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Master of Transportation Sciences

Master's thesis

Understanding Commuter Stress as an Effect of the Transport Mode Choice: A Case Study in Indonesia

Anisa Fauzi Ratnasari

Thesis presented in fulfillment of the requirements for the degree of Master of Transportation Sciences, specialization Traffic Safety

SUPERVISOR :

Prof. dr. An NEVEN

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2022
2023

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ACKNOWLEDGEMENTS

I am grateful for the opportunity to submit this thesis, which represents the end of my studies in transportation sciences with a specialization in road safety at Hasselt University, made possible through the VLIR-UOS Master Scholarship. Working on this research has been an enriching experience, providing invaluable insights into transport mode choice and the factors contributing to commuting stress.

This thesis would not have been completed successfully without the continuous assistance of numerous individuals. First and foremost, I would like to express my heartfelt gratitude to my UHasselt supervisor, Prof. dr. An Neven, and UHasselt mentor, Brent Peters, whose direction, support, and constructive advice significantly helped in the improvement of my thesis report. Their knowledge and commitment have helped to shape the quality of this work.

I am also thankful to my family and friends for their endless support, affection, and understanding during this journey. Their persistent encouragement and faith in me have strengthened me, allowing me to overcome obstacles and finish this thesis.

Finally, I want to thank VLIR-UOS for providing me with this incredible chance to pursue a Master's Degree. The scholarship has been essential to my academic and personal development, and I am grateful for their investment in my education.

Anisa Fauzi Ratnasari
June 1, 2023

ABSTRACT

Jakarta Metropolitan Area (JMA) faces many transportation problems. This study examined the relationship between commute stress and transport mode preference. A questionnaire survey was used with a sample size of 629 participants. The study learned about the factors that influence transport mode preferences, compared stress levels across modes of transportation, investigated how mode choices affect stress levels, and recommended coping with commuting stress and improving the commuting experience. Compared to other modes of transportation, the data showed that using MRT (Mass Rapid Transit) was associated with the lowest stress levels, whereas on-demand transportation was related to higher stress levels. The report emphasises the significance of improving public transport services and infrastructure to offer reliable substitutes for private vehicles. Age, travel time, travel cost, activity duration, the time when commuting, affordability, speed, and accessibility, were discovered to influence mode choice. Furthermore, people living further away from their destinations, people with lower income, and newcomers residents were more likely to be stressed when using public transport. The study also underlines the importance of expanding public transport and improving road infrastructure and traffic law regulations to improve travel quality. Media distraction, mindfulness practises, and proactive planning were mentioned as potential coping mechanisms to lessen commuter stress. These findings offer valuable insights into transportation mode preferences and commuting stress levels among commuters in urban areas and provide ideas to minimise stress and improve the overall commuting experience.

Highlights:

1. The study examines the factors influencing commuter stress and mode choice in the Jakarta Metropolitan Area.
2. On-demand transport, specifically taxis, was discovered to be the most stressful way of transportation.
3. MRT came as the mode of transportation with the lowest travel stress levels.
4. Affordability, speed, and accessibility were discovered to be significant factors influencing mode choice in transportation.
5. It was discovered that traffic congestion and journey time were related to commuter stress.
6. Rainy was observed to enhance commuter stress.
7. Policy and regulatory changes, public transit, and road infrastructure improvements are critical variables in improving commuter travel quality.
8. Distraction techniques, mindfulness, and travel planning were indicated as coping techniques.

Keywords: Transport mode choice, commuter stress, Jakarta Metropolitan Area, factors influencing mode choice, travel quality, coping mechanisms.

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BPS	: *Badan Pusat Statistik* (Central Bureau of Statistics)
BRT	: Bus Rapid Transit
DKI Jakarta	: *Daerah Khusus Ibukota Jakarta* (Special Capital Region of Jakarta)
JMA	: Jakarta Metropolitan Area
KRL	: *Kereta rel listrik* (Electtric Multiple Unit)
KMO Test	: Kaiser-Meyer-Olkin Measure of Sampling Adequacy Test
LRT	: Light rail transit
MRT	: *Moda Raya Terpadu* (Mass Rapid Transit)
WHO	: World Health Organization

1 INTRODUCTION

1.1 Problem Statement

Jakarta Metropolitan Area (JMA) is known as Jabodetabek, consisting of DKI Jakarta and four other adjacent administrative regions or municipalities (Kabupaten) – Bogor, Depok, Tangerang and Bekasi. JMA has an area of approximately 8000 km^2. This metropolitan area, one of the world's most densely populated areas after Tokyo, is one of the world's biggest megacities, with a population of more than 30 million (Central Bureau of Statistics, 2020). This metropolitan area's population is growing at a pace of 2.9% per year. The residents experience daily challenges due to traffic congestion, long commutes, and a lack of transportation choices (Saffan & Rizki, 2018).

FIGURE 1 The Jakarta Metropolitan Area Map (Syahputri, 2022)

Commuters are inseparably linked to the transport system, as a high percentage of Indonesians use private transportation. Besides, other government policies, such as fuel subsidy policies, contribute to a less sustainable transportation system (Rosida et al., 2019). Congestion is the most severe issue in Indonesian urban transportation. Central Bureau of Statistics in 2019 explained that the number of commuters who experience congestion in Greater Jakarta is very high compared to urban areas, 70% of total commuters. Furthermore, traffic fatalities are significantly high and continue to be so (Soehodho, 2017). The main issue appears to be a supply-demand imbalance in transportation needs, with annual motorisation growth of 10%, followed by annual road infrastructure growth of less than 1% (Rahayu, 2018).

Commuting is an essential daily activity for many people in JMA as they travel to and from work, school, or other activities. People commute from the suburbs to

Jakarta on a daily basis. This condition makes transportation, as a basic need for people to carry out their activities, a critical concern. Most residents in the area commute by private vehicles, such as cars or motorcycles, while others use public transportation (Suatmadi et al., 2019). Consequently, JMA is facing a fast-growing population and is dealing with issues such as transportation quality. The condition worsens as the absence of first and last-mile trip facilities that link to and from public transportation. This circumstance inhibits commuters in the greater Jakarta area from using public transport (Tjahjono et al., 2020).

Commuting might also be a stressful experience (Regan & Buckley, 2003). Commuter stress perception is a critical aspect of urban mobility and a key concern for people who commute within or across regions. Moreover, the transportation mode used for commuting significantly impacts stress levels, with different modes presenting different stressors. For example, driving alone can cause stress due to traffic congestion, road accidents, and parking difficulties (Novaco et al., 1989; Mann & Abraham, 2006). On the other hand, public transportation may cause stress due to crowdedness, delays, and uncertainty regarding arrival times (R. E. Wener et al., 2003; Cantwell et al., 2009). In terms of commuting, stress is associated with physical and mental health. Nearly all forms of commuting can cause stress, with the rush to work or school in the morning particularly unpleasant. Some modes of transportation may contribute more to stress levels than others. Commuting is an overall experience which affects a significant portion of the population daily. As a result, the stress experienced during commuting has a significant impact on a large number of people (Legrain et al., 2015).

The consequences of commuting stress may discourage people from switching to a more environmentally sustainable mode of transportation (Legrain et al., 2015). This is a source of concern, the potential public health effects of stress and the serious health and life satisfaction implications of stressful commuting. Commuting stress has also been proven to affect a person's ability to focus or finish the job (R. Wener et al., 2005). Poor job performance is also linked to commuting stress, which is undoubtedly impacted by these health and burnout mental effects (Amponsah-Tawiah et al., 2016).

Several stress-related factors have been found in the psychological and sociological literature (Gottholmseder et al., 2009), including cost, time, distance, and personal preferences, which influence the transport mode choice. However, it is crucial to understand the extent to which stress perception influences transport mode choice and whether alternative modes of transportation can mitigate commuting stress. Furthermore, the availability and accessibility of various forms of transportation can influence mode choice and, as a result, the stress level encountered while commuting. Furthermore, the influence of individual variables such as age, gender, income, and lifestyle in shaping stress perception and mode choice must be considered (Gottholmseder et al., 2009).

There are many factors contributing to stress while commuting. Those can be

broadly grouped into objective (time, comfort, control) and subjective stressors (feeling, desire, satisfaction) (R. W. Novaco et al., 1989). While commuting, objective or environmental stressors have a negative impact on a person's control or comfort. Furthermore, subjective stressors impact a person's satisfaction with a mode. The personal subjective factors act as a filter through which objective stressors are experienced. Objective stresses are concrete characteristics of the travel experience, such as journey time, comfort, safety, and dependability.

On the other hand, subjective stressors are human perceptions and evaluations of those objective stressors. A link between travel time, congestion, and stress has been discovered in several studies. Commuting time is positively related to commuting stress (Gottholmseder et al., 2009; Wener & Evans, 2011; Legrain et al., 2015). The longer commuters have to commute, the more stressed they are. The stress of driving a car has been compared in recent studies. Wener and Evans discovered in 2011 that car drivers are more stressed than bus and train commuters. In the United Kingdom, private car commuting was more stressful than walking and cycling (Gatersleben & Uzzell, 2007), as walking or taking public transportation may be more enjoyable (Legrain et al., 2015).

Furthermore, there has been little research on the psychological health of Indonesian commuter workers. Rahmadana (2014) conducted one of these studies, which examined commuters' quality of life in Medan, North Sumatra, using 384 samples. According to this study, commuters' quality of life is significantly influenced by their age and gender. In particular, people above the age of 50 were shown to have a higher quality of life, and men outperformed women in terms of quality of life. On the other hand, Sugianti & Anggorodi (2013) carried out qualitative research. They investigated the stress levels of TransJakarta bus passengers. The results of this study showed that almost all commuter workers experience stress in carrying out their commute activities due to the poor management of the TransJakarta Busway transportation and congestion, which is considered a source of stress (stressor). Rosida and colleagues (2019) conducted a quantitative study of multiple logistic regression on the relationship between car and non-car usage in Jakarta and Denpasar. According to the findings of this study, car commuting is perceived to be more stressful than non-car commuting in both high and low-impedance metropolitan areas.

This study filled a research gap by doing extensive quantitative research on several modes of transportation, including active and on-demand transportation. The study focused on the relationship between commuter stress and mode of transportation choice. Several significant criteria influenced the selection of JMA as the case study region, including severe traffic congestion, long travel times, and limited public transportation options. These elements substantially impact the daily lives of millions of people in this metropolitan area. As a result, this study provided a comprehensive understanding of commuter stress due to transportation mode choice in a densely populated and congested urban environment.

1.2 Research questions

Based on the research problem discussed, the main research question is formulated as follows:
"What is the relationship between transport mode choice and commuter stress experience in Jakarta Metropolitan Area?"
The following are the sub-questions that support the main research question:

1. What factors influence the transport mode choice?
2. How does transport mode choice impact stress levels among commuters, and are specific modes of transportation more stress-inducing than others?
3. How do personal and environmental factors shape transport mode choice and commuter stress experience?
4. What strategies can be implemented to reduce stress levels and improve the overall commuting experience?

1.3 Objectives of the study

The main goal of this research is to understand better the stress level experienced by commuters and the impact of that stressful experience on commuters. The research also aimed to understand better the individual and trip factors and situations that can contribute to travel stress. Studying commuter stress perception lies in the fact that urban commuting experiences are a crucial aspect of the quality of life for metropolitan area residents.

Understanding the relationship between transport mode choice and commuter stress perception is essential for policymakers and individual commuters, as it can inform decision-making on transport infrastructure and mode choice. JMA is known for its congested road and inadequate public transportation system, leading to high levels of commuter stress. This study can provide insights into factors that contribute to stress in different modes of transportation and help identify potential solutions to mitigate stress in the commuting experience.

The study's findings have the potential to provide significant information to commuters when deciding on a preferred method of transportation. Commuters can make more informed choices based on full awareness of both the advantages and drawbacks of each mode by studying and comparing the stress levels associated with each mode. The study's findings focused on specific aspects that lead to stress in various modes of transportation, such as traffic congestion, delays, comfort levels, and general dependability. This knowledge can help commuters balance these issues and make decisions that fit their specific preferences and needs.

Furthermore, studying the relationship between commuter stress and mode choice might provide useful insights for guiding decisions on transport infrastructure and policy. Policymakers can make informed decisions to address these concerns by understanding the stress factors associated with various modes

of transportation, such as traffic congestion, public transport delays, or overcrowding. Implementing solutions such as upgrading public transit, optimising traffic management systems, or promoting active modes of transportation can help minimise commuting stress. These efforts aim to improve the commuting experience, resulting in a more pleasant and efficient transportation system for JMA.

1.4 Research Overview

This study is organised into six chapters. In the first chapter, Jakarta Metropolitan Area commuters' current conditions are highlighted, including traffic, public transport and some factors which can contribute to the stress level. Moreover, the section addresses the importance of reducing commute stress to improve well-being and discusses this study's research questions and objectives. Chapter 2 addresses various factors related to commuter stress, either objective or subjective stressors. The section describes each factor in detail.

Chapter 3 presents the research method, including data collection, survey materials, and analysis method. The remaining chapters focus on making sense of the analysis results. The results of the analysis are discussed in Chapter 4. Chapter 5 discusses in-depth all the results and relates them to previous findings, address the limitations and provides recommendations for further study and the limitation of the current study. Finally, chapter 6 provides the conclusions of the current study.

2 LITERATURE REVIEW

A comprehensive literature review is intended to identify indicators of the relationship between transport mode choice and commuting stress.

2.1 Commuting and travel behaviour: transport mode and decision making

This section examines the elements that influence travel behavior. Many elements influence travel activities, including transportation methods, trip purpose, and social contact with other individuals (Kitamura, 1988; Axhausen & Gärling, 1992). Commute refers to the frequent journey people take between their home and their place of work or other daily activities. It is characterised by routine and repetitive nature (Lyons & Chatterjee, 2008). The daily commute from home to their place of job or study is known as commuting, and it is a necessary component of modern life. In various contexts, "commuting" can signify many different things, but it most often relates to how frequently people commute to their destinations (Mokhtarian & Salomon, 2001). The concept of commuting is rooted in urban culture and has significant well-being, social and economic consequences in local and regional (Chatterjee et al., 2020; Guo et al., 2020; Rolfe, 2013).

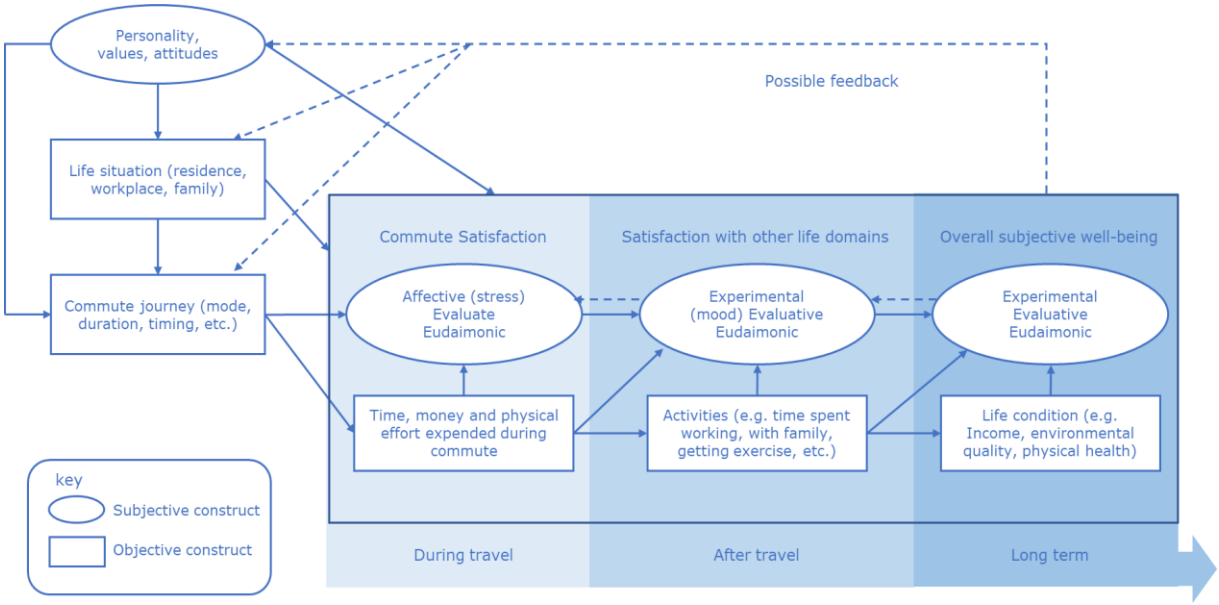


FIGURE 2 The relationship between commuting and subjective well-being (Chatterjee et al., 2020)

Decisions regarding what to accomplish during the day, including possible travel plans, must be made. According to Primerano and colleagues (2008), an individual travels for various reasons, the main goal of which is to participate in a sequence of activities. Stopher and colleagues (1996) classified activities as mandatory, flexible, and optional. Mandatory activities are scheduled on a regular basis (typically daily), in a specific location, and at a specific time. Flexible

activities are regular activities with some flexibility in location or time, whereas optional activities are activities with varying qualities. It is also possible that a long duration of necessary activity leaves little time for alternative activities, and therefore the frequency of optional activities becomes zero. Individual decisions influence daily actions. Commuting is generally associated with an obligatory activity that must be completed at a specific time. Job commuting takes place over other activities for most individuals and has a higher tolerance threshold to longer trip distances or travel times (Næss et al., 2019). Longer commuting times are connected with lower happiness, higher stress levels, and other unpleasant feelings (Raveau et al., 2016; Zhu & Fan, 2018).

Human dynamic mobility fluctuation varies from day to day due to complex iterations between compulsory routine journeys, historical dependencies, and various needs throughout the days (Joewono et al., 2017; Susilo, 2005). Millions of people commute to and from work every day, making it an essential part of daily life in this setting. However, it has negative personal and social-ecological consequences, such as physical and psychological health, a loss of leisure time, and increased climate emissions, contributing to global warming (Stein et al., 2022). People's commutes are influenced by their life circumstances and personal characteristics. The commute journey can have objective and subjective effects on the commuter during, after, and in the long run (Chatterjee et al., 2020). Commuting has objective consequences for those who do it, such as expenditure of time, money, physical effort, and potential injuries or pollution exposure. There is evidence that the unpleasant commute experience "spills over" into how people feel and perform at work and at home, in addition to the subjective effect. (Chatterjee et al., 2020).

Páez & Whalen (2010) investigated the relationship between attitudes and commute satisfaction by mode, gaining a deeper understanding of why people are dissatisfied with the duration of their trip, with a conclusion that the average commuter would desire to reduce commute time regardless of the form of transportation used. Commuting stress can be caused by several factors. As a result, the desire to shorten travel time can be seen as a response to reducing stress and discomfort in the journey. Some people utilise their commute time to reflect and relax; they may view it as a good transition between their home and work lives and a chance to "shift gears" (Mokhtarian & Salomon, 2001). Many people use coping methods, such as alternative routes or relaxation techniques, to improve the benefit they can get from their journey and reduce any bad aspects. Many people use coping strategies to improve their commute experience, such as taking alternate routes or adopting relaxation techniques Larson (1998).

2.2 Commuting Impacts

The connection between well-being, health and transportation is indirect. It includes several factors that influence individual and community health outcomes. Motorised vehicles, for example, can directly influence health due to emissions and

air pollution. Physical exercise from active modes of transportation, such as cycling and walking, can positively impact health by lowering the risk of chronic diseases. Some policymakers have suggested that transportation-related strategies should address well-being-related issues effectively and comprehensively, including satisfaction, mobility, and accessibility (Bell, 1990). Merriam-Webster describes well-being as "the state of being happy, healthy, or successful." Although there is disagreement about the best definition, most people agree that well-being includes the presence of happy feelings and moods as positive affect and the absence of unhappy feelings as negative affect, as well as cognitive well-being or life satisfaction and positive well-being (Diener et al., 2002). Because physical health is a significant factor influencing overall subjective well-being, the effect of commuting on physical health has a substantial potential to affect overall subjective well-being (J.-P. Zhang et al., 2008).

Some research has been conducted on **commuting and human health and well-being**. The main finding from previous research has focused on how commuting characteristics, especially traffic congestion, affect human well-being (Smith, 2017; Smyth et al., 2008; Litman, 2020). A few studies have also investigated the mode of transportation and the number of mode transfers as potentially essential variables in the commuting experience. Having to transfer has been associated with lower levels of travel satisfaction for transit commuters (Ye & Titheridge, 2017). There is evidence showing how commuting time affects time allocation to other pursuits. According to R. E. Wener et al. (2003), reducing travel time can dramatically lessen the consequences of perceived stress. The time lost while travelling has been determined to negatively impact someone's health and well-being.

The link between commuting, health, and well-being has drawn increasing focus over decades. In research conducted in London began in 2009, two dimensions of positive and negative well-being were evaluated and compared to various modes of commuting while accounting for travel distance. For positive elements, self-rated life satisfaction was used, and for negative parts, mental distress. Walking was found to be favourably associated with greater life satisfaction than driving. The research also discovered a negative correlation between high mental stress among commuters who use public transportation and connectivity for public transportation or network density (Chng et al., 2016).

The effect of commuting on **physical health** is a potential way to affect overall subjective well-being (Dolan et al., 2008). R. Novaco & Gonzalez (2009) investigated the link between commute stress and physical health. They discovered that people stuck in traffic had higher levels of physical impedance during their travel. Higher blood pressure, lower frustration tolerance, more negative mood, greater work absences, and a higher vulnerability to colds and flu regardless of job absences were among the consequences. Individuals with higher levels of commute stress also reported lower overall residential and job satisfaction levels. A previous study found progressively greater adrenaline and noradrenaline

levels and decreased felt work control in a study of three levels of traffic congestion exposure with urban bus drivers (Evans & Carrère, 1991). Conversely, according to Humphreys et al. (2013) and Schäfer et al. (2020), more active commuting time is connected with higher levels of physical well-being. For significant health advantages, the World Health Organization advises 150 minutes of moderate physical activity per week. Walking or bicycling to work every day, on the other hand, results in a lower BMI, percentage of body fat, and waist circumference and enhances emotional and physical well-being (Laverty et al., 2015; Flint et al., 2014; Millett et al., 2013; Humphreys et al., 2013). Moreover, using a car results in the direct health costs of forced inactivity and the opportunity health costs of forgoing more physically active forms of transportation (e.g. walking or cycling) (Frank et al., 2007; Wen et al., 2006).

Active commutes as a form of physical activity may contribute significantly to total physical activity and thus have significant health benefits (Kahlmeier et al., 2010). The absence of illness is correlated with cycling to work. Fewer people report being ill, the more frequently they cycle to work and the farther they journey (Hendriksen et al., 2010). While commuting duration is predictably associated with inhalation of air pollutants among commuters, one study estimated that the benefits of physical activity offset the potential impact of air pollution for people who cycle up to 3.5 hours daily (Tainio et al., 2016).

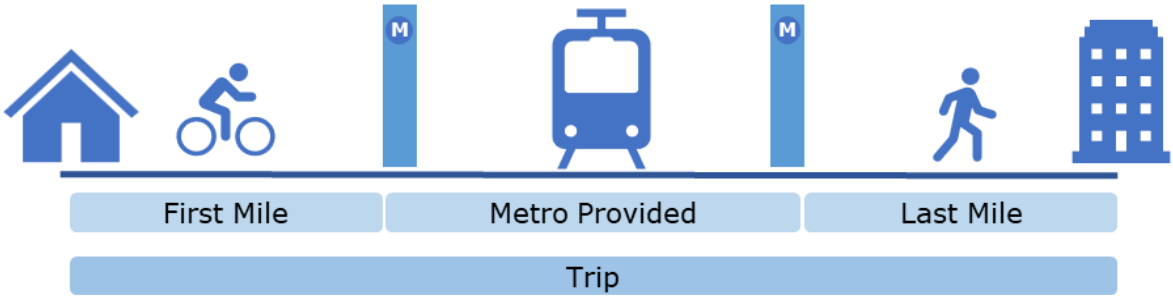


FIGURE 3 Active transport concept in the first and last miles trip (King, 2016)

Active travel is more relaxing and exciting than driving or public transportation (Gatersleben & Uzzell, 2007). This study found that these passive modes of transportation are considered more tedious and stressful. Furthermore, longer travels have been linked to fatigue and poor sleep symptoms in male Tokyo workers (Kageyama et al., 1998), as well as poor sleep in New York train commuters (Walsleben et al., 1999), which can lead to cardiovascular abnormalities and dysfunction associated with the onset of heart disease. Studies on passive commuter types show that long commutes are linked to greater absenteeism (Kluger, 1998). Active travel time is not related to improved mental health but is associated with better physical well-being (Humphreys et al., 2013). Longer car commutes are linked to lower life satisfaction and more time strain (Clark et al., 2020).

Traffic emissions in Taiwan have become an extensive and serious source

of human exposure to air pollution as motorcycle ownership and use have increased significantly (Huang et al., 2012). Many kinds of research have shown that riders who are exposed to air pollution have significantly reduced lung function, a higher risk of developing cardiovascular and infectious diseases, and increased phlegm and acidity of the airways (Wu et al., 2010; Ekpenyong et al., 2012; Lawin et al., 2016); (Carvalho et al., 2018). Furthermore, motorcycle owners are less likely to take the bus than non-motorcyclists. It may be challenging to persuade motorcycle and private car owners to take the bus unless public transportation is made more attractive (Yun et al., 2013).

According to research, cars produce air pollution linked to transportation that kills tens of thousands of people annually in Europe (World Health Organization, 2005), noise pollution from traffic that has been linked to cardiovascular disease and sleep disturbances (WHO, 2007) and greenhouse gases that speed up climate change, which is on track to become significant public health risk (McMichael et al., 2006). Car-oriented environments may therefore raise health inequities because poorer groups suffer a disproportionate share of car-related health costs and because poorer groups confront the debilitating impacts of being carless in a car-oriented environment more frequently (Goodman et al., 2012).

Moreover, cars are also significant contributors to **road traffic injuries**. Road traffic accidents are the eighth leading cause of death among all ages (WHO, 2018). Road traffic injuries (RTIs) are the largest cause of unintentional injuries, accounting for the majority of unintentional injury deaths (Bachani et al., 2017). Being involved in a traffic accident can significantly affect commuters' well-being and stress levels(R. Novaco & Gonzalez, 2009). According to WHO 2022 data, despite having around 60% of the world's vehicles, low and middle-income countries account for 93% of all road deaths. Road traffic accidents result in significant economic damage for victims, their families, and entire countries. These costs result from the price of medical care, lost wages for individuals who are killed or disabled by their injuries, and caregiving expenses for family members who must take time off from work or school to look after the injured. Most nations lose 3% of their gross domestic product to road accidents (WHO, 2022).

2.3 Commute Stress

Certain types of commuting might even be more stressful than others. Novaco et al., 1989 observed that the causes of commute-related stress could be divided into two groups, objective and subjective impedance. The objective factors are commuting time, distance, speed (as a mix of time and distance) or commuting conditions such as traffic congestion. Subjective elements include perceived control over the commute, predictability of commuting conditions, and personal characteristics such as gender or family situation. These stressors have a negative effect on a person's comfort or sense of control while travelling. Moreover, factors like mode satisfaction impact the subjective perception of these stressors. According to Majumdar (2021), older commuters are more likely to be satisfied

than younger commuters. These individual subjective variables filter the perception of objective stressors (Legrain et al., 2015). Novaco et al. (1989) concluded that having personal control over travel reduces stress.

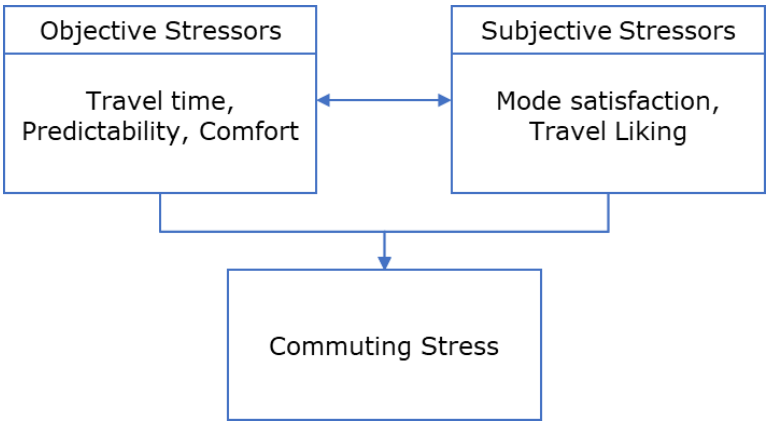


FIGURE 4 Stressors of Commuting Stress. (Legrain et al., 2015)

Furthermore, research has found a link between stress and transportation. It is common and naturally frustrating to be stuck in traffic or wait for a delayed train (Ettema et al., 2012). Stress is frequently caused by demands that are met while travelling. However, it is unclear how commuting and worry are related. For instance, merely because a delay occurs does not imply that the user encountering it is under stress. Gottholmseder et al. (2009) observed that individual stress correlated with travelling to work. The physical separation of house and job location involves daily travel, which is thought to influence perceived stress levels.

In 1991 Novaco et al. observed that stress perceived as due to commuting also varies across gender. Compared to males, women report more stress from their commutes. Thus, women may experience more significantly disadvantageous health effects from commuting than men. Moreover, a study found that the negative relation between commuting time and well-being holds only for women and is not because of a shorter work week or occupational segregation but because of greater responsibility for housework and childcare compared to men (Roberts et al., 2011).

A study distinguished between two types of impedance: physical impedance, such as speed, and subjective impedance, which is measured by drivers' perceptions of their inability to avoid traffic, reduced speed due to traffic jams, experience with traffic control devices, and other characteristics of their journey (R. W. Novaco et al., 1989). According to Sposato et al. (2012), control is the most powerful determinant of commuting stress, followed by the duration of the commute, predictability and impedance. Control has a strong relationship with commute time and predictability. There are many methods to implement control. Flexibility in work schedules, which allows employees in Atlanta, Georgia, control over when they commute, has been linked to lower commute stress, according to research by Lucas & Heady, 2002. Though choice and control are closely linked

concepts, some contend that choice can have an ambiguous impact on stress, especially if the options are not perceived as favourable (Koslowsky et al., 2013).

The majority of commute stress research has concentrated on car drivers, but research on those who use public transportation has found some similarities and some differences. Early research found that as train crowding in Stockholm increased, so did stress (Lundberg, 1976). Moreover, (Evans et al., 2002) found that predictability is associated with decreased stress for train commuters, as it is for driving commuters, possibly because predictability provides cognitive control in circumstances where commuters do not have behavioural control. Besides, optimisation to service quality reduced stress for New York City rail commuters by shortening commute times and improving predictability (R. Wener et al., 2005).

A study by Gatersleben and Uzzell (2007) evaluated commute stress among various modes of transportation and concluded that those who walk or cycle to work have the lowest stress, and those who drive have the highest stress. Furthermore, it has been discovered that feelings of comfort and safety from traffic are linked with lower commute stress in pedestrians (Legrain et al., 2015). According to research conducted in Rotterdam, active commuters' emotional states are more sensitive to weather factors such as temperatures, clouds, precipitation, and wind than other commuters (Böcker et al., 2016). Additionally, Stradling et al. (2007) discovered that the presence of weather protection influences satisfaction with bus services, but they did not study weather influences. Rainfall and wind speed have a detrimental impact on cycling frequency, with a 24°C air temperature producing the highest frequency (Böcker & Thorsson, 2014). Böcker et al. (2013) found that pedestrians and cyclists had lower mood levels when it was dark and shiny, hotter than 25°C, and raining. Furthermore, St-Louis et al. (2014) discovered that season impacts influence satisfaction with slow modes. Walking and cycling provide less satisfaction during the Canadian cold winter season, with cyclists suffering the most.

Active commuters were found in the study by Legrain et al. (2015) to be the least likely to report feeling stressed during their journey by a comparative study that used self-reported stress levels on a 5-point Likert scale. The majority of people who reported stress were drivers. It was evident that travelling by car is very different from travelling by walking, and as a result, various factors cause the stress associated with these journeys, and this could include factors like traffic congestion, unpredictability, and the lack of perceived control. (Abou Zeid, 2009). Moreover, R. E. Wener & Evans, 2011 analysed the stress of travelling by train and driving and discovered that driving is more stressful. Meanwhile, on-demand transportation (ODT) refers to adaptive transportation services that use a fleet of vehicles to give customers affordable and flexible transportation when and where they need it. According to Greenblatt and Shaheen (2015) study, on-demand transport may reduce commute stress due to time savings.

Comfort or discomfort also serves as a mediator of impedance. Crowding has

been linked to commuting stress, particularly stress associated with public transport (Koslowsky et al., 2013). Travelling in uncomfortable heat or noise levels and available seats is also known to cause stress (R. Novaco & Gonzalez, 2009; R. E. Wener et al., 2004). These physical or environmental events that cause a slower-moving trip, a loss of control, or discomfort are objective stressors contributing to a stressful commute.

2.4 Commuting Stress Coping Method

Coping, as defined by Monat & Lazarus (1991), refers to an individual's efforts to handle demands or conditions that are believed to be greater than their available resources. Coping is a dynamic process that fluctuates over time in response to changing load and situational judgement (Moos & Holahan, 2003). The primary goal of coping is to prevent the individual from adverse physical or psychological effects that may hurt them (Odacı & Çıkrıkçı, 2012).

According to Lazarus & Folkman (1984), there are two types of stress coping: (1) emotion-focused coping and (2) problem-focused coping. Emotion-focused coping is a stress-coping strategy that includes efforts to reduce the negative emotions that frequently come with stress. Further, problem-focused coping is a method of reducing stress by attempting to understand the causes better and trying to find feasible solutions. Emotion-focused responses involve positive reinterpretation of events, while others involve seeking out social support, whereas problem-focused responses may involve several discrete activities such as planning, direct action, seeking assistance and screening out other activities (Carver et al., 1989).

Folkman & Lazarus 1980 stated that emotion-focused coping means trying to control the emotional impact of stressful or potentially stressful experiences. In other words, when faced with a stressful circumstance, emotion-focused coping aims to reduce the unpleasant emotions that occur in reaction to the stressor rather than addressing the problem directly. To address the emotional suffering caused by the stressor, examples of emotion-focused coping include social support, defence mechanisms, and engaging in relaxation methods. Mindfulness is a form of attentional cultivation that has been shown to influence stress response towards various unpleasant psychological and physical settings, and this is a potential alternative approach for reducing commuter stress (Brand et al., 2012; Lindsay et al., 2018). Mindfulness is an open-minded, nonjudgmental awareness of the present moment (Bishop et al., 2004; Kabat-Zinn, 2003; Ludwig & Kabat-Zinn, 2008). This state of being relaxed yet alert and present has been shown to improve subjective perceptions of personal well-being while also regulating and boosting physiological functioning in the form of improved immune response and lower cortisol levels (Brand et al., 2012; Davidson et al., 2003; Lindsay et al., 2018).

Problem-focused coping refers to coping strategies that involve actively

attempting to understand and address a difficult situation. However, if a person lacks control over the situation, this type of coping may be ineffective (Lazarus & Folkman, 1984). Cognitive evaluation, time management, assertiveness, relaxation and meditation, and exercise are examples of stress management approaches for problem-focused coping. In short, problem-focused coping includes actively taking on to ease a stressful circumstance (Folkman & Lazarus, 1980). Problem-focused coping strategies are most effective when the stressful situation can be changed, whereas emotion-based coping is most helpful when the stressful situation cannot be changed. However, commuting in a private vehicle appears to be an unchangeable stressor. A person trapped in traffic will be unable to materially modify the circumstance, rendering any problem-focused coping mechanisms ineffectual (Glanz et al., 2015).

2.5 Factors of transport mode choice

A wide range of literature has provided findings about factors influencing individuals' mode choices. Commuters use a variety of transportation options, including walking, cycling, driving, and taking public transportation (bus or train). Active commuting modes, such as walking or cycling, are frequently used in general (Gordon-Larsen et al., 2009). Passive commuting refers to minimising modes that do not require a lot of physical activity, such as driving or riding in a vehicle or taking the bus or train. The commute includes one or more of these modes and can vary in complexity based on the number of transfers. Transfers can include transfers between modes, such as walking to the bus, driving to a parking lot, and continuing as a passenger in another vehicle, as well as transitions within the same mode, such as transferring by bus or train. However, public transportation commutes are typically more complicated than active and car commutes because they frequently involve transfers between buses and trains in addition to walking or cycling to bus stops or train stations (Lucas & Heady, 2002).

There are numerous of researches on selecting a method of transportation. Interesting research has examined numerous factors that have been identified as influencing commuters' mode of transportation, including the travel environment (Thøgersen & Møller, 2008), psychological variables (Chen & Chao, 2011), and economic aspects (Belgiawan et al., 2019). Haustein et al. in 2018 identified the three unique commuter segments: (1) unhurried timely commuters, (2) self-determined commuters, and (3) busy commuters. Unhurried timely commuters are those who take a more casual attitude to their commute and less stress on time constraints. They usually plan ahead of time for their journey and prefer a stress-free commute.

In contrast, self-determined commuters prioritise flexibility in their commuting choices. They frequently have more control regarding their schedule and route of transportation. Finally, busy commuters are people who are under a lot of time pressure and see their commute as a rushed and unpleasant experience because of external reasons like work expectations or time limits. According to the

discrete departure time choice model findings, self-determined commuters are younger and more likely to work flexible hours. In contrast, unhurried timely commuters travel farther to work and use public transportation more frequently. Previous research has identified time availability and convenience as important in mode choice decisions (Frank & Pivo, 1994).

Numerous studies have discovered that personal characteristics, family attributes, living environment, weather conditions, and other factors influence transport mode choice. M. Bradley & Vovsha, in 2005, investigated how household interactions affected travel choices. For instance, a child's requirements at home can affect the family's morning travel plans. The planning of the schedule would be affected if a parent needed to drop the child off at school before heading to the office. Zhang et al. (2020) evaluated the impact of essential factors on school travel decisions using tree-based and logit-based models in their study of student travel. The findings indicate that private car ownership, an unfavourable environment for walking and bicycling, and the ease of adults guiding kids encourage cars to use for school travel. While leaving during peak hours instead of other times, students are more likely to choose cars. Also, they utilise motorised transportation to take their children to school because of the greater distance.

Journey distance has been discovered that when faced with longer travel distances, people are more likely to prefer private vehicles for transportation (Levinson & Kumar, 1995). Similarly, C. R. Bhat and Guo (2007) discovered a negative link between journey distance and the minimized utilising of public transport, indicating that the likelihood of using public transport decreases as travel distance grows. In addition, research has regularly proven travel time to impact mode choice decisions. Cervero and Duncan (2003)conducted a study in California that found that longer journey times were related to a higher likelihood of taking public transport. Another important consideration is travel cost, which has been found to influence the mode of transportation selection. Higher travel expenditures, such as fuel costs or public transport charges, were related to a lower likelihood of utilising private vehicles (Hensher & Puckett, 2007).

Moreover, in terms of age, younger people use public transport more frequently than older people. With the rising age, the proportion of people who utilise public transportation as their primary mode of transportation has decreased (Levin, 2019). This could be linked to the fact that in comparison to young individuals, older people's health deteriorates, and more health problems become more widespread as they age (Hitimana, 2022).

The provision of pedestrian facilities plays an important role in encouraging active transportation. If there is a well-designed pedestrian network and facility, 42% of respondents are willing to walk up 300m rather than take a motorcycle taxi for their first and last mile. Commuters (17%) require public transportation integration to switch from one method to another (Tjahjono et al., 2020). Axhausen et al. in 2002 found that matching transportation efforts to current

patterns, weather, and the goal of each trip was difficult. Whereas, Environments with high-quality active and public transportation infrastructure are widely recognised for encouraging people to use sustainable modes of transportation (Buehler et al., 2017; Ewing & Cervero, 2010).

2.6 Transportation in JMA

There are several types of transportation available in JMA: (1) private transport: car and motorcycle (2) public transport includes Bus Rapid Transit (BRT), intercity buses, privately operated buses such as Kopaja, Metromini Mayasaribakti, and PPD, Light Rail Transit (LRT), Mass Rapid Transit (MRT), and Commuter Rail (KRL); (3) on-demand transport, such as taxi and ride-hailing (ojek online). Furthermore, there are Bajaj, which provide local transport on specific of the city's short streets, and Angkot (paratransit, which is an unplanned service), which, due to their small size, have the potential to become door-to-door services in JMA. (4) Active transportation, such as cycling and walking.

Six toll roads connect Jakarta to the rest of the satellite city. (1) Prof. Dr. Ir. Soedijatmo Toll Road connecting to Soekarno-Hatta International Airport, (2) Jakarta-Tangerang Toll Road connecting to Tangerang and further west to Merak, (3) Jakarta-Serpong Toll Road connecting to Serpong, (4) Depok-Antasari Toll Road connecting to Depok and planned to continue to Bogor. (5) Jagorawi Toll Road connecting Bogor and Ciawi in the south; (6) Jakarta-Cikampek Toll Road connecting Bekasi and Cikampek in the east; (7) Jakarta Inner Ring Road; (8) Jakarta Outer Ring Road I and II The JMA's road network is extensive. However, congestion is a significant problem, particularly during peak hours (Yudhistira et al., 2019).

Traffic congestion in JMA has become a problem that the government must address (Salim et al., 2019). The current public transportation system is connected with poor vehicle conditions, inadequate infrastructure for non-motorised modes, poor customer service, and unpleasant travel circumstances (Jannah et al., 2020). The city gave priority to the construction of road networks, most of which were made to accommodate private vehicles. There is also a lack of integration between different types of transportation, resulting in limited connectivity between regions. Furthermore, poor maintenance of road infrastructure has raised safety concerns among commuters (Leung, 2016).

Through the "Jak Lingko" scheme, an integrated transportation trip for the passenger, the city has taken tangible measures to transform its car-oriented city planning paradigm and deliver seamless mobility. The Jak Lingko integration concept also offers smooth travel between Transjakarta and the newly created MRT Jakarta and LRT Jakarta, as well as trains (KRL). Physical integration with these modalities has already begun at a number of stations. On the other hand, the public transportation system is also underdeveloped, with limited coverage and low quality of service in the Jakarta satellite city.

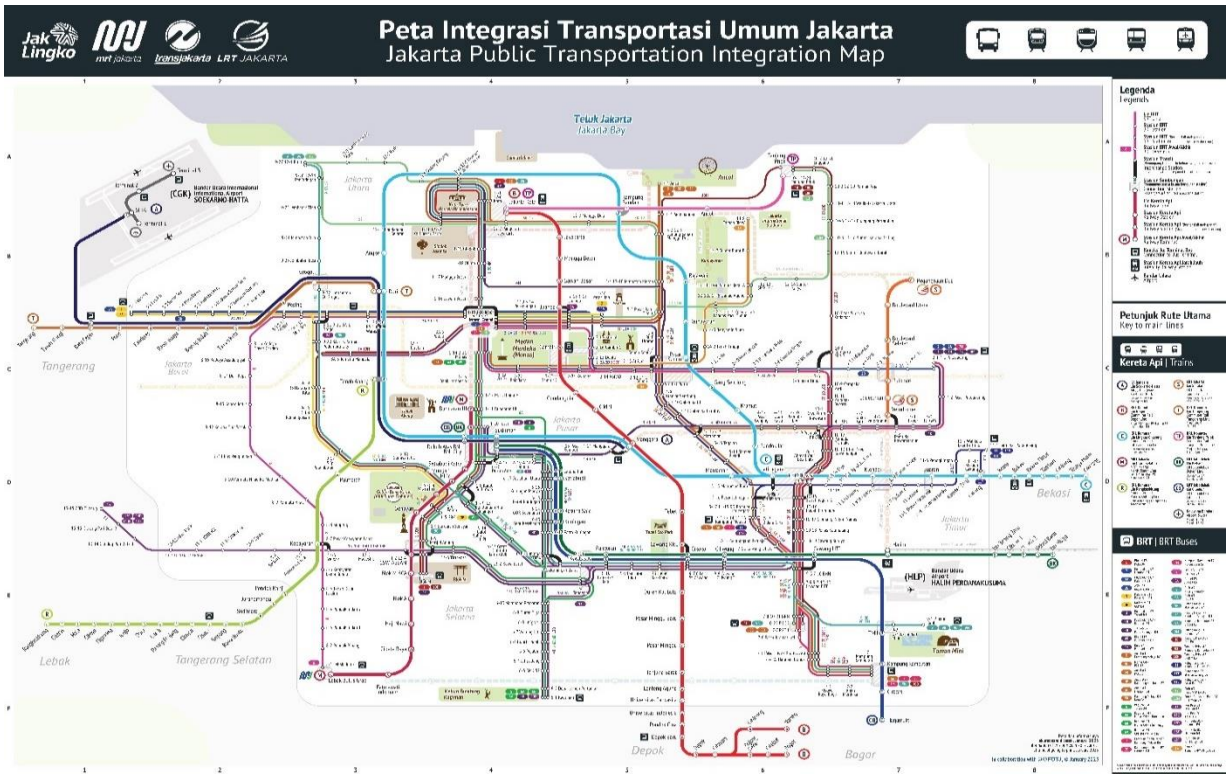


FIGURE 5 JMA public transportation integration map (transportforjakarta.com)

The commuter line (KRL) currently has roughly 1 million daily passengers. It is extremely popular among Jakarta workers who live in adjacent cities. As a result, during peak travel periods when road traffic is equally congested, commuter trains in Jakarta can get overcrowded. In **FIGURE 5**, the network currently consists of six primary lines: (1) Red: Bogor-Jakarta, (2) Yellow: Bogor-Jatinegara, (3) Blue: Bekasi-Jakarta, (4) Green: Rangkasbitung-Tanah Abang, (5) Brown: Tangerang-Duri, and (6) Pink: Tanjung Priok-Jakarta.

The greater Jakarta Transport Authority has a primary target to achieve in 2024 of 50% increasing public transport share and reaching 60% in the next five years. **FIGURE 6** illustrates the modal split in Jakarta, where public transit accounts for 11.17% of overall transportation utilisation. Shared modes account for 12.32% of the modal split. However, private transportation dominates the majority of transport in Jakarta, accounting for 77.81% of the modal split (cars 14.53% and motorcycles 63.28%). This reliance on private vehicles demonstrates the city's prevailing preference for individual forms of transportation, which may impact traffic congestion, environmental impact, and overall urban mobility difficulties. Private transportation, particularly motorcycles, is the most frequent mode of transportation, according to findings from Asian country studies (Tuan, 2015). It can also be seen on the chart that pedestrians and cyclists are not counted. JMA area has very low pedestrian and cycling facilities (Tjahjono et al., 2020).

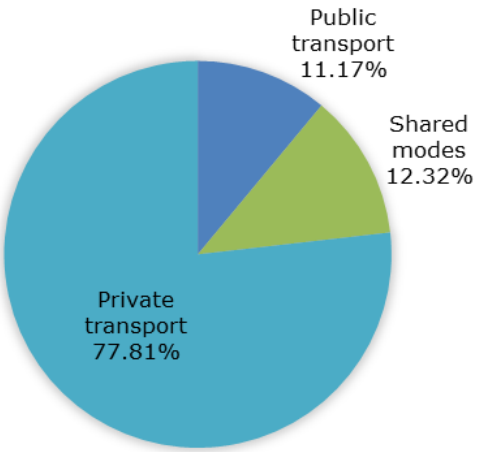


FIGURE 6 Modal split in Jakarta (transformative-mobility.org)

To solve JMA's transportation issues, the Indonesian government has initiated several policy actions. These include infrastructure investments such as the development of the Jakarta MRT and LRT lines. In April 2019, the city-owned transportation operator PT MRT Jakarta began commercial operation of its 16-kilometre rail line, which connects central and southern Jakarta via 13 stations. MRT corridor expansion plans are set to commence in 2027, with the first 5.8 km (Phase 2A) installed, followed by another 6.0 km (Phase 2B). In April 2019, PT LRT Jakarta began commercial operation of 5.8 km of the LRT system to integrate residential and business districts from Jakarta's northern and eastern residential neighbourhoods, thereby reducing congestion. The corridors are expected to be developed by 20 kilometres in five phases by 2027 (ITDP, 2021).

Furthermore, as a result of the limited capacity of formal public transit systems, informal modes of transportation have evolved as critical options for commuters. These informal types of transportation, also known as "ojek" or motorcycle taxis, "angkot" or minibuses, and "bajaj" or three-wheeled vehicles, and "becak" play an important role in fulfilling the mobility demands of JMA residents. These modes frequently operate outside the legal system where their existence is tolerated and offer the public flexible and economical mobility options. They highlighted numerous significant aspects of informal transport modes, such as their widely available presence, flexible routing, and ability to adapt to specific routes and passenger demands. However, this informal ojek is problematic since it is regarded as a free rider in the transportation market due to its disrespect for regulations (Harjoko et al., 2012).

In 2015, Go-Jek, a local start-up specialising in ride-hailing services, developed the first mobile application for ordering ojek and launched the online ojek trend. Go-Jek also provides on-demand services such as online vehicle taxi, truck courier, package, grocery, and food delivery, but it is best known for its enormous mobile-app-based ojek service (Go-Ride), commonly known as ojek online (Go-Jek, 2023). Following Go-Jek's success, other businesses such as Grab, Uber, and Maxim established online ojek services in Indonesia using mobile device applications to compete with Go-Jek. Conventional ojeks may enjoy the economic

advantages of collecting passenger payments without being subjected to the same restrictions and regulations as formal public transportation alternatives. In contrast to professional public transportation companies, which must comply with licencing, safety, and operational laws, conventional ojeks sometimes operate without official authorization and disregard traffic rules and regulations.

When opposed to conventional ojek, there are several advantages to using online ojek, such as an easy ordering method, distance-based pricing (rather than informal negotiations as with traditional ojeks), and an additional cashless payment mechanism. The mobile app has gained a following and changed commuting habits in Jakarta, decreasing the attractiveness of traditional modes of public transit such as taxis and city buses (Suatmadi et al., 2019).

Angkot is a popular public mode for passengers with a definite route but no fixed schedule that follows the city's network's designated routes. The local government, which is overseen by the Bureau of Road Traffic (DLLAJ), has numerous responsibilities, including determining the fare, collecting retribution for using terminals and collecting retribution for licencing (Joewono et al., 2015). Angkot has several cars and vans with 12-16 seats (Joewono & Kubota, 2007). Bajaj is a registered auto-rickshaw taxi service with three-wheelers that also provides door-to-door service for a negotiated charge. Becak is a three-wheeled manpower-bicycle taxi that provides door-to-door service in the neighbourhood for a negotiated charge. It is prohibited in DKI Jakarta but not elsewhere in JMA (Cervero, 2000).

TABLE 1 Characteristics of paratransit in JMA

Type	Routes	Schedules	Capacity	Service
Angkot	Fixed	un-fixed	12-16	Mixed
Bajaj	un-fixed	un-fixed	2-3	Feeder
Ojek	un-fixed	un-fixed	1-2	Feeder
Becak	un-fixed	un-fixed	1-2	Feeder

Source: (Li et al., 2011)

Angkot Bajaj Ojek Becak

FIGURE 7 Paratransit in JMA

3 METHOD

3.1 Research design

This study heavily relies on using questionnaires to collect the data. To answer the research question, this study will use a quantitative method to analyse the factors that make the workers choose transport mode, its relation to commuting stress, commuter stress coping and travel satisfaction.

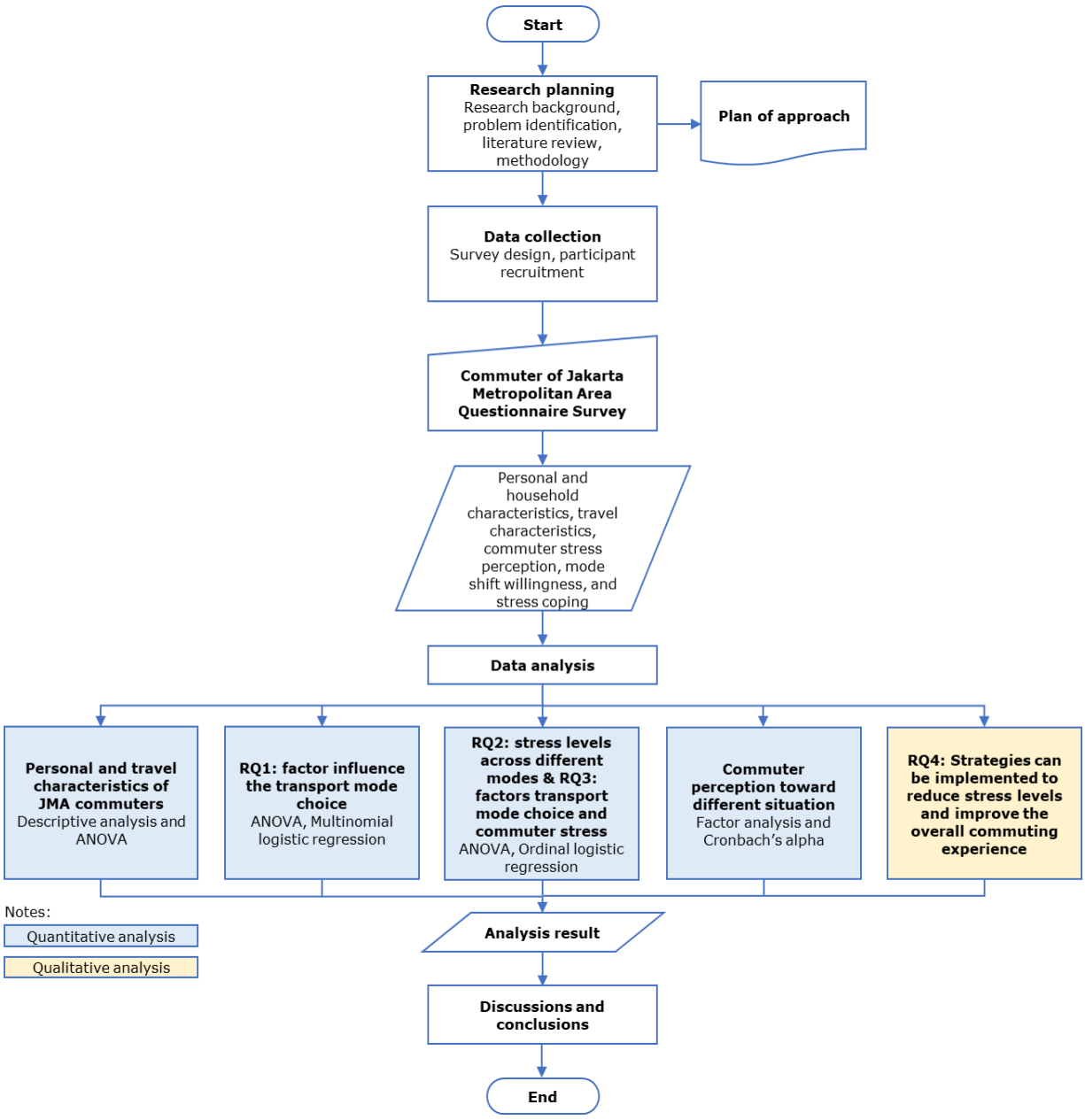


FIGURE 8 Research methodology flowchart

The first stage in the research process, as shown in **FIGURE 8** ***Research methodology flowchart***, was to identify the research background, problem, objective, and previous works on a similar subject and plan the research method. As a result, the primary data survey questionnaire was designed and collected

continuously from December 2022 to February 2023. Sections 3.1, 3.2 and 3.3 will review the process and survey content. The collected data is analysed and classified into four analyses, further explored in Section 3.4.

3.2 Participants

Finding participants for a thesis survey is crucial in ensuring the study's success. The writer obtained the essential data for this study by conducting a travel survey in the Jakarta Metropolitan Area, consisting of DKI Jakarta and four other adjacent administrative regions or municipalities (Kabupaten) – Bogor, Depok, Tangerang and Bekasi. The researcher selected this location because of its high commuter population (BPS, 2019.), making it ideal for investigating commuter stress perception on different modes. The respondent should live in JMA. Additionally, the population aged between 17 and over was chosen as the legal age to have a driving license. However, no specific exclusion criteria for participant selection were specified. This decision was made to increase the sample's inclusivity and to acquire different views within the chosen population.

The survey questionnaire was spread online in order to reach prospective participants. The online survey questionnaire using Qualtrics was distributed through various channels, including social media platforms and targeted online groups. The questionnaire was specifically distributed across channels: LinkedIn, WhatsApp groups, and Instagram communities of Bike2Work. These channels were chosen for their large reach and different user demographics, which allowed for a diversified sample of participants. Moreover, this method was chosen due to its ease of use, convenience, and ability to reach many respondents (Pollfish, 2022). To ensure that the study population was represented, the survey was distributed to individuals of various ages, occupations, and places within JMA. In addition, efforts were made to target specific online groups and communities that covered a variety of occupations and interests related to commuting.

The sample size was calculated using the following formula based on the (Lwanga & Lemeshow, 1991) sample size computation with an unknown large population.

$$n = \frac{Z^2 p(1-p)}{d^2} = \frac{1.96^2 0.5(1-0.5)}{0.05^2} = 384.16 \approx 385$$

where:

n = minimum number of samples
Z = degree of confidence = 1.96
p = estimated proportion = 0.5
d = limit of error = 0.06

Based on the calculation above, this study used a target sample of 385 respondents divided over the five study areas in proportion to the population in each area. **TABLE 2** shows each city's target and actual distribution and represents

the representativeness of the population. It can be concluded that the data met the target, referring to the Lemeshow sample method.

TABLE 2 Target and actual distribution of samples by region

Study area	Population	Proportion of population (%)	Target sample	Actual sample
Jakarta	10,644,776	34.0%	131	228
Bogor	6,541,895	20.9%	80	91
Depok	2,085,935	6.7%	26	86
Tangerang	6,495,455	20.7%	80	91
Bekasi	5,581,268	17.8%	69	133
Total	31,349,329	100%	385	629

Data source: BPS 2021

3.3 Procedure data collection

Several steps were taken during the data-gathering process for this thesis survey to ensure the data's accuracy, validity, and representativeness. Conducted a small-scale pilot test first to identify any issues with the question clarity, accuracy, order and bias. The small-scale pilot test was conducted with 20 participants, which selected randomly. Several significant findings about the survey instrument were gathered during the pilot test. Problems with question clarity, correctness, and order were specifically identified. Some questions have been identified as unclear or confusing to participants, while others required modification to ensure accurate and consistent interpretations. Furthermore, the issue of bias was thoroughly addressed throughout the pilot test. By looking at the initial responses, potential biases caused by question framing, and answer possibilities. To ensure accurate and neutral data collection, these biases were addressed through adjustments such as rephrasing questions or including additional information.

Moreover, this study ensured anonymity and confidentiality, encouraging honest and accurate responses. Participants were informed about the study's goal and assured that their responses would be kept confidential. The survey questionnaire was created using the Qualtrics platform as one of the first stages. This platform was selected for its user-friendly interface, flexibility in survey design, and ability to gather efficiently. After completing the questionnaire, the research team reviewed and approved the English version. This step was required to ensure the questionnaire included relevant and comprehensive questions that would provide valuable insights into commute behaviour in the Jakarta Metropolitan Area. When the questionnaire was approved, it was translated into Bahasa Indonesia to make it more accessible to prospective participants who may not be fluent in English.

The survey questionnaire was intended to be user-friendly, with clear and

concise questions and a logical flow, to promote even more participation. The researcher developed straightforward questions that allowed respondents to understand easily, used simple questions, and avoided technical terms or jargon that might be unfamiliar to respondents. Moreover, to give the survey a logical flow, the researcher ordered the questions and made them relate to each other. The questions flew with related questions grouped. The questionnaire was also designed with a progress bar to show how much of the survey had been filled. This feature allowed participants to monitor their progress visually and encouraged them to finish the survey.

The researcher monitored the answers and performed quality control checks throughout the data-gathering process to ensure the accuracy and validity of the data. This was achieved by inspecting the data for missing responses, outliers, and inconsistencies. Outliers and inconsistencies were identified through data screening approaches with visual inspection and data cleaning procedures. Missing data were handled by setting the questionnaire to force respondents to answer and excluding the entire data set from the participant with missing data from analysis. The team also confirmed that the data fulfilled the sample size and distribution criteria. The dataset was reduced by 254 unfinished data respondents. These respondents were excluded from participating because their data needed to be completed, with significant portions of their responses missing or incomplete. By removing these occurrences, the researcher guaranteed that the final dataset for analysis only contained complete and reliable answers.

Overall, the data-gathering procedure for this thesis survey was comprehensive and systematic. The researcher carefully designed the survey questions to ensure clarity, unambiguous and relevance to the research objectives. Moreover, used proper sampling strategies to select a population-representative sample. The snowball sampling method was used to begin participant recruiting by locating and contacting a limited number of people who fit the study's inclusion criteria. These people were then invited to suggest or invite others in their networks who met the study criteria and were interested in joining. This iterative procedure enabled the sample size to be increased, improving the sample's diversity and representation. Furthermore, convenience sampling was used in the data collection method. Participants are chosen for convenience sampling based on their accessibility and willingness to participate. This strategy was used to reach a large number of people fast and efficiently via online platforms.

The use of the Qualtrics platform, as well as careful questionnaire design and quality control checks, guaranteed that the data collected was of high quality and offered valuable insight travel behaviour of Jakarta Metropolitan Area commuters. While no data collection process can guarantee absolute perfection, combining using the Qualtrics platform, designing thorough questionnaires, and implementing stringent quality control measures ensures high' confidence in the data's quality. These actions were taken to ensure the integrity of the research findings and the reliability of the survey results.

3.4 Materials

To measure commuter stress perception on different modes, participants were asked to fill in different types of question sets. The survey data collection process took two weeks. In terms of survey duration, participants completed the questionnaire in an estimated time of about 12 minutes. Furthermore, as mentioned previously, a pilot study was conducted before the actual survey to test the feasibility of the survey questionnaire and to identify any issues that might arise during the survey. Based on the pilot test, minor adjustments were made, such as rephrasing some questions for clarity.

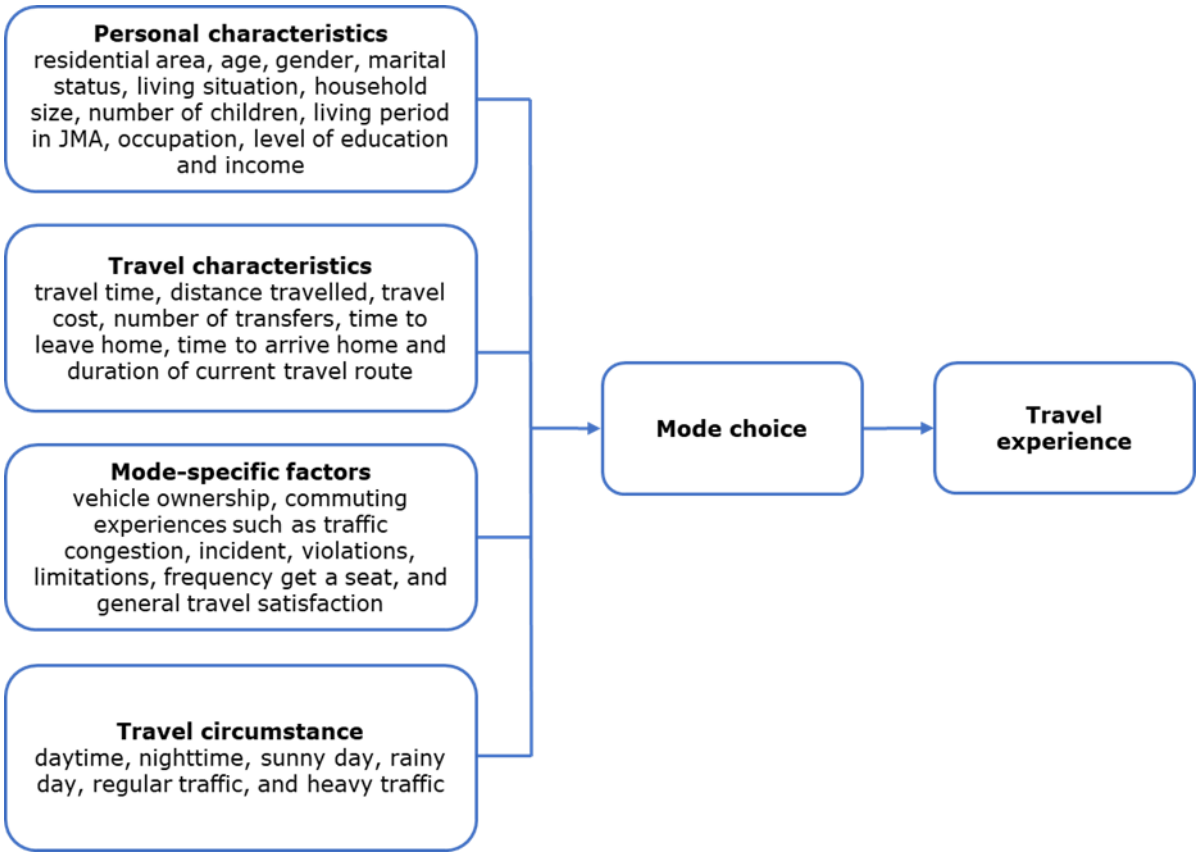


FIGURE 9 Travel experience and mode choice variables

The first set of questions attempts to gather personal information about commuters. The following information was requested: residential area, age, gender, marital status, living situation, household size, number of children, the living period in JMA, occupations, degree of education, and income. The second question group gathers information about commuters' travel characteristics, such as mode of transportation, travel time, distance travelled, travel cost, activity purpose, and duration.

The third group of mode-specific factors questions seeks information on particular aspects of commuters' modes of transportation. These variables include vehicle ownership, commuting experiences such as traffic congestion and violations, limitations, and general travel satisfaction. The questionnaire also

determines respondents' willingness to relocate their residences or workplace to avoid lengthy commutes or traffic congestion. Furthermore, the questionnaire inquires about commuters who use private vehicles about their desire to switch to public transportation.

The fourth set of queries looks for information on commuter stress during various travel circumstances, such as (1) time of day (daytime, nighttime); (2) weather (sunny day, rainy day); (3) traffic condition (regular traffic, and heavy traffic). This set of questions aims to better comprehend commuter stress levels in different traffic conditions. Furthermore, the fifth question group gathers data on commuter perception in different situations. Finally, the last set of questions is designed to collect information about commuters' opinions on factors that can improve trip quality and coping with stress while travelling.

3.5 Data analysis

From four sets of questions, the last part requires Commuters' perspectives on factors that can enhance trip quality and stress management while travelling. Those questions use open-ended answer type, meaning the commuter could answer based on their desires. Moreover, the other close-ended questions are considered a quantitative method. Hesse-Biber and Johnson, in 2015, described the mixed method as a combination of both methods. This technique allows for exploring complementary questions that can provide an overall view of a problem, add depth to the research, and support the result from various viewpoints.

3.5.1 Quantitative research

Quantitative research attempts to quantify occurrences, establish statistical relationships between variables and generalise findings to the population from which the sample was drawn (E. H. Bradley et al., 2007). Data clearing was conducted, and the outlier respondents and unfinished questionnaires were removed from the dataset before analysis as the required respondents for this study were at least 17 years, so the respondents younger than this age were removed. The preliminary screening of quantitative data generated a final valid response.

SPSS 28.0.1.1 was used to perform the quantitative analysis. The descriptive statistic summarised the data and was to be performed first. The goal is to identify the data from each data variable's minimum, maximum, average, median, frequency distribution, and standard deviation. These measures are used to summarise and describe the data's properties, such as its central tendency, variability, and distribution. In other words, it briefly explains the study's data. It can be used to generate hypotheses, identify outliers, and detect data errors.

The quantitative research of this study focuses on (1) identifying the variables that affect mode selection, (2) levels of stress that commuters experience among different modes, (3) factors that influence commuter stress, and (4) the effects of

mode selection on stress levels experience in JMA. To identify the difference in personal and travel characteristics among commuters in JMA, ANOVAs were performed for the first two analyses. The values for which the p=0.1, p=0.05, and p=0.01 levels are regarded as significant were proposed by Fisher (1992), and this study used p=0.05.

According to the survey results, there are twelve different options for the commuter's mode of transportation. However, this study transforms these data into four categories: public transport, private transport, active transport and on-demand transport. Private transportation includes privately owned cars and motorcycles driven by passengers for their own needs, typically on public roads. Moreover, this study categorised ride-hailing services and taxis as on-demand transportation since they allow passengers to plan their trip conveniently and be picked up from an agreed location. Conversely, public transportation refers to forms of transportation that follow set routes and schedules, including subways, light rail systems, commuter trains, and other networks (Vuchic, 2007). Finally, active transportation was defined as cycling and walking.

This study applied **multinomial logistic regression (MNL)** to determine which factors significantly influence transportation mode choice. The dependent variable is the mode of transportation used, and the independent variables are the personal characteristics, travel characteristics and mode-specific factors. Moreover, this method is also used to approximate different variables towards commuting stress. This study used several independent variables that can describe the likelihood that commuters chose a particular mode of transportation. These variables attempted to show a picture of the commuters' backgrounds. After running this analysis, the study discovered coefficients and p-values for each term in the model. For each unit increase in the independent variable, the coefficients represent the expected increase/decrease in the log odds of the outcome variable of transport mode.

The p-value for each of these coefficients represents the likelihood of seeing the results if there is no relationship between independent variables in the mode of transportation used. A p-value of 0.05 or less indicates that the result is statistically significant and that the difference is not due to chance alone. Furthermore, this analysis will yield an accuracy measure. Based on the independent variables, logistic regression predicts the likelihood of the occurrence of a specific event. The discrete choice model is a mathematical function that predicts a person's decision based on utility or relative attractiveness (Ben-Akiva et al., 1985). As a result, the multinomial logit model was an analytically convenient modelling method when using discrete choice methods. The disaggregate travel demand approach with the multinomial logit model (MNL) was used to model intercity mode choice for intercity business trips. (Johnson, 1981) explains the technique in detail. In brief, the multinomial logit model is as follows:

$$P_n(i) = \exp(V_{in}) / \sum_{j=1}^{K} \exp(V_{jn})$$

Where:
$P_n(i)$ = probability of Individual n choosing mode i,
$V_{jn}(i)$ = utility derived by individual n from mode j,
K = number of available modes of transportation.

The utility by an individual n from mode j, V_{jn}, is derived as a linear function of the explanatory variables using the following formula:

$$V_{jn} = \beta_{0j} + \beta_{1j}X_{1n} + \beta_{2j}X_{2n} + \beta_{3j}X_{3n} + \ldots\ldots\ldots + \beta_{nj}X_{qn}$$

Where:
β_0 = alternative specific constant for mode j
$\beta_{1j}, \beta_{2j}, \beta_{1j}, \ldots, \beta_{nj}$ coefficients associated with explanatory variables
$X_{1n}, X_{2n}, X_{3n}, \ldots, X_{qn}$ explanatory variables for individual n
q = number of explanatory variables included in the model

Ordinal logistic regression analysis was also used to analyse the association between commuter stress levels (1=very relaxed to 5=very stressed) to independent variables: personal characteristics, travel characteristics and mode-specific factors. This method, also known as cumulative logistic regression models, is suitable for this research because they are used to model categorical dependent variables of an ordered nature.

Several variables are built to gain a more profound knowledge of the impact of commuter stress and to identify the stressors of particular modes in greater detail. The universal (not mode-specific) variables are first included in a general model created for the entire sample. Additionally, dummy variables are used to observe the effects of different modes of transportation on stress, including public, private, active, and on-demand modes.

Furthermore, In the commuter perception section, with ten statements, used a 5-point Likert scale (1=strongly disagree to 5=strongly agree). An exploratory factor analysis was performed to determine whether specific questions are connected to one another and can be included in a certain underlying factor. Understanding the differences between the underlying factors and the similarities between variables included in each component is aided by grouping variables into many factors (Cudeck, 2000). Obtaining components for each evaluation question for this study aided in relating quantitative findings from students with qualitative conclusions.

Several important outputs generated from exploratory **factor analysis** should be paid attention to. The extraction or communality score (r2) should be at least 0.7 to be considered ideal in adequately explaining 50% of the variance in a factor (Beavers et al., 2013). Beavers et al. also consider the value from the

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) test to explain the degree of shared variance in a factor, with a minimum recommended value of 0.7. Then, the eigenvalue and the scree plot show the number of factors that explain the relationship between the variables. To support the findings, **Cronbach's alpha** test was conducted for each factor to assess its internal consistency. A value ranging from 0.7 – 0.9 is considered acceptable (Tavakol & Dennick, 2011).

3.5.2 Qualitative research

In contrast to quantitative research, Qualitative research aims to comprehend a particular phenomenon in-depth based on human experience, discover connections between ideas and actions, and create and improve theory (E. H. Bradley et al., 2007). **FIGURE 10** explains the analysis process with a deductive approach. The analysis started with developing a code structure, which provided insight into what to expect from the data. It was important to read through the entire dataset to familiarise the data. This gave an overview of the idea of identifying the key patterns. The script of respondents' answers to the two open-ended questions was translated into English as soon as the data was available. The next step was to review transcripts to understand the content without directly coding them and then begin generating codes. It was an iterative process that required going back and forth to revise the codes and code structure as well as re-review the transcripts. Rather than forcing the codes to conform to the existing structure, the initial code structure was modified based on the findings (E. H. Bradley et al., 2007).

Furthermore, the process ended when no new codes were generated, yielding the final list of codes. These codes were grouped to reflect the themes that could provide answers to the research questions. The next step in the analysis was to compare and relate all of the data. The volume of data and the back-and-forth process necessitated the use of a computer-assisted data analysis programme, Nvivo version 14, in this study to effectively manage and analyse data for the last two questions about can improve the quality trip and stress coping method to answer RQ5. There were 603 people who responded to CO.01 and 600 people who answered CO.02.

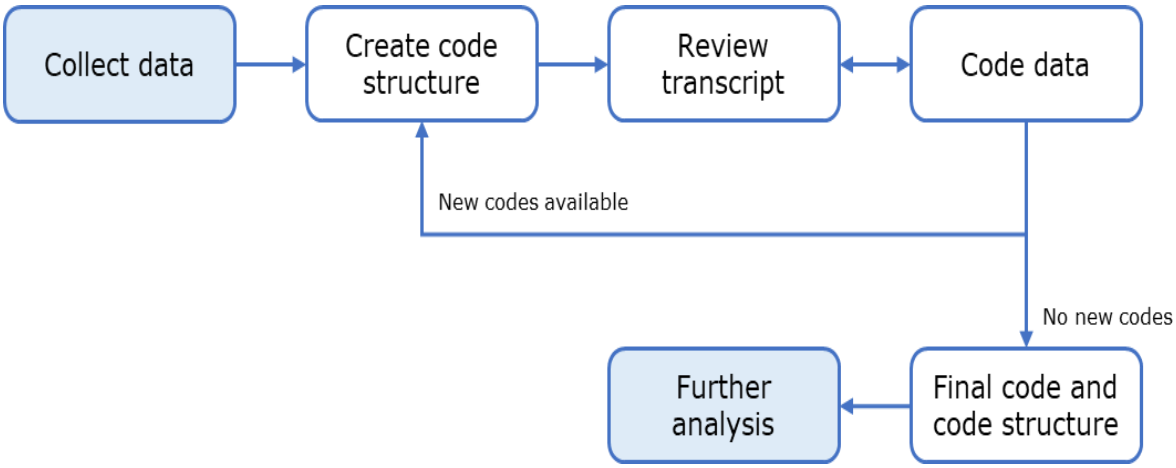


FIGURE 10 Qualitative research analysis process (Sitohang, 2022)

The first step was converting the data into codes representing the theme. Each code represented a distinct concept. The next step was to group codes with similar themes under main themes, reflecting research question 5 about commuters' perspectives on factors that can improve trip quality and stress management while travelling. The transcriptions of the complete survey responses are available in Appendix. Some of the most difficult challenges in transcription are translating words for emphasis, the number of nouns, and sentence structure completion. However, the same Indonesian word for emphasis can be translated differently into English.

A methodical approach was used to solve these issues, including carefully reading the original text to capture the intended emphasis or emphasis equivalent in the English transcription. The translated nouns were checked to ensure they accurately reflected the intended meaning and were consistent throughout the transcription. Furthermore, despite any differences in sentence construction between Indonesian and English, efforts were made to reconstruct sentences in a way that kept the substance and delivered the intended meaning in English. This method ensured that the transcribed data accurately conveyed the respondents' opinions while remaining true to the original survey results. This qualitative dataset was examined in a complementary manner to provide an extensive overview of the relationship between transport mode choice and commuter stress factors.

4 RESULTS

4.1 Respondents' profile

To provide an overview of the collected data, **TABLE 3** illustrates the JMA respondent's personal characteristics to summarise The data gathered to evaluate the distribution of personal attribute differences. Almost half of the respondents surveyed (49%) are between 25-34 years old, with (51%) are male and the rest female. While the education level of JMA respondents varies, whose completed diploma/university dominated (66%). In this study, there were included respondents with age 17 years and above. The youngest respondent is 17 years old, and the oldest is 68 years old. Only (14%) in this study were above 45 years old.

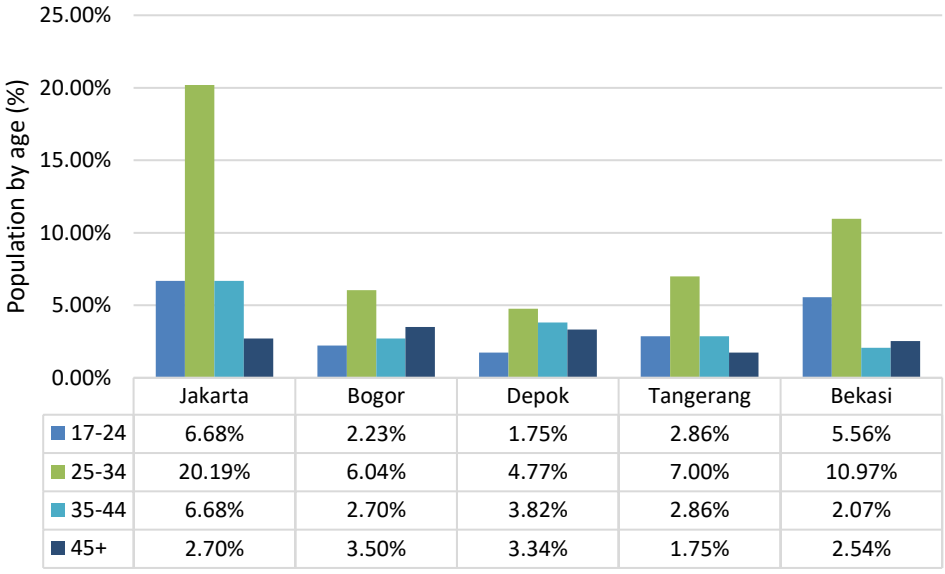
TABLE 3 Personal characteristics

Category	Variable	Frequency	Percentage	Std. Deviation	ρ
Residential area*	Jakarta	228	36%	1.58	<0.001
	Bogor	91	14%		
	Depok	86	14%		
	Tangerang	91	14%		
	Bekasi	133	21%		
Gender	Male	320	51%	0.5	0.336
	Female	309	49%		
Age	17-24	120	19%	9.88	0.065
	25-34	308	49%		
	35-44	114	18%		
	45+	87	14%		
Marital status	Married	316	50%	0.5	0.321
	Not married	313	50%		
Occupation	Entrepreneur	29	5%	1.362	0.109
	Employee	354	56%		
	Civil servant, military, or police	115	18%		
	Unemployed	22	3%		
	Student	57	9%		
	Freelancer	52	8%		
Education	Completed secondary school	98	16%	0.584	0.597
	Completed diploma/university	414	66%		
	Completed post-graduate	117	19%		
Income*	< Rp. 5.000.000	109	17%	3.189	0.004
	Rp. 5.000.001 – Rp. 10.000.000	239	38%		
	Rp. 10.000.001 – Rp. 15.000.000	68	11%		
	Rp. 15.000.001 – Rp. 20.000.000	30	5%		
	> 20.000.000	67	11%		
	I prefer not to say	116	18%		

Category	Variable	Frequency	Percentage	Std. Deviation	ρ
Living situation*	Living alone	104	17%	0.484	<0.001
	With family	477	76%		
	Sharing house/apartment	48	8%		

*Significance levels on the choice of transportation mode: < 0.05

This study used ANOVAs to assess the variation in the distribution of personal characteristics across different modes of transport. **TABLE 3** analysis of the eight variables indicated significant ρ-values for several variables, including residential area, income and living situation. These findings indicate that these specific characteristics were significantly different.



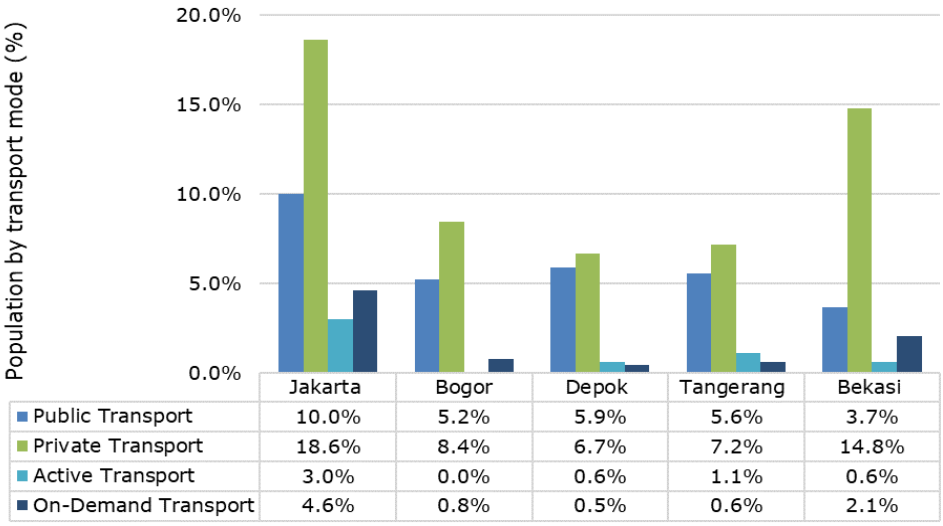
	Jakarta	Bogor	Depok	Tangerang	Bekasi
17-24	6.68%	2.23%	1.75%	2.86%	5.56%
25-34	20.19%	6.04%	4.77%	7.00%	10.97%
35-44	6.68%	2.70%	3.82%	2.86%	2.07%
45+	2.70%	3.50%	3.34%	1.75%	2.54%

FIGURE 11 Population by age

Based on **FIGURE 11**, the age group of 25 to 34 years represents 48.97% of all respondents, representing the commuting population in its highest proportion. Conversely, the 45+ age group had the lowest percentage in each area.

4.2 Transport mode choice

FIGURE 12 illustrates mode preferences in JMA, including DKI Jakarta, Bogor, Depok, Tangerang, and Bekasi. In Jakarta, public transportation has the most significant rate of utilisation (10.0%), followed by private transportation (18.6%). Bogor has the second-highest use of public transport, at 5.2%, and private transport, at 8.4%. Depok, Tangerang, and Bekasi have similar percentages of people who use public transit, ranging from 5.6% to 5.9%. Active transport, including walking and cycling, is rarely used across all regions. Jakarta has the highest rate (3.0%), whereas the rest of the regions have little or no use of active transportation. Across the regions, on-demand transit is used moderately. Jakarta leads the way with 4.6%, followed by Bekasi with 2.1%. Overall, it shows that private transportation is preferred over public transportation in all regions.



	Jakarta	Bogor	Depok	Tangerang	Bekasi
Public Transport	10.0%	5.2%	5.9%	5.6%	3.7%
Private Transport	18.6%	8.4%	6.7%	7.2%	14.8%
Active Transport	3.0%	0.0%	0.6%	1.1%	0.6%
On-Demand Transport	4.6%	0.8%	0.5%	0.6%	2.1%

FIGURE 12 Population by transport mode

The overview of commuter proportion between males and females using particular travel modes for three different activities: Mandatory, occasional and leisure is shown in **FIGURE 13**. Among four travel modes (public, private, active, and on-demand), the private vehicle was the most popular travel mode for each type of activity for both males and females. In any activity, males constantly have a higher percentage for private transportation than females.

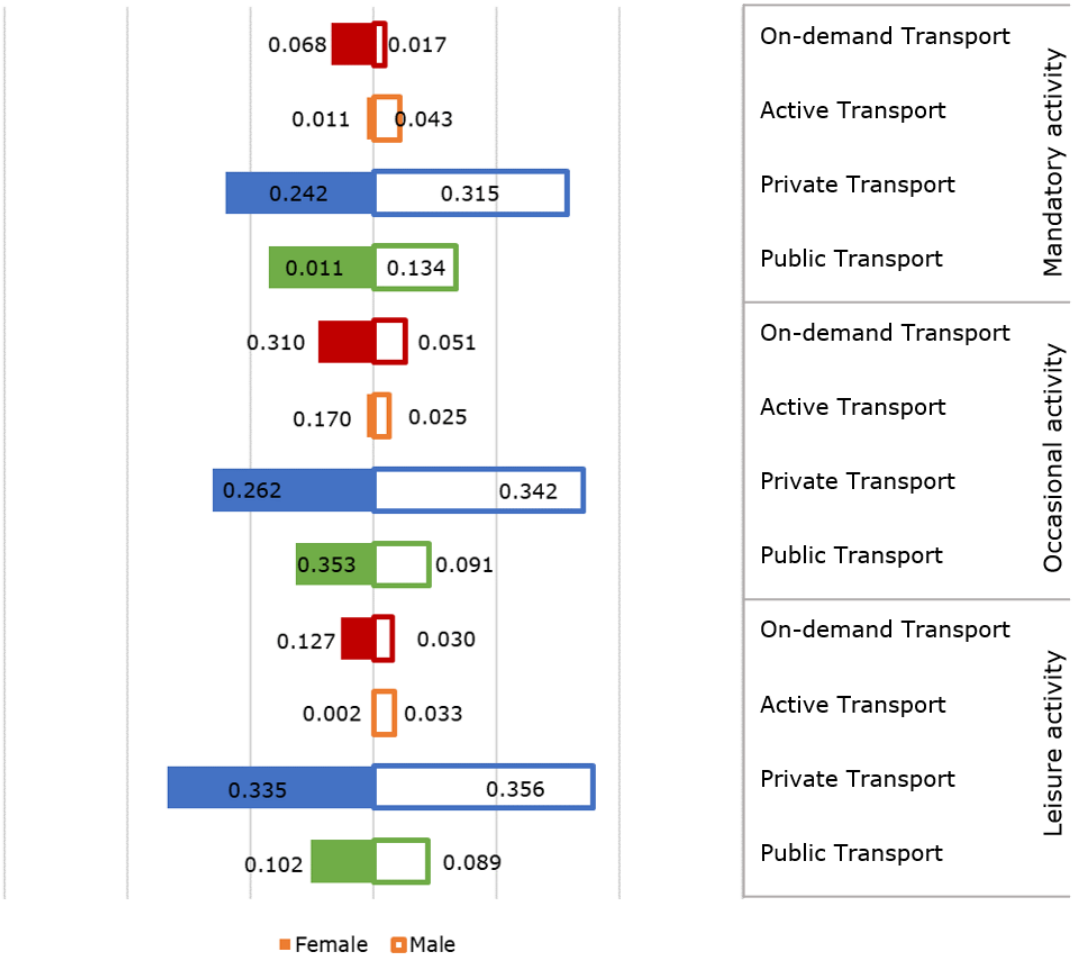
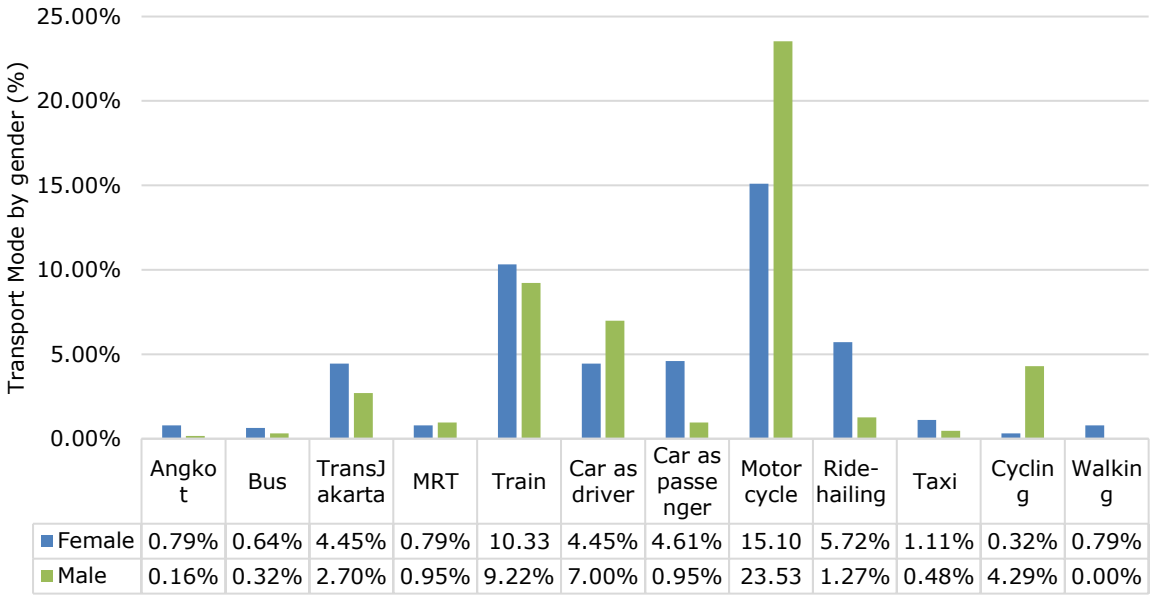


FIGURE 13 JMA Commuter's travel mode with different activity purposes

This study focuses on the modes of transport commuters prefer in the mandatory activity category. **FIGURE 14** provides insight into commuter mode choice behaviour for mandatory activity in JMA based on gender. The data is divided into gender categories, with different percentages for every mode of transportation. Regarding car usage as a passenger, females account for 4.61% of this category, while males account for a smaller percentage of 0.95%. Conversely, motorcycles are popular among males, accounting for 23.53%, and females account for only 15.10%. Interestingly, when it comes to cycling, females have a relatively smaller participation, accounting for only 0.32%, while males have a much higher contribution of 4.29%.



	Angkot	Bus	TransJakarta	MRT	Train	Car as driver	Car as passenger	Motor cycle	Ride-hailing	Taxi	Cycling	Walking
Female	0.79%	0.64%	4.45%	0.79%	10.33	4.45%	4.61%	15.10	5.72%	1.11%	0.32%	0.79%
Male	0.16%	0.32%	2.70%	0.95%	9.22%	7.00%	0.95%	23.53	1.27%	0.48%	4.29%	0.00%

FIGURE 14 Transport mode use by gender

FIGURE 15 shows that private transport is the most popular method of travel among commuters, accounting for 56% of the total. Motorcycles are the most popular mode of private transportation, accounting for a significant 39% of the total. These data highlight JMA commuters' reliance on private vehicles, mainly motorcycles, to meet their mandatory travel demands. Trains were also an essential mode of public transit, accounting for 19.55% of the total. On the other hand, walking had the lowest mode share at 0.79%. Bicycling was more popular than walking for active mobility. These data demonstrate the variety of transit options available to JMA passengers. Understanding the distribution of mode shares is critical for policymakers and transportation planners in developing efficient transportation solutions.

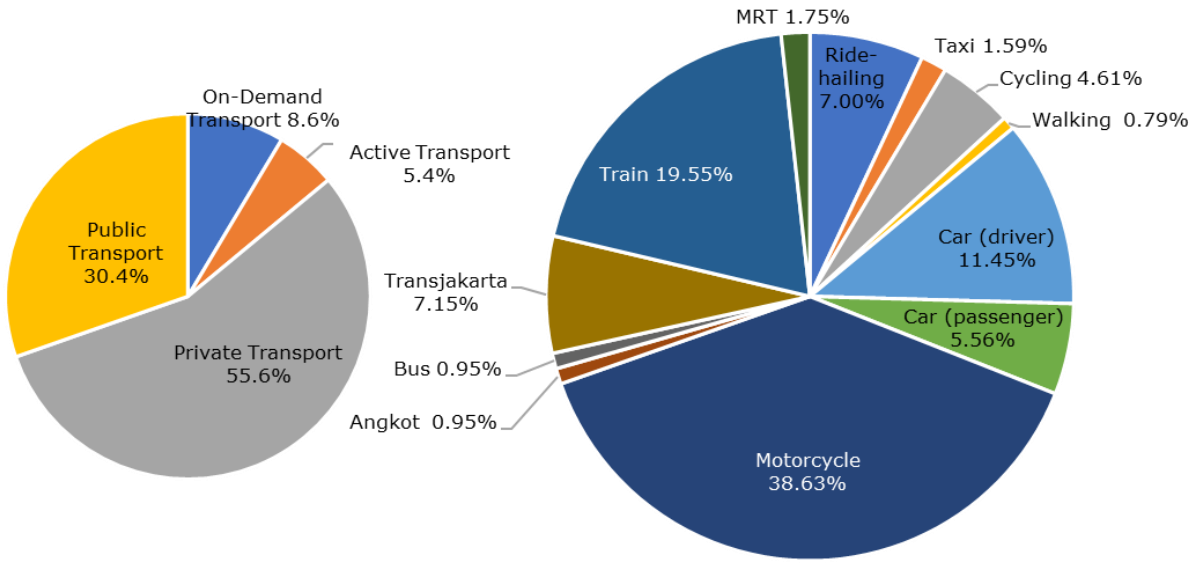


FIGURE 15 Transport mode used for daily activity

Stress levels were measured on a scale of 1-5, with higher values indicating higher stress. The ANOVA analysis was applied to assess commuter stress levels across various modes of transport. The mean stress levels and standard deviations for four dummy categories were calculated: public transport, private transport, active transport, and on-demand transport. **TABLE 4** shows a statistically significant difference in stress levels across the different modes of transportation ρ=<0.001. Participants who used on-demand transportation, such as ride-sharing services or taxis, had the highest mean travel stress score of 2.81. This suggests that people who use on-demand transportation may experience higher stress levels during their commutes than those who use other kinds of transportation. Participants who used private transportation, including cars and motorcycles, had a slightly lower mean travel stress than those who used on-demand transportation, with a score of 2.71. Participants who took public transport reported an average travel stress score of 2.64. Active transport participants had the lowest mean stress score of 1.85. This shows that those who engage in activities like walking or cycling have reduced stress levels during their commute. According to these data, stress levels differ greatly depending on the form of transportation used. Active Transportation users have the lowest stress levels of the four categories. This table also shows that active transport has a significant difference from other modes.

TABLE 4 Travel stress on different transport categories

Travel stress	N	Mean	Std. Deviation	F	ρ
Public Transport	191	2.64	1.16	6.209	0.000
Private Transport	350	2.71	1.148		
Active Transport	34	1.85	0.989		
On-Demand Transport	54	2.81	1.117		
Total	629	2.65	1.156		

Tukey HSD		difference	Std. Error	Sig.
Public Transport	Private Transport	-0.065	0.103	0.923
	Active Transport	.791*	0.212	0.001
	On-Demand Transport	-0.171	0.176	0.766
Private Transport	Active Transport	.856*	0.205	0.000
	On-Demand Transport	-0.106	0.167	0.92
Active Transport	On-Demand Transport	-.962*	0.25	0.001

*Significance levels < 0.05

TABLE 5 shows the mean travel stress levels experienced by commuters using various means of transport in the study. The mean scores range from 1.27 to 3.00, with the MRT having the lowest standard (Mean = 1.27) and taxis having the highest mean (Mean = 3.00). The MRT is the mode associated with the lowest degree of travel stress, meaning that commuters who use this mode have a lower stress level during their journeys.

TABLE 5 Commuter stress levels across different JMA

Travel stress	N	Mean	Std. Deviation	F	sig.
Angkot	6	2.33	1.033	3.987	<0.001
Bus	6	2.17	1.169		
Transjakarta	45	2.58	1.055		
Train/KRL	123	2.83	1.164		
MRT	11	1.27	0.467		
Ride-hailing	44	2.77	1.179		
Taxi	10	3.00	0.816		
Car as driver	72	2.86	1.092		
Car as passenger	35	2.46	1.010		
Motorcycle	243	2.70	1.180		
Cycling	29	1.86	0.990		
Walking	5	1.80	1.095		
Total	629	2.65	1.156		

Based on a survey, this paragraph intends to investigate the causes of JMA commuters' mode choice. The questionnaire gathered responses from various commuters, and the percentages represent the proportion of respondents who listed each aspect as the main reason for their mode of transportation choice. According to **FIGURE 16**, affordability is the top factor influencing their selection, which has been identified as an essential factor by 64% of respondents. Additionally, speed is important to commuters, as 60% of respondents expressed. Accessibility comes in third, with 44% of commuters citing it as a significant factor.

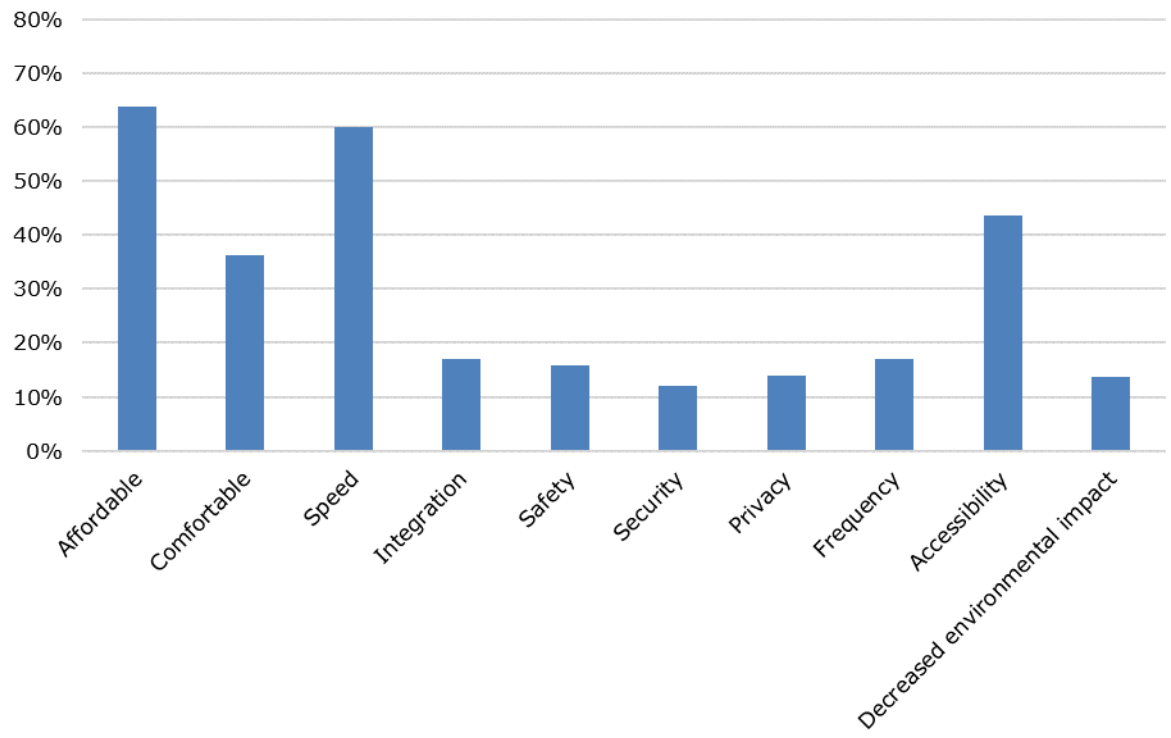


FIGURE 16 Reason for choosing the primary mode

However, it is essential to mention that security obtained the lowest percentage for commuters' mode choice as a deciding factor. Security involves securing against various potential dangers, such as terrorism and criminal acts like theft. According to the survey, only 12% of respondents thought security was important.

4.2.1 Factors influence transport mode choice

A detailed multinomial logistic regression analysis was conducted to investigate the determinants impacting transport mode choice in the Jakarta Metropolitan Area. Investigations were initially conducted based on various characteristics, namely personal, travel, and mode-specific factors. Those variables are (1) Personal characteristics: residential area, age, gender, marital status, living situation, household size, number of children, living period, occupation, level of education, and income; (2) Travel characteristics: mandatory activity purpose, travel distance, travel time, travel cost, activity duration, time to leave home, time to arrive home, duration current travel route; (3) Mode-specific factors: vehicle ownership (number of car, motorcycle, and bicycle), driving license, number of the crash, number of traffic violations, physical limitation, frequency of traffic congestion and number of transfers were discovered into a multinomial logistic regression model.

TABLE 6 Modal fitting transport mode factors

Model Fitting Information				
Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1329.193			
Final	444.090	885.102	273	0.000

In this test, on-demand transport is used as the preferred transport. According to the model fitting data in **TABLE 6**, the final model fits the data much better than the intercept-only model, as indicated by the chi-square test findings (Chi-Square = 885.102, df = 90, ρ=<0.000). This implies that the predictor variables in the model contribute to explaining the variation in mode choice.

TABLE 7 Likelihood of factors influencing transport mode choice

Effect	Sig.	Effect	Sig.
Residential area	0.016	Travel cost	0.000
Age group	0.660	Activity duration	0.021
Gender	0.306	Time to leave home	0.934
Marital status	0.706	Time to arrive home	0.069
Living situation	0.427	Duration of current travel route	0.194
Household size	0.477	Number of cars	0.003
Number of children	0.227	Number of motorcycles	0.000
Living period in JMA	0.066	Number of bicycles	0.471
Occupation	0.278	Driving license	0.001
Level of education	0.263	Number of crash	0.341
Income	0.088	Number of traffic violations	0.188
Mandatory activity purpose	0.017	Physical limitation	0.110
Travel distance	0.159	Frequency of congestion	0.644
Travel time	0.000	Number of transfer	0.005
Negelkerke	0.859		
Classification	84.7%		

*Significance levels < 0.05

TABLE 7 shows Nagelkerke value of 0.859 was achieved, indicating that these variables explained 85.9% of the mode choice variable. These results indicate that the model explains a significant portion of the variation in mode choice. The model's relevance of each predictor variable was determined using likelihood ratio tests. The final model is compared to the -2 log-likelihood values for the reduced models that eliminate each predictor variable. Several variables (residential area, mandatory activity purpose, travel time, travel cost, activity duration, number of cars, number of motorcycles driving license, number of transfers) are statistically significant with ρ-value <0.05 in predicting transport mode choice, while others are not.

TABLE 8 Factors associated with transport mode choice, MNL significant results

Variables		B	Sig.	Exp(B)		B	Sig.	Exp(B)
Intercept	**Public**	-5.677	0.999		**Private**	23.395	0.997	
Residential area								
Tangerang		4.251	0.002	70.147		1.981	0.135	7.252
HH size								
1		3.326	0.047	27.819		1.333	0.403	3.794
Living period in JMA								
Up to 1 year		-4.846	0.006	0.008		-5.610	0.001	0.004
Occupation								
Employee of the private sector		2.606	0.080	13.547		3.034	0.038	20.789
Unemployed		4.404	0.178	81.770		8.005	0.007	2995.17
Education								
Completed secondary school		2.622	0.121	13.767		3.642	0.030	38.164
Income								
< 5.000.000		5.151	0.002	172.601		4.205	0.010	67.021
Mandatory activity purpose								
Work		4.768	0.010	117.720		5.383	0.002	217.767
Travel time								
60-89 minutes		4.073	0.214	58.755		7.828	0.024	2510.84
Travel cost								
Rp. <5000		30.042	0.000	1.1E+13		5.107	0.048	165.141
Rp. 5000-14999		29.210	0.000	4.8E+12		6.040	0.005	419.816
Rp. 15000-24999		22.709	0.000	7.3E+09		-0.918	0.546	0.399
Rp. 25000-49999		20.994	0.000	1.3E+09		-1.298	0.372	0.273
Activity duration								
6-8 jam		4.343	0.018	76.914		0.130	0.933	1.139
Time to arrive home								
Not rush hour		2.263	0.040	9.612		1.279	0.225	3.591
Number of cars								
0		-2.080	0.396	0.125		-4.360	0.040	0.013
Number of motorcycle								

Variables	B	Sig.	Exp(B)	B	Sig.	Exp(B)
0	-4.599	0.048	0.010	-7.471	0.001	0.001
1	-4.916	0.034	0.007	-5.706	0.012	0.003
2	-5.629	0.023	0.004	-6.614	0.006	0.001
Driving license						
Yes, for the car	2.013	0.050	7.488	1.976	0.042	7.211

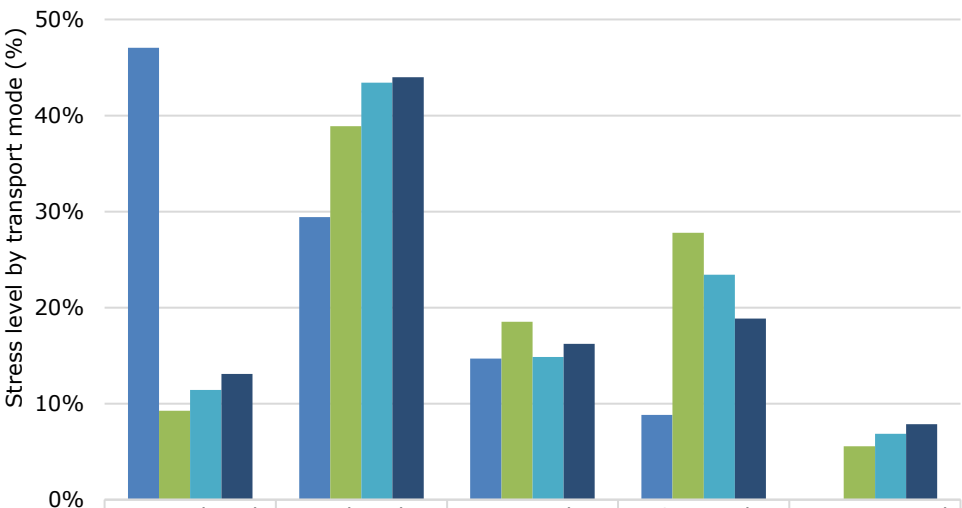
*Significance levels < 0.05

From **TABLE 8** above, it can be concluded that Tangerang, with a significant p-value of 0.002, suggests a higher likelihood of preferring public transportation over on-demand transportation. Furthermore, the p-value is 0.047. It implies that those with smaller household sizes are more inclined to use public rather than on-demand transportation. The coefficient is -4.846, with a p-value of 0.006. This negative coefficient indicates that people who recently relocated to JMA are less likely to prefer public and private travel over on-demand transit. Employees in the private sector and the unemployed with p-values less than 0.05 are more likely to choose private transportation over on-demand transportation. Those who have lower education are more likely to use private transport. Lower-income people are significantly more likely to use public than on-demand transportation. Individuals commuting for work are more likely to choose public and private transportation over on-demand transportation.

Individuals with a longer trip duration are more likely to choose private transportation over on-demand transportation. Furthermore, travel costs considerably influence persons' use of public transportation. People who participate in longer-duration activities are more likely to use public transportation rather than on-demand transportation. Arriving home during non-rush hours increases the likelihood of taking public transport. With a p-value of 0.050, having a driver's licence for a car increases the likelihood of using private transportation.

4.2.2 Commuter stress factors

The percentage breakdown of respondents' commuter stress levels is shown in **FIGURE 17**. The majority (47.06%) of respondents who reported utilising active transportation were "Very relaxed," followed by 29.41% who were "Relaxed." The most significant percentage of on-demand transportation users, 38.89% were "Relaxed," followed by 27.78% who were "Stressed." Regarding private transportation, the most extensive number, 43.43% reported feeling "Relaxed," followed by 23.43% who reported feeling "Stressed." In the case of public transport users, the majority 43.98% reported "Relaxed", followed by 18.85% who reported "Stressed" stress levels. Overall, the findings of this study provided insight into the distribution of stress levels among JMA commuters.



	Very relaxed	Relaxed	Neutral	Stressed	Very stressed
Active Transport	47.06%	29.41%	14.71%	8.82%	0.00%
On-Demand Transport	9.26%	38.89%	18.52%	27.78%	5.56%
Private Transport	11.43%	43.43%	14.86%	23.43%	6.86%
Public Transport	13.09%	43.98%	16.23%	18.85%	7.85%

FIGURE 17 Commuter stress levels across different transport modes

According to the model fitting data in **TABLE 9**, the final model commuter stress factors considerably improve the fit over the intercept-only model, as indicated by the p-value <0.05 in all transport modes' These findings imply that the model's predictor variables contribute to explaining variation in commuter stress. Moreover, all the Negelkerke pseudo-R-square of each category are more than 0.6, which means that all independent variables can explain variations in the dependent variable (stress level).

The model's relevance of each predictor variable was determined using likelihood ratio tests. Several variables, including residential area, age group, living period, income, driving license travel distance, activity duration, time to arrive home, physical limitation and travel satisfaction, were statistically significant predictors of commuter stress experience (p-value=<0.05), the analysis conducted by splitting data based on the transport modes category. Overall, the ordinal logistic regression analysis shows that various factors significantly impact commuter stress levels in the JMA.

TABLE 9 Factors associated with commuter stress on different modes, significant results of ordinal regression model

Variables	Estimate	Sig.
Public Transport		
Residential area		
Jakarta	-3.845	0.001
Bogor	-4.472	0.000
Depok	-3.844	0.001
Tangerang	-4.270	0.001

Variables	Estimate	Sig.
Age group		
35-44 years	2.989	0.009
Living period		
Up to 1 year	3.677	0.010
Income		
−< 5.000.000	-3.681	0.002
5.000.001 - 10.000.000	-3.208	0.006
[X11=3]	-2.378	0.087
15.000.001 - 20.000.000	-3.585	0.033
Travel distance		
30-39 km	2.723	0.007
Activity duration		
1-3 jam	-4.868	0.026
Time to arrive home		
Not rush hour	-1.610	0.018
Driving license		
Yes, for motorcycle	-2.769	0.002
Physical limitation		
No	-2.984	0.003
Travel satisfaction		
Very dissatisfied	19.293	0.000
Satisfied	15.946	0.000
Neutral	14.716	0.000
Satisfied	11.108	0.000
Private Transport		
Residential area		
Bogor	-0.888	0.043
Travel satisfaction		
Very dissatisfied	7.987	0.000
Dissatisfied	5.148	0.000
Neutral	3.551	0.000

TABLE 9 shows the effects of several independent variables on the likelihood of experiencing various levels of commuter stress while utilising different modes of transportation. First, the elements that influence commuter stress levels while taking public transportation. People between the ages of 35 to 44 are more sensitive to be stressed. People who have recently moved to JMA, have a lower salary, and live more kilometres away are more likely to experience commuter stress. Commuters who spend time doing shorter activities are less likely to be stressed during their commute. Furthermore, avoiding rush hour travel is linked to a lower risk of commuter stress on public transit. People who do not have any physical constraints are much less likely to experience commuter stress.

Meanwhile, two variables have a p-value of <0.05 on the likelihood of commuter stress levels for persons using Private Transportation. The term residential area was discovered to significantly affect commuter stress levels. The coefficient estimate for the Bogor residential area, in particular, was negative, with a p-value of 0.043. This shows that compared to other places, residents in Bogor are associated with a lower likelihood of experiencing travel stress while utilising private transport. Furthermore, higher levels of travel satisfaction are connected with a lower risk of feeling commuter stress. These findings help to improve our understanding of the factors that influence commuter stress levels in the context of transport mode choice in JMA.

4.2.3 Specific Circumstances on Commuter Stress Probability

The perceived stress levels associated with various commuting scenarios were investigated using Likert-scale variables. Descriptive statistics provided an overview of each condition's mean and standard deviation. In addition, an analysis of variance (ANOVA) was performed to establish the significance of differences in stress levels between situations. According to **TABLE 10**, participants determined commuting stress as moderate (M = 3.13, SD = 0.963). When stress levels were compared across conditions, they all demonstrated statistically significant differences ($\rho < 0.001$).

TABLE 10 Perceived stress levels in different commuting circumstances

	N	Mean	Std. Deviation	F	sig.
Commuting is stressful	629	3.13	0.963		
Day time	629	2.62	1.051	22.52481	< 0.001
Night time	629	2.43	1.062	16.79215	< 0.001
Sunny day	629	2.64	1.046	27.84803	< 0.001
Rainy day	629	3.25	1.134	28.41556	< 0.001
Heavy traffic	629	3.74	1.126	25.56052	< 0.001
Normal traffic	629	2.29	1.032	20.77626	< 0.001

Participants reported higher stress levels during heavy traffic conditions (Mean= 3.74, SD = 1.126) than during normal traffic conditions. Commuting stress was also considerably higher on rainy days (Mean= 3.25, SD = 1.134) than on days with bright sunlight. These data imply that high traffic and adverse weather, like rain, significantly contribute to elevated commuting stress levels.

Following the results of ANOVA analysis, ordinal logistic regression was used to investigate the link between various commuting conditions and experiencing stress levels, as shown in **TABLE 11**. The model-fitting information reveals the goodness-of-fit and the role of predictor variables in explaining the variation in stress levels during commuting. The resulting ordinal logistic regression with $\rho < 0.001$ on all modes. This indicates that the model's predictor variables help explain the variation in perceived stress levels while commuting.

TABLE 11 Conditions with the significant result associated with stress levels

Circumstances	Estimate	Sig.	Chi-square	df	sig.
Day time			226.139	24	<0.001
Never	-1.848	0.000			
Sometimes	-1.569	0.001			
About half the time	-1.478	0.001			
Most of the time	-1.193	0.010			
Sunny day					
Most of the time	1.048	0.038			
Rainy day					
Never	-1.828	0.000			
Sometimes	-0.915	0.004			
About half the time	-0.981	0.001			
Most of the time	-0.848	0.002			
Heavy traffic					
Never	-1.594	0.002			
Sometimes	-0.624	0.032			
About half the time	-0.804	0.002			
Normal traffic					
Sometimes	1.127	0.029			
About half the time	1.245	0.018			
Negelkerke	0.323				

Estimates for various stress levels during the day indicate that stressful commuting has a significant impact. Individuals who never encounter stress during the day are more likely to disagree or strongly disagree with the statement than those who experience stress occasionally, approximately half of the time or most of the time. When people are stressed most of the time on sunny days, their likelihood of agreeing or strongly agreeing with the statement increases. Furthermore, various stress levels on a rainy day and during heavy traffic considerably impact the likelihood of agreeing or strongly agreeing with the statement.

In summary, the ordinal logistic regression analysis supports the ANOVA findings by demonstrating the considerable influence of various commuting situations on perceived stress levels. The ordinal logistic regression analysis results show that different commuting circumstances considerably influence the likelihood of agreeing with the statement "commuting is stressful." Time of day (day and night), weather conditions (sunny or rainy), and traffic conditions (heavy or normal) all contribute to people's perceptions of commuting stress.

4.2.4 Exploring Commuter Perception

Respondents were also asked to evaluate their commute perception in the survey. There were ten five-point Likert scale questions, with 1 being a strong

disagreement with the statement and 5 representing a strong agreement with the statement. **FIGURE 18** shows the distribution of responses for each question in the score summary. The graph shows that most responses somewhat agree regardless of the question. The graph shows that around 50% of the respondents somewhat agree with the statement, "My commute affects my productivity."

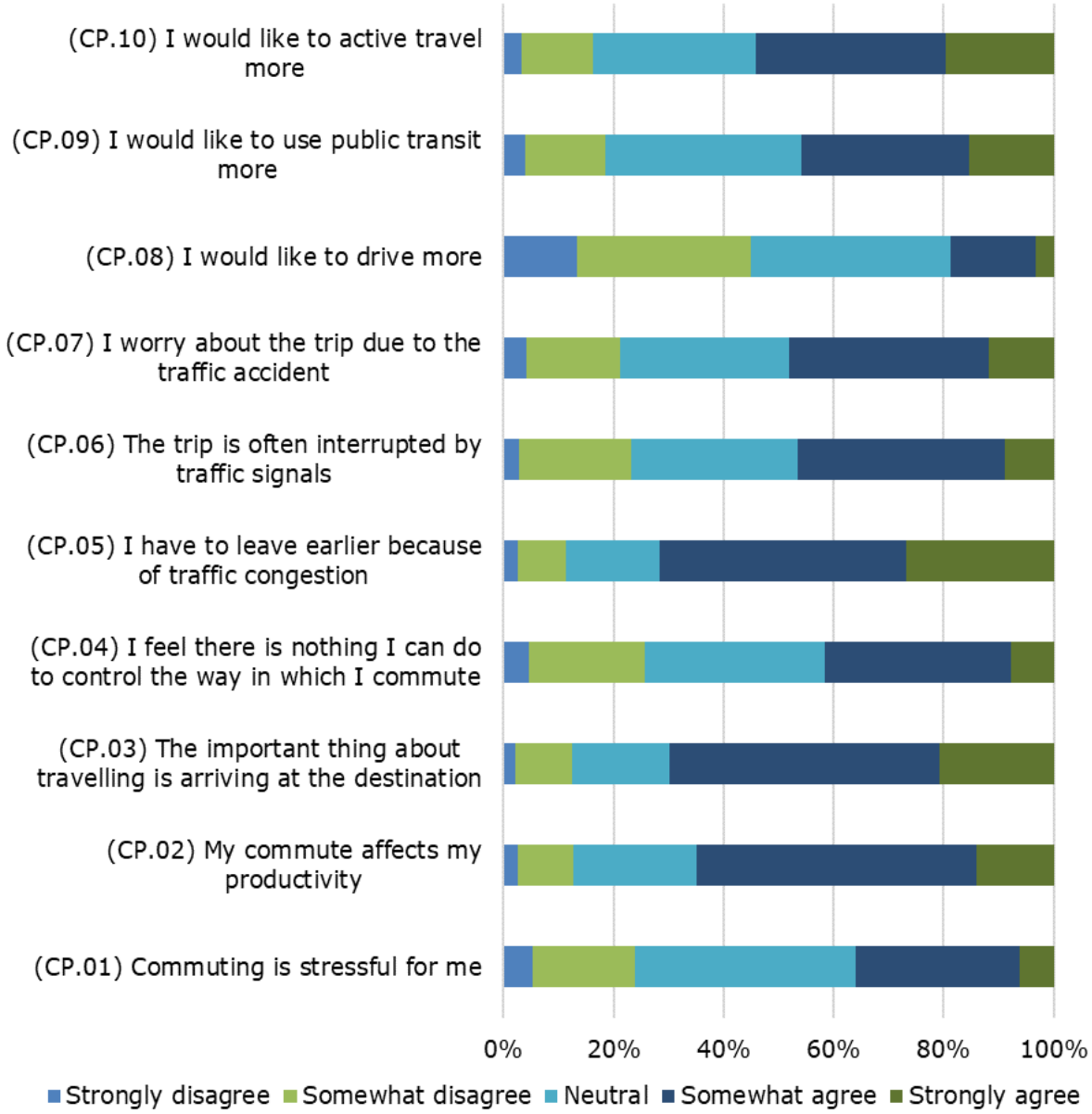


FIGURE 18 Proportion of survey commuter perception question

The respondents' perceptions were assessed using a 5-point Likert scale ranging from 1 "strongly disagree" to 5 "Strongly agree". The factor analysis was conducted, as shown in **TABLE 12**, to explore the underlying factors in commuter perception in the Jakarta Metropolitan Area. An exploratory factor analysis (EFA) was performed using principal component analysis and varimax rotation. The minimum factor loading criteria was set as 0.30.

With a score of 0.708, the Kaiser-Meyer-Olkin (KMO), which can be

interpreted that the variables have a middling degree of measuring the common variance in a factor and the measure of sampling adequacy shows that the sample size is enough for the analysis. The result of Bartlett's Test of Sphericity, which tests the null hypothesis that the correlation matrix is an identity matrix, was significant (Approx. chi-square= 665.092, df = 45, ρ =0.000), showing that there is a correlation among the variables for factor analysis to be meaningful.

TABLE 12 Factor analysis survey commuter stress perceptions

Total Variance Explained						
	Initial Eigenvalues			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.421	24.214	24.214	1.933	19.333	19.333
2	1.425	14.249	38.463	1.554	15.537	34.870
3	1.078	10.783	49.246	1.438	14.376	49.246
4	0.935	9.348	58.594			
5	0.880	8.795	67.389			
6	0.781	7.807	75.196			
7	0.720	7.200	82.396			
8	0.635	6.352	88.749			
9	0.598	5.977	94.725			
10	0.527	5.275	100.000			

	Rotated Component Matrix		
	1	2	3
CP.01	0.708		
CP.02	0.589		
CP.03	0.499		
CP.04	0.636		
CP.05	0.372	0.500	
CP.06	0.350	0.581	
CP.07		0.689	
CP.08		0.659	
CP.09			0.769
CP.10			0.814
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			0.708
Bartlett's Test of Sphericity		Approx. Chi-Square	665.092
		df	45
		Sig.	0.000

The higher the absolute value of the loading, the more the factor contributes to the variable. We have extracted three variables wherein the 10 items are divided into 3 variables according to the most important items, which are similar responses in component 1 and components 2 and 3 simultaneously. Three components with eigenvalues greater than one were recovered in this analysis. These three variables explained 49.246% of the total variation. The first component explained

19.33% of the variance, the second component explained 15.54%, and the third component explained 14.38%.

The commonalities are displayed in this column following the extraction, along with the percentage of variance in each variable that the extracted components contribute to. Variables with low commonalities, on the other hand (close to 0), indicate that the derived components do not adequately explain them. The component CP.05 "I have to leave earlier because of traffic congestion" and CP.06 "The trip is often interrupted by traffic signals", in this case, has a relatively low value of 0.372 and 0.35, indicating that it is not closely tied to the underlying factors discovered through the factor analysis.

After executing a varimax rotation with Kaiser normalization, the factor loadings are displayed in the rotated component matrix. The factor loadings indicate the relationship between each item and the extracted factors. A threshold was applied to exclude correlation <0.30. The rotation of the component matrix indicates the presence of three separate elements. Component 1 appears to indicate a sense of commuting stress, component 2 appears to have travel constraints that reflect inconveniences linked to traffic signals and concerns about traffic accidents, and component 3 shows preferences for alternate modes of transportation. Moreover, Cronbach's alpha test proved the internal consistency of each factor. As **TABLE 13**, Cronbach's Alpha is 0.590, indicating moderate internal consistency.

TABLE 13 Cronbach's alpha reliability measure

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
CP.01	30.63	17.217	0.387	0.248	0.535
CP.02	30.13	17.66	0.344	0.186	0.546
CP.03	30.01	18.191	0.255	0.094	0.567
CP.04	30.57	17.723	0.297	0.169	0.557
CP.05	29.92	16.89	0.407	0.205	0.528
CP.06	30.47	17.017	0.402	0.2	0.53
CP.07	30.42	16.983	0.378	0.218	0.535
CP.08	31.13	19.948	0.031	0.044	0.62
CP.09	30.38	18.757	0.156	0.158	0.592
CP.10	3'.22	19.48	0.071	0.15	0.613
Cronbach's Alpha	0.59				

In summary, the factor analysis indicated three underlying components in commuter perception: perceptions of commuting stress, travel constraints and preferences for other forms of transportation. These variables provide important insights into the various characteristics of commuter perception in the JMA.

4.3 Improve the quality of the trip

4.3.1 Factors that can improve the quality of the trip

The study revealed that 602 of the 629 respondents answered the question about variables that can increase the trip experience. Because one person could cite more than one aspect, the 602 respondents provided 751 references. The investigation highlighted multiple factors that could improve trip quality in JMA. The data revealed three major themes: policy and regulation, public transportation, and road infrastructure.

TABLE 14 Final code of factors that can improve the quality of the trip

Factor can improve the quality of the trip			
Distraction technique	(1)	Public transportation	
Environment		• Accessible public transport	(13)
• Green infrastructure	(1)	• Improve schedule accuracy	(20)
• Pollution reduction	(3)	• Improving the feasibility of public transportation	(88)
Use of technology to improve transportation efficiency	(9)	• Increasing public transport frequency and capacity	(167)
Policy and Regulation		• Integrated public transport payment system	(2)
• Car restriction	(34)	• Integration of public transportation	(49)
• Decrease the fuel price	(1)	• Public transportation route expansion	(66)
• Encouraging the use of public transportation	(7)	Road infrastructure	
• Enforcement of traffic rules and regulations	(78)	• Improvement of road facilities	(49)
• Flexible working scheme	(15)	• Road expansion and widening	(34)
• Lower the ride-hailing fare	(3)	• Road repair and maintenance	(106)
Time management	(2)		
Active travel	(3)		

Policy and regulation (138) were identified as significant factors in improving commuter trip quality. Enforcement of traffic rules and regulations (78) emerged as the most mentioned policy alternative, following car restriction with (34) remarks. This included ideas like instituting an odd-even licence plate scheme, imposing high taxes, and limiting the purchase of private vehicles for each family. Other initiatives, such as flexible working schemes (15), have also been highlighted as useful method.

Enhancing public transport (405) was also noted as a key element in improving the quality of journeys. Moreover, Increased frequency and capacity

(167) for trains, buses, and other public transport modes were among the suggestions offered by respondents as ways to make it better. In addition, respondents highlighted the necessity of expanding the public transportation network (66) to get to previously unreached areas and enhancing the feasibility of public transportation (88), including comfort, safety, security, and affordable rates.

Additionally, it was determined that improved road infrastructure was a crucial component in raising trip quality. Respondents recommended prioritising road maintenance and repair (106) to fix the numerous damaged or potholed roads outside Jakarta. Additionally, respondents highlighted the need to build and widen roads (34) and improve road facilities (49), such as pedestrian walkways, lighting, and signage.

The analysis identified policy and regulation, public transport, and road infrastructure as critical elements in improving the quality of travel in the Jakarta Metropolitan Area. The most frequently mentioned policy option was car restriction, whereas the most frequently suggested transportation option was increasing frequency and capacity. The most common road infrastructure alternatives were road repair and maintenance.

4.3.2 Commuter stress coping methods

A total of 673 references were found using NVivo based on the comments from the 596 participants who answered the question on methods to cope with the stress of commuting. The findings demonstrate that JMA commuters apply a variety of stress-reduction techniques. The coping mechanisms can be broadly divided into five categories: social interaction, mindfulness, trip planning, self-care techniques, and distraction techniques.

TABLE 15 Coping Methods for Commuting Stress Levels

Commuting stress coping methods			
Distraction technique		Planning the trip	
Eat or drink	(28)	Set travel time (depart earlier or not in the rush hour)	(37)
Listening to music/podcasts/ Quranic recitation	(240)	Find an alternative route	(7)
Playing game	(16)	Use other transport option	(42)
Scrolling social media	(35)	Self-care technique	
Singing	(23)	Keep healthy	(8)
Watching or reading	(46)	Sleeping	(29)
Mindfulness		Take a rest or a deep breath	(32)
Being patient	(42)	Use aromatherapy	(1)
Enjoy the scenery	(38)	Social Interaction	(20)
Praying or dhikr	(29)		

There were 240 remarks about listening to music, podcasts, or Quranic recitation as a coping strategy among the respondents. Listening to music while commuting helps commuters focus their attention away from the difficulties of their commute and provides an overall feeling of relaxation and enjoyment. For those who commute by public transport, this was followed by watching a movie or reading a book (46).

Moreover, 109 references of commuters surrendering to the conditions of their travel, practised mindfulness by performing patience, enjoying the scenery, or praying, were recorded. In addition, 86 references discovered that people chose to plan their trip by selecting the departure time and trying to find an alternate route or mode of transportation. Surprisingly, just 20 respondents applied social interaction, indicating that JMA commuters choose coping mechanisms that are more independent in nature. They rely on social engagement to cope with the stress of their everyday travels, such as talking on the phone with friends or family or talking with fellow passengers. The distraction approach was the most commonly utilised coping mechanism, with 388 references across all sub-categories. The most common distraction tactic was listening to music/podcasts/Quranic recitation.

5 DISCUSSION

5.1 General discussion

This study intended to investigate several aspects related to transport mode choice and commuter stress: (1) examine factors that influence transport mode choice and underlying motivations behind commuters' choice, (2) quantify and compare the level of stress across different modes of transportation, (3) investigate the impact transport mode choice on stress level among commuters, (4) examine various factors to understand their influence on transport mode preferences and stress level experienced by commuters, (5) propose strategies to reduce stress levels and enhance the overall commuting experience. This allows a complete understanding of JMA commuters' transport mode preferences and commuting stress levels.

5.1.1 Factors Influencing Mode Choice

This research aimed to look into the mode of transportation preferred by commuters in the Jakarta Metropolitan Area (JMA), as well as the distribution and factors influencing mode choice. This study's findings are comparable with prior research in the region and provide important insights into travel patterns. Private transportation, particularly motorcycles, is the most commonly shared mode of transportation, which is consistent with findings from Asian country studies (Tuan, 2015). Motorcycles are popular due to several variables, including affordability, flexibility, and convenience. Furthermore, the reliance on private vehicles can be related to unstable transport systems, impacting their accessibility and efficiency. This conclusion emphasises the importance of improving public transport infrastructure and services to provide commuters with reliable and convenient alternatives to private vehicles.

Tangerang indicates a preference for using public transit over on-demand transportation. Public transport, specifically the KRL/train system, represented a significant mode share in the JMA. This can be due to its effectiveness in connecting Jakarta with its satellite cities and giving commuters a viable alternative (Elizandri et al., 2021). In terms of cost and trip time, public transport modes (specifically commuter line trains) are faster and more efficient than private vehicles, particularly cars (Lestari, 2013). Providing a dependable and efficient train network helps reduce congestion and improve commuter mobility options. Active transport, such as walking and cycling, had the lowest mode share in this survey due to the lack of pedestrian-friendly facilities (Tjahjono et al., 2020). Walking is an important mode of urban mobility. Improvements in the quality of pedestrian facilities (walkability) in a certain region may encourage people to walk (Setianto & Jo'wono, 2018).

Furthermore, the study's conclusions on the impact of **affordability, speed, and accessibility** as determining modes of transportation are similar to previous research. Several studies have found that these factors influence an individual's

mode of transportation (Gottholmseder et al., 2009; R. W. Novaco et al., 1989). The affordability factor emphasises the financial side of transportation decisions, indicating that commuters prioritise cost-effective options. According to a study by Herawati and Mutharuddin in 2013, the entire cost of public transport for one-time commuting journeys was 5,000 to 15,000 rupiah less than private vehicles.

This study's findings on the factors influencing travel mode choice verify several earlier findings, such as the impact of socio-demographic characteristics, travel characteristics, and mode-specific factors. The **residential area** determines the mode of transportation chosen. This study found that with a significant p-value of 0.002, Tangerang suggests a higher likelihood of preferring public transportation over on-demand transportation. Additionally, Jakarta has the greatest percentage of commuters who use public transportation compared to other region. Despite the government's substantial investment in the transport industry, it has not been able to convince people to switch modes because not everyone has access to TransJakarta, MRT, or LRT. The fact is that the total public transport service area only covers 49% of the population, and their actual location is not near bus stops or stations (Marks et al., 2016; UN.ESCAP, 2017). Meanwhile, city transit, which is supposed to serve as a feeder for mass transportation, is incapable of providing efficient service. As a result, many prefer to travel in their private vehicles to their destinations (Pradonoputro, 2020).

In terms of **age**, the result shows that older individuals are less likely to choose public transport than other modes. This finding is consistent with earlier research showing that age impacts transportation mode preferences (Hitimana, 2022; Levin, 2019). It is proposed that older people may prefer the ease and flexibility provided by private transport choices, which allows them to keep their independence while meeting their specific mobility demands.

Moreover, this study found that **travel time and cost significantly impact** personal transport mode preference. It found that commuters with longer commute duration are more likely to choose private transportation over on-demand transportation. These findings are consistent with prior research showing the impact of trip time and cost on mode selection decisions (Bhat & Guo, 2007; Levinson & Kumar, 1995). Furthermore, travel costs considerably influence persons' use of public transportation. Individuals are more likely to prefer public transit when they believe it is less expensive. This finding is consistent with the economic rationale underlying the mode selection decision in which consumers attempt to minimise travel expenses (Cervero & Duncan, 2003).

An interesting finding arose about the link between **activity duration** and transport modes. Individuals who engage in longer-duration activities are more likely to use public transportation rather than on-demand transportation. This research implies factors such as time availability and the need for a reliable mode of transportation (Frank & Pivo, 1994). Additionally, this study discovered that **the time to return** home substantially impacts transportation mode choice. Several

academics have looked into this link and found evidence to support the impact of timing on mode choice judgements. Mokhtarian & Chen (2004) found that travel time reliability was important in mode choice judgements. In JMA, arriving home not in rush hour increases the likelihood of taking public transport more than on-demand transport.

The number of cars and motorcycles owned by respondents influenced the study's findings on transportation mode choice. People with no car or motorcycle are more likely to use on-demand transport. Another factor that influences persons' transport mode preferences is **driving license** ownership. This study found that having a driver's licence for a car considerably increases the likelihood of using private transportation. According to research, getting a driver's licence increases the possibility of people switching from public transit to private vehicle use (Cheng et al., 2019).

5.1.2 Variables shaping commuter stress

According to the findings of this study, commuters who used on-demand transportation, such as ride-sharing services or taxis, had the highest mean travel stress score of 2.81 compared to those who used public, private, or active transportation. This finding shows that in the context of the JMA study, on-demand transport users may experience higher levels of commuting stress. However, it is crucial to highlight that these findings may contradict earlier studies indicating that on-demand transit can reduce commute stress by saving time (Greenblatt and Shaheen, 2015). Further research is needed to understand the underlying causes contributing to the greater stress levels reported among on-demand transportation customers in this case study.

People aged 35 to 44 are more prone to stress during their daily commute when using public transport. This finding contradicts prior studies highlighting the impact of older age having higher satisfaction on the commute (Majumdar et al., 2021). Individuals in this age range may experience unique obstacles or responsibilities contributing to their elevated stress levels, such as work constraints or family duties. Those who have **just relocated or a newcomers** to the Jakarta Metropolitan Area (JMA) are particularly vulnerable to commuting stress. This conclusion is consistent with prior studies demonstrating newcomers' difficulties when adjusting to a new city (Pieniążek et al., 2017). These individuals' unfamiliarity with the routes, schedules, and dynamics of the public transportation system may lead to a sense of stress during their regular commute.

Furthermore, this study found that **lower-income** people are more likely to experience stress when utilising public transportation. This finding is consistent with prior studies on the impact of socioeconomic characteristics on commuter stress (Gottholmseder et al., 2009). Limited financial resources may limit commuters' transportation alternatives, forcing them to rely on public transportation, frequently associated with overcrowding, delays, and discomfort.

These unfavourable conditions can contribute to increased stress levels in people with lower incomes, who may have fewer options for transportation. Lower-income commuters demonstrated lower levels of commuting satisfaction, according to (Ye & Titheridge, 2019).

This study's objective stressor discovered that those who **live further** away from their destinations are more likely to experience commuting stress when taking public transport. This finding is consistent with the previous study that has shown the impact of distance on commuter stress levels (Evans et al., 2002). Longer commutes can increase commuter stress levels by increasing travel time, exposure to crowded circumstances, and possible delays in public transit systems. Furthermore, commuters who engage in **shorter activities** are less likely to be stressed. This finding shows that people who spend time doing things requiring less mental and physical effort may have lower stress levels. Although there is no direct support for this conclusion in the previous literature examined, it is consistent with a larger knowledge of the relationship between activities and stress reduction. More research into the relationship between activity duration and commuter stress levels might provide more information.

Travel **outside of rush hour** has been associated with lower commuter stress on public transport. This is consistent with prior research that has found a link between commute time and commuting stress (Gottholmseder et al., 2009; Legrain et al., 2015; R. E. Wener & Evans, 2011). The evidence consistently demonstrates that longer commute times are connected with higher stress levels among commuters. The current study adds to existing knowledge by showing the possibility of stress reduction through an effective travel schedule, notably avoiding peak hours. Finally, one study found that physical limitations may increase the risk of suffering commuter stress while using public transportation. This finding emphasises the significance of considering individual characteristics and demands when building transport systems and regulations. It also emphasises the importance of inclusive and accessible transportation infrastructure that can satisfy commuters' different needs.

The outcomes of the investigation of private transport passengers gave intriguing insights into the relationship between travel stress and several parameters. To begin, residents of Bogor were shown to have a reduced risk of feeling travel stress than residents of other regions. This could be linked to a variety of conditions; additional inquiry into the specific reasons is required. Secondly, individuals who use private transportation that report higher levels of trip satisfaction are less likely to experience commuter stress. This finding is consistent with earlier studies that found a link between **travel satisfaction** and general well-being (Litman, 2020). Travel satisfaction as one of the subjective stressors implies that when people have a positive view of their travel experience, which includes factors like convenience and dependability, they are less likely to be stressed during their commute.

Individuals tend to be more stressed by heavy traffic and rainy conditions. Numerous studies have found a link between traffic conditions and commuting stress. **Heavy traffic** is a substantial environmental stressor for commuters, according to research by (Gottholmseder et al., 2009; R. W. Novaco et al., 1989; Stokols et al., 1978). Long periods of congestion and delays can disturb people's schedules, contributing to stress levels. In addition, weather factors particularly inclement weather, have been highlighted as additional stressors while commuting. According to (Koslowsky et al., 2013; R. Novaco & Gonzalez, 2009), **rain** and other severe weather conditions enhance persons' stress levels while travelling. Unfavourable weather conditions can make travel more difficult, increase the chance of accidents, and cause discomfort, heightening commuter stress.

5.1.3 Factor associated with travel quality

The study's findings focus light on several factors that have the potential to improve the quality of commuter travel. Policy and regulations, public transportation, and road infrastructure were highlighted as essential aspects in improving the entire travel experience in the investigation. These findings are consistent with past research and provide valuable insights into the precise recommendations made by respondents.

JMA commuters are getting reacquainted with the city's well-known traffic congestion as Indonesia gradually moves on from the COVID-19 epidemic, with data showing that Jakarta's traffic has virtually returned to pre-pandemic levels. The Data Traffic Index confirms this, demonstrating that morning and evening rush hour traffic has returned to pre-pandemic levels. At 8 a.m., the congestion level was 57 percent, significantly higher than the 37 percent recorded in 2021 and only a few points lower than the 62 percent recorded in 2019 (Harish, 2023).

Policy and regulation were highlighted as essential parameters in increasing the quality of commuter trips. The most often stated policy alternative was enforcing traffic rules and regulations. These findings are consistent with the findings of (Susilo et al., 2007), who emphasise the importance of effective laws and regulations to encourage sustainable transportation options while mitigating the negative effects of private vehicle use.

Moreover, **enhancing public transit** has emerged as a vital component in enhancing the quality of commuter trips. Kuo and colleagues (2023) research highlights the need to boost public transport modes' frequency and capacity to provide efficient and reliable services. Furthermore, Giuliano (2005) found the need to expand the public transport network to previously unreached locations, providing passengers with improved accessibility and convenience. A larger coverage area allows commuters to reach their destinations more quickly.

The outcomes of this study further emphasise the relevance of **improved**

road infrastructure in improving trip quality. Respondents emphasised the importance of prioritising road maintenance and repair, as well as building and widening roads and improving road facilities such as pedestrian walkways, lighting, and signage. Lindsney and Verhoef (2001) discovered the significance of road maintenance and repair in improving trip quality. Potholes, uneven surfaces, and other hazards that might degrade the travel experience are reduced on well-maintained roadways. Neglecting road upkeep can result in discomfort, vehicle damage, and longer travel times, all contributing to a lower-quality journey.

This study discovered three main **coping mechanisms**: (1) **media distraction**, (2) **mindfulness practises**, and (3) **proactive planning**. Based on Lazarus and Folkman (1984), mindfulness practices is one of the emotional-focused coping mechanism. Meanwhile, media distraction and proactive planning can be categorized as problem-focused coping. Listening to music, podcasts, or Quranic recitation as a kind of distraction has evolved as a common coping mechanism among commuters in JMA. This finding is consistent with research showing that drivers who listen to self-selected music have lower stress (Wiesenthal et al., 2000). Music has been shown to redirect attention away from commuting challenges, resulting in relaxation and enjoyment (Thomée, 2018). To relieve the stress of commuting, commuters who use public transportation may participate in enjoyments such as viewing films or reading books.

Furthermore, a large number of commuters used mindfulness as a coping mechanism. Mindfulness is a practice for cultivating attention that has been demonstrated to alter stress responses in various circumstances (Brand et al., 2012; Lindsay et al., 2018). This relaxed yet mindful state of awareness can promote subjective well-being and regulate physiological functioning, resulting in lower stress levels. Mindfulness requires being present in the moment with an open-minded, nonjudgmental awareness (Bishop et al., 2004; Kabat-Zinn, 2003; Ludwig & Kabat-Zinn, 2008).

Commuters who plan ahead of time, such as choosing departure times and other routes or modes of transportation, have more control over their travel circumstances, allowing them to avoid or reduce unpleasant situations. This conclusion supports prior research that has emphasised the importance of trip planning (Khattak et al., 1999). Commuters can anticipate potential stressors and make decisions that lead to a more comfortable and pleasant commuting experience by taking a proactive approach to trip planning. Proactive preparation gives commuters control over their travel circumstances, allowing them to avoid or minimise stressful situations. This research implies that commuters prefer more independent coping techniques.

5.2 Limitations and future research

Several sources of limitations should be considered in this investigation for the current study. One of the study's limitations is the small sample number of

participants using active and on-demand transport. The survey-based approach applied in this study only gathered the perspectives of a small number of commuters, which may not accurately represent the experiences and opinions of all JMA daily commuters. To overcome this limitation, future research could try to increase the sample size by incorporating a broader variety of individuals, including active commuters and on-demand transport users. Furthermore, conducting research with a narrower focus on the variables connected with active and on-demand transportation can provide deeper insights into the specific stress factors associated with these modes of transportation.

Furthermore, convenience and snowball sampling was employed in this study to pick individuals based on their availability and willingness to participate. This sampling procedure may introduce selection bias because the sample may not be representative of the entire JMA commuter population. To ensure a more representative sample of JMA commuters, future studies could employ a more accurate sampling technique, such as random sampling.

Additionally, another drawback of self-reported data is the possibility of bias. Commuters are more likely to respond in socially desirable or culturally tolerable ways. This bias may have an impact on the findings' accuracy and validity. To address this limitation, future research should investigate alternate data-gathering approaches, such as observational studies or the use of objective measurements, in order to present a complete picture of commuter experiences. By direct observation, researchers can examine and record numerous characteristics, such as facial expressions or elevated heart rate. A more comprehensive knowledge of commuter stress can be obtained by combining these observations with interviews or surveys conducted shortly after the observations.

Several alternatives for further research can be pursued to advance the understanding of commuter stress and coping strategies in the Jakarta Metropolitan Area (JMA). First, investigating the impact of contextual factors on commuter stress, such as the quality of transportation in JMA, the availability of alternative transportation modes, and urban planning strategies, can provide valuable insights. Understanding how these factors interact with individual-level characteristics might help guide targeted interventions and policy proposals to reduce commuting stress.

Secondly, analysing statistical data from transport authorities can provide a comprehensive and objective view of commuter behaviour and stress levels. This information can include travel times, congestion patterns, modal shares, and other relevant parameters. By evaluating this data, researchers can gain new insights into the impact of traffic conditions and infrastructure on commuter stress.

Finally, conducting interviews or focus group conversations with commuters might provide a more in-depth insight into their experiences and coping techniques. These qualitative approaches can capture nuanced aspects of

commuter stress, individual viewpoints, and cultural effects that surveys may not fully capture. Furthermore, for future research, addressing the influence of commuter stress on job productivity could be an exciting path to explore. Investigating the link between commuter stress and work-related outcomes such as job performance, job satisfaction, and employee well-being may bring broader implications and solutions to boost workplace productivity.

5.3 Practical implications

The research findings have significant practical implications for many stakeholders involved in planning transportation, urban development, and commuter well-being in the Jakarta Metropolitan Area. The necessity for sustainable and long-term solutions is highlighted by identifying elements that increase commuter stress, such as congested traffic and adverse weather conditions. A more comprehensive strategy is required rather than financing road expansion projects. Strategies that not only reduce present congestion but also advance sustainable transportation options should be given top priority by transport authorities. This involves funding the creation of intelligent transport systems, expanding public transportation networks, and developing infrastructure specifically designed to support pedestrians and cyclists. Authorities can successfully manage commuter stress while contributing to long-term environmental sustainability by taking a holistic approach and promoting a move towards sustainable modes of transportation.

Furthermore, commuters' coping methods, such as listening to music or engaging in mindfulness practises, offer the potential for specific treatments to improve passenger well-being. Public transit companies could consider providing comfortable seating, Wi-Fi connectivity, and dedicated quiet spaces to make travelling less stressful. Furthermore, supporting mindfulness-based programmes and stress reduction strategies, whether through specialised mindfulness applications or workplace wellness efforts, might assist commuters in better managing their stress levels.

Employers can help reduce commuting stress by establishing flexible work arrangements like teleworking, working from home (WFH), or flexible work hours. This can help minimize dependency on peak-hour traffic while giving employees more control over their commute experiences. Collaboration among employers, transportation authorities, and urban planners are critical for creating supportive environments that prioritise employee well-being and enable efficient and relaxed commute experiences.

Finally, the study's findings have significant practical implications for improving commuter well-being in the Jakarta Metropolitan Area (JMA) and other places. To successfully address the identified stressors and promote sustainable transportation choices, interventions tailored to individual modes of transportation are required. Commuters might be encouraged to adopt suitable coping mechanisms and investigate other transportation options by focusing on

targeted interventions such as stress-management skills training and awareness programmes. Raising awareness about the adverse impacts of stress can encourage people to look at more environmentally friendly modes of transportation. It is critical to carry out these initiatives while encouraging stakeholder engagement to produce a more efficient, sustainable, and commuter-friendly transport system in the JMA. Furthermore, the study's results can be transferred to other regions by adapting and customising the approaches to each location's specific characteristics and needs while considering local infrastructure and commuter habits. This method can potentially improve commuter well-being beyond the JMA commuters and contribute to developing more sustainable transport systems on a larger scale.

6 CONCLUSIONS

The purpose of this study was to look into several factors of commuter stress and mode choice in the Jakarta Metropolitan Area. The findings provide useful insights into commuters' transport mode preferences and degrees of commuting stress. The study verified the dominance of private transportation, particularly motorbikes, in the JMA in terms of factors influencing mode choice. Affordability, flexibility, and convenience are all aspects to consider. However, the dependence on private vehicles is also influenced by the unstable conditions of Greater Jakarta's public transportation networks. The report emphasises the significance of enhancing public transport infrastructure and services in order to give commuters reliable and convenient options.

The KRL/train system contributes to an important mode share in the JMA. Its popularity comes from its efficacy in connecting Jakarta with neighbouring cities and providing a faster and more efficient alternative to private vehicles. This study highlighted the importance of improving pedestrian facilities in order to promote walking as a significant mode of urban transport. Affordability, speed, and accessibility were discovered to be significant variables in transportation mode preferences. Residential area, age, travel time, travel cost, activity duration, time to return home and driving licence ownership were also identified as relevant variables in mode choice decisions. The comprehensive investigation of the factors influencing commuter preferences would help the government design strategies to improve sustainable and efficient transport systems in the JMA and other locations.

This research discovered a correlation between traffic congestion, travel time, weather conditions, and commuter stress levels. Commuters' stress levels were observed to rise as a result of traffic congestion and longer commute times. Inclement weather also contributed to increased levels of stress while commuting. Improving commuter travel quality requires consideration of regulations and laws, public transport, and road infrastructure. Potential techniques include enforcing traffic rules and regulations, applying car limitations, and increasing the frequency and capacity of public transport. Road maintenance and repair, as well as the construction of pedestrian walkways, lighting, and signs, were identified as critical components of road infrastructure enhancement.

Commuters frequently use several methods to cope with stress related to their mode of transportation. To reduce stress, commuters who use public transport frequently watch films and YouTube or read a book. Listening to music, mindfulness practises, and planning the trip were discovered to be helpful solutions for all modes of transportation. However, it is important to note that this study's weaknesses include a small sample size and convenience sampling, which may induce selection bias. Future studies could use larger and more representative samples and different data collection methods. Investigating the impact of environmental elements and employing objective measures could lead to a complete knowledge of commuter stress and coping techniques.

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APPENDICES

APPENDIX 1 Social Media Survey Promotion

MOBILITEITSWETENSCHAPPEN
TRANSPORTATION SCIENCES
UHASSELT

CALL FOR RESPONDENTS !!

Hello! My name is Anisa Fauzi, and I am a Masters student in the Transportation Sciences Study Programme at UHasselt. I am now doing a survey for my thesis, "Commuter Stress Perception in the Jakarta Metropolitan Area."

Criteria:

- Age: ≥ 17 years old
- Domiciled in JABODETABEK – Jakarta, Bogor, Depok, Tangerang, Bekasi
- As a commuter travelling within JABODETABEK
- Participants can use various modes of travel, either by public transportation, private vehicles or walking

*There is a language option.

If you meet the stated criteria. Please be willing to participate in this research by filling out the survey at the following link

bit.ly/surveianisa2023

The total e-wallet balance incentive is IDR 500,000 for 10 lucky respondents. If interested, please fill in your initials and e-wallet phone number at the end of this survey

Thank you for your attention and willingness to fill out this survey.

If you have questions please contact
anisafauzi.ratnasari@student.uhasselt.be

MOBILITEITSWETENSCHAPPEN
TRANSPORTATION SCIENCES
UHASSELT

CALL FOR RESPONDENTS !!

Hallo! Perkenalkan saya Anisa Fauzi, mahasiswa S2 Prodi Transportation Sciences UHasselt. Saat ini saya sedang melakukan survei terkait tesis saya yang bertema "Commuter Stress Perception in Jakarta Metropolitan Area"

Kriteria:

- Usia: ≥ 17 tahun
- Berdomisili di JABODETABEK – Jakarta, Bogor, Depok, Tangerang, Bekasi
- Sebagai komuter melakukan perjalanan dalam JABODETABEK
- Peserta dapat menggunakan berbagai moda perjalanan, baik dengan angkutan umum, kendaraan pribadi maupun berjalan kaki

*Terdapat pilihan bahasa

Apabila memenuhi kriteria yang disebutkan. Mohon kesediaannya untuk berpartisipasi dalam penelitian ini dengan mengisi survei pada tautan berikut

bit.ly/surveianisa2023

Insentif saldo e-wallet total Rp.500.000 untuk 10 responden beruntung. Jika berminat silakan isi inisial nama dan no hp e-wallet dibagian akhir survey ini

Atas perhatian dan kesediannya dalam mengisi survei ini saya ucapkan terima kasih.

Jika ada pertanyaan silakan hubungi
anisafauzi.ratnasari@student.uhasselt.be

APPENDIX 2 Question sets for commuters and possible answers

Question for JMA commuters	Possible answer
Personal characteristics (PC)	
(PC.01) Residential area	1=East Jakarta 2=West Jakarta 3=Central Jakarta 4=North Jakarta 5=South Jakarta 6=Bogor Regency 7=Bogor City 8=Depok City 9=Tangerang Regency 10=Tangerang City 11=South Tangerang 12=Bekasi Regency 13=Bekasi City
(PC.02) Age	1=17-24 2=25-34 3=35-44 4=45-54 5=55-64 6=65+
(PC.03) Gender	1=Male 2=Female
(PC.04) Marital status	1=Married 2=Widowed 3=Divorced 4=Not married / Single 5=I prefer not to say
(PC.05) Living situation	Living alone, with family, sharing a house/apartment
(PC.06) Household size	1,2,3,4,5,6,>6
(PC.07) Children	0,1,2,3,4,>4
(PC.08) Living period in JMA	1=Up to 1 year, 2=Over 1 year up to 3 years 3=Over 3 years up to 5 years 4=Over 5 years up to 10 years 5=Over 10 years up to 15 years 6=Over 15 years up to 20 years 7=Over 20 years
(PC.09) Occupation	1=Entrepreneur 2=Employee 3=Civil servant 4=Unemployed 5=Retired 6=Student 7=Freelancer 8=Driver of online taxi/ride-hailing 9=Other
(PC.10) Level of education	1=Secondary school 2=High school 3=Bachelor 4=Master 5=PhD 6=I prefer not to say
(PC.11) Income	1= < 2.500.000 2= 2.500.001 - 5.000.000 3= 5.000.001 - 7.500.000 4= 7.500.001 - 10.000.000 5= 10.000.001 - 12.500.000

Question for JMA commuters	Possible answer
	6= 12.500.001 - 15.000.000 7= 15.000.001 - 17.500.000 8= 17.500.001 - 20.000.000 9=> 20.000.000 10= I prefer not to say 11= I do not have fix income
Travel characteristics (TC)	
Frequency of vehicle usage by:	
(TC.01) Car	Never, less than once per month, once per month, 2-3 times per month, 1-2 days per week, 3-5 days per week, every day
(TC.02) Motorcycle	
Frequency of travelling in a week for a specific activity:	
(TC.03) Mandatory activity	0-7 days
(TC.04) Occasional activity	
(TC.05) Leisure activity	
(TC.06) Mandatory activity purpose	Work, study, course, other
Transportation mode based on activity type	
(TC.07) Mandatory activity	Car as a passenger, car as a driver, motorcycle, paratransit, TransJakarta, Bus, KRL, MRT, LRT, taxi, ride-hailing, scooter, cycling, walking
(TC.08) Occasional activity	
(TC.09) Leisure activity	
(TC.11) Second transport mode	Car as a passenger, car as a driver, motorcycle, paratransit, TransJakarta, Bus, KRL, MRT, LRT, taxi, ride-hailing, scooter, cycling, walking
Typical mandatory commute	
(TC.12) Distance	<5, 5-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60+ km
(TC.13) Travel time	<30, 30-59, 60-89, 90-119, 120+ minutes
(TC.14) Activity duration of the day	1-3, 4-5, 6-8, 9-10, >10 hours
(TC.15) Time to leave home	00.00-04.59 14.00-15.59
(TC.16) Time to arrive home	05.00-05.59 16.00-16.59 06.00-06.59 17.00-17.59 07.00-07.59 18.00-18.59 08.00-08.59 19.00-19.59 09.00-09.59 20.00-20.59 10.00-11.59 21.00-23.59 12.00-13.59
(TC.17) Duration of current travel route	1=Less than 1 year 2=Over 1 year up to 2 years 3=Over 2 years up to 4 years 4=Over 4 years up to 6 years 5=Over 6 years up to 8 years 6=Over 8 years up to 10 years 7=Over 10 years
(TC.18) Travel cost	<5.000, 5.000-9.999, 10.000-14.999, 15.000-24.999, 25.000-49.999, 50.000-74.999, 75.000-99.999, 100.000+
(TC.19) Number of transfers*	0,1,2,3,>3
Mode-specific factors (MF)	
Vehicle ownership	

Question for JMA commuters	Possible answer
(MF.01) Number of cars	(number)
(MF.02) Number of motorcycles	
(MF.03) Number of bicycles	
(MF.04) Number of scooters	
(MF.05) Driving license	No, yes for car, yes for motorcycle, yes for both
(MF.06) Driving school	No, yes for car, yes for motorcycle, yes for both
(MF.07) Duration hold car driving license	<1,1-5,6-10,11-15,>15
(MF.08) Duration hold motorcycle driving license.	
Commute related	
(MF.09) Reason for choosing the primary mode	Affordable, comfortable, speed, integration with other modes, safety, security, privacy, frequency, accessibility, and decreased environmental impact.
(MF.10) Mix with public transport	Yes, no
(MF.11) Frequency of traffic congestion	Daily, 4-6 times a week, 2-3 times a week, once a week, never
(MF.12) Frequency to get a seat in public transport*	1=Never 2=Sometimes 3=About half of the time 4=Most of the time 5=always
(MF.13) From home to stop*	Walking, bicycle, motorcycle, paratransit, car, ride-hailing
(MF.14) From stop to activity destination*	
(MF.15) Willingness to switch to public transport**	1=Definitely not 2=Probably not 3=Neutral 4=Probably yes 5=Definitely yes
(MF.16) Type of private vehicle**	Privately owned, office facility
(MF.17) Reason to worry***	1=Inadequate infrastructure, potholes and mixed with motorised vehicles 2=After I arrive at my location, I lock my bike in a place where I will not be able to see it 3=Sweating excessively before arriving at my location 4=crashing
Crash and violation number	
(MF.18) Number of crashes in 5 years	0,1,2-3,4-5,>5
(MF.19) Number of travel violation	0,1,2-3,4-5,>5
Limitation	
(MF.20) Physical limitation	No, driving a car, riding a motorcycle, cycling, walking, using public transportation
(MF.21) Type of limitation	Vision impairment, deaf, mental disorder, acquired brain injury, physical disability, I prefer not to say
Avoid long commute	
(MF.22) Change place of residence (MF.23) Change the place of activity.	1=Definitely not 4=Probably yes 2=Probably not 5=Definitely yes 3=Neutral

Question for JMA commuters	Possible answer	
Travel experience (TE)		
(TE.01) Travel Satisfaction	0=Very dissatisfied 1=Dissatisfied 2=Neutral	3=Satisfied 4=Very satisfied
(TE.02) Today travel stress experience	4=Very stressed 3=stressed 2=Neutral	1=Relaxed 0=Very relaxed
(TE.03) At day time	1=Never	
(TE.04) At night time	2=Sometimes	
(TE.05) On a sunny day	3=About half the time	
(TE.06) On a rainy day	4=Most of the time	
(TE.07) In heavy traffic	5=always	
(TE.08) In regular traffic		
Commuter perception (CP)		
(CP.01) Commuting is stressful for me	1=Strongly disagree	
(CP.02) My commute affects my productivity	2=Somewhat disagree	
(CP.03) The important thing about travelling is arriving at the destination	3=Neutral 4=Somewhat agree	
(CP.04) I feel there is nothing I can do to control the way in which I commute	5=Strongly agree	
(CP.05) I have to leave earlier because of traffic congestion		
(CP.06) The trip is often interrupted by traffic signals		
(CP.07) I worry about the trip due to the traffic accident		
(CP.08) I would like to drive more		
(CP.09) I would like to use public transit more		
(CP.10) I would like to active travel more		
Commuter opinion (CO)		
(CO.01) Factors can improve the quality trip	Open-ended question	
(CO.02) Stress coping method		

APPENDIX 3 Survey questionnaire

Block 1: Welcome & GDPR

Have you ever felt stressed on your trip?

Dear participant,

My name is Anisa Fauzi Ratnasari. I am a master's student in Transportation Sciences at Hasselt University, Belgium. For my master's thesis, I am gaining more knowledge about the stress perception of commuters in the Jakarta Metropolitan Area. The research is done based on this questionnaire.

For this questionnaire, we are looking for commuters who meet the following characteristics to fulfil:

- Age: ≥ 17 years
- Live in the Jakarta Metropolitan Area (JABODETABEK – Jakarta, Bogor, Depok, Tangerang, Bekasi)
- Doing commute within JMA, teleworking on some days is still possible
- Participants can use different travel modes, either public transport, private vehicle or active transport (walking or cycling).

You may help me by completing the survey below. Answering the questions will take about 10 minutes, and all responses are anonymous.

Block 2: Informed consent

Name & contact details of researcher:

Anisa Fauzi Ratnasari (graduate student):
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Before starting the survey, please read the information below thoroughly:

- I have read the above information about this study (e.g., research objective).
- I understand the purpose of this research as well as what is expected of me during this research.
- I know that I will participate in this questionnaire study
- I understand that my participation in this study is voluntary and that I have the right to discontinue my participation at any time during the intake (by closing the browser window). I do not have to give a reason for this, and I know that no disadvantage can arise for me.

- I understand that the results of this research may be used for scientific purposes and may be published. My name will not be published, and the confidentiality of my data is guaranteed at every stage of the research.

- I know that the results of this research will be kept for two years and deleted after this period.

- For any complaints or other concerns regarding the processing of personal data, I can contact the UHasselt data protection officer: at dpo@uhasselt.be

For more information about exercising my rights or submitting a complaint, please see our privacy statement at https://www.uhasselt.be/en/terms-of-use-privacy

I have read and understood the above information and received answers to all my questions regarding this study.

- o I agree to take part in this study and agree that my answers will be registered.

- o I do not agree to take part in this study.

If the answer was "I do not agree to take part in this study", proceed to the end of the survey

Block 3: Personal Characteristics

Where is your residential area?

- o East Jakarta

- o West Jakarta

- o Central Jakarta

- o North Jakarta

- o South Jakarta

- o Bogor Regency

- o Bogor City

- o Depok City

- o Tangerang Regency

- o Tangerang City

- o South Tangerang

- Bekasi Regency
- Bekasi City

How old are you? Please input the number your age example: 30

What is your gender?

- Male
- Female

What is your marital status?

- Married
- Widowed
- Divorced
- Not married / Single
- I prefer not to say

How is your living situation?

- Living alone
- With family
- Sharing a house/apartment

How many people live in your household, including you?

- 1
- 2
- 3
- 4
- 5
- 6
- >6

How many children do you have?

- 0

- 1
- 2
- 3
- 4
- >4

How long have you lived in Jakarta Metropolitan Area (JABODETABEK)?

- Up to 1 year,
- Over 1 year up to 3 years
- Over 3 years up to 5 years
- Over 5 years up to 10 years
- Over 10 years up to 15 years
- Over 15 years up to 20 years
- Over 20 years

What is your profession?

- Entrepreneur
- Employee
- Civil servant
- Unemployed
- Retired
- Student
- Freelancer
- Driver of online taxi/ride-hailing
- Other _____

What is your highest education?

- Secondary school
- High school

- Bachelor
- Master
- PhD
- I prefer not to say

How much is your monthly income? (IDR)

- < 2.500.000
- 2.500.001 - 5.000.000
- 5.000.001 - 7.500.000
- 7.500.001 - 10.000.000
- 10.000.001 - 12.500.000
- 12.500.001 - 15.000.000
- 15.000.001 - 17.500.000
- 17.500.001 - 20.000.000
- > 20.000.000
- I prefer not to say
- I do not have fix income

How many of these private vehicles do you have in your household? Please input the number 0/1/2/3/...

Cars _____

Motorcycles _____

Bicycles _____

Scooters _____

Do you hold at least a driving license, either for a car or motorcycle?

- No
- Yes, for the car
- Yes, for motorcycle

- Yes, for both

Did you join driving school when you learned to drive a car or ride a motorcycle?

- No
- Yes, for the car
- Yes, for motorcycle
- Yes, for both

If the answer was “Yes”, proceed to depend on the mode

How long have you held your car driving license? (year)

- <1
- 1-5
- 6-10
- 11-15
- >15

How long have you held your motorcycle driving license? (year)

- <1
- 1-5
- 6-10
- 11-15
- >15

How often do you drive a car?

- Never
- Less than once per month
- Once per month
- 2-3 times per month
- 1-2 days per week
- 3-5 days per week

- Every day

How often do you ride a motorcycle?

- Never
- Less than once per month
- Once per month
- 2-3 times per month
- 1-2 days per week
- 3-5 days per week
- Every day

"Commute means travel some distance between one's home and place of activity on a regular basis."

How frequently do you commute in a week for each type of activity? (days)

Mandatory activity _____

Occasional activity _____

Leisure activity _____

What is your mandatory/routine travel purpose?

- Work
- Study
- Course
- Other _____

How many crashes have you had in the last 5 years?

- 0
- 1
- 2-3
- 4-5
- >5

How many traffic violations have you done in the last 1 year?

- 0
- 1
- 2-3
- 4-5
- >5

Do you have any limitations because of your physical condition while travelling with a specific travel mode? (multiple answers are possible)

- □ No
- □ Driving a car
- □ Riding a motorcycle
- □ Cycling
- □ Walking
- □ Using public transportation

What kind of limitations do you have? (multiple answers are possible)

- □ Vision impairment
- □ Deaf
- □ Mental disorder
- □ Acquired brain injury
- □ Physical disability
- □ I prefer not to say

Block 4: Travel Characteristics

"The main transportation mode is the mode used to cover the most distance in your commute."

For **mandatory/routine** activity purposes, what is your main transportation mode?

- Car as a passenger

- Car as a driver
- Motorcycle
- Paratransit
- TransJakarta
- Bus
- Train/KRL
- MRT
- LRT
- Taxi
- Ride-hailing
- Scooter
- Cycling
- Walking

For occasional activity purposes, what is your main transportation mode?

- Car as a passenger
- Car as a driver
- Motorcycle
- Paratransit
- TransJakarta
- Bus
- Train/KRL
- MRT
- LRT
- Taxi
- Ride-hailing
- Scooter

- Cycling
- Walking

For leisure activity purposes, what is your main transportation mode?

- Car as a passenger
- Car as a driver
- Motorcycle
- Paratransit
- TransJakarta
- Bus
- Train/KRL
- MRT
- LRT
- Taxi
- Ride-hailing
- Scooter
- Cycling
- Walking

Please answer the following questions based on your typical mandatory/routine experiences commuting

Why do you choose that specific mode as the primary mode? (multiple answers are possible)

- □ Affordable
- □ Comfortable
- □ Speed
- □ Integration with other modes
- □ Safety

- □ Security
- □ Privacy
- □ Frequency
- □ Accessibility
- □ Decreased environmental impact

What is the distance in kilometres that you usually travel one way? (from home to activity destination)

- o <5
- o 5-9
- o 10-19
- o 20-29
- o 30-39
- o 40-49
- o 50-59
- o 60+

How many minutes is your main commuting travel time per single trip? (from home to activity destination)

- o <30
- o 30-59
- o 60-89
- o 90-119
- o 120+

How much does your travel cost per trip from origin to destination?

- o <5.000
- o 5.000-9.999
- o 10.000-14.999

- 15.000-24.999
- 25.000-49.999
- 50.000-74.999
- 75.000-99.999
- 100.000+

Do you usually get a seat?*

- Never
- Sometimes
- About half of the time
- Most of the time
- Always

How many hours do you work/school/course on average per day, including overtime?

- 1-3
- 4-5
- 6-8
- 9-10
- >10 hours

What time do you typically leave your residence to commute?

- 00.00-04.59
- 05.00-05.59
- 06.00-06.59
- 07.00-07.59
- 08.00-08.59
- 09.00-09.59
- 10.00-11.59

- 12.00-13.59
- 14.00-15.59
- 16.00-16.59
- 17.00-17.59
- 18.00-18.59
- 19.00-19.59
- 20.00-20.59
- 21.00-23.59

What time do you typically arrive at your residence from commute?

- 00.00-04.59
- 05.00-05.59
- 06.00-06.59
- 07.00-07.59
- 08.00-08.59
- 09.00-09.59
- 10.00-11.59
- 12.00-13.59
- 14.00-15.59
- 16.00-16.59
- 17.00-17.59
- 18.00-18.59
- 19.00-19.59
- 20.00-20.59
- 21.00-23.59

In an average week, how often do you encounter traffic congestion on your commute?

- Daily
- 4-6 times a week
- 2-3 times a week
- Once a week
- Never

Do you mix your specific mode with public transport?**

- Yes
- No

How long have you been travelling the route that you presently take?

- Less than 1 year
- Over 1 year up to 2 years
- Over 2 years up to 4 years
- Over 4 years up to 6 years
- Over 6 years up to 8 years
- Over 8 years up to 10 years
- Over 10 years

If you wanted to relocate to avoid a long commute or heavy traffic, how feasible would it be for you?

	Definitely not	Probably not	Neutral	Probably yes	Definitely yes
Change your place of residence	○	○	○	○	○
Change your place of routine activity (office/school)	○	○	○	○	○

Do you want to change from your specific mode to public transportation?**

- Definitely not

- Probably not
- Neutral
- Probably yes
- Definitely yes

How do you get from home to angkot stop?*

- Walking
- Bicycle
- Motorcycle
- Paratransit
- Car
- Ride-hailing

How do you get from angkot stop to your activity location?*

- Walking
- Bicycle
- Motorcycle
- Paratransit
- Car
- Ride-hailing

How many transfers are needed during the trip?*

- 0 (direct)
- 1
- 2
- 3
- >3

What is your biggest worry while commuting? ***

- Inadequate infrastructure, potholes and mixed with motorised vehicles

- After I arrive at my location, I lock my bike in a place where I will not be able to see it
- Sweating excessively before arriving at my location
- Crashing

How satisfied or dissatisfied are you with your routine commute (Move the graphic smile slider based on your condition. There are 5 options on the graph below, the lowest is very dissatisfied, dissatisfied, neutral, satisfied, and the highest is very satisfied)

How did you feel about your trip today? (Move the graphic smile slider based on your condition. There are 5 options on the graph below, the lowest is very stressed, stressed, neutral, relaxed, and the highest is very relaxed)

Please indicate your stress level while commuting with your main transport mode about each situation

	Never	Sometimes	About half the time	Most of the time	always
At day time	○	○	○	○	○
At night time	○	○	○	○	○
On a sunny day	○	○	○	○	○
On a rainy day	○	○	○	○	○
In heavy traffic	○	○	○	○	○
In regular traffic	○	○	○	○	○

Please indicate what you feel precisely below based on your experiences. To what degree do you agree with this statement while commuting using your primary

transport mode

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
Commuting is stressful for me	○	○	○	○	○
My commute affects my productivity	○	○	○	○	○
The important thing about travelling is arriving at the destination	○	○	○	○	○
I feel there is nothing I can do to control the way in which I commute	○	○	○	○	○
I have to leave earlier because of traffic congestion	○	○	○	○	○
The trip is often interrupted by traffic signals	○	○	○	○	○
I worry about the trip due to the traffic accident	○	○	○	○	○
I would like to drive more	○	○	○	○	○
I would like to use public transit more	○	○	○	○	○
I would like to active travel more	○	○	○	○	○

In your opinion, what factors can contribute to improving the quality of your trip? (For example, increasing mass public transit, repairing roads, and so on.)

_____

What method do you use to cope with stress while commuting?

_____

End of the survey: We thank you for your time spent taking this survey. Your response has been recorded.