking at stations. In order to manage this demand, more sustainable ways of getting to and from the stations need to be found, rather than relying on cars.

An example of this is presented by the New Mandurah Line which will demonstrate sustainability in action through:

- reducing the use of motor vehicles and encouraging public transport use by locating residential and commercial/mixed use development close to major public transit services;
- encouraging pedestrian activity and bicycle usage by providing pedestrian and cycleway linkages within the project area, and connecting the project area to the surrounding community;
- generating local business opportunities, resulting in increased local employment opportunities;
- encouraging energy efficient housing options; and
- providing a mixture of affordable housing options.

PASSENGER SURVEY

In April 2009 we surveyed approximately 550 transit users at 3 selected transit stops and stations in Perth metropolitan, the Esplanade, Murdoch and Cockburn Central stations as random stations on the new rail Mandurah Line to obtain railway user information during weekdays. The following section describes in brief the data collection and passengers survey results.

Information collected included:

- trip origin and destination
- means of getting to and away from the train system
- transfer characteristic behaviors within the system

The surveys used were developed working with the assistance of representatives of the Public Transport Authority (PTA) of Western Australia Governments and included the above characteristics as they were considered essential to system planning. These surveys clearly had a much stronger travel behavior focus than the previous (2008) Customer Satisfaction Surveys conducted by the PTA.

DATA COLLECTION

The data collection for the survey was successful in terms of the number of responses from passengers, with 550 distributed (face-to-face interviews) a total of 544 valid surveys were obtained from across the 2 stations. It is considered that the data collection exercise provided acceptable and reliable evidence for each of the individual stations.

The intent of the data collection was to obtain information about who was using rail services at the selected stations, how they were accessing the station and additionally, the most important determinant of user information with a transit stop or station – attractiveness of the services based on frequency and reliability in an environment of personal safety, and only indirectly the physical characteristics of that stop or station.

Passengers were approached and asked a series of questions regarding both the travel and train stations' characteristic of their trip. In order to capture users of a majority of the trains serving the selected stations data was collected during the morning peak hour (7 AM to 9 AM) and afternoon peak hour (3 PM to 5 PM) on April 2009, The weather was clear during the survey and no major problems were observed that would affect the use of the Perth rail system.

Survey data collected was oriented to obtain information with the following survey objectives:

- Origin purpose;
- Mode of access to the public transport system;
- Destination address;
- Destination purpose;
- Egress mode from the public transport system
- Household car ownership availability for the trip made;
- Journey made by car;
- Ticket type; and gender/age.
- Customer satisfaction
- Suggestions

Data collected was entered into an Analytical Software SPSS for validation and analysis. The survey data was sorted and a cross-analysis of potentially relevant passengers factors such as travel frequencies, preferred station locations, and variations among sub-groups (age, gender, profession, and place of residence) was consequently obtained.

THE SURVEY STATIONS

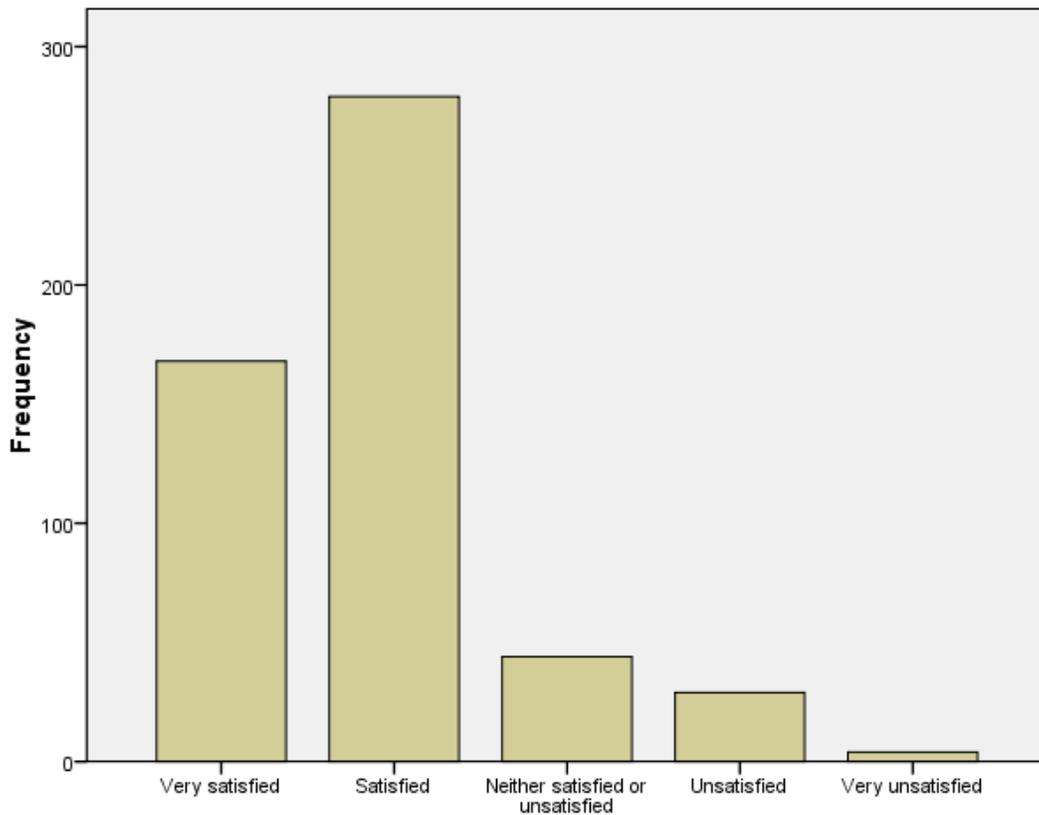
1. Esplanade Station is a below ground railway station located in the CBD of Perth, Western Australia. Situated parallel to William Street, it features integrated bus services at the neighboring Esplanade Bus port. It is served by a north-south railway line, the southern part of which is the inter-urban Mandurah Line, the northern part of which is the urban Joondalup Line. Through services operate between these lines, connecting Esplanade Station to the Perth Underground station, less than 1km away, the neighbouring southern city of Mandurah and the northern suburb of Clarkson.
2. Murdoch Station is a railway station located in Murdoch, Western Australia. Situated in the Kwinana Freeway median strip, and perpendicular to South Street interchange, it also features integrated bus services on the concourse level; this level will operate as a bus station. It is served by the inter-urban Mandurah Line, with services to both the Perth CBD and the neighbouring city of Mandurah.
3. Cockburn Central Station is a railway station located in Jandakot, Western Australia. Situated in the Kwinana Freeway median strip, and just north of the Beeliar Drive/Armadale Road interchange. It is served by the inter-urban Mandurah Line, with services to both the Perth CBD and the neighbouring city of Mandurah. When the station was commissioned, Cockburn Central became a suburb of its own.

SURVEY HIGHLIGHTS

Passenger Origin-Destination Data

The principal objectives of the travel surveys were to determine the methods used by Passengers to get to and from the rail system and to identify transfer patterns used by Passengers within the system during a given trip.

Overall, survey results support the observation of user satisfaction with the New Mandurah Line experience and indicate that, in general, they are least happy with factors related to access, followed by some factors related to security and safety and connection and reliability. When we considered the level of satisfaction and importance ratings in tandem, factors that require improvement at the 9 stops and stations surveyed pertain most to security and safety, connection and reliability, and least to amenities. (See Table 2)



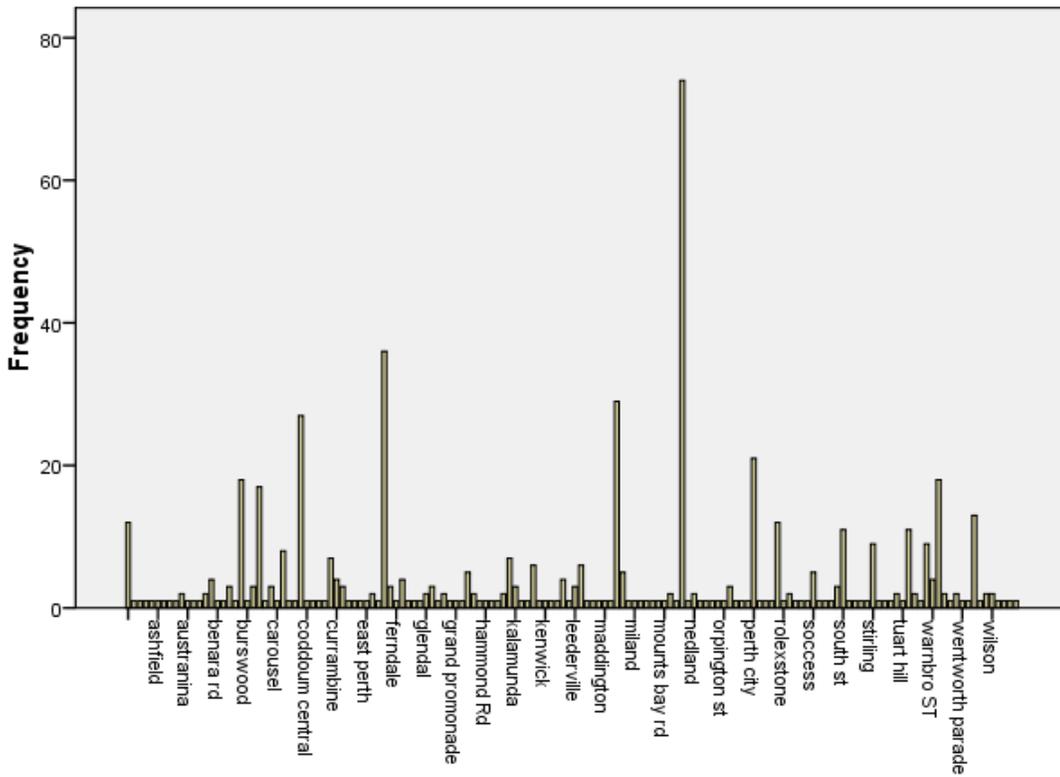
The travel survey developed for each selected train station was a similar version to that applied to selected adjoining bus stops.

In total, 550 Passengers were asked to report their first station boarded and last stations disembark for their one-way trip.

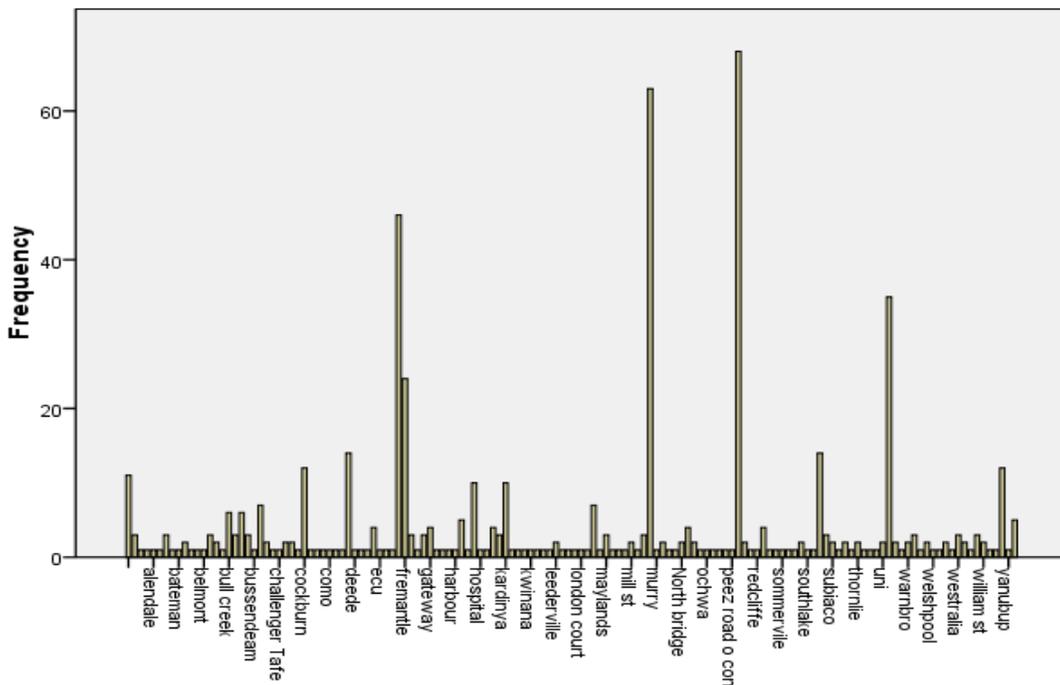
The survey consisted of twenty five questions, some with multiple parts. Most questions were multiple choices with an option of “Other”, if necessary. Open-ended questions were succinct and to-the-point, such as “What is your age last birthday?”, so that responses could be tallied straightforwardly.

Surveys were not considered to be valid if they did not report a “first” and a “last” station (which, of course, had to be different from the first station). Results for these distributions are:

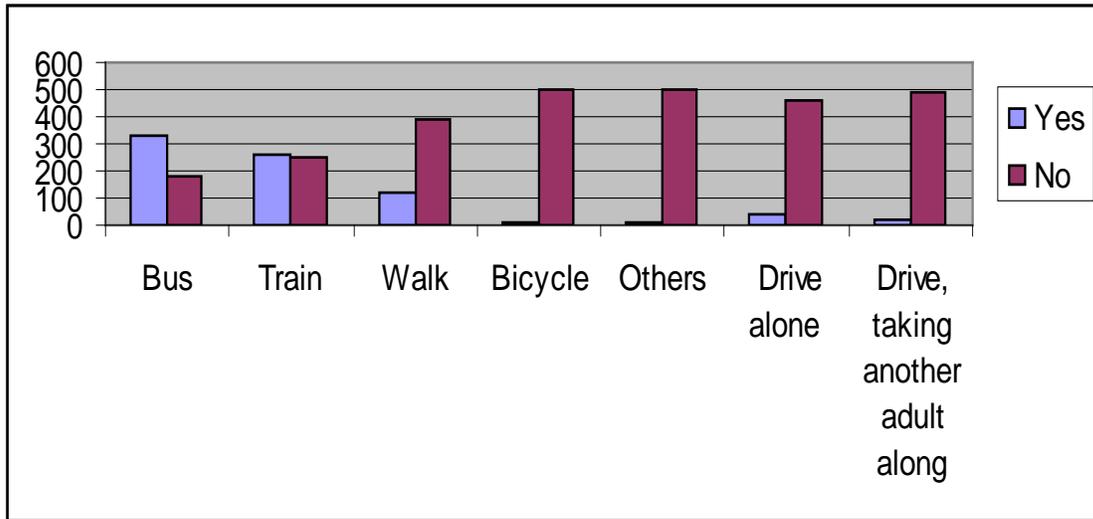
- **Origin:** On the New Mandurah Line, the distribution of station boardings was spread somewhat evenly across 3 stations, including Esplanade, Murdoch and Cockburn Central stations, nearly 10.1% of respondents stated they boarded at Esplanade (Perth City) either the Perth City Station (Murry St.); 13.6 at Murdoch Station approximately 8.5% at Mandurah Station. (See Table 3)



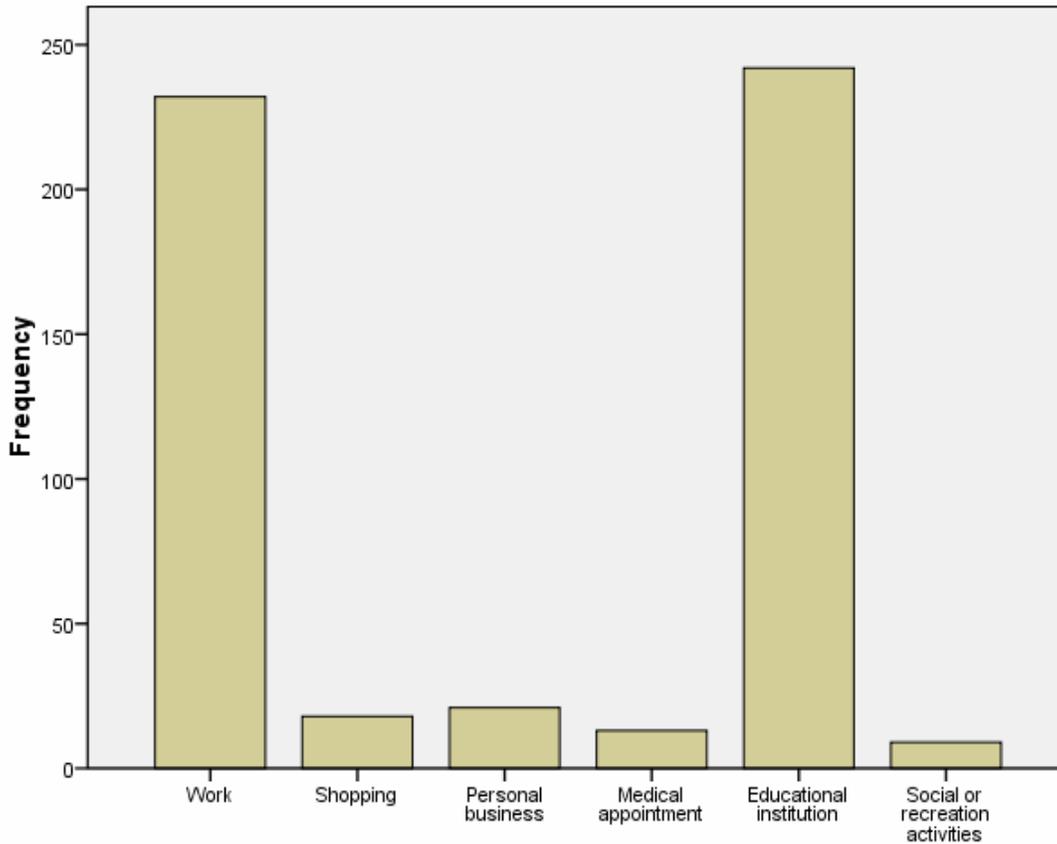
• **Destination:** for the new Mandurah Line, approximately 12.1% of all respondents stated they disembarked at Perth City Station (Murry St.); 11.6% at Murdoch Station and approximately 8.5% at Esplanade (Perth City) nearly 6.4% of respondents stated they disembarked at University of Western Australia bus stop. (See Table 4)



• **Method Travel Used:** Passengers reported they had driven to the station, less percentage (43.0%) of respondents stated that they don't drive car to the stations (54.0%). (See Table 5)

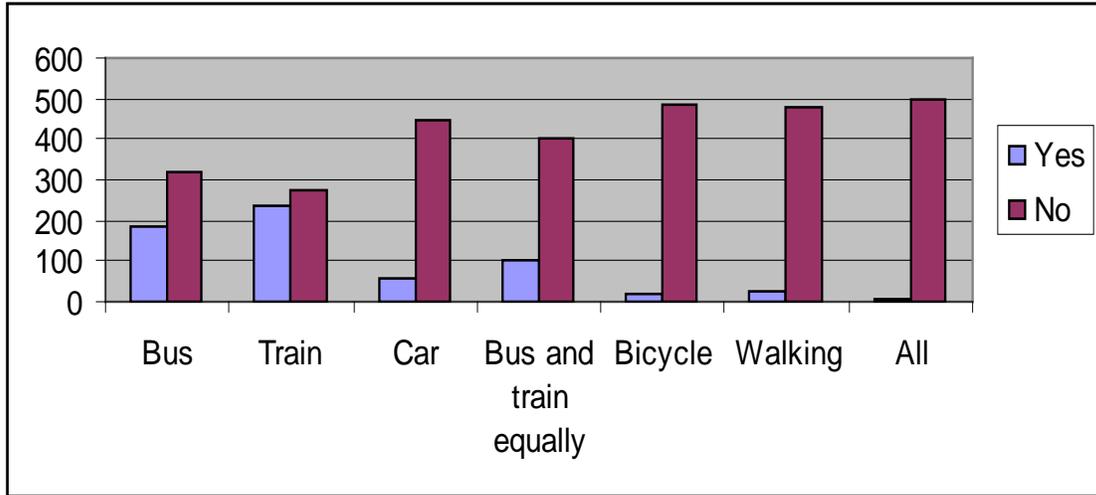


• **Trip Purpose:** Over 45.2% of all respondents stated their trip purpose was Education. In contrast, 43.4% stated their trip purpose was work. (See Table 6)



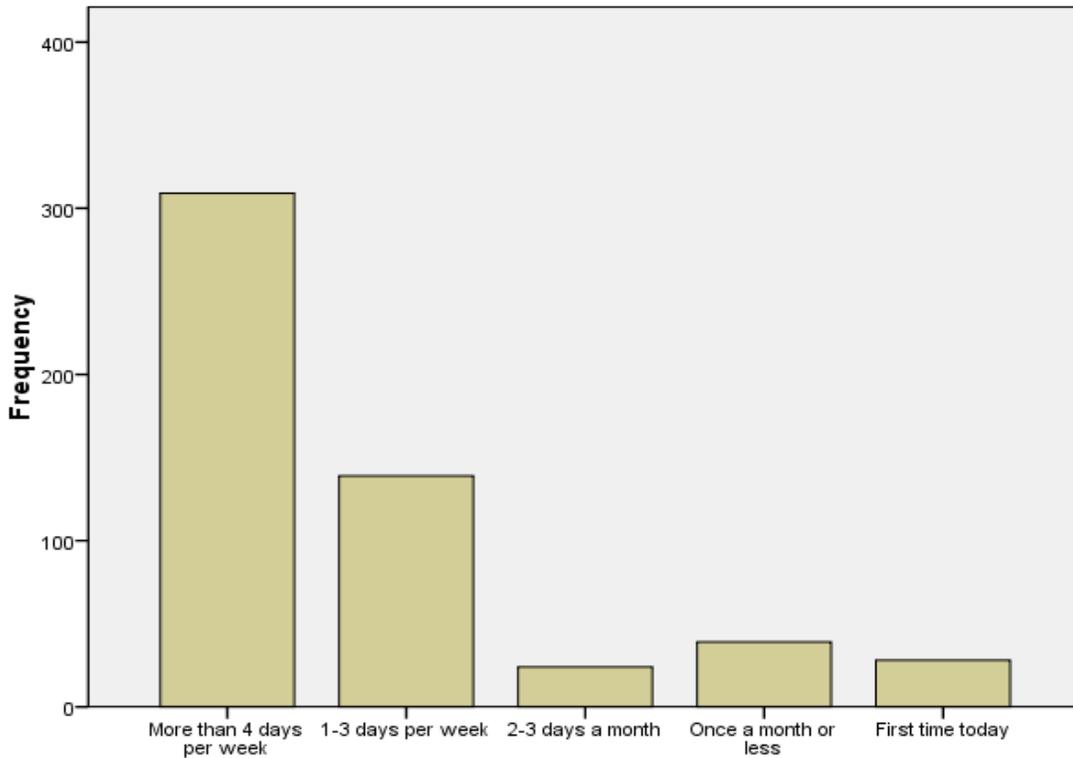
• Trip Method:

69.7% of respondents stated that the bus or train station was within walk distance of their point of origin, for the first bus or train on the trip. (See Table 7)

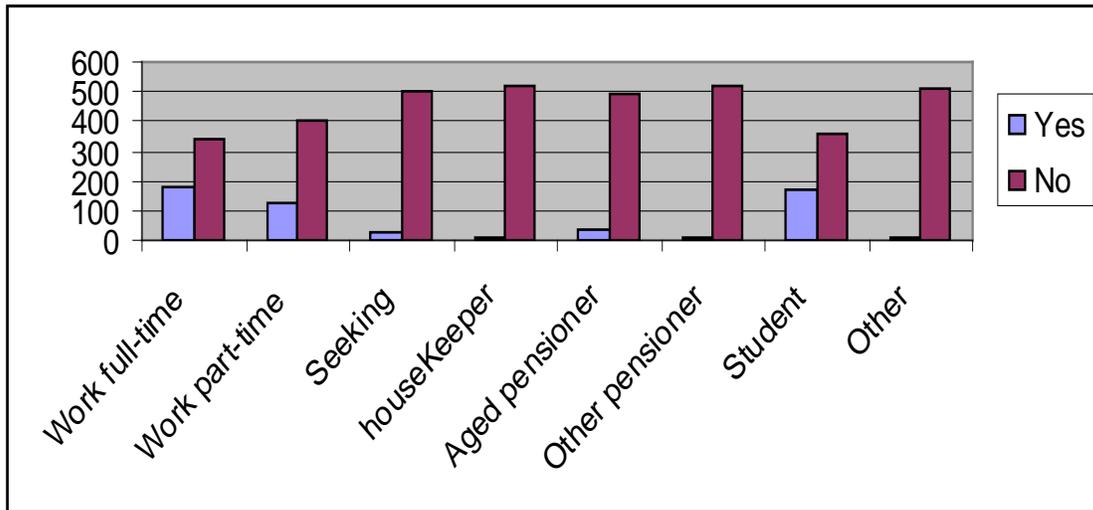


• Trip Frequency:

Approximately 26.7% of all respondents stated they rode the bus or train for their trip more than 4 days per week. An additional 25.7% stated they rode the train 3-4 days per week. (See Table 8)



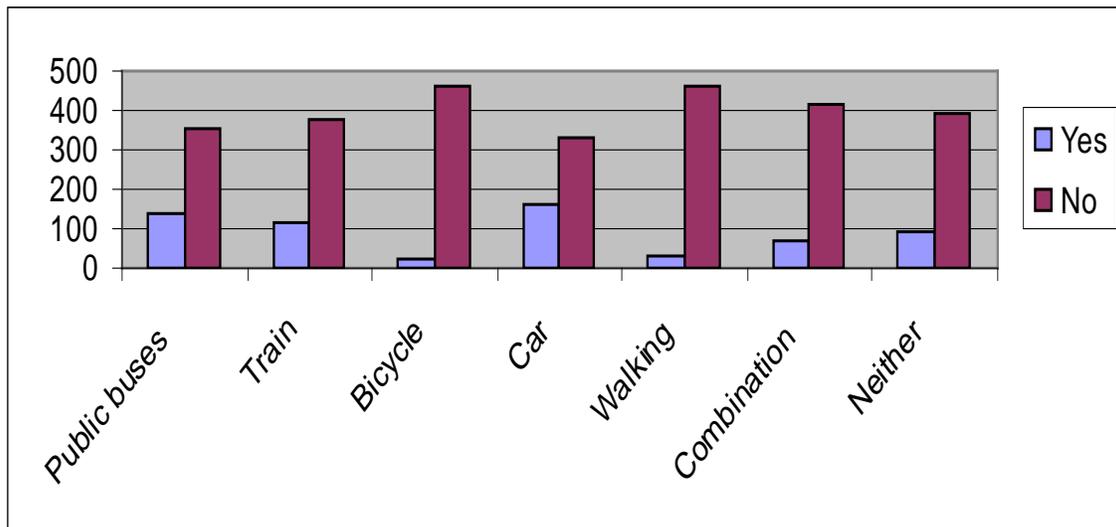
- **Employment Type:** 32.4 % respondents stated that they are employed full-time, 22.3% working part-time, 4.5% seeking work and 30.4 are higher education student. (See Table 9)



- **Demographic Characteristics:** The survey had a slightly higher percentage of 50.3% female Passengers than 49.7% of male passengers.

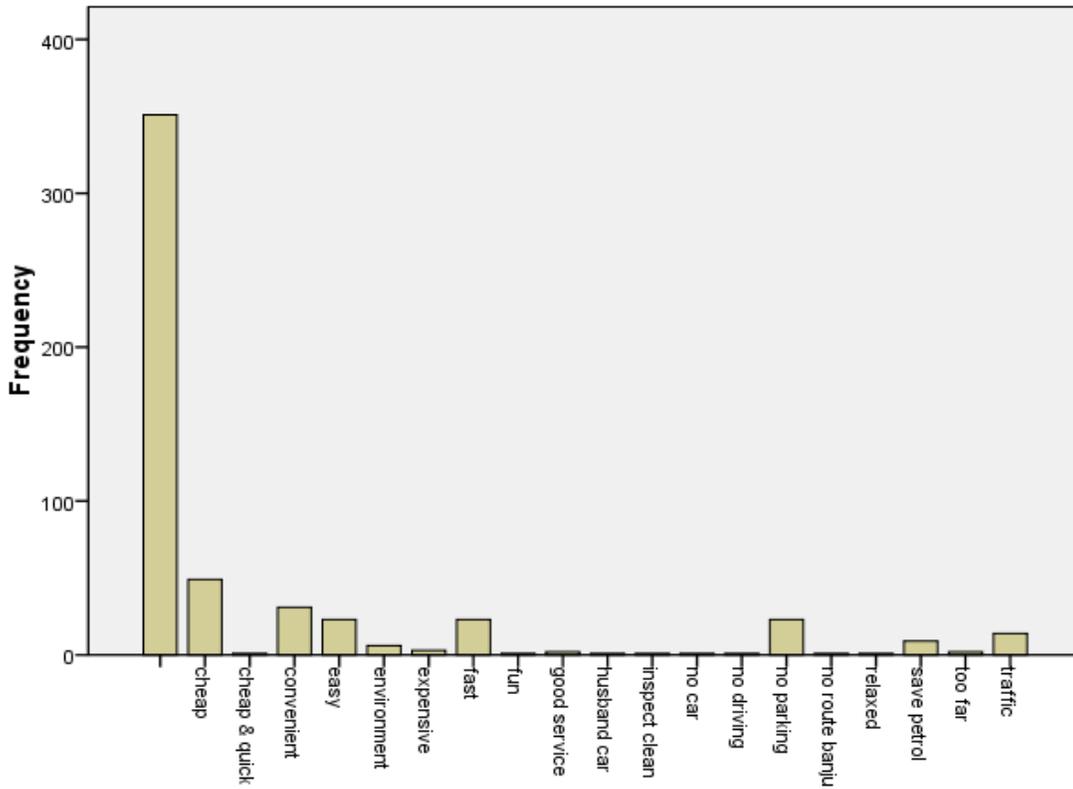
- **Household car ownership trip made:**

32.5% of respondents stated they were using cars in their households, with the majority using public transport - 27.8% using buses and 23.0 % using trains. (See Table 10)

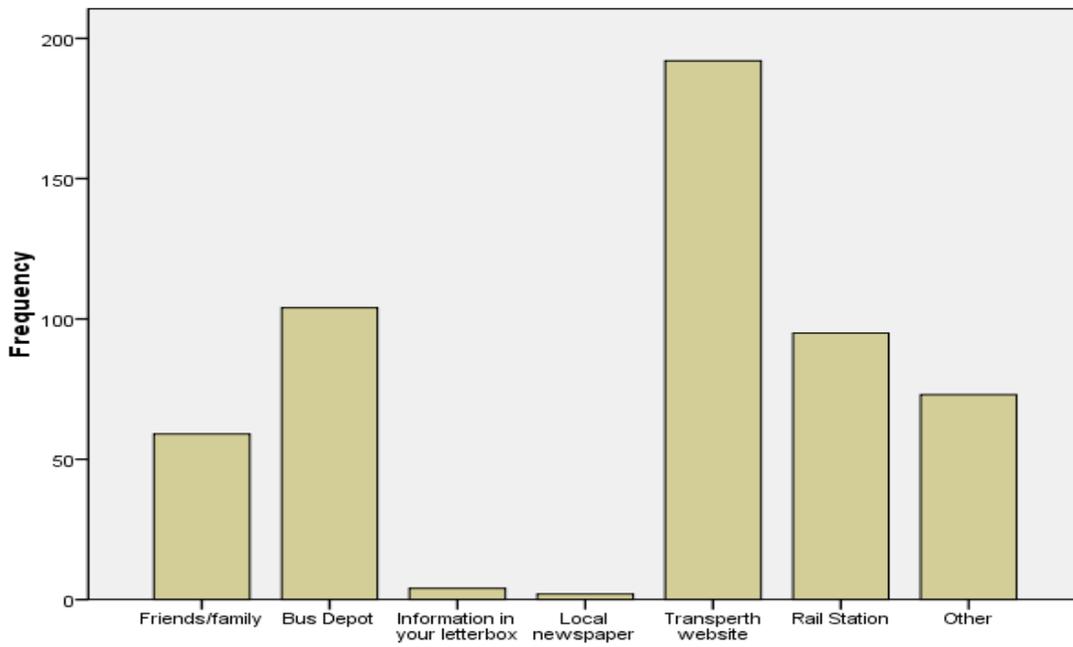


- **Information about train stations and reasons for using the public transport:**

- 64% of the respondents using public transport stated that the reasons for using the trains were; 9.0% cheaper, 4.4% easier, 4.2% faster, 4.2% no parking, 2.6% traffic, 1.7% saving petrol, 1.1% environmental and 5.7 convenient. (See Table 11)



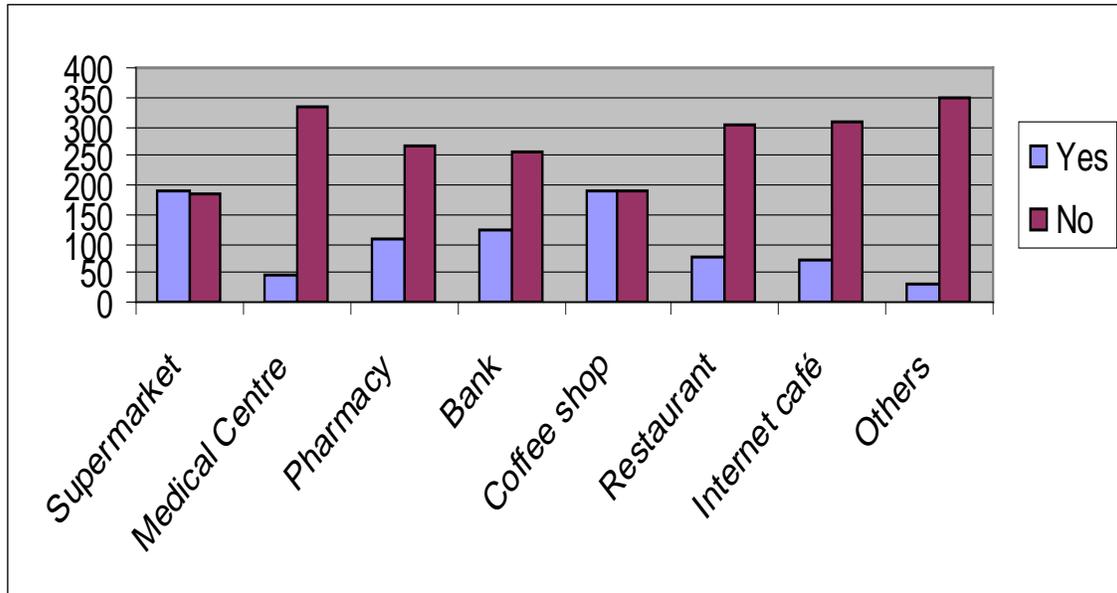
(b) 35.3% of the respondents used the PTA website to find information's about the trip time and 17.5 at the train stations and buses stops. (See Table 12)



• **Train Stations facilities and conveniences:**

- (a) 57.5% of respondents said they would like to live next to train station for transport convenience, In contrast, 42.5% said “No”.
- (b) 72.2% of respondents said they would like to see more shops at the train station, in contrast, 27.8% said “No”.

Table 13 below shows what kind of shops or convenience stores they would like to see at the train stations.



The New Mandurah Line served as the demonstration rail transit line for the south western metropolitan area and was envisioned as the core segment of a suburban rapid transit system. Development of a New Mandurah Line was, and continues to be, viewed as an integral link to achievement of smart growth and economic development goals by providing an opportunity to promote higher density, mixed-use development patterns in conjunction with rapid transit corridors and stations.

According to the Passenger Survey Results, it would appear that the New Mandurah Line is getting people out of their cars and reducing congestion:

- For most passengers on the 3 selected stations, the option of driving was available.
- Just over half of those surveyed reported that a vehicle was available to them even though they chose to use the train to complete their trip.
- Those that had previously driven and now take the train were asked if they had travelled on the new Mandurah Line. A majority had; indicating that the train is helping to reduce traffic congestion on this major artery as it is cheaper, faster and more convenient.

The New Mandurah Line and the 9 Stations Development was created to promote transit-oriented development in the City of Perth. The intent of this development is to encourage a mix of uses and activities near the train stations, which will serve the train users, visitors, area workers, and residents. A mix of uses is an essential element necessary to encourage the New Mandurah Line passengers, maximizing rail investment and area revitalization. The development describes land uses, urban design and economic development strategies around various stations in the City of Perth.

Further, it became clear that in addition to serving the overall intent of encouraging transit-oriented development, the New Mandurah Line would also provide the foundation for the revitalisation of the three selected Stations.

The New Mandurah Line included 9 stations utilising transit-oriented development practices and others serving as mixed-use commercial activity centres.

The Cockburn Central Station and Wellrad Station along the New Mandurah Line are both designed to be integrated into neighbourhoods with moderate residential densities and neighbourhood retail.

CONCLUSIONS:

This paper describes an analysis of survey data to identify the preferences of train and bus users. The analysis of the collected data shows that the train stations and bus stops should include:

- A shopping plaza around the rail station which is a focus point;
- A cafe, convenience retail store, child care facility, aged care facility, clinic, newsagent, pharmacy and ATM;
- Office employment facilities around the main shopping plaza;
- The provision of mixed-use employment attached to dwellings within residential areas;
- A network of well lit and overlooked footpaths/cycle-ways connecting with the main plaza;
- The use of trees and buildings along all footpaths to give pedestrians and cyclists a feeling of intimacy and security.
- Full and ready access for people with disabilities and the elderly.
- The provision of a park & ride facility near the station. This would accommodate patrons living beyond the TOD where no close alternative station site exists with an exclusive park & ride.
- Discouragement of automobile-oriented uses such as auto repair and service shops, box or shed retail, and drive-thru fast food within the Station Area.
- Priority for pedestrians and bicycles in building design and street layout.
- Establishment of residential density targets in Station Area Plans to provide flexibility and encourage a variety of development intensities and heights.

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