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**The effects of traffic congestion on Auckland commuters: An examination into the consequences and solutions of commuting stress for organizations.**

A thesis presented in a partial fulfillment of the requirements for the degree of Master of Arts in Psychology at Massey University, Albany, New Zealand.

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## **Abstract**

Auckland's roadways are choked for up to two and a half hours every morning as employees commute to their jobs. Car ownership figures reported for Auckland are high in international comparison, the number of private cars is rising faster than the population. A quasi experimental field study was conducted on 33 Auckland commuters, as a pilot, to assess the effects of traffic congestion on state stress and job performance, using the State Driver Stress Inventory and peer and self assessments. A direct link between traffic congestion and job performance has not been studied before, however previous research posits to a relationship between traffic congestion and task performance. This study expands on previous work by including average speed and number of obstacles in its definition of the independent variable impedance.

It was found that commuting by any mode of transport is regarded as stressful for some individuals. Heavily impeded participants had poorer peer ratings of performance. The State Driver Stress Inventory, travel logs, and behaviour bases observation scales received further validation and were found to be appropriate for New Zealand samples. Ways of minimising the impact of traffic congestion on commuters in the region are suggested. Limitations of the study and projected future investigations are discussed.

## **Acknowledgments**

This thesis has proved to be a huge eye opener into the realm of research. At times it has been unbelievably frustrating while at others completely satisfying. Watching the first person complete the questionnaire that I had thought about and agonised over, even dreamed about for so long was an exciting experience that I will not forget.

Thanks must first go to my supervisor, Gus Habermann, for being brave enough to take me on board and steer me through the rough patches. His foresight and persistence at the crunch have been invaluable to me. Thanks also to my incredibly supportive parents and to Carla, Barry and Craig for all their help.

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## 1. Introduction

It is 7.30 a.m. as you get into your car on a sunny Auckland morning. Now you wait. It's a good day and it only takes you 25 minutes to get onto the motorway. Now you wait. It's nose to tail for the 18 kilometre journey into your central city job. Now you wait. You try various things to ease the strain on your journey: you loosen your clothing; turn the radio on; change the station; open the window; shut the window; turn the radio up; turn the air conditioning on; change lanes to get ahead of the person next to you. And you wait. Forty-five minutes after getting on to the motorway you finally pull into your car park – an hour and 10 minutes after you left home. Now you are ready for that full 9 hours of work – are you?

An Ernst and Young report (2000) claims that Auckland's traffic congestion costs the region \$1 billion a year in delays, catch up costs and lost business, up from the \$750 million estimated in 1997 (New Zealand Herald, 25/3/2000). This figure can be expected to grow considerably when some ominous facts are taken into consideration.

Auckland is the largest, and fastest growing, region in New Zealand. Its population of 1.2 million people is expected to nearly to double over the next fifty years. Helping the Auckland population commute are 650, 000 vehicles, that is nearly one for every two people (Auckland City Council figures, 2001). This puts Auckland city's vehicle ownership per head in the top three in the world – and rising (New Zealand Herald, 17/4/2000). Currently annual traffic growth (4%) exceeds annual population growth

(2.5%). If the trend continues the number of cars on Auckland roads could double in the next twenty years.

Seventy-one percent of Aucklanders use their cars to commute to work, and as few as eight percent use public transport (Auckland City Council, 2001). These figures are even more disturbing when you consider that the use of public transport has actually decreased in recent times. Between 1986 and 1996, the number of trips to work for car drivers in the Auckland region increased by 21% and the number of trips by those using public transport decreased by 50%.

Compounding Aucklanders' increasing love for their cars is the current regional road network. Although the motorway system was conceived in the 1960's, it remains incomplete more than 40 years later. As it stands, it is 60 percent complete (Metro Magazine, November, 2000). Auckland now has a 2 ½ hour long traffic jam every morning from 7a.m. to 9.30 a.m. The Southern Motorway is beyond its intended capacity for much of the time between 7 a.m. and 7 p.m. (New Zealand Herald, 4/5/2000).

What are the consequences of this huge problem? The Ernst and Young report goes some way towards answering this question, but what of the effect on the people sitting in those cars for up to two hours every morning? How do they feel upon arriving at work and having to start an eight – (or more) hour day, after already slogging through heavy traffic? What are the consequences for the organizations employing these people?

Courier company SUB60s' General Manager, David Tombs, has reported to the New Zealand Herald (25/3/2000) that a "handful" of his courier drivers need counseling every year as a direct result of sitting in traffic jams. Alasdair Thompson, the Northern Employers' and Manufacturers' Association chief executive, has said "Auckland businesses reached exasperation point just over a year ago and congestion is now their number one concern" (New Zealand Herald, 25/3/2000). These are issues which have received little attention in the psychological literature.

### **1.1 Driving, stress, and work performance**

A review of research relevant to the psychology of transportation, reveals considerable work in the area of driver behaviours (Boyce & Geller, 2002; Hennessy & Wiesenthal, 2001; Deffenbacher, Lynch, Oetting & Yingling, 2001; Pinto, 2001; and Lundqvist, 2001) and causes of road accidents (Hingson, Heeren, Levenson, Jamanka, Voas, 2002; Marcil, Bergeron, & Audet, 2001; Lajunen, 2001; Strayer, Johnston, 2001; and Raithe, 2001). There is very little work published on the effects of driving in congested traffic per se. Evans and Carrère (1991) and Evans (1994) studied the impact of high levels of driving among bus drivers. It was found that bus drivers have excess rates of absenteeism; mortality; early retirement and stress related illness. A survey found that traffic congestion was one of the largest contributors to these problems.

Recently, in a study of college students, Rasmussen, Knapp and Garner (2000) found that students compared the stress induced while driving to that experienced when sitting end

of year final examinations. Of more relevance, some studies have concentrated on the effects of employees commuting to their place of work by private car.

Stokols, Navaco, Stokols and Campbell (1978) examined the cumulative effects of traffic congestion on the mood, physiology and task performance of private car commuters. The study used the word "impedance" to define the combined effects of commuting distance, commuting time, and number of months en route on the private car driver. It was found that impedance was significantly correlated with systolic blood pressure and a decrease in task performance. Further, those who had endured the most congestion were reported as having a higher level of annoyance upon arriving at work.

Ten years later, Schaeffer, Street, Singer, Baum (1988) considered the average speed of the journey as a contributor to impedance. Commuting to and from the workplace in a private car was conceived of as a stressor, and as in the earlier study driving to work was associated with significant increases in systolic blood pressure. More evidence for the relationship between traffic congestion and stress was presented by Gulian, Mathews, Glendon, Davies and Debney (1989) who defined driver stress by 5 factors. These were identified as: driving aggression; dislike of driving; tension and frustration connected with successful or unsuccessful overtaking; irritation when overtaking and heightened alertness and concentration. It was also found that variables outside those considered while driving, such as life stresses, are predictive of driver stress.

Hennessy and Wiesenthal (1997) measured both state and trait stress and found that driving in highly congested traffic conditions would result in higher state stress than driving in low congestion. Also, those who were more predisposed to stress, that is had higher trait stress, showed even further elevation in state stress than those who were lower in trait driver stress.

These studies have clearly illustrated that traffic congestion may negatively effect drivers of private vehicles who have to contend with heavily congested roads. However, while a number of these studies (for example, Schaeffer et al., 1988) have measured and briefly mentioned the impact this stress is having on task performance, such as comparable proofreading tasks and the Stroop Color Discrimination Task (Glass & Singer, 1972) and others have commented upon the possibility of this effect extending over to job performance, none has thus far tried to measure directly the impact the traffic may be having on employees' job performance when they arrive at work.

There exists little or no research into the effects of commuting on job performance globally. Further, there has been no appraisal of these relationships within New Zealand organizations. Yet, the impact of the traffic congestion is undeniable, "There are an awful lot of businesses, and not just big businesses, with a deep concern about commercial viability being detrimentally affected by gridlock." (Alasdair Thompson, the Northern Employers and Manufacturers Association chief executive, *New Zealand Herald*, 25/ 3/ 2000).

## 1.2 Significance of Research

The practical significance of this line of research lies in providing further options for enhancing productivity, or at least alleviating the negative impact of factors affecting performance at the workplace. Job performance can be influenced by various factors, both within and outside the organization. Factors within the organization, such as lighting, noise, and temperature, are easily controlled (Riggio, 1996). Those extraneous to the organization, such as traffic congestion, are not. However, the impact of the latter factors should not be ignored. Conversely, effects of variables “outside work” need to be accounted for, and organizations should take initiatives to minimise the costs of lost performance.

Based on press coverage, and personal accounts, regarding Auckland traffic problems, and some analogies from stress research in adjacent areas, it can be assumed that the effects of the traffic congestion on individuals are sizeable, and that the effects “flow over” into a person’s job performance during the rest of the workday.

Readers responding to a New Zealand Herald survey reported that their top two traffic annoyances were: frustration at sitting in tailback queues and increased travel time. (New Zealand Herald, 6/16/2000).

The linkages between traffic congestion, stress and job performance are not known. What is known is that traffic congestion can act as a stressor for some individuals (Gulian, et al., 1989; Hennessy and Wiesenthal, 1997; Evans and Carrère, 1991; Rasmussen et al.,

2000; Evans, 1994; Schaeffer et al., 1988; Stokols, 1978). Stressors result in physical, behavioural and physiological outcomes (Jex, 1988). The result of these effects include, increased heart rate, increased blood pressure, withdrawal and decreased effort (Riggio, 1996). By extension, can one not assume a link between traffic congestion, stress and job performance? There appears to be no formalised model to guide empirical research on those links. Therefore, a more accurate investigation into the relationships is certainly warranted.

This project will contribute, and is relevant, to job performance evaluation, employee well-being research, and stress research. This study will also extend previous findings by considering average speed and number of obstacles in the definition of the independent variable, impedance. Previous definitions were described as flawed, "Since impedance reflects resistance to movement from start to destination, a measure of how rapidly commuters move through the environment should be a better index of impedance than time or distance alone" (Schaeffer et al., 1988, p. 946).

The study will move towards determining whether the effects of commuting conditions on task performance (e.g. Stokols et al., 1978) are accompanied by behavioural adaptation, as questioned by Stokols et al.

Further, it is hoped that the results will be of use to all organizations in that the initiatives derived from the findings will enable organizations to minimise the impact of the traffic congestion.

## **2. Commuting Stress**

### **2.1 Definition of Stress**

As indicated above, various consequences of commuting on persons have been studied. Schaeffer et al. (1988, p. 954), state “There is converging evidence for a link between certain conditions of commuting by automobile and public transit and the occurrence of stress reactions.” It can therefore be concluded that commuting to and from work qualifies as a daily stressor.

Koslowsky, Kluger and Reich (1995) purport that organizational consequences of commuting, such as withdrawal, attitude change, and lowered performance are “logical” consequences of commuting due to strain rather than stress.

They argue that the terms stress and strain have not always been distinguished clearly. In the “correct usage” (p. 8), stress refers to a job stressor, the stimulus or cause of strain, which is the response to the stimulus. Therefore, in the present study commuting stress refers to the conditions and variables present in the commute to work, resulting in subjective strain responses (self-reports of poor performance).

This definition parallels a common definition of psychological stress in Lazarus and Folkman’s (1984) stress theory which defines stress as a relationship between person and environment that is appraised by the person as taxing or exceeding his or her resources and endangering the person’s well-being.

## 2.2 Mediator and Moderator Variables

As with stress in general, the effects of commuting stress are influenced by moderators and mediators. Individuals react differently to the same stimuli. Each person has a threshold after which strain is likely to result (Koslowsky, et al., 1995). At a basic level, some people prefer noise in their environment while others, silence; some are more comfortable at a warmer temperature, others in cooler. Some are not even consciously aware of their surroundings but these environmental conditions effect them nonetheless.

At a deeper level, an individual's locus of control and their perception of the events around them can moderate the relationship between stress and strain. Koslowsky and Krausz (1993) believe that it may be more important to consider a commuter's reaction to a commute than an impersonal "hard" measure such as the length of the journey or the average speed. Kluger (1992) also suggests that it is the predictability of the commute that may yield an effect. In this way, a commute that regularly takes 45 minutes may be seen as less stressful than a commute that can take between 10 and 45 minutes. For this reason, Kluger suggests a focus on the variance (standard deviation) of commute times as a stressor variable.

Control over the environment has been found to be a major intervening variable in the stress/strain relationship (Glass and Singer, 1972). According to Gulian et al. (1989), it is the loss of control that leads to the immediate interpretation of adverse driving conditions as stressful. In the commuting context, the element of control is tied in with the mode of

transport used to commute. For example, an individual in a private car has more control over temperature and noise, as well as the route taken, than a commuter on a bus.

Schaeffer et al. (1988) found, with regard to behavioural performance, that drivers who had a choice of routes to work performed more poorly under high impedance conditions than those drivers using only one route,  $F(1, 38) = 3.04, p < .09$ .

Lack of control can also be perceived as positive. The passenger on a train for example, does not have to concentrate on driving. The commuter is free to relax, perhaps finish off some work or even sleep. Taylor and Pokock (1972) found that those using private transport to commute, experienced far more negative effects of commuting than those who used public transport. Koslowsky and Krausz (1993) documented a correlation between commuting time and stress at .23 ( $p < .01$ ), for participants who drove to work as compared with .15 ( $p < .05$ ) for those who used public transport (p. 91). The results partially support the assumption that commuting by private car is more stressful than public transport.

The present study attempts to explore this relationship further by assessing control (via driver stress questionnaire). Koslowsky et al. (1995) distinguish actual control and perceived control. To reduce negative implications, actual control does not need to be exercised. If an individual believes that there is the possibility of control, this may be enough to decrease strain responses. Both have been found to be moderators (Landy, 1992). However, the influence of perceived control in moderating the commute-induced

stress/strain relationship is unclear. In other areas of stress research there is much evidence to suggest that perceived control moderates the effects of a variety of stressors on well-being, performance, and affective responses (Koslowsky et al., 1995). As commuting has been demonstrated to be a stressor, it is surprising to find inconsistent results. This research will add to this debate.

In the Novaco et al. (1991) study, gender was found to be a strong moderator. Women in the study reported their trip as being more negative than men. A similar effect was also found by Frankenhauser, Lunderberg, Fredrikson, Melin, Tuomisto, Myrsten, Heldman, Bergman-Losman and Wallin (1989) who showed that women took longer to “unwind” from the commute home after work. Koslowsky et al. (1995, p. 93) explain these findings by explaining the dual role of women as worker and home maker, “women, even in the more egalitarian society that exists today, are still the ones generally involved with family chores and as a consequence of the above, time pressures are more a part of life for women than for men.”

### **2.3 Commuting Stress as an Environmental Stressor**

As mentioned in the introduction, the environment in which the person commutes has the potential to be very stressful with noise, air pollution, temperature and possibly crowding all combining to influence the journey. Therefore it seems logical to class commuting stress as an environmental stressor that impedes one’s movement between two or more points, as suggested previously (Stokols et al., 1978).

Although commuting itself has rarely been listed explicitly as an environmental stressor, it fits easily into one of the many formulations that have been suggested for linking the stages between stressors and reactions in theoretical models of stress (Koslowky, et al., 1995).

Commuting can be conceived as one more variable whose potential influence exists before the beginning of the workday. It can be viewed in such models as “potential baggage” (Koslowky, et al., 1995, p. 38) accompanying the worker to the organization.

However, a stressor will not always result in strain. For some people, the opposite may be true in that it may bring a positive outcome. Koslowky, et al. (1995) report that “drivers will tell you that the time spent in the car on the way to work is the only time when they are able to think and plan their future activities.” Many people may indeed enjoy this time. However, it must be remembered that everyone must also have a threshold at which the stimuli become too much, leading to stress.

In conclusion, stressor stimuli do not affect all people in the same way. For some, a threshold is reached very quickly, while for others, it is never reached. Although the relationship between environmental stimuli and strain has received attention in the literature, inconsistent results hampered efforts to develop appropriate and conclusive models representing this relationship.

Individual differences in reaction to environmental stressors have been explained by moderator and mediator variables. The latter are postulated as having an effect on the stress/strain relationship. Whatever the specifics of the relationship, commuting impacts on individuals in terms how they operate at the workplace. Of interest to this study are the behavioural and emotional outcomes of commuting in some individuals.

## **2.4 Stress Models**

Numerous models of stress (occupational and other) have been outlined in the literature regarding different occupations and circumstances. This section will provide a brief review of some of those models.

Models of job stress originate from two distinct perspectives (Bliese & Halverson, 1996). The first of these, the “individual-level” perspective, regards individual differences as the key factor in determining how people will react to work environments. Conversely, the second perspective, the “nomothetic” perspective, focuses on the consistencies among people when they perceive and react to similar work environments.

Examples of models from the more prevalent individual level perspective, include the person-environment fit theory (French, Caplan, & Harrison, 1982), the transactional model (Lazarus & Folkman, 1984), and the facet model (Beehr & Newman, 1978). Bliese and Halverson (1996) observe that these models all assume that individual differences, such as those in abilities and beliefs, determine how a situation will be perceived.

The nomothetic perspective is conducive to examining similarities in how environments are appraised by humans. Nomothetic stress models assume that the environments themselves vary in how stressful they are.

The present study renders it difficult to determine commonalities between commuting environments (noise, light, pollution level), so a stress model based on individual differences is more appropriate.

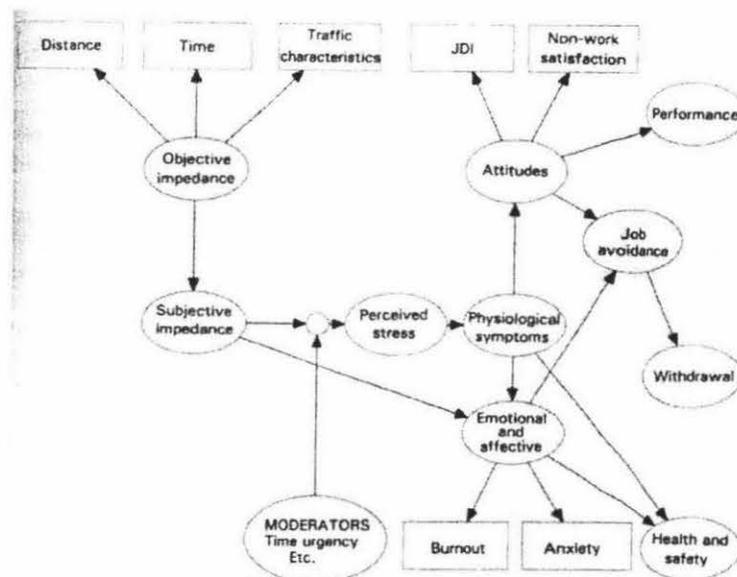
In their work regarding commuting and stress, Koslowsky et al. (1995), report on a model of multiple stressors based on the work of Broadbent (1971) and discussed by Landy (1985). The model proposes that when multiple stressors are present in an environment they may interact with one another to produce a different effect. The stressors may combine in three ways resulting in superadditive, linear or canceling effects (Koslowsky, et al, 1995, p. 56). The explanation of these effects is relatively straightforward.

Presented together, stressors may produce an interaction resulting in effects that are greater than, equal to or less than, what would be expected if the stressors were presented singularly.

This model is of some relevance to commuters, as they have little control of the environment which they find themselves in. This may result in noise, heat and time delays all occurring at the same time for a person sitting in private car (or on a public bus).

The demand-control model is another model pertinent to this study. The model suggests that limited decision making freedom and control in meeting the demands of the environment will result in strain for an individual. Sölderfeldt, Sölderfeldt, Jones, O'Campo, Muntaner, Ohlson and Warg (1997) conducted a multi-level analysis of the model with human service workers and concluded that organizational factors impacted on employees well being. Can the same be said for the commuter? An item regarding control in the commuting stress questionnaire in this study may lead to some conclusions.

Perhaps the most pertinent model for this research is that shown below by Koslowsky, Kluger and Reich (1995), whose work directly concerns the stress associated with commuting.



**Figure 1. Commuting Stress Model. Koslowsky, Kluger and Reich (1995). Commuting stress, causes, effects and methods of coping, p. 119, New York: Plenum Stress.**

Their individual-level model encompasses several other models from theories relevant to stress and commuting, such as those in social and industrial psychology. The model was substantiated by field and laboratory findings, to a degree.

This model is based largely on the Person–Environment model of stress, which insists that stress results from an imbalance between a person’s abilities and the demands placed upon them by their surroundings. It can be seen that this does indeed “provide a very adept description of what takes place in a commuting situation” (Koslowsky, et al., 1995, p. 110).

From a P-E perspective, the commuter sitting in heavy congestion has little ability to govern the situation, and the demands placed upon them by that situation. Linked to this, the expectation of the trip, built from previous commutes, is also included within the model. As an example, if a trip normally takes around 35 minutes, but for some reason has already taken over an hour, Koslowsky et al. believe it will become a stressful experience.

P-E fit theory in Koslowsky’s opinion, may be too broad for the purpose of modeling commuting stress. In the Koslowsky model, moderators are used to improve prediction. One of these, perhaps the most salient for those in traffic congestion, is time urgency. “Time urgency is one of the most critical moderator variables” (Koslowsky, et al., 1995, p. 110). The more “time aware” a commuter is, the more likely they will have a negative experience.

Of direct importance to this study, is the first stage of the model which contains a measure of impedance. The second stage concerns the forming of the subjective commuting experience based on an adaptation of the P-E fit model. The third stage in the model involves the first level of strain measure, perceived commuting stress. The next stage includes some of the physiological strain responses, the physical symptoms that tend to wear off over a short period of time, “usually with minutes or hours after finishing the commute” Koslowsky, et al., 1995, p. 122).

In the next stage, emotional and behavior problems are more prominent: mood changes; fatigue; anxiety; depression and burnout. As with the physiological symptoms these temporary effects can develop into long term psychological problems, which can include: attitudinal changes; job satisfaction; non-work satisfaction and organization commitment.

Attitudinal changes can manifest themselves as absenteeism, lateness and, in the final stage of the model, job avoidance. The section below shows how employees enduring longer commutes may leave an organization entirely in pursuit of better commute conditions. Therefore this model depicts well what is occurring in organizations well for the purposes of this research.

The overview makes it clear that this model is relevant to the current research. In particular, the stages concerning impedance, perceived commuting stress, physiological strain responses, physical symptoms, and emotional and behavior problems are most

pertinent. As Koslowsky et al. (1995, p. 124) point out, the model can “impinge on the organization in several ways” the health and safety of the employees, the employees performance and the effects of the home environment on the other two. The model makes the implications for organizations explicit. Employees’ health and safety, their effectiveness and implications for the efficient functioning of the entire organization are all at risk.

### **2.5 Significance of Traffic Congestion for Organizations**

The previous sections hinted at the significance of this research to psychological perspectives, especially Industrial/Organizational psychology. What of the importance of this research for the business community? Ommeran (2000, p. 15) uses the “Search Model” to describe the behaviour of workers in the labour market. The basic assumption of this model is that a job is characterised by the wage paid and the commuting costs, in terms of time and distance, for that wage. Essentially, workers take the distance they will be forced to commute into account when deciding upon a job. As seen in the psychology literature, Ommeran notes that the labour market literature too, has focused little on the location of the job, and the impact this has on employees.

However, it has been found that “Labour and residential moving and commuting behaviour are mutually dependent” (Ommeran, 2000, p. 23). Individuals with longer commuter distances are more motivated to change jobs. Further more, a job seeker is likely to seek a job with a higher wage if a potential job is at a larger commuting distance.

Ommeran's research with Dutch respondents in 1992 and 1993 yields more definitive results. It was found that commuting time and the probability of searching for another job are not linearly related, "If commuting time exceeds 50 minutes, the probability of searching for another increase sharply. Those with commuting times more than 60 minutes search about 50 percent more in the labour market than those who work nearby" (Ommeran, 2000, p. 171). Also, if commuting time increases from 45 to 60 minutes, the search response is likely to be much stronger than if commuting time was to increase from 30 to 45 minutes.

These issues become more pertinent each year in Auckland. Travel log reports from Aucklanders published in the New Zealand Herald stipulate that commuting time increases each year.

Policies aimed at reducing commuting will have positive effects for organizations in the long run as employees may obtain shorter commuting times, and perhaps cover distances at lesser costs. Therefore they are less likely to seek employment at another organization or location.

Another perspective taken by Immergluck (1998) suggests that organizations may be missing out on better candidates because of the higher commuting costs incurred for some people. Furthermore, commuting costs may result in those with a lower social economic status remaining unemployed, because they simply cannot afford transport to

job interviews. While the last issue is outside the bounds of this thesis it is worth mentioning as another example of the negative effects of traffic congestion.

Distances, commute times and socioeconomic barriers conspire to hinder employment opportunities. These effects may be particularly large for those members of the labour force who are young, lower-skilled or employed part-time. These groups could find the cost of commuting to more distant locations prohibitive, especially if low wages are offered. For higher-skilled workers, the opportunity costs of commuting may be higher but constitute a smaller percentage of overall wages than for low-skilled workers.

In a review of 30 articles concerning intra-urban spatial barriers to employment, Ihlanfeldt (1992) concluded that a five minute reduction in travel time increases the probability of employment by as much as 7 percent. Ihlanfeldt attributes 27 percent of the difference in employment rates between white and black youth to inferior physical access. Can the same be said in New Zealand for urban Maori youth? This question also deserves some attention, considering the traffic congestion in the Auckland region.

## **2.6 The Organizational Behaviour Consequences of Commuting**

The main types of behavioural outcomes associated with commuting are absenteeism, lateness, turnover, and changing levels of performance (Koslowsky, et al., 1995). Taylor and Pocock (1972) found that subjects who traveled more than 90 minutes to work showed a greater absence frequency than those who traveled less than 90 minutes. Martin (1971) concluded that for male workers, absenteeism was related to distance traveled, but not for female workers.

Another relationship studied is that between commuting distance and lateness. Those commuting over long distances are more likely to be late than those commuting over shorter distances. The reader will note that responses from respondents in this study (cf. Substantive Results section), most commonly cited lateness as a detriment to performance in the earlier portion of the day.

It has been postulated that turnover is related to commuting distance, as discussed earlier. The effects of commuting are probably moderated by other variables that have produced “contrary” results (Martin, 1971, p. 83). A question is used in the current research to gauge whether participants had, at any time, considered leaving their job due to problems commuting. Turnover may be thought of as a way of coping with commuter stress.

As stated earlier, studies have demonstrated a relationship between commuting and task performance. Schaefer et al. (1998) found that participants with high impedance or low commuting speed had lower scores on a proofreading task administered immediately after arriving at work than subjects whose average driving speed was higher. Following the Schaefer et al. study, the participants in the present study were required to complete the questionnaires as soon as they arrived at work, and performance was measured after the first hour of work.

Along with attitudinal and emotional effects, physical consequences of commuting have also been studied. These include back problems, cancer and cardiovascular problems. Such ailments, in turn have indirect effects on performance.

### 3. Aims and Hypotheses

Given that little is known regarding the impact of traffic congestion and job performance, the most general aim of this research is to increase our understanding of the linkages between modes of transport to work, stress and job performance. As reviewed in the Background section, there is an established link between traffic congestion and *task* performance. This project is intended to replicate, with modifications, some of the empirical research published overseas and examine if traffic congestion impacts on *job* performance of New Zealand employees. Specifically, the research targets psychological consequences of facing unfavourable transportation conditions and the ways these consequences are related to task performance in a job, analysed on a small sample drawn from a New Zealand work organization.

This research will be a pilot study to test whether further investigation into this relationship within New Zealand is warranted. With this in mind, a further aim of the present work is to see if the current instruments used in this area produce results which assimilate those found with samples from overseas. It is also hoped that Self and Peer ratings will be found to be an adequate tool for assessing job performance.

A final aim of this research is to provide recommendations for work organizations in New Zealand. The project is intended to clarify practical implications of being a participant in traffic under difficult conditions. Knowing more about these implications may assist employers to design and/or implement measures that may reduce the deleterious consequences of commuting and transport conditions, to work performed.

With these aims in mind it is hypothesised that:

- H1. Private Car commuters will experience greater impedance than those commuters using other modes of transport.
- H2. Stress will be induced while driving (as indicated by individual levels in state stress); this stress will transfer to the work environment.
- H3. A relationship will be found between impedance and state stress such that participants reporting higher impedance will have higher levels of state stress (driver stress) than those with lower impedance.
- H4. State stress and work performance will be related such that participants who have higher state stress will manifest lower performance than those with lower state stress.
- H5. Impedance and job performance will be related such that participants facing higher impedance will have poorer performance than participants with lower impedance.

## **4. Method**

This chapter documents parameters of data collection (analysis, including statistical options, will be reported in the Results chapter later). It begins with a description of the group of participants. A statement of research design is followed by the list of variables. Working definitions are given and procedures of operationalising each variable are characterized. Psychometric instruments used to measure the dimensions are explained. A separate section documents the timeline of data collection and the nature of procedure used to collect data. Finally ethical issues are discussed.

Further information on methods is provided in the Appendices.

### **4.1 Participants**

Thirty organizations around Auckland were contacted by letter and asked if they would like to participate in the study. Organizations and participants were presented with an information sheet detailing the finer points of the study, including the measurements that would be taken and their expected outcomes. Only two organizations responded. One was selected, based on its size and availability to participants.

In the organizational psychology literature, the term "sample" is regularly used in a broader sense, meaning a possibly small and often non-representative group of participants (not infrequently, a "convenience sample" that has been chosen on pragmatic grounds). In statistical sampling theory and generalisation theories, the use of the term is more restricted. In a tighter sense, the term "sample" can only be applied if a population

had been formally defined, a sampling procedure was used to draw a sample from the population, and the level of representativeness can be assessed. Logistic and practical constraints of a pilot study such as the current one make listing of members in a large population (e.g. all employed residents of Auckland), or execution of random sampling procedures, unviable. In the following, the term "sample" will be used in the more relaxed sense encountered in I/O psychology. The Discussion chapter returns to issues of limited representativeness and generalisability.

The sample came from a medium sized law firm in the central city. Thirty-four participants ranging in age from 19 to 70 and with a mean age of 37 agreed to participate. Of these, 47 % were male, 53% female, 38% were solicitors. The rest of the sample consisted of receptionists (6%), senior associates (9%), secretaries (9%), information technology staff (6%), management (8%), legal executives (6%), library staff (3%), law clerks (6%), consultants (6%), and accounts staff (3%).

Seventy seven percent of commuting trips were made by private car, 19% by bus, 2% by foot, 1% by taxi, and 1% by train.

The average length of commute was 15 kilometres with a range between 3 and 82 kilometres, while the average length of time using the same route was 32 months. Participants navigated an average of 12 obstacles per commute and travelled at an average of 48 kilometres per hour. Participants took an average of 29 minutes to commute with a range of 6 to 90 minutes.

## 4.2 Design

This study can be classified as a quasi-experimental field study. All participants underwent the same measurement, consisting of four parts that occurred over a week: travel logs; the State Driver Stress Inventory; a biographical questionnaire and performance assessment. These are summarised in the table below.

**Table 1. Variables and their Measurement.**

Variable	Measurement	Implementation Time
Impedance	Travel logs	Daily immediately upon arrival at work
State stress	State Driver Stress Inventory	Daily immediately upon arrival at work
Biographical information	Biodata questionnaire	On the first day of the study
Job performance	Behaviour based observation scales	Daily from 10.30 a.m.

## 4.3 Variables

### 4.3.1 Definition of Impedance

As stated in the introduction, Stokols et al. (1978) first used the construct “impedance” to operationalise the additive effects of an individual's commute to the work place. The original three factors (distance, time and months using the same route) have been expanded in this study, after Schaeffer et al. (1988, p. 955) stipulated that a more “rigorous” definition of impedance was needed, to include average speed and the number of obstacles (such as traffic lights and roundabouts) negotiated. Adopting Schaeffer et al.'s (1988, p. 946) definition that “impedance reflects resistance to movement from start to destination” a measure of how rapidly commuters travel (that is, average speed) should

be included. The same argument can be made for the inclusion of the number of obstacles in the calculation of impedance.

The greatest amount of impedance will result from travelling large distances slowly. As: distance; time; number of months on the route; and the number of obstacles encountered all increase and average speed decreases, impedance can be said to increase.

Therefore:  $\text{Impedance} = (\text{months on route} + \text{distance} + \text{time} + \text{number of obstacles}) - \text{average speed}$

#### *4.3.2 Definition of Job Performance*

The definition of what constitutes job performance has received much attention in the literature (e.g., Cambell, 1990; Cambell, McCloy, Oppler, & Sager, 1993; Conway, 1996; Murphy, 1989). Two common themes emerge from multiple definitions. First, the construct of job performance should not only represent any behaviour carried out by an employee but these behaviours should be directly relevant to the goals of the organization (Campbell, Ford, Rumsey, Pulakos, Borman, Felker, De Vera, & Riegelhaupt, 1990; McCloy, Campbell & Cudeck, 1994; Murphy & Shianella, 1997; Bush, Bush, Ortinau & Hair, 1990; Jex, 1998). The second theme is that job performance is multidimensional and as such should be measured through multiple procedures (McCloy et al., 1994; Katzell & Guzzo, 1983; Murphy & Shianella, 1997).

Research in applied psychology and business administration sought to provide models that may serve as a foundation to devising psychometric assessment systems (Fletcher, 1997; Gillen, 1999; Huber & Fuller, 1998; Wynne, 1997). Reliance on traditional

approaches has been challenged from the angle of contemporary psychological theories such as cognitive analysis (DeNisi, 1996), and Foucauldian constructionist assumptions (Findlay & Newton, 1996).

In their review of the literature, Murphy and Shiarella (1997, p. 826) concluded that the facets of job performance can be broken down into 2 main categories: (1) individual task performance; and (2) behaviours that create and maintain the social and organizational context that allow others to carry out their individual tasks. Clearly, traffic congestion can impact on both of these categories. As indicated above, it has been found that task performance is affected by traffic congestion and further that commuting results in feelings of anger and hostility towards others. These feelings may easily flow over into the workplace, resulting in poor inter-relations among employees as well as impaired teamwork, customer service and organizational citizenship (Murphy & Shiarella, 1997).

This impact on interpersonal relations is crucial considering that the use of teams and groups has increased in recent times. Although interpersonal aspects of organizational life may not be needed to complete each specific task, they are “absolutely necessary for the smooth functioning of teams and organizations” (Murphy & Shiarella, 1997, p. 827).

Some models of job performance have been devised in an effort to define dimensions common to all jobs. Within this study it was important to consider the particular culture and design of the organization. Some organizations may place greater emphasis on teamwork compared to individual facets of job performance or completion of tasks.

Consider, for example, the differences between a professional organization and a manufacturing organization. It was thus necessary to work closely with the sample organization in fine-tuning constructs of job performance.

For the purpose of this study, job performance is defined to encompass all the behaviours and actions, including interpersonal relationships, that are judged to be relevant to attaining the goals of the organization. This definition appears suitable partly because it recognises that job performance is multifaceted. The five dimensions in the performance ratings used within this study express this definition, in that they assume performance is not solely output-based, and account for the social or teamwork contribution of employees.

All the performance ratings for each participant (5 self and 5 peer, for each of the 5 days of the study) were used for data analysis. That is, performance ratings were not averaged, or summed over a day or week. However, the Total Performance variable is calculated as a daily average of the self and peer ratings of each participant.

#### *4.3.3 Definition of Traffic Congestion*

Traffic congestion, the high volumes of vehicles causing delay, can be conceived of in two ways, recurring and non-recurring. Recurring congestion is predictable in that it occurs during the same daily peak times or around the same locations (OECD Scientific Expert Group, 1994). This thesis will consider the recurring traffic congestion that occurs

on Auckland's motorways and streets from the hours of 7.30am to 9am every working day.

#### 4.4 Measures

##### 4.4.1 *Travel logs*<sup>1</sup>

Upon reaching their place of work, participants were required to complete a log of their commute. Such logs have been used in previous research and found to be a useful and simple method of obtaining impedance information (Schaeffer et al., 1988). The logs were completed each day as research suggests a single measure cannot fully capture the “complexity and interaction of feelings, thoughts, and behaviour patterns” (Hennessy & Wiesenthal, 1999, p. 420) experienced while driving. The log detailed the length of the journey (kilometres), the time taken (hours), average speed (kilometres per hour), time on route [that is, the length of time seen travelling the same way to work] (months), mode of transport, number of obstacles (such as traffic lights), and perceived level of congestion (measured on a six-point Likert scale), as well as demographic data.

##### 4.4.2 *State Driver Stress Inventory*

Along with the log books participants were required to complete the State Driver Stress Inventory<sup>2</sup>. The measure was developed by Hennessy and Wiesenthal (1997) to study the relationship between traffic congestion, driver stress and direct versus indirect coping behaviours. Permission to use the inventory was obtained from the authors. They report that the inventory was developed to assess the situation-specific experience of driver

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<sup>1</sup> A copy of the travel log appears in Appendix II.

<sup>2</sup> A copy of the SDSI appears in Appendix III.

stress, to show the impact of the traffic congestion that the employees feel at that moment they arrive at work.

The measure was constructed using the 11 items of the Driver Behaviour Inventory - General (Gulian et al., 1989) used in measuring trait driver stress, plus 10 items from the Stress Arousal Checklist of Mackay, Cox, Burrows, and Lazzarini, (1978). All items in the State Driver Stress Inventory are worded to represent state rather than trait measures of stress; for example, 'Trying but failing to overtake is frustrating me', rather than 'Trying but failing to overtake frustrates me.' The measure has demonstrated high reliability in both low and high congestion conditions. As discussed in a previous section, perceived control and time urgency are argued to relate to commuting stress, therefore three items intended to tap time urgency were included: ('I am in a hurry, 'I am concerned about getting to my destination on time', and the reverse keyed item 'I have a flexible time schedule). One item tapped perceived control ('I feel I have control of this situation').

In the present study the inventory was modified further, converting the original scale range of 0 to 100 to Likert scale from 1 (strongly disagree) to 6 (strongly agree) to indicate the extent to which participants agreed that each item pertained to their experience in the present driving situation. Six-point scales were used as many people have difficulty in making meaningful distinctions if they are asked to handle more than seven categories (Fletcher, 1993). Six points will also force participants to make a rating

that points clearly to the upper or lower half of the scale. Specific instructions were given asking the participants to rate how they feel at that time following their commute.

#### 4.4.3 *Performance Measurement*

Participants were asked to assess their performance, and had their performance rated by a peer or (if appropriate) a supervisor. In a study of construct validity of multiple job performance measures the results revealed that self, supervisors, and peers can be equally valid as sources of performance information. It also showed the importance of collecting performance data using multiple methods of measurement (Vance, MacCallum, Coovert, Hedge 1988).

Behaviour Based Observation Scales, BOS (Smith & Kindall, 1963) were developed from job descriptions and discussions with the Human Resource Manager<sup>3</sup>. These scales provided the rater with statements of behavioural standards, that is actual examples of employee behaviour, against which ratees' observed behaviour can be compared, then ranked on a 5-point Likert scale.

Working with the sample organization, examples of what constitutes effective and ineffective job performance were obtained from the Human Resource Manager and from job descriptions. This involved a rudimentary job analysis (examining how the component tasks in each job are done, for example the order the tasks are done in, the skills needed, and when the tasks are performed and why). This analysis yielded

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<sup>3</sup> A copy of the general structure of the BOS appears in Appendix IV.

examples which were grouped into a series of separate performance dimensions for each different job.

Participants were rated on five dimensions: dependability; core task proficiency; organization commitment; team work/social contribution; and innovation. Core Task Proficiency concerned quantity, quality, and accuracy of output as well as customer service. This dimension was different for each position covered in the study. For example, the Administration Manager had a distinct set of behaviours on which to be rated by the Human Resources Manager. The remaining four performance dimensions were constant across all job titles (for example, a secretary should show the same level of commitment to an organization as a solicitor).

Bradley and Pursley (1987) found that the resulting factors from such a performance evaluation provide “meaningful” (p. 43) links to what subordinates and supervisors see as relevant job-related factors, assuring validity.

#### *4.4.4 Biodata/ History Sheets<sup>4</sup>*

This consisted of standard questions regarding age, sex, and position within the organization. It also asked if the participant had any disability which affected their travel arrangements, to ensure that the impedance calculation of any disabled participants was not confounded. The history sheet also contained a very brief “qualitative” question regarding whether participants believed their performance had been affected by traffic

congestion in the past, and whether they had considered changing jobs because of traffic congestion. The question was included because Ommeran (2000) has found that some commuters consider changing a job for another that has a shorter commute time.

#### **4.5 Performance Assessment: Self and Peer Review Issues**

Job performance within a professional organization does not lend itself easily to performance measurement. The difficulty is due to several aspects of the nature of the organization, jobs, and tasks performed by job holders. A key issue is choice of dimensions or variables to measure in order to appraise performance (Huber & Fuller, 1988; Wynne, 1997). These variables cannot be measured by simplistic approaches to ‘hard data’ as performance in such an organization does not tend to produce countable, “objective” output. Furthermore, the characteristics of existing job performance that could be embodied in rating scales are disputable. Finally, it is not immediately evident which levels of performance certain job-related tasks constitute lower, average, good, or excellent performance (Fletcher, 1997).

Hoffman, Nathon and Holden (1991) comment that performance ratings must be behaviorally based in order to meet legal standards and legal precedents. For this reason, a more “subjective”, behaviour-based performance measurement was utilised in this study.

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<sup>4</sup> A copy of these appear in Appendix V.

A typical professional organization is characterised by a combination of standardisation and decentralisation<sup>5</sup> (Robbins & Barnwell, 1994). This arrangement results in high levels of autonomy rather than multiple levels of bureaucracy. The only part of the organization that is fully elaborated is the support staff. Secretaries, wordprocessors, librarians and IT employees all have a direct line of authority whereas Partners in a law firm do not. Accordingly, peer and self rather than supervisory ratings had to be used, rather than some objective measure of performance.

The questions of whether employees in general are capable of objectively assessing their job performance, and whether peer evaluation of performance is psychometrically sound, have been widely debated (Huber, Neale, & Northcraft, 1987). Individuals differ in their ability to self-monitor their activities at the workplace, and faithfully assess their own performance (Jawahar, 2001). Miller studied self-monitoring and level of satisfaction in groups of professional employees relatively similar to our participants.

Specific studies addressed the validity and reliability of self and peer ratings as means of performance appraisal. In many cases, interpretation of findings on psychometric validity and reliability was optimistic (Shore, Shore & Thornton, 1992; DeNisi & Stevens 1981; Fox, Ben-Nahum, & Yinon, 1989; Huber, Neale, & Northcraft, 1987; Kane & Lawler, 1978; Landy & Farr, 1983; Wexley & Klimoski, 1984). As Bowman (1999), states, “[B]ased on the belief that the employee has important insight about how the job should be done, self-appraisals can provide valuable data...” (p.565). Furthermore, self-assessments and co-worker ratings together can be used as a “powerful tool” for

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<sup>5</sup> The sample organization’s structural design appears in Appendix I.

individual behaviour change in that they increase an individual's self-awareness (Church, 1997, p. 984). Saavedra and Kwun (1993) posit that since peers are active participants in the workplace, they may report observations that differ from those of a disinterested, passive observer. Similarly, Murphy and Cleveland (1991) posit that behaviours observed by peers are both qualitatively and quantitatively distinct from those observed by supervisors, because peers see diverse and dissimilar behaviours.

Mabe and West's (1982) review of research on self-reported abilities found correlations with a variety of criteria.

The relationship of peer-and self-assessment with other ratings has mainly concentrated on supervisory ratings. Peer and supervisory ratings were found to correlate highly in Harris and Schaubrock's (1988) meta-analysis. Farh, Werbel and Bedeian (1988) found large and similar multiple correlations for self and department chairperson (supervisor) ratings of faculty members with four performance measures, as well as a .78 correlation between self and chairperson ratings.

The reluctance to use self-assessments seems largely due to concerns that people will not be capable of making accurate self-assessments if they tend to present themselves in self-enhancing and socially desirable ways. (Analysis of the data obtained will reveal whether this has occurred in the current study.)

While it can be seen that some moderate to strong relationships have been found, some researchers believe otherwise. Church (1997), for example, reports that an expected correlation between self and others seems to be about .30, representing 9% of shared variance in the rating process. It is possible to argue that given the 91% of variance unexplained by this process, the relationships are marginal. However, the fact that there is any convergence in ratings at all is encouraging.

#### **4.6 Procedure**

All participants were presented with an information sheet and consent form<sup>6</sup> and given ample opportunity to ask questions. Those interested in participating were assigned a five digit number to ensure confidentiality. Data collection took a week. Each morning employees were asked to report to the cafeteria where they completed the travel log and the State Driver Stress Inventory (SDSI), in that order, with specific instructions to consider only the commute they had just made in answering the questions. On the first day (Monday) only, participants completed the biodata sheet.

After respondents returned the log and SDSI they were given their Behaviour Based Observation Scales (BOS). One of the BOS was labelled "Self", to be completed by them; the other was labelled "Peer", to be completed by a peer, or in some instances a supervisor as instructed. When the participants were handed the BOS's they were requested to complete them at 10.30 a.m. and they were further reminded by an email at 10.15 a.m. The BOS's were collected from 10.30 a.m. onward.

A major methodological concern is the short-term oscillation of levels in the variables relevant to this research. Perceptions such as those regarding a daily trip to work, and stress levels (only state rather than trait stress was measured) can change in a short term, distortions in memory functioning may also impact on measuring these variables. The possibility that some of these perceptions change within a short span of time governed the decision to collect data immediately after the employee's arrival at the workplace.

The accurate time course of transportation and stress affecting work performance is also unknown. Some effects may develop in the first hour or half an hour of a work day, others persist for a full day, still others may be cumulative and may be detected in performance over months or years. Consequently, the decision when to measure job performance as a dependent variable is non-trivial. Novaco et al. (1990, p. 255) found that "the arousal inducing, mood-affecting consequences of the commute to work carried over to our mid morning testings." This lends some support to the option to take performance ratings as early as possible each day, after job related activities were actually undertaken by the employee. A rating given at 10 o'clock was deemed appropriate to capture performance levels (e.g. decline due to impedance if such existed).

#### **4.7 Ethical Issues**

The study did not pose difficult ethical issues. However, the act of measuring performance may raise concern of privacy. Employees would have been wary of reporting truthfully if they felt it would show them not performing adequately. Further,

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<sup>6</sup> A copy of these appear in Appendix VI.

they might presume that their employers will more than likely wish to see the data to compare them to their own, and see who is performing “to” their abilities.

These issues were discussed with the participating organization and the employees. Employees had to sign an "Agreement to Participate" form in order to give their fully informed consent. The employer's impression that the study may bring benefit does not entail that employees be willing or confident in participating. This was explained to both the employees and the employers, ensuring that no participant feels coerced in any way into participating.

The research procedure and data analysis was clarified for all participants, supervisors where appropriate, and organization, by way of a fact sheet. They were informed of the unobtrusive nature of the surveys and log books. They recognised they had the right to leave the study at any time, and they were under no obligation to complete the study in full.

Participants were asked to complete a permission form stating that they understand the nature and purpose of the study and that they give the researchers full permission to use the data gained from the study in publications and further research in the same area.

No participants in the study were under 18 years of age, so acquiring consent caused no particular problem.

Each participant was identified by a numbering system to ensure confidentiality and anonymity. Further, all the data from the study are kept in a locked drawer in the principal researcher's office for 12 months after the completion of the study, and then destroyed. Only the thesis supervisor and the principal investigator will have access to this information.

Participants were not paid, but they were offered vouchers to compensate them for the time and effort they expend by participating. This is common practice in all forms of social research. It was made clear to the participants that the vouchers would be presented regardless of whether they complete the study in full, it is assumed therefore that the vouchers were not perceived as an incentive to complete the study but rather as post hoc facto compensation.

Participants were given ample opportunity to ask questions in all stages of the study.

## **5. Results**

This chapter presents the empirical findings of the research under two main headings. The first section, 'Methodological findings' outlines some results that relate to the properties of the data collection procedures (and in particular, measuring instruments) applied to the data set generated in a New Zealand organization. Further, it describes univariate distributions of some primary variables, transformations applied to those variables and index generation procedures leading to composite indices.

While these findings are not meant to provide a direct answer to research questions, knowing about such properties of the data collection instruments and variables is a prerequisite of testing the hypotheses. In this sense, results documented in the initial section are directly relevant to the main objectives and to hypothesis testing.

The second, longer section, presents the 'Substantive findings'. These are the numerical results addressing the research questions that relate to effects of commuting to work, and relationships among transportation, stress, and job performance dimensions. A major part of this section presents findings from testing the hypotheses formulated in the Aims and Hypotheses section above.

### **5.1 Methodological findings**

As a first stage of data processing, frequency distributions of both primary and secondary (derived) variables were checked. Univariate results have some psychological relevance in themselves (e.g. they inform about degree of impedance of our commuters). More

importantly, these findings guide application of statistical procedures in hypothesis testing.

The following sections report some of the univariate distributions, beginning with job performance, and continuing with impedance and stress dimensions.

Table 2 displays the daily average (out of a maximum of 5) performance rating generated by the BOS, for both self and peer ratings. Interestingly, although all the ratings remain fairly constant throughout the week, the peer ratings have a negative trend whereas the self ratings do not. The table also shows that self ratings tended to be lower than peer ratings.

**Table 2. Daily BOS Means and Variances.**

	Monday	Tuesday	Wednesday	Thursday	Friday
Self Rating – Dependability	Mean: 4.02 Variance: .38	Mean: 4.04 Variance: .24	Mean: 3.98 Variance: .42	Mean: 3.86 Variance: .50	Mean: 3.89 Variance: .25
Self Rating - Core Task Proficiency	Mean: 4.03 Variance: .34	Mean: 4.00 Variance: .21	Mean: 3.95 Variance: .27	Mean: 4.03 Variance: .22	Mean: 3.97 Variance: .20
Self Rating - Organizational Commitment	Mean: 4.22 Variance: 3.36	Mean: 4.24 Variance: .23	Mean: 4.35 Variance: .36	Mean: 4.27 Variance: .23	Mean: 4.36 Variance: .24
Self Rating - TeamWork/ Social	Mean: 4.15 Variance: .58	Mean: 4.10 Variance: .23	Mean: 4.19 Variance: .33	Mean: 4.07 Variance: .20	Mean: 4.18 Variance: .23
Self Rating - Innovation	Mean: 3.95 Variance: .56	Mean: 3.85 Variance: .43	Mean: 3.88 Variance: .49	Mean: 3.89 Variance: .36	Mean: 3.92 Variance: .48
Overall (Average) Self Rating	Mean: 4.07 Variance: .34	Mean: 4.05 Variance: .17	Mean: 4.07 Variance: .27	Mean: 4.03 Variance: .18	Mean: 4.06 Variance: .17
Peer Rating -	Mean: 4.31	Mean: 4.18	Mean: 4.22	Mean: 3.99	Mean: 4.11

Dependability	Variance:	.39	Variance:	.21	Variance:	.54	Variance:	.52	Variance:	.44
Peer Rating - Core	Mean:	4.19	Mean:	4.18	Mean:	4.03	Mean:	3.80	Mean:	3.75
Task Proficiency	Variance:	.55	Variance:	.35	Variance:	.50	Variance:	.63	Variance:	.50
Peer Rating -	Mean:	4.50	Mean:	4.29	Mean:	4.25	Mean:	4.20	Mean:	4.20
Organizational	Variance:	.37	Variance:	.35	Variance:	.33	Variance:	.46	Variance:	.41
Commitment										
Peer Rating -	Mean:	4.43	Mean:	4.3	Mean:	4.34	Mean:	4.21	Mean:	4.00
TeamWork/ Social	Variance:	.38	Variance:	.28	Variance:	.39	Variance:	.34	Variance:	.36
Peer Rating -	Mean:	4.28	Mean:	4.13	Mean:	3.94	Mean:	4.17	Mean:	3.84
Innovation	Variance:	.36	Variance:	.41	Variance:	.39	Variance:	.49	Variance:	.44
Overall (Average)	Mean:	4.34	Mean:	4.22	Mean:	4.16	Mean:	4.07	Mean:	3.98
Peer Rating	Variance:	.32	Variance:	.26	Variance:	.33	Variance:	.32	Variance:	.30

Table 3 shows the total average (that is over the entire data collection period) ratings of job performance for both the self and peer ratings. Interestingly, self ratings of performance are lower than peer ratings suggesting self presentation biases may be minimal.

**Table 3. Total Average Self and Peer Performance Ratings.**

	Mean	Variance
Self Rating – Average Rating Overall	4.06	.23
Peer Rating – Average Rating Overall	4.17	.31

Table 4 shows the total averages (out of a possible range of 1 to 5) for the six factors of the SDSI. The six factors all appear reasonably similar and with acceptable variances.

**Table 4. Total Averages of the SDSI factors.**

	Mean	Variance
Time Urgency Factor	3.78	1.30
Control Factor	3.59	2.80

Manipulation Check Factor	3.68	2.86
Negative Mood Factor	2.43	1.28
Positive Mood Factor	3.16	1.49
Predisposition to Stress Factor	2.83	1.02

Initial normality checks of the variables suggested that the Impedance data were not normally distributed. Although normal distribution is often not found in samples of such size, the impedance figures were found to be largely uneven in their distribution compared to the other variable data. For this reason, a logarithmic transformation of the impedance data was performed. The table below shows that the log transformation resulted in reduced spread of the data, with the standard deviation and variance figures moderately changed to resemble characteristics of the other variables. This analysis suggested the data were suitable for further investigation.

**Table 5. Descriptive Statistics.**

	SDSI Score	Self Rating	Peer Rating	Overall Performance	Impedance	Log Impedance
Std. Deviation	3.4781	.4275	.5543	.9169	43.1729	1.071
Variance	12.0969	.2233	.3073	.8408	18863.903	1.1472

Some limited validity and reliability checks were viable (within the constraints imposed by a small non-representative sample). These shed further light on the status of subsequent findings. They also assist in showing that the psychometric tools and indices, originally developed overseas, are workable in a New Zealand organizational environment (and can generate results comparable to those found in previous studies overseas).

### *5.1.1 State Driver Stress Inventory*

Hennessy and Wiesenthal (1997) reported high reliability for most SDSI scores.

Cronbach's alphas for the overall stress score are .97 and .95 for low and high congestion states, respectively. The adjusted inventory used within the study (with Likert scales implemented) yielded a Cronbach alpha of .59 which is marginally acceptable but lower than overseas estimates for the same instrument. Correlational analysis of the instrument (Hennessy & Wiesenthal, 1997) showed that some factors are significantly correlated up to the  $r = .70$  level.

### *5.1.2 Job Performance*

As described in the Methods chapter, the study relied on a performance appraisal system involving 5 separate constructs of job performance. These constructs and the corresponding ratings scales only have an instrumental role, as the aim is to generate and use a total indicator of job performance (e.g. in testing the relevant hypotheses).

However, given that these aspects have been selected by the researcher's decision, and the instrument is used on a new sample, the question whether the lower-level performance constructs are related is relevant in itself.

Correlational analysis was used to explore the extent to which the 5 job performance facets may be related, and the particular patterns of interrelations. An inter-correlation

matrix of the 5 variables was first generated for self-ratings of performance (findings in Table 6). The same type of matrix was then produced for peer ratings (Table 7).

**Table 6. Correlations of Self Ratings of Performance.**

		Self Rating - Dependability	Self Rating – Core Task Proficiency	Self Rating – Organization Commitment	Self Rating - Teamwork/Social	Self Rating - Innovation
Self Rating – Dependability	Pearson Correlation	1.000	.614**	.565**	.498**	.568**
	Sig. (2-tailed)		.000	.000	.000	.000
	N		124	124	124	124
Self Rating - Core Task Proficiency	Pearson Correlation		1.000	.614**	.636**	.750**
	Sig. (2-tailed)			.000	.000	.000
	N			124	124	124
Self Rating – Organization Commitment	Pearson Correlation			1.000	.522**	.686**
	Sig. (2-tailed)				.000	.000
	N				124	124
Self Rating – Teamwork/Social	Pearson Correlation				1.000	.605**
	Sig. (2-tailed)					.000
	N					124
Self Rating – Innovation	Pearson Correlation					1.000
	Sig. (2-tailed)					
	N					

\*\* Correlation is significant at the 0.01 level (2-tailed).

**Table 7. Correlations of Peer Ratings of Performance.**

		Peer Rating - Dependability	Peer Rating – Core Task Proficiency	Peer Rating - Organization Commitment	Peer Rating - Teamwork/Social	Peer Rating – Innovation
Peer Rating – Dependability	Pearson Correlation	1.000	.651**	.654**	.595**	.544**
	Sig. (2-tailed)		.000	.000	.000	.000
	N		80	80	80	80
Peer Rating – Core Task Proficiency	Pearson Correlation		1.000	.663**	.722**	.798**
	Sig. (2-tailed)			.000	.000	.000
	N			80	80	80
Peer Rating - Organization Commitment	Pearson Correlation			1.000	.724**	.671**
	Sig. (2-tailed)				.000	.000
	N				80	80
Peer Rating – Teamwork/Social	Pearson Correlation				1.000	.786**
	Sig. (2-tailed)					.000
	N					80
Peer Rating – Innovation	Pearson Correlation					1.000
	Sig. (2-tailed)					
	N					

\*\* Correlation is significant at the 0.01 level (2-tailed).

As Tables 6 and 7 show, Pearson correlation coefficients in both the peer and self-appraisal matrices reached values as high as  $r = .50$  to  $r = .80$  (all significant at the  $p < .001$  level). Some correlations are more moderately statistically significant.

Self ratings of Core Task Proficiency correlated strongly with self ratings of Innovation. This relationship is reproduced in the peer ratings of performance with a similar  $r$  value, although in the latter matrix it is not the only coefficient above  $r = .7$ . Core Task Proficiency also correlated strongly with Teamwork and Social contribution in both peer ( $r = .722$ ,  $p < .000$ ) and self- ( $r = .636$ ,  $p < .000$ ) ratings of performance.

Further analysis was conducted to ascertain how much self and peer ratings of job performance co-vary, at the level of 5 facets. Taking the facet ratings separately, a correlation matrix was generated showing the extent to which self and peer ratings of each facet are interrelated (Table 8).

**Table 8. Correlations of Self and Peer Rating Dimensions.**

		Self Rating - Dependability	Self Rating – Core Task Proficiency	Self Rating – Organization Commitment	Self Rating – Teamwork/Social	Self Rating – Innovation
Peer Rating – Dependability	Pearson Correlation	.575**	.435**	.436**	.417**	.400**
	Sig. (2-tailed)	.000	.000	.000	.000	.000
	N	78	78	78	78	78
Peer Rating – Core Task Proficiency	Pearson Correlation	.529**	.494**	.328*	.491**	.450**
	Sig. (2-tailed)	.000	.000	.003	.000	.000
	N	78	78	78	78	78
Peer Rating - Organization Commitment	Pearson Correlation	.580**	.383*	.430**	.434**	.351**
	Sig. (2-tailed)	.000	.001	.000	.000	.002
	N	78	78	78	78	78
Peer Rating – Teamwork/Social	Pearson Correlation	.519**	.383*	.341*	.438**	.333*
	Sig. (2-tailed)	.000	.001	.002	.000	.003
	N	78	78	78	78	78
Peer Rating –	Pearson					

Innovation	Correlation	.444**	.446**	.332*	.406**	.378*
	Sig. (2-tailed)	.000	.000	.003	.000	.001
	N	78	78	78	78	78

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the .05 level (2-tailed).

All Pearson coefficients of the matrix are positive, all statistically significant, and practically all exceed the level of  $p < .001$ , indicating a remarkable level of co-occurrence between self and peer ratings on this small sample. Looking at self/peer correlations for the same facet index (e.g. self assessed Dependability correlated with Dependability assessed by peer), the strongest correlation is found for the constructs Dependability ( $r = .575$ ) and Core Task Proficiency ( $r = .494$ ).

Taken as a whole, self ratings of performance correlated moderately with peer ratings of performance ( $r = .59$ ,  $p < .000$ ). This result appears very strong when compared with other studies. Harris and Schaubroek (1988) for example, reported results of a meta-analysis based on observations from 36 studies, representing 3,957 individuals, yielding average correlations of .35 for self and supervisor ratings and .36 for self and peer ratings. Similarly Nowack's (1992) investigation of ratings obtained for self versus others-combining subordinates, peers and supervisors-of .21 for his management practices feedback questionnaire.

Calculation of the overall means of the self and peer ratings (that is, the averages of the total sum of an individuals self and peer ratings for each day of the week) showed that peer ratings were slightly higher, though with slightly lower standard deviation (.55 and .47 respectively). This suggests that self presentation biases were minimal compared with recent studies. For example, Harris and Schaubroek found that that correlations with self-

ratings were modest and on average about one-half standard deviation higher than supervisory ratings.

## **5.2 Substantive findings**

### *5.2.1 Commuting History*

Participants responses to the brief history/biodata section indicated that they believed Auckland's traffic congestion greatly affected their performance. Seventy four percent believed that traffic congestion had increased over the last year. Sixty one percent had made at least one change to their commute route in order to avoid congestion, while thirteen percent had made 10 changes to their route over the last year alone. While only three percent admitted to traffic congestion being the sole reason for missing a day of work, forty eight percent stated that traffic congestion had affected their job performance.

This group was asked to describe the ways in which they believed their performance was affected with an open ended question. The majority of performance detriments related to direct output problems such as being late and not being able to complete jobs that needed to be done upon arrival. However a number of responses (as shown by table 9 below) indicated that traffic congestion can have an impact on other areas of performance such as social ability. Most commonly respondents reported feeling "stressed", "short tempered" and "distracted".

**Table 9 . Performance Detriments Responses.**

Impact	Response	Percentage of Responses
Output Related	Late	25%
	Falling behind	15%
	Rushed	3%
	Distracted	15%
	Total: 64%	Tired
Social Contribution Related	Short Tempered	15%
	Loss of Patience	3%
	Total: 36%	Stressed

More disturbingly, thirty two percent of respondents indicated that they had considered changing jobs in the last year solely because of traffic congestion. Those that had indicated they had considered changing jobs due to traffic congestion recorded a higher State Driver Stress Score on average than those who did not feel that traffic congestion warranted changing jobs.

This quotation typifies the answers to the open ended question, “I travel outside the peak hours of 6:40 to 9:00 and usually that means an easy drive. Before such changes I was finding that I was taking up to an hour just to get through the one traffic light to get onto the motorway. That time was creating a considerable stress, indeed it was change travel time or sell up and move elsewhere, that is to the isthmus, which would have been ridiculous.”

The frequencies of impact responses on these primarily, open-ended items suggest that traffic conditions did have an impact on participants. They warrant investigation of mental and behavioural consequences as a result of commuting. In what follows, findings from two subsets of such analysis are presented:

- (i) Correlational analysis exploring relationships among impedance dimensions;
- (ii) Testing of the five hypotheses formulated in the section "Aims and Hypotheses".

### **5.2.2 Correlational Analysis**

#### *Impedance*

Pearson Correlational analysis of the five impedance components revealed a strong significant correlation between Length of Commuting Distance and Time ( $r = .69, p < .000$ ). As you would expect, those traveling the greater distances take longer to commute. Weak correlations were found between Length of Commute Distance and Average Speed ( $r = .27, p < .05$ ); Average Speed and Number of Months on Route ( $r = .26, p < .05$ ); Time and Number of Obstacles ( $r = .22, p < .05$ ); and Average Speed and Number of Obstacles ( $r = .19, p < .05$ ). All these correlations are consistent with the notion that those travelling the furthest are at the greatest risk in terms of being affected by traffic congestion because they have to negotiate more obstacles and they are subjected to stressors for longer periods of time than those making shorter trips.

### **5.2.3 Hypothesis Testing**

As predicted by the first hypothesis, the mode of transport chosen by commuters was found to be a significant factor in the amount of impedance experienced by the

commuter. Fifty three percent of those travelling by car felt that their performance was affected compared with 50 percent of bus users. However, 50 percent of bus users had considered changing jobs solely because of the traffic congestion experienced in their commute. Train patrons expressed the greatest level of state stress, which is interesting considering that they are not actually driving the vehicle in which they are traveling. This provides further confirmation for models that posit lack of control as one of the key factors determining whether people perceive their environment as stressful (Landy, 1992; Glass & Singer, 1972; Thompson, 1981; Murphy, 1988).

Hypothesis one was tested by comparing the two relevant groups of respondents in terms of reported impedance. As the groups are independently defined, do not have shared members, and particular impedance figures for individuals in a group are not assumed to be influenced by impedance figures in the other group, a two-tailed t test was calculated. Groups for the test are respondents who use private cars, versus using other modes of transport, respectively. The dependent variable is the composite index of Impedance (cf. Design section). It was found that impedance in private car commuters significantly differs to impedance reported by those who used buses ( $t = 6.74, p < .000$ ). A significant mean difference in impedance was also found between all modes of transport (excluding private car use) and private car use ( $t = -.44, p < .000$ ). Car users were found to be more impeded than those that used other modes of transport to commute. Therefore, the results suggest strong support for hypothesis one, although no significant difference was found between mode of transport and performance ratings nor state driver stress score.

Strong support was found for the second hypothesis, which predicted that stress would be induced from commuting. A strong positive correlation was found between perceived level of congestion and state stress ( $r = .61, p < .000$ ). Normally, causality is not inferred from a correlation, and a significant correlation coefficient, in itself, does not establish a causal relationship. However, this result still suggests that as commuters experienced greater levels of congestion, their state stress increased. More support was found for this hypothesis when the participants were dichotomised into high and low congestion groups.

The hypothesis was tested by comparing the two relevant groups of respondents in terms of state stress. As with hypothesis one, a two-tailed  $t$  test was calculated. Groups for the test are respondents who reported a low congestion level (of between 1 and 3 inclusive) versus those that reported a high congestion level (of between 4 and 6 inclusive). The dependent variable is the total score derived from the State Driving Stress Inventory. It was found that those in high congestion conditions reported greater state stress ( $t = 7.42, p < .000$ ) than those in lower congestion conditions. While this result is significant, and suggests strong support for hypothesis two, it should be remembered that the congestion level reported was that which was perceived by the participants rather than a definitive number of cars, buses and other modes of transport on the road ways. Therefore, what may be considered congested by one participant may not be considered so by another.

The third hypothesis predicted that participants with higher impedance scores would have higher scores on the state stress inventory. In general, this does not seem to hold for our

small sample. The hypothesis was tested in two ways. First, groups reflecting different traffic conditions were formed and a two-tailed t test was calculated. Groups for the test are respondents who reported a high degree of impedance versus those that reported a low degree of impedance (dichotomised at the median). The dependent variable is the total score of stress. The comparison of the groups revealed that although there seemed to be a difference between the two groups in the expected direction, this difference failed to reach a level of significance ( $t = .229$ ,  $p = .820$ ) and can be due to random error. In its original form, the third hypothesis was not supported by the data.

However correlational analysis shows at least some modest linkage between conditions of transportation and driver stress. Time urgency, a factor of driver stress, correlated with both the Number of Months on Route and the Number of Obstacles encountered suggesting that congestion has a greater impact on those traveling the same route for a higher number of consecutive days. Further, the longer the commute in minutes, the more negative participants felt upon arriving at work ( $r = .18$   $p < .05$ ). The Length of Time of the commute, the Number of Months on the route and the Number of Obstacles on the route all correlated weakly with participants predisposition to stress, suggesting that these three factors induced the greatest strain on participants as they commuted each morning.

A day by day analysis of the sum scores from the State Driver Stress Inventory revealed that participants were most stressed on Wednesday and slightly less so (but noticeably more than the other days) on Thursday. That Wednesday happened to be September 12, earlier that morning two planes full of people and fuel had been flown into the tallest

towers of the World Trade Center in New York City. (Refer the Discussion chapter for a fuller examination of the consequences of this).

No support was found for the fourth hypothesis, which predicted that participants with higher state stress would have lower performance ratings than those who expressed lower state stress. As the two groups are independently defined, and the groups do not have shared numbers, a two-tailed t test was calculated. Groups for the test are respondents who reported high levels of state stress, versus those that reported low levels of state stress on the composite index on the State Driver Stress Inventory. The dependent variable is the performance rating generated from the self and peer BOS.

It was found that although some participants with high state stress did receive lower performance ratings, t-tests revealed no significant differences between the two groups for self ( $t = 1.58, p = .12$ ), peer ( $t = -.01, p = .992$ ), nor overall (average of both self and peer) performance ratings ( $t = .248, p = .8$ ).

In line with the research of those pioneering this field of study (e.g. Stokols et al., 1978; Schaeffer et al., 1988; and Hennessy & Wiesenthal, 1997) the Impedance variable was dichotomised at the median to compare high and low impedance groups by way of t tests.

The fifth hypothesis predicted that those participants that were impeded greatly would have poor performance ratings compared to those who were not impeded. The groups for

the two-tailed t-tests are respondents who reported a high degree of impedance versus those that reported a low degree of impedance, respectively. The dependent variables are the total self and peer ratings as well as the overall (average of both self and peer ratings) figure, generated from the BOS.

Partial support was found for this hypothesis in that a significant difference in overall performance for those in high and low impedance groups was found ( $t = 2.88, p < .05$ ). As expected, participants who had to travel the longest distances, took longer to commute and had to negotiate more obstacles, had lower performance ratings overall compared to participants who were not impeded as much in their commute to work. Interestingly, as suggested by the correlational analysis, a significant difference was also found in peer ratings of performance between participants in high and low performance groups ( $t = .258, p < .05$ ) but not for self ratings ( $t = .2, p = .64$ ).

Correlational analysis of the self and peer rating performance dimensions along with the impedance factors showed that the average speed of the commute had the largest impact on performance, correlating with four of the five factors for both self and peer evaluations.

A weak negative correlation was found between impedance sum score and peer rating of performance ( $r = -.286, p < .05$ ), indicating that those who endured greater impedance were not performing as well as others, according to their peers. Number of route changes

was found to correlate weakly with the number of days missed due to traffic congestion ( $r = .39, p < .05$ ).

### **5.3 Summary of Results**

The predictions of hypotheses 1, 2 and 5 received moderate to strong support. It has been shown that commuting by private car induces the greatest amount of impedance but that this does not necessarily translate into induced state stress. However, commuting by any means in high congestion does have the potential to engender state stress in some participants. The components of the commute that contribute greatest to impedance were found to be the length of the commute in distance and time. Further more, high levels of impedance are more likely to result in performance deficits than lower levels of impedance.

Hypotheses 3 and 4 were not supported. Although participants that were impeded greatly did generally express greater state stress there was no significant difference in the amount of stress they reported compared to those that were not as impeded. Further, although a number of weak to moderate significant correlations were found between state stress and performance ratings, a significant difference was not found for performance between high and low state stress groups.

## 6. Discussion

The present study supplies further evidence about the psychological consequences of traffic congestion in the Auckland metropolitan area, one that has often been described as a major practical problem (Gulian, et al., 1989, Hennessy and Wiesenthal, 1997, Evans and Carrère, 1991, Rasmussen et al., 2000, Evans, 1994, Schaeffer et al., 1988, Stokols, 1978). Given that very little is known regarding the impact this congestion is having upon commuters, particularly within a New Zealand context, the general aims of this research were to:

- extend an established link between traffic congestion and task performance to test whether traffic congestion has some measurable impact on job performance for a sample Auckland business;
- measure the level of stress, if any, commuters feel upon arriving at work after sitting in heavy traffic;
- discuss the consequences for organizations employing these commuters;
- test whether the instruments used in previous studies were suitable for use with a New Zealand sample, and whether they would produce similar results;
- make some suggestions for commuters and organisations to minimise the consequences of commuting in traffic congestion.

The current chapter documents the extent to which particular goals of the research (cf. Aims and Hypothesis section) have been accomplished. It interprets our findings in the context of the organization chosen for the study, the broader New Zealand organizational

arena, and the overseas environments in which research on job-relevant psychological consequences of transportation options was conducted and published.

It compares the pattern of the local Auckland findings to those documented overseas; it attempts an explanation of why certain patterns of data are similar to those in published research, while others are divergent.

Although a study linking commuting and job performance has not been performed before, some of what is reported here compares well with what has been reported in the literature. Schaeffer et al. (1988), as well as Hennessy and Wiesenthal (1999) and Rasmussen et al. (2000) concluded that commuting induced stress. The findings presented here suggest that the morning commute to work, utilising any mode of transport, is regarded as stressful by some individuals. The findings supported the hypothesis predicting that commuters travelling by private car experience greater impedance than other commuters. This suggests that, although the car offers more freedom in terms of the conditions of the commute (leave time, route taken, noise, heat and so forth), these commuters will travel at lower average speeds, take longer to get to work, and endure the stressful conditions for a greater time period.

Similarly, evidence was found for the link between certain conditions of the commute and stress reactions. In particular, it was found that the length of the commute in kilometres, and the average speed of the commute, were directly related to the amount of state stress reported. This result is in agreement with Stokols et al. (1978) and Hennessy

and Wiesenthal (1999). Time urgency was also found to affect the commute-stress relationship, supporting the work of Stokols et al. and Hennessy and Wiesenthal (op.cit).

Further, those commuters that used private cars reported higher levels of state stress than commuters that used buses and taxis. Commuters that travelled in high congestion conditions also reported greater state stress. As public transport was shown to be less stressful than commuting by private car, as well as inducing less impedance, it can be suggested that employers should encourage the use of public transport in order to minimise performance deficits.

Stokols et al. (1978) set the precedent of dichotomising impedance, to test for a relationship between high levels of stress and high levels of impedance. This was followed by the work of Schaefer et al. (1988), Hennessy and Wiesenthal (1999), and Novaco et al. (1990). In spite of accepting this methodological option (which could be criticised for reducing the full potential of the data set), the results found with our restricted sample provide little evidence for the relationship.

However, the results lend support to Schaeffer et al. (1988) and Novaco et al. (1990), in that deficits in performance (although they suggested task performance) result from commuting in high impedance conditions.

Peer ratings of work performance showed that participants with a high degree of impedance performed poorly compared to those that were not impeded as greatly. This

result extends the findings of Novaco et al. (1990) and Schaeffer et al. (1988). It suggests that since a car commuter must be concentrating and thinking of their commute, at least to some degree, they get to work more emotionally if not physically, "tired" than other commuters. Commuters using public transport for example, have the luxury of completely "switching off" and not concerning themselves with the task of controlling a vehicle.

However, why was this relationship only significant for peer ratings and not self ratings for both correlational analysis and tests of differences in means? Organizations and researchers have, historically, been reluctant to use peer and self evaluations due to concerns that these sources of information can be subject to biases (Huber, Neale, & Northcraft, 1987; Kane & Lawler, 1978; Landy & Farr, 1983; Wexley & Klimoski, 1984; and Bowman, 1990).

A significant difference was found for overall performance ratings in low and high impedance groups, and a difference, though not significant, was found for self ratings. Furthermore, reliability analysis showed that all the performance ratings had reasonable internal consistency. Therefore, it would have to be assumed that this is fairly minimal evidence of self presentation bias within the results.

Hoffman et al.'s (1991) meta-analysis of studies that compared self and supervisor ratings, found that although self and peer ratings were highly correlated, self ratings were higher on average than supervisory ratings. Hoffman concluded that this was evidence of

self presentation bias. Given this conclusion, it can be said that self presentation biases were minimal amongst the sample used within this study since, on average, the peer ratings were actually higher than the self performance ratings.

Interestingly, hypothesis three was not supported. The respondents state stress scores were not statistically different between high and low impedance groups. However, a significant difference was found between high and low congestion states, suggesting more evidence for Hennessy and Wiesenthal's (1997) hypothesis that driving in highly congested traffic conditions would result in higher state stress than driving in low congestion.

This result has a two-fold affect for this research. First, it affirms the previous findings, which suggests that the State Driver Stress Inventory is reliable in that it generated consistent results. Secondly, the measure was easily completed and understood by the participants. The language and structure of the items was analogues to "New Zealand English." Therefore this result satisfies one of the aims of the study in that it suggests the measure is suitable for the New Zealand population.

It makes logical sense to assume that if stress is brought about by commuting, then those commuters who are impeded the most will have higher levels of stress. The findings suggest that the impedance – stress relationship is not a linear one and is highly dependent on individual differences. As reported above (cf. Stress Models section) stressors may combine in three ways resulting in superadditive, linear or canceling effects

(Koslowky, et al., 1995). The explanation of these effects is relatively straightforward. Presented together, stressors may produce an interaction resulting in effects that are greater than, equal to or less than, what would be expected if the stressors were presented singularly.

For example, the results suggest a commuter impeded only marginally may express the same levels of state stress that another commuter expressed after much high levels of impedance. Some mediators and moderators were discussed in the introduction and can explain this difference. These included attitudinal variables, such as locus of control, as well as conditions of the commute conditions such as heat, noise and lighting.

Hennessy and Wiesenthal (1999) report no differences between males and females with regard to the levels of state stress resulting from commuting, however Novaco et al (1991) found women were more stressed than men after commuting. Our results cast some doubt on previous findings, in that no differences were found between males and females in reported state stress after commuting. However, gender differences found in various studies may be partly affected by sampling differences.

It was found, in agreement with Sölderfeldt et al. (1997), that absenteeism was related to the distance participants commuted. In the current study the relationship was found to be true for both sexes, not only males as found by Sölderfeldt et al. (1997).

No support was found for the fourth hypothesis, which predicted that participants with higher state stress would have lower performance ratings than those who expressed lower state stress. T tests revealed no significant differences between the two groups for self, peer, nor overall performance ratings. This is perplexing, in that it has already been shown that (a) impedance induces stress and (b) Impedance induces performance deficits for some commuters. Therefore, it may be concluded that, as with the relationship between impedance and state stress, the relationship between impedance and stress and job performance is moderated by many different factors. Perhaps there are direct, un-mediated pathways of influence, whereby impedance in itself reduces job performance. Perhaps it works through mediating variables other than stress, for example, through physiological fatigue, mental fatigue, more negative cognitions about the job or about the organization (such as decreased organization commitment).

Evidence corroborating the suggestion by Ommeran (2000) that as a consequence of congestion employees change jobs to reduce their commute times, seems to emerge from our data. Thirty two percent of the respondents indicated they had considered changing jobs solely due to traffic congestion. Clearly, employees in this group consider the commute conditions alongside more traditional benefits of employment, such as remuneration and promotion possibilities. This implies that organizations need to promote themselves as “commuter friendly.”

Contrary to the findings of Edwards, Cooper and Baglioni (1990), supporting their linear stress model, this study suggests that stress has non-linear effects and is moderated by

commute conditions, such as average speed and commute time. It also underlies conclusions of Novaco et al. (1991) and McCormick (1997) that the psychological consequences of environmental conditions in one life domain (such as commuting) can transfer to another (the work environment, for example) in a positive or negative way.

Kluger (1992) suggested that the standard deviation of commute times could be linked to the amount of stress experienced in a particular commute. Modest evidence of this relationship was found here. Although participants with a high level of variance in their trip times experienced greater stress than those with low variance, the difference was not statistically significant.

The central proposal investigated here is that Auckland commuters, who are impeded greatly in their commute to work, are not performing as well as they could be, upon reaching their place of work. Our findings confirm several major aspects of this relationship. This group is more likely to seek another job that has more favourable commute conditions and has higher rates of absenteeism than low impedance groups. This is evidence of actual changes in behaviour, solely as a result of commuting, as suggested by Koslowsky et al.'s (1995) commuting stress model.

The research further indicates that instruments such as the State Driver Stress Inventory, Behaviour Based Observation Scales and Driver Logs are suitable for use with a New Zealand sample and produce sensible results that may be compared to studies conducted elsewhere.

## 6.1 Contribution

Contributions of this research are to be evaluated within the constraints of logistics, samples, and operationalisation. Two fields where contributions are obvious are in terms of job performance evaluation and stress research, with findings bearing upon debate, initiated by similar studies in the literature. Evidence for the utility of self and peer evaluations in the professional organization context was also provided. The State Driver Stress Inventory was further validated with a moderate, but significant, level of internal consistency.

The five performance dimensions used were also confirmed as useful and valid. Behaviour based observation scales proved to be an effective and efficient method for obtaining performance information within a professional organisation. The use of self and peer ratings also received further validation, particularly when there is no direct supervisor or line of authority.

Just as Koslowsky and Krausz (1993) found, commute time was positively correlated with state driver stress scores, and that commuting by private car is more stressful than public transport. This result strengthens Schaeffer's assertion, as private car users will have far more choice in terms of the route they take.

A moderate positive correlation between control and impedance confirms Schaeffer et al.'s (1988) assumption that, for some commuters, an increase in choice is more stressful.

However, as discussed in the introduction, examining the issue of whether "control" acts as a mediator in the commute - stress relationship has yielded mixed statistical evidence. In this study, there was no evidence of a direct link between control and stress.

## **6.2 Limitations**

The present study has limitations, some of which are obvious on considering the group of participants and the nature of the organization on which the data collection and analysis are based. Some of the limitations are simply a consequence of the logistic proportions of the study, and the difficulty in engaging various organizations and creating a more appropriate (let alone representative) sample.

Ideally, this study would have been conducted on a large manufacturing organization with a direct line of authority. In this way an objective measure of performance may have been obtained from output levels or line supervisors.

### *6.2.1 Self and Peer Assessment*

The use of self and peer ratings is problematic in that a number of errors can occur in this process based on (1) cognitive limitations, (2) intentional manipulation, and (3) organization influences. See the "Self and Peer Assessment Issues" section and Bowman (1999) for a full discussion of these.

Of particular relevance here is the assertion by Bowman (1999, p.568) that people strongly detest having to evaluate others, "Most people, especially in light of all the other

questions about the reliability and validity of personnel appraisal, are as reluctant to judge others as they are to be judged themselves". Consider the case of group members with a goal of maintaining the social integrity of the group. In this situation, group members may be reluctant to disturb a positive work-group climate. There is evidence of this within this study. When informed of the format of the research, a number of would be participants commented that they could not rate their peers as it would be "unprofessional" and could "cause huge rifts between us".

### *6.2.2 Data Collection*

Another limitation is that baseline stress levels were not taken prior to measurement of the stress induced by driving. This may have resulted in a stronger case for the impact of driving on stress levels. However, the State Driver Stress Inventory does have the predisposition to stress factor, which was shown to be higher for those in the higher impedance group.

A better understanding of how the solicitors performance in particular was effected by traffic congestion could have been obtained by comparing billing hours of those in high and low impedance and stress groups as this would have offered, perhaps, the only objective measure of performance.

Self selection bias may also factor in the results here as respondents from the sample organization where not chosen but rather volunteered. Therefore, those that chose to participate may have been those that were more affected by traffic congestion resulting in

a sample that does not represent the population completely. However, this problem was somewhat unavoidable given the circumstances.

### *6.2.3 Generalisability*

One of the main aims of this study was to test whether instruments used in studies overseas could be used with a New Zealand population. This pilot study has certainly proved that useful data can be obtained and that further in-depth research is warranted. However, as this was a pilot study, the generalisability of these findings is somewhat limited. Strictly speaking we can only generalise to organisations and jobs closely resembling the one our study relies on.

As stated above (cf. the "Self and Peer Assessment Issues" section) a typical professional organization is characterised by a combination of standardisation and decentralisation<sup>7</sup> (Robbins & Barnwell, 1994). This arrangement results in high levels of autonomy, rather than multiple levels of bureaucracy. The sample group were rating fellow team members rather than someone above or below them in authority and as the sample size is relatively small, the participants were very familiar with those whom they were rating.

Further, although other regions within New Zealand experience traffic congestion to some degree, Auckland's congestion is by far the worst. Commuters in Gisborne, for example, are certainly impeded in their travel to work, but not to the same degree, with the same level of possible detriments as an Auckland commuter. It is likely that

professionals react differently to commuting conditions than do other groups of workers. Their remuneration reflects their higher education and as such their transport options may be far greater than someone who works in a factory. The findings, therefore, may only be implied to other medium sized law firms in the urban Auckland region.

Having said that, the findings do have implications for all New Zealand, and the initiatives presented may be of practical value to New Zealand organizations, large or small.

#### *6.2.4 International Act of Terror*

As reported in the Results chapter, on the third day of data collection, as the participants commuted to work, they were bombarded with the images and reports of the horror that had occurred in New York City, America (very early New Zealand time) through the night. It was the focus of the morning papers, and virtually all that was talked about on morning radio. As participants entered the room allocated for the study it was all they were talking about, a number of the staff were American and had family in New York and many had clients in similar circumstances.

The State Driver Stress Score daily averages for Wednesday and Thursday were noticeably higher compared to the rest of the data collection period. Perhaps, as the week progresses, people naturally become more stressed as deadlines move closer. Or there are more commuters on the road because people are not giving themselves a “long weekend”.

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<sup>7</sup> The sample organization’s structural design appears in Appendix I.

The results may have been exaggerated as a result of the events in America (though a two tailed t test revealed not significantly).

While it is perhaps exciting, as this may be some of the very little psychological data available immediately after the event, it is problematic in that it shows even though specific instructions were given to participants to base their answers solely on the commute they had just made, other elements of their lives were impacting upon their scores.

### **6.3 Looking Ahead - Future Studies**

Future replications need to use genuine and preferably representative samples. Particular attention needs to be devoted to groups using the different modes of transport. Other forms of organization should be studied to test for differences between organization forms. Do professionals react differently to blue collar workers for example? If it can be said that professionals earn more than blue collar workers, and as commute conditions have been shown to affect stress reactions, then perhaps professionals travelling in more expensive (quieter, temperature controlled) cars will express less negative consequences than blue collar workers.

Professionals do not have the same time restrictions on their commute as blue collar workers might. In general professionals do not have a "clock in" time but rather set their own arrival time around a guideline.

Questions remain about the actual costs of the performance deficits shown. Organizations will be inclined to consider the impacts of traffic congestion more seriously if a dollar value (cost) can be attributed to the loss in performance and absenteeism. More analysis needs to be done so financial loss due to every hour spent in congestion can be estimated.

Some other questions that have been raised throughout this study also warrant further investigation. Ihlanfeldt (1992) for example, found commuting difficulties resulted in poorer employment rates for black youth. The question that should be investigated further is whether youth in lower socio-economic groups within Auckland face the same problems, as it impacts employing organizations as well since the group of selectable candidates and skills may be greatly reduced.

Further studies of this nature may assist in developing a more comprehensive model of the links between commuting stress and job performance, utilising Koslowsky et al.'s (1995) commuting stress model. This model may first be formulated in view of a simpler organization structure, such as a manufacturing plant, so that output measures can be easily conceptualised and operationalised. In doing so, more can be learnt regarding the impact that control and other variable have on this relationship.

## **6.4 Initiatives**

People prefer travelling in private vehicles. This form of transport provides convenience, comfort, privacy but not speed over public transport. This preference accounts for the large numbers of vehicles on Auckland's roads at peak periods. Therefore, to persuade

more employees to use different modes of transport, it is necessary to educate them about the negative effects of prolonged exposure to peak congestion, and also make the alternative more attractive, primarily through making it cheaper and more convenient.

#### **6.4.1 Initiatives to Reduce Traffic Congestion Impacts**

##### *Demand Side Vs Supply Side*

This section will present initiatives to all organizations as suggestions for the reduction or minimisation of the impacts of traffic congestion. These initiatives will be presented in a way which impacts upon the demand side of the traffic congestion problem, that is car dependency and car demand, that Auckland faces. Supply side congestion management measures are intended to increase the existing capacity of the roadways and as such are beyond the scope of both the research and thesis presented here.

The aim of these initiatives is to minimise the impact of traffic congestion by:

1. Reducing the need to make a trip
2. Reducing the length of trips
3. Promoting public transport
4. Promoting car pooling
5. Shifting travel from peak hour locations (divert traffic away from congested locations),
6. Shifting peak hour travel (migrate trips to less congested time periods)
7. Educating commuters about the negative effects of stress and,
8. Educating commuters and employees on ways of managing stress

**Table 10. Classification of Congestion management measures. Based on larger table from, From Road Transport Measures, congestion control and demand management, OECD Scientific Group, 1994, p. 18.**

TYPES OF MEASURE	STRATEGY CLASS	MEASURES
DEMAND SIDE	LAND USE & ZONING	Land use and Zoning Policy Site Amenities & Design
	COMMUNICATIONS SUBSTITUTES	Telecommuting Tele-Conferencing
	ECONOMIC MEASURES	Transit & Rideshare Financial Incentives Public Transport Pass Programs
	ADMINISTRATIVE MEASURES	Transport Partnerships Alternative Work Schedules

#### **6.4.2 Land Use and Zoning**

Put simply these initiatives concern the geographical placement of the work site in the cosmopolitan area and the physical design of the work site. Downs (1992) reports that commuters are happy to travel long distances in traffic so that they can live where they choose. Further, people's willingness to commute longer distances has repeatedly undermined attempts to shorten commuting times by building housing near workplaces and encouraging workers to occupy that housing.

As an organization, it may prove cheaper in the long term to relocate outside of the central city near residential areas where rent, building and electricity costs and costs associated with traffic congestion are much less. A similar alternative is to offer a global village approach where employees congregate in an external location and work from there rather than making the longer and more taxing commute into the central city. Locations could include the North Shore and Manakau. Organizations could also look to construct a site that is close to public transport services.

Typically, employment sites are designed to suit the motorist commuter first. For example, consider the number of organizations that provide car parks for their employees, consider also the number that have suitable features for employees to ride bikes or jog/walk to work, such facilities could include lockable storage areas, bicycle shelters and changing rooms. Provide lockers for cyclists to store equipment and clothing and, if possible, install showers in your washrooms. Perhaps allow cyclists 15 minutes at the start of the day to freshen up. Some employers have provided ironing boards and irons for cyclists changing into office clothes (Transport 2000 trust, 2000).

An example of success with this initiative is found in the Netherlands that reports that since 1990 the Ministry for Housing, Regional development and the Environment has encouraged businesses to locate near public transport services. An evaluation of the impact of a business relocating near public transport services in the Hague found a 50 percent increase in employee usage of public transport, and a 50 percent decrease in their use of cars. (Organisation for Economic Co-operation and Development [OECD], 1994, p. 28).

### *Telecommunications Substitutes*

It is well known that the use of telecommunications technologies as a substitute for motorised trips holds potential to reduce congestion. Telecommuting refers to employees 'commuting electronically' to the workplace through the use of computers. Modems, faxes, telephones and the internet. This allows employees to work from home or from a

global village as mentioned above. Teleconferencing utilises television, telephone and computer communication in the place of trips taken to meet face to face with individuals or groups. Advantages include saving time for travel, lessens impact of power or status and enables users to be better prepared.

Telecommunications substitutes will result in fewer and shorter trips, which in turn may result in changes to the mode of transport used. For example, employees with less distance to travel may change from motorised commuting to walking or bicycle trips. They may also car pool with others going to the same global village.

The 1994 OECD report on road transport research reports that the full effect of telecommuting has not yet been established beyond "limited sample/time case studies" (OECD report, p. 30), of which they provide 4 examples, including the following: In the State of California (USA) "In preliminary findings among State of California telecommuters, work trip rates decreased 30 percent from .9 trips per day to .63, compared to a second control group where work trip rates did not change. In the project, workers telecommuted either one or two days per week. The project involved over 400 State employees across 13 agencies. Travel diaries were used to track travel impacts." (OECD, p. 32). Further, in a pilot study in Los Angeles, 80 percent of telecommuters reported an increase in work productivity, and the majority of supervisors said productivity increased (OECD, 1994).

### *Economic Measures*

These economic measures are financial incentives aimed at increasing the use of public transport amongst employees. These initiatives are in the form of subsidies for public transport tickets. The employing organization can purchase monthly passes and then sell them on to employees at a much cheaper rate, inducing them to use public transport.

Another possibility is to provide financial incentives to those employees who create and participate in car pooling groups. Incentives can come in the form of guaranteed car parks and fuel subsidisation.

Car pooling travel usually offers the same door to door transport that travelling in ones own private car does, therefore it can be an appealing option for many commuters. It also offers more flexibility than public transport and offers many benefits over driving alone, the largest of these being the money saved however consider also that it is time to relax without the stress of driving (Transport 2000 Trust, 2000).

Car pooling can be further enticed by offering those who car pool the most attractive car parks, those under shelter or nearest to the door for example.

Use of public transport in Auckland has fallen 89 per cent between 1955 and 2000, with Aucklanders making just 33 trips a year each on public transport in 2000 (New Zealand Herald, 24/7/01). The benefits of public transport over private car include, not needing to park, being able to relax and fare discounts.

A fine example of the possibilities of initiating such measures is once again provided by the OECD report performed in 1994. In many German cities, some private and public employers have contracts with public transport companies which accept the firm card as a transit pass. The employer pays 50 to 90 percent of the least expensive normal pass per employee. Thus, the public transport has a guaranteed income every month, the employer can reduce parking facilities and the employee has a free transit pass.

### *Administrative Measures*

These measures are not purely transport demand management orientated but are instead organizational level policy initiatives designed to minimise the impact of traffic congestion.

The first of these measures asserts that by looking beyond the scope of one organization and considering transportation partnerships, goods and employees can be moved about more efficiently and with decreased time in traffic congestion. These employee formed groups involve extensive communication between employers to establish where finished goods, supplies or employees might have similar origins and or destinations so that “ridematching” (OECD report, p. 51) can take place.

Commuter Transport Services, Inc (CTS) is a non profit company serving the Los Angeles (USA) area. CTS works primarily through employers’ transport coordinators to promote ridesharing among employees, but also assists “unaffiliated” commuters via an

on-line telephone matching system. The organization provides matchlists to employees and “master” lists to coordinators, and processes employee survey data into commute management plans for employers. CTS also provides information on transit service and vanpool vendors. CTS’ funding is primarily public but some businesses also contribute.

Approximately 250,000 commuters are registered with CTS and the organization estimates that nearly 340,000 individuals have been placed into ridesharing arrangements by CTS since its inception in 1974. A comparison of Commuting trips made between CTS clients with those of non-clients showed that CTS assisted firms generated 10 percent fewer trips than non-clients.

Further, petrol and parking could be subsidised for employees who use car pooling and/or ridesharing initiatives. Ridesharing in America has been found to cut the number of daily trips made by employees by as much as 17 to 40 percent (Downs, 1992).

Another administrative initiative is the development of alternative work schedules. The peak congestion period is between 7.30 a.m. and 9 a.m., due to the fact that most organizations start and end their work day at the same time. Modifying the times at which employees begin and finish work is not a new concept. Examples such as flexi-time, the 4/40 week, and shift work have been used with some success as a means of improving job satisfaction (Muchinsky, 1997). These initiatives can equally be applied as means of reducing the time employees spend in traffic congestion.

Flexi-time work schedules allow employees to select their own working hours based around a core time, normally from around 10 a.m. to 3 p.m., when they must be at work. By beginning their commute later or earlier employees will reduce their peak congestion commuting periods. Similarly, employees could work fewer but longer days, 8 a.m. to 6 p.m. for example with a three day weekend or a midweek break.

Many Swiss companies for example, and almost all public sector agencies, have introduced flexible or freely arrangeable work hours. The obligatory block hours are between 8:30 a.m. and 11:15 a.m. and between 2 p.m. and 4 p.m. The employees are free to work any hours between 6:30 a.m. and 6:30 p.m. for a total of 42 hours per week. The results have been positive in terms of reducing trips made in peak congestion (OECD, 1994).

### *Psychological Initiatives*

So far this section has dealt with supply side initiatives aimed at reducing the need to make unnecessary trips. However as this research is psychologically grounded, it must consider the psychological solutions also. These initiatives are aimed at reducing the impact of stress that occurs over a period of time, for example commuting the same route for a week or more. A section follows discussing how to deal with stress as it occurs during the commute. However, it must be noted that these initiatives are no different from the others in that they must be implemented by organizations at the individual and organizational level.

The first step must be to educate employees about stress and its effects. Awareness of stress reactions and repercussions should include looking for physiological, psychological, social and behavioural changes in people.

Physiological changes can include, muscle tension, headaches and a depletion in immunity. Psychological, concentration/ memory, confidence, self esteem, depression and anxiety. Mood swings and loss of sexual interest are social consequences of stress that should not be ignored. Finally, behavioural changes may include, excessive drinking, bad eating, absenteeism and withdrawal.

The next step is to educate employees about what can be done, starting at the individual level. It is important to develop self-awareness, allowing people to notice changes in themselves and seek help. This can include learning to delegate, improving communication, learning to be flexible, and normalising the reactions experienced.

Individuals are unlikely to seek help however if they do not receive support from those around them in the workplace. For this reason, psychological initiatives should also be implemented at the organization level. The use of counseling services should be encouraged as well as internal social support networks to create a safe culture in the workplace. In their study of theoretical models of social support in relation to stress, Dignam and West (1988) found social support from co-workers and supervisors directly reduces or prevents illness symptoms.

### *Psychological Initiatives at the time of the Commute*

Individuals are most likely to experience a stress reaction while actually commuting, that is while they are being presented with the stimulus. During this time there are numerous techniques that can be employed to reduce the negative effects stress.

During a strain response, breathing automatically becomes more shallow and frequent resulting in a decrease in the amount of oxygen in the blood. Controlled breathing or diaphragmatic breathing is a method of breathing which allows your lungs to expand more allowing more oxygen to enter your blood (Farhi, 1996). Each breath should be controlled, making sure air is completely exhaled. This can be practiced by counting slowly to five as you breath in and out, repeating about four times.

Another method to reduce stress which can be performed while driving is relaxation. When stressed, muscles automatically tense, resulting in poor oxygen delivery and build up of lactic acid which damages the muscles. Effective relaxation can decrease heart rate and blood pressure as well as help control your breathing (Mitchell, 1977). There are various relaxation methods available to the commuter, these are discussed in detail in numerous relaxation books.

As discussed by McKay, Davis and Patric (1981), Cognitive Stress Intervention is a way of using thought to control the stress response. They state that “modern” stress can result from thought itself, worrying about what might happen and imagining different stressful situation can elicit the same stress response as a life threatening stress.

The intervention is based around reducing, substituting or even eliminating negative self talk. This kind of discourse is often untrue and can be rationalised so that stress can be controlled or reduced.

### *Cost Effectiveness*

This thesis has shown the detrimental effects, economically, that prolonged exposure to traffic congestion can have on organizations. Conversely, some of the initiatives here will require initial financial backing as well as monitoring costs.

Obviously the costs of the initiatives need to be less than that which is lost due to traffic congestion. The cost effectiveness of an economic measure (Transit and rideshare financial incentives, public transport pass programs) can be expressed as the programme cost minus the reduction in performance deficits, parking costs, transport costs, lost opportunities and catch up costs – a negative result indicating the amount saved by the initiative's implementation.

### *Implementation Issues*

In order for these initiatives to be effective, they must be put into action in such a way as to ensure that they are adhered to by all those involved, not only employees but the employers and the organisation a whole. It is important that those at the head of the organization are seen to “walk the talk” by complying with and supporting initiatives that are bought into use.

These initiatives will gain credibility, and are more likely to be successful, if they are supported in full. As such, they should be formalised and seen to have the support of senior management. The initiatives will also be far more successful if employees are given ample opportunity to voice their opinion on their outcome and use. In doing so they will have some 'buy in' into the final results and are therefore more likely to accept and follow them.

It would have to be expected that, initially, employees would react negatively to changes that restrict, or make more expensive, the use of their private car. As such, it is important to explain to employees the possible causes and effects of stress, so that they can fully comprehend the reasons for the changes that are to be brought about.

Issues of equity may arise, by the fact that "car poolers" and those using public transport will receive subsidised travel and those that do not lose out. It is also important to consider the culture of organizations when implementing initiatives. For example, making it more acceptable for someone to leave five minutes early when a bus is due, and rescheduling meetings so that employees can use a bus or alternate means of transport.

## **6.5 Conclusions**

The question of what to do about Auckland's traffic congestion has been debated since the late seventies, and will continue to be debated for years to come. It has been apparent,

and is further highlighted by the findings in this research that the problem will require much planning, investment and time to solve.

This study has shown that commuting by private car induces the greatest amount of impedance but that this does not necessarily translate into induced state stress. However, commuting by any means in high congestion does have the potential to engender state stress in some participants. The components of the commute that make the greatest contribution to impedance were found to be the length of the commute in distance and time. Further more, high levels of impedance are more likely to result in work performance deficits than lower levels of impedance.

Although participants that were impeded greatly did, generally, express greater state stress there was no significant difference in the amount of stress they reported compared to those that were not as impeded. Further, although a number of weak to moderate significant correlations were found between state stress and performance ratings, a significant difference was not found for performance between high and low state stress groups.

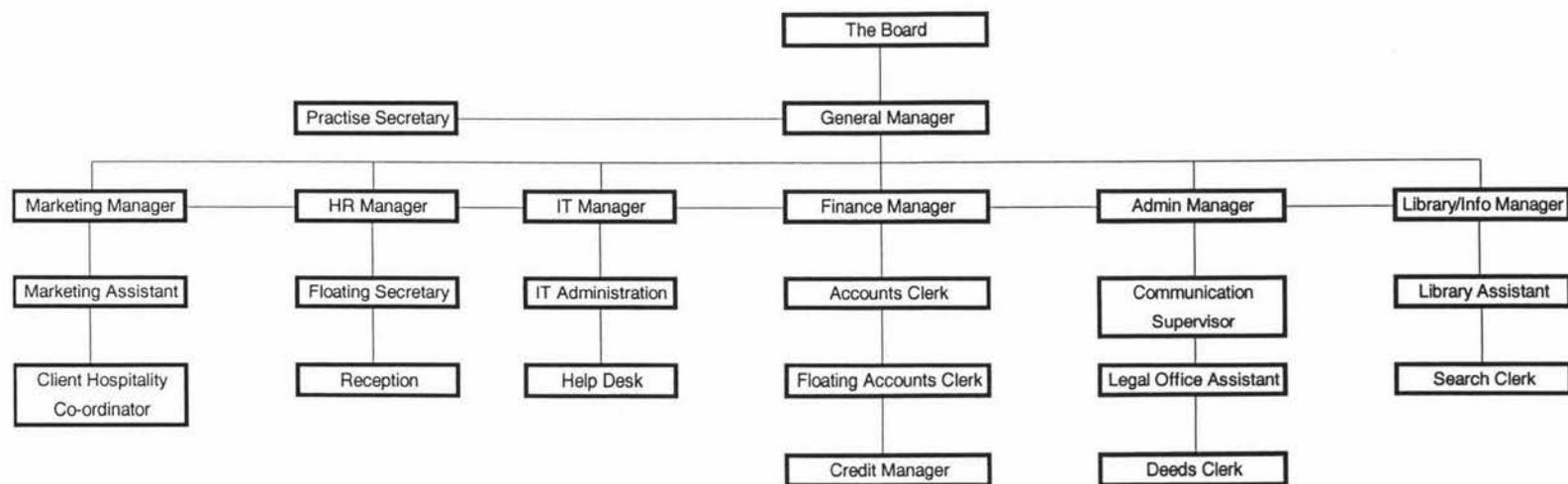
The effectiveness of the initiatives presented above will be dependent upon how they are implemented and received by employees. It will also be necessary to monitor their effectiveness in terms of reducing the number of trips or hours spent in peak traffic congestion. As the 1994 OECD report (p. 132) puts it "Effectively addressing a road

traffic concern may require a continuous commitment of resources beyond that of just implementing a measure and assuming that the problem is solved.”

Obviously one measure may not work as well for one organisation as another, and different combinations of multiple measures may prove to be the most effective for an organization. Finding this combination will require patience and a high degree of communication between and among employers and employees. Similarly, organizations need to ‘think outside the square’ and consider that clear lines of communication and co-operation must be constructed between organizations within the same areas with Auckland. In this way full advantage can be made of initiatives aimed at transportation partnerships.

Auckland's traffic congestion acts as a stressor. It decreases the work performance of some commuters. Organizations need to take action in order to protect themselves, and their employees, from the debilitating effects of traffic congestion. The psychological impact of commuting and traffic congestion is an energetically advancing area of investigation and certainly warrants further study in New Zealand.

*Appendix I.*



**Figure 2. Sample Organisations' Structure**

*Appendix II*

## THE EFFECTS OF TRAFFIC CONGESTION ON JOB PERFORMANCE

Daily Log Entry

**Think back to the journey to work that you have just made as you answer the questions below. These questions relate specifically to this trip only.**

1. What mode of transport did you use to get to work today? For example, private car, bus, or walking.

.....

2. How long did your journey take in minutes?

.....(mins)

3. How far did you travel in kilometers to get to work?

.....(kms)

4. What do you estimate your average speed to have been in kilometers per hour?

.....(km/hr)

5. How long, in months, have you been using the same route to get to work?

.....(months)

6. How many obstacles, such as traffic lights, roundabouts, stop and give-way signs, did you go through to get to work this morning?

.....

7. On a scale of 1 to 6 where 1 is little or no congestion and 6 is highly congested, how congested do you feel the road ways were today on this particular trip to work?

1

2

3

4

5

6

Little Congestion

Highly Congested

*Appendix III*

## THE EFFECTS OF TRAFFIC CONGESTION ON JOB PERFORMANCE

*Questionnaire*

**Think about the journey you have just made to work today as you answer the questions below. For the following statements, please indicate, from 1 to 6, the extent to which they apply to you during the journey you have just made.**

1 = Strongly Disagree  
2 = Somewhat Disagree  
3 = Mildly Disagree

4 = Mildly Agree  
5 = Somewhat Agree  
6 = Strongly Agree

1. I am in a hurry.
2. I feel I have control of this driving situation.
3. I am concerned about getting to my destination on time.
4. Traffic conditions are congested.
5. I have a flexible time schedule.
6. I am annoyed by driving behind other vehicles.
7. Trying but failing to overtake is bothering me.
8. Trying but failing to overtake is frustrating me.
9. I am not patient during this rush hour.
10. Because I am irritated I am driving aggressively.
11. I do mind being overtaken.
12. I am feeling aggressive.
13. I am feeling frustrated.
14. I am losing my temper when other drivers are doing silly things.
15. I am feeling tense when overtaking other vehicles.
16. I am feeling satisfied when overtaking other vehicles.
17. I am feeling tense.

## THE EFFECTS OF TRAFFIC CONGESTION ON JOB PERFORMANCE

*Questionnaire*

**Think about the journey you have just made to work today as you answer the questions below. For the following statements, please indicate, from 1 to 6, the extent to which they apply to you during the journey you have just made.**

1 = Strongly Disagree  
2 = Somewhat Disagree  
3 = Mildly Disagree

4 = Mildly Agree  
5 = Somewhat Agree  
6 = Strongly Agree

18. I am feeling uneasy.

19. I feel nervous.

20. I am feeling bothered.

21. I am feeling distressed.

22. I am feeling peaceful.

23. I am feeling relaxed.

24. I am feeling contented.

25. I am feeling comfortable.

26. I am feeling calm.

## *Appendix IV*

### Performance Rating - General Structure

**These ratings below relate directly to the performance of the individual since they have arrived at work today. Base your ratings on the actual behaviors you have observed this morning only.**

Write the number that relates to the level of the behavior observed at the end of each statement.

- 1 = seldom performs correctly to standards expected
- 2 = performs below acceptable level, below standards expected
- 3 = performs at minimal acceptable level, meets standards expected most of the time
- 4 = performs above acceptable level, exceeds standards expected
- 5 = performs consistently above acceptable level, greatly exceeds standards expected

**Put an N if you believe a statement is not applicable to the employee being rated.**

**Remember that your ratings are completely confidential. Your organization will not know the results of the study for a particular individual.**

#### **(A) DEPENDABILITY**

- (i) Clothes**
- (ii) Punctuality**
- (iii) Composure and emotional stability**

#### **(B) CORE TASK PROFICIENCY**

- (i) Quantity of output:**
- (ii) Quality of work output:**
- (iii) Accuracy:**
- (iv) Customer/client service:**

#### **(C) ORGANIZATION COMMITMENT**

- (i) Overall job related attitude**
- (ii) Responsibility, commitment and dedication**
- (iii) Integrity and professional ethics**

#### **(D) TEAMWORK/SOCIAL**

- (i) Relationship with others**
- (ii) Communication, includes clients and other employees**

#### **(E) INNOVATION**

- (i) Suggestive ideas**
- (ii) Works without direct supervision or requests**
- (iii) Creating improved processes and routines**

*Appendix V*

## THE EFFECTS OF TRAFFIC CONGESTION ON JOB PERFORMANCE

**Please complete both sides.**

1. Gender

Male

Female

2. Job Title

.....

3. Age

.....

4. Do you have a disability which affects your travel arrangements?

Yes

No

**THINK BACK OVER THE LAST YEAR.**

5. How many times did you have to change the route you take to work because of traffic congestion?

6. How many days of work did you miss because of traffic congestion?

7. Can you think of a time when your performance at work was affected by the traffic congestion you experienced that day?

Yes

No

8. If you answered yes to the above question, in which way was your performance affected?

9. Has the level of traffic congestion increased since you began commuting to work?

Yes

No

10. Have you considered changing jobs or residence because of traffic congestion?

Yes

No

*Appendix VI*

## THE EFFECTS OF TRAFFIC CONGESTION ON JOB PERFORMANCE

## INFORMATION SHEET FOR PARTICIPANTS

My name is Iain McCombe and I am completing a Masters degree at Massey University. My supervisor is Dr Gus Habermann a senior lecturer from Massey University.

I am sure you have experienced the annoyance of the morning traffic congestion on our motorways and inner city streets. The traffic regularly features in local and national papers as well as radio and television news stories. Ernst and Young has calculated that this congestion costs the Auckland region upwards of \$1billion dollars a year in catch up costs and lost opportunities.

I am interested in the effects of sitting in the morning traffic congestion on your ability to perform your job. The results of this study will help your organization devise means of decreasing the effects of this congestion and could potentially be used as more evidence to local councils and government of the problems this region is facing in terms of traffic congestion. If you agree to participate in the study you will be asked to complete a daily log entry detailing such things as the distance of your journey and the time it takes you to get to work. You will also be asked to complete a short questionnaire about your journey and how it has made you feel that day. After this you can begin your normal working day but your job performance may be observed for the purposes of the study. The data obtained will be formed into two groups so that comparisons can be made between those that travel to work by private car and those that travel by other means, such as public transport.

You will be provided with an identification number for the purpose of keeping your identity anonymous. In this way your organization will not know the results of the study for a particular individual. I will keep a master list of names and numbers to aid in the collection of data but once data analysis has begun all names will be erased. All information that you provide will remain completely confidential and will only be viewed by myself and my supervisor. The results will be summarised in my thesis. Some findings might be used, in an anonymous form, to support later academic research.

You will be compensated for your time and effort by your choice of petrol or music vouchers. These vouchers and your organizations commitment to the study do not mean that you must participate in the study. Further, you are free to withdraw from the study at any time. Please do hesitate to ask any questions regarding the study, at any time before, during or preceding the study.

## THE EFFECTS OF TRAFFIC CONGESTION ON JOB PERFORMANCE

### PARTICIPANT CONSENT FORM

I have read the information sheet and have had the opportunity to discuss details of the study with Iain McCombe. My questions have been answered to my satisfaction, and I understand I can ask further questions at any time.

I understand I am under no obligation to complete the study in full and I can withdraw from the study at any time.

I agree/do not agree to participate in the research project. Comprising a daily log entry, performance measurement and completion of a questionnaire.

Name: \_\_\_\_\_

Signed: \_\_\_\_\_

Date: \_\_\_\_\_

**Thank you for your time.**

Iain McCombe.

## THE EFFECTS OF TRAFFIC CONGESTION ON JOB PERFORMANCE

### PARENT / LEGAL GUARDIAN CONSENT FORM

I have read the information sheet and have had the opportunity to discuss details of the study with Iain McCombe. I have discussed the study with my adolescent who has indicated s/he is willing to be involved. My questions have been answered to my satisfaction, and I understand I can ask further questions at any time.

I understand that my adolescent is under no obligation to complete the study in full and that s/he can withdraw from the study at any time.

I agree/do not agree to my adolescent, \_\_\_\_\_ (adolescents name) participating in the research study, comprising of a daily log entry, questionnaire and performance measurement.

Name: \_\_\_\_\_ (Parent or guardian)

Name: \_\_\_\_\_

Signed: \_\_\_\_\_

Signed: \_\_\_\_\_

Date: \_\_\_\_\_

**Thank you for your time.**

Iain McCombe.

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