# TYPOLOGY OF PRIVATE CAR USERS DURING COVID-19 PANDEMIC IN KAYURINGIN JAYA

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**ABSTRACT**

The Covid-19 Pandemic was indicated in March 2020, which has changed people's daily activities patterns. Implementing the restricting regulation imposed by the government made some of the people's daily activities diverted to an online system. As a result, community mobility has decreased, especially on private car usage. However, there is a shift in vehicle usage which many people are starting to switch their mode to the private car in daily travel. This condition was predicted would continue even after the Pandemic ends. The increase in private car usage will worsen the congestion than before the Covid-19 Pandemic appropriate steps and handling are needed to prevent the increase in congestion. One of them is by knowing the characteristics and journeys of private car users during the Covid-19 Pandemic. This research is a typology of private car users during the Covid-19 Pandemic to identify the similarities and differences in the characteristics possessed by each private car user through the typological groups formed. Through this research, it can be seen the movement patterns and characteristics of the people who use private cars. This study uses the Hierarchical Cluster Analysis method. The analysis is based on several variables such as private car usage frequency variables, socioeconomic characteristics variables, demographic variables, household variables, and household travel patterns object of this research is 107 households which are owners and use of private cars for further analysis and form clusters of private car users that have the same characteristics of each cluster. The typology of private car users is compiled based on the unique characteristics possessed by each cluster that is formed. The results of this study are 8 typologies of private car users, which are divided from intensive users to irregular users. Typology 1 has the largest number of respondents and dominates the frequency of trips by private car users. The benefit of this research for the government is as input in the formulation of policies to regulate the use of private cars so that the policies taken by the government can be right on target

**Keywords:** private car, typology, covid-19, mobility, user characteristic.

## INTRODUCTION

According to the World Health Organization state in December 2019, the newest virus epidemic resembling Sars and Pneumonia viruses was found in Wuhan, China. This virus is known as Corona Virus Disease 2019 (Covid-19)(Huang,2020). In March 2020, the first case of Covid-19 was discovered in Indonesia, and the number of cases continues to increase over time. Covid-19 has caused the government to take unprecedented action. In this case, is restrictions for social and mobility (De Vos, 2020). Lockdown on an area, city, and even country scale and mobility restrictions have been carried out by almost the entire world to contain the spread of Covid-19 (Cartenì, 2020). This condition has led to drastic changes in the household's daily activities, travel patterns, and mobility. At the first phases of the Covid-19 Pandemic, the government decided to reduce public transport services to prevent transmission on public transportation and reduce mobility. This restriction regulation continued with PSBB (*Pembatasan Sosial Berskala Besar*), which lasted for 14 days and was extended.

During the restriction, people started to shift from public transport to private mode. Private vehicles are considered safer in terms of hygiene and can perform Social distancing better than public transportation during the Pandemic (Beck, 2020). This mode shift resulted from government measures to contain Covid-19 spread and personal preference (Das, 2021). At Kayuringin Jaya, motorcycles are the most used private vehicles owned by the household than cars. However, private cars choose to use private cars during the Covid-19 Pandemic instead of using motorcycles. According to CDC, cars are the safest mode to maintain social distancing while traveling during

Covid-19. In addition, private cars are more efficient to use, especially for longer travel distances (Abdullah, 2021).

The shifting in modal choice to travel during the Covid-19 Pandemic increased private car usage in Bekasi City. Also, other studies showed that car usage relatively rise at an early period of Covid-19 (Moloy, 2021). Suppose no regulation impacts increasing congestion in Bekasi City due to an uncontrolled increase in the use of private cars, which is predicted to occur when Covid-19 ends and community activities retentively. Before the Covid-19 Pandemic, 2 million vehicles were crossing Bekasi City every day, based on records from Jasa Marga. This number decreased by 10% during the first PSBB determination at the beginning of the Covid-19 Pandemic. This condition did not last long because, according to Waze data, there was a 22.5% increase in traffic volume in August 2020. This number continues to increase close to 90% of the traffic volume before the Covid-19 Pandemic.

Handling this problem requires an effective and targeted strategy that prioritizes public health. Private car users have characteristics that have differences and similarities between users. This identification is carried out through typology analysis, which divides private car users into several groups based on the similarities in their characteristics.

Typology is a process that emphasizes the classification of characteristics that have similar characteristics or have certain specificities that are created based on the period associated with an environment and community activities (Ramandhika, 2012). By analyzing the typology of private car users, it will be known how the characteristics and patterns of people's travel during the Covid-19 Pandemic are by their typology. Furthermore, research on the typology of private car users can determine their background during the Covid-19 Pandemic and their socio-economic characteristics and travel patterns. Typological Analysis Research is th to regulate the use of private cars to prevent an increase in congestion due to private cars during and after the Covid-19 Pandemic.

**Typology Of Private Car Users**

It may be expected that the Covid-19 has effect preference towards travel modes. While public transportation has decreased, in another hand private car usage started to increased (Haas, 2020) Not only effected on mode preference, the Covid-19 Pandemic has affected the reduction of daily household mobility and travel patterns (Atchison,2020). Before the Covid-19 Pandemic, private car users were dominated by commuting and work activities, besides other trips such as shopping, recreation, and other activities (Li, 2015). In contrast, work, school, and health activities are carried out during the COVID-19 Pandemic. For other purposes such as recreation, family gatherings, shopping, and other activities, there has been a significant decline to touch the zero travel cases during the initial phase of the Pandemic. Covid-19 (Brough et al., 2020).

According to (Dedele et al., 2020), the characteristics of private car user can be seen from the socioeconomic side of the community. According to the socio-economic factors seen from age, gender, education level, number of children, marital status, income, and employment status. Based on the previous study, socioeconomic and demographic characteristics and the affordability of public access to public and social facilities are variables that assessed the characteristics of mode users. Under normal conditions, the characteristics of private car users are users who are in a higher age group or retirement ranging from (more than 35 years old), high income, and belonging to the upper economic group. They have good access to private cars (Das, 2021). However, during the Covid-19 Pandemic, the younger age group (20 years - 40 years), with higher education status and an increased number of travel frequencies, chose to use private cars (Abdullah, 2021)

Typological analysis based on socioeconomic and mobility characteristics was carried out by (Oostendorp 2019). Based on this research, the typology related to private cars used as the primary vehicle or combined with public transportation has characteristics. These users are in a higher age group or retired ranging from (more than 35 years old), living in a spouse's household. or alone, in a decentralized environment, with a high rate of private car ownership, with a percentage of 85% compared to other typologies that do not use private cars.

**RESEARCH AND METHODS**

**Approach And Study Area**

The survey was conducted between May 1st, 2021, to June 10th, 2021. During the survey period, the condition of Covid-19 in Bekasi City was relatively stable, with an average increase in positive confirmed cases of Covid-19 at 20%. The implementation of the research in May 2021 coincides with the Eid al-Fitr holiday. Currently, the government is implementing a ban on going home and blocking some toll road sections that connect Bekasi City and areas such as Bandung and the Central Java area and only allow local homecoming on May 6th, 2021. until May 17th, 2021. The survey period after the Eid holiday is May 21st, 2021, to May 28th, 2021. The Covid-19 condition in Bekasi City has increased by 2.54%. Kayuringin Jaya Village experienced an increase of 24 positive cases of Covid-19 in this period.

A total of 107 samples has obtained, among which were spread over 26 RW in Kayuringin Jaya. The number of respondents is around three until five respondents each RW. It depends on the width of the road in each RW. the survey is designed to collect information about private car users' socioeconomic characteristics, mobility, and travel patterns during the Covid-19 Pandemic.

**Survey Design**

Data collection through questionnaires will be carried out online and paper-based. Respondents will be asked to fill out online questionnaires through online survey platforms or in printed form. The use of online surveys is related to the Covid-19 Pandemic that occurred when researchers were going to research so that online surveys became an alternative for researchers in collecting data. The questionnaire in this study will focus on data and information related to the typology of private car users during the Covid-19 period under the aims and objectives of the author's research. The questions in the questionnaire will be divided into three parts: *demographic, socio-economic characteristics, characteristics of travel patterns* and *mobility of private car users before the Covid-19 Pandemic, and travel patterns* and *mobility of remote car users during the Covid-19 period.* The survey questionnaires will be distributed through the Head of the RW through social media to distribute to residents. The object of this research is the household, the user, and the owner of a car in Kayuringin Jaya.

**Hierarchical Cluster Analysis**

Grouping the objects with close characteristics together by measuring the distance between each object based on the variables suggested in the study is the main idea of cluster analysis(Segev,2010). The purpose of Hierarchical cluster analysis is to build a tree diagram called dendrogram were the case that was viewed as having similarities placed on branches that are close together (Tullis,2013)

Hierarchical Cluster Analysis was carried out with Agglomerative Hierarchical Clusters through the Average Linkage method. Namely, the analysis is done by grouping data based on the proximity of the distances possessed to form cluster groups with similarities between each cluster member and between clusters. The hierarchical cluster analysis group Jaya during the Covid-19 Pandemic. Based on 107 private car users who are a sample of 26 RW in Kayuringin Jaya Village. The clustering of private car users based on socioeconomic variables and travel patterns.

**Table 1**. Analysis Variable

| Variables | Sub Variables | X |
| --- | --- | --- |
| Frequency | Weekday Frequency | X1 |
| | Weekend Frequency | X2 |
| | Monthly Frequency | X3 |
| Socioeconomy | Profession | X4 |
| | Education | X5 |
| | Income | X6 |
| | Household travel cost | X7 |
| | Car ownership | X8 |
| | Motorcycle Ownership | X9 |
| | Bicycle Ownership | X10 |

| | House ownership | X11 |
| --- | --- | --- |
| | House Building Area | X12 |
| Demografic | Age | X13 |
| | Gender | X14 |
| | children in Family | X15 |
| | Family members | X16 |
| | Distance to Hospital | X17 |
| | Distance to Market | X18 |
| Distance | Distance to Office | X19 |
| | Distance to Park | X20 |
| | Distance to School | X21 |
| | Distance to worship place | X22 |
| | Distance to PT Station | X23 |
| Travel Patterns | Travel Destination | X24 |
| | Travel Purpose | X25 |
| | Travel Origin | X26 |

**Descriptive Analysis**

Descriptive analysis is an analysis that describes research data without testing. The presentation of descriptive analysis data can be done through graphs, diagrams, tables, mean, mode, median data spread, and percentage calculation. In the Typology research of car users during the Covid-19 Pandemic in Kayuringin Jaya Village, descriptive analysis was used in profiling/described data from cluster analysis. This analysis was conducted to determine the characteristics possessed by each cluster based on the mean and modus values.

## RESULTS AND DISCUSSION
### Hierarchical Cluster Analysis

Multicollinearity test is carried out to determine how similar or relationship with other independent variables is. This test is carried out using the Tolerance (Tol) or Variance Inflation Factor (VIF) method (Widarjono., 2013). The toll value must be greater than 0.10, and the VIF value is below 10. Based on the test results on the data obtained, the data can meet the requirements, and there is no multicollinearity problem. It can be seen based on the Tolerance (Tol) value. The overall data is more than 0.10, which is in the range of 0.309 to 0.799. Furthermore, based on VIF, the data has a value smaller than 10, namely in the field of 1.252 to 3 240.

Cluster grouping through Cluster Hierarchy Agglomerative will form clusters consisting of n to 1 large cluster. The more the number of clusters formed, the closer to the characteristics of each cluster member. The analysis was carried out several times to obtain the appropriate number of clusters. In this case, the resulting cluster did not dominate the number of cluster members more than 80% in one particular cluster.
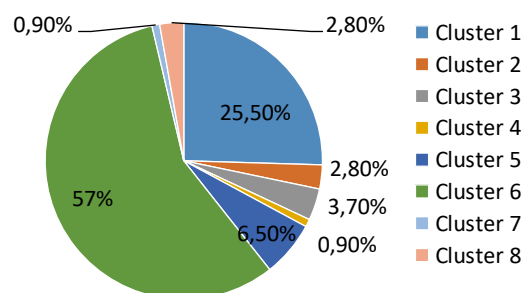


**Figure 1.** Cluster Distribution.

The cluster analysis results carried out were 8 clusters used as the analysis results (Fig. 1). The eight clusters are carried out so that the clusters formed have a larger distance value so that the characteristics and similarities of each cluster member. It can also clarify the differences between one cluster and another. The clusters that are formed will then be defined (Profiling) to determine the characteristics of each cluster. The profiling process uses descriptive analysis.

In the profiling (Table.2), we can see that the characteristics are divided into two types, namely general characteristics and unique characteristics. The general characteristics are the characteristics possessed by each cluster and are the similarities between each cluster that is formed. There are three variables included in the general characteristics: transportation expenses, homeownership, and travel origin.

**Typology**

The unique characteristics possessed by these eight clusters will then become the basis for forming a typology of private car users. Typology research conducted by Marie Vogel (2014) and Oostendorp (2019) divides typology based on the frequency of trips and the characteristics of vehicle users. The typology of private car users will be distinguished based on several variables.

In previous studies conducted by Bergstrom and Magnusson (2010) in Sweden, the classification is built from variations in vehicle usage intensity. The typologies will be driven by the private car user's trip frequencies. The frequency of trips is divided into intensive users, regular users (weekdays or holidays), and irregular/infrequent users. Furthermore, household economic conditions will further identify typological groups. This is related to how the economic level affects private car use. That higher income level is more likely to drive than lower-income (Ha, 2020). The economy is divided into the high economy, middle economy, and low economy. Another one, travel distance, is related to the private car user's typology, where the car is most likely chosen for a long-distance trip, especially in the Covid-19 period (Abdullah 2021). Travel distance is divided into long-distance, medium distance, and short distance. The frequency of trips is identified based on the frequency of trips made by private car users on weekdays, holidays, and one monthly trip. Intensive users are private car users who make the economic conditions and the distance traveled by private car users.

The majority of weekday trips 5-10 times, weekend trips five trips, and monthly trips 20-25 times in 1 month. Regular users are divided into regular users into weekdays as well as weekends s. Regular on weekdays are users who travel more on weekdays compared to holidays. The average weekday trips reach 5-10 times while for holidays only 1-2 times. Regular trips on weekend private car users, who use private cars more on holidays, range from more than five trips, while on weekdays they only make five trips. However, these two regular users still have one monthly trip ranging from 15-20 trips. The last category in this travel frequency is irregular or infrequent users, namely those with less than 15 trips in 1 month.

The economic conditions of private car users are identified based on income variables, building area variables, and vehicle ownership variables. Each variable will be given a score between 1 to 4, a score of 1 to indicate the lowest characteristics while 4 for the highest. Based on the results of these calculations, clusters with a total number of high, medium, and low scores were obtained. *The high economy has a total score of 12-14; The middle economy has a total score of 10-11, and Low Economy has a total score of 8-9.* The economic category is carried out only based on each cluster's characteristics and is not an economical category for the community in Kayuringin Jaya.

Travel distance is identified based on the total distance between the origin of the trip and the trip's destination. The trip's destination consists of the distance to the office, school, worship place, market, hospital bus stop, and park. Based on these results. The cluster is divided into three categories: short distance, long-distance, and short distance. The typology formed is based on the three variables above and considers other unique characteristics possessed by each cluster. Based on these results, the resulting typology of private car users is divided into eight typologies.

**The Eight Typologies**
**Typology 1 Intensive User, Medium Economy, Near mileage**

Private car users in typology 1 are young users, 20 to 29 years old, who are male. Private car users actively travel both on weekdays and weekends. Private car users in typology 1 are young users, 20 to 29 years old, who are male. Private car users are users who actively travel both on weekdays and weekends, s. The frequency of trips made by private car users in this typology reaches 10-15 times on weekdays and is more than equal to 5 times on weekends s. The total number of trips made reached more than 25 trips in 1 month. Private cars make the most frequent trips to the office or workplace, intending to work. Work trips are not only made on weekdays but also on weekends s. Based on this, it can be seen that users include workers who do Work From Office (WFO) during the Pandemic.

The distance traveled by private car users tends to be close, only around 2 km to 15 km. The furthest distance is carried out for work activities. The distribution of activity locations is carried out in the Bekasi City or DKI Jakarta area. Economically, this typology belongs to the middle category. This typology has several modes to travel, which are dominated by motorcycle ownership with two vehicles. Based on this description, Typology 1 is a young worker who intensively travels only to work on weekdays and weekends. Included in the middle economy, and have a choice of modes to carry out activities.

**Typology 2 Regular Users High Economy Weekdays, Medium Mileage**

Private car users in typology two are dominated by private car users aged 30-39 years, who are working class. Travel by private car is only for activities on weekdays (Monday to Friday), while for holidays the trip is carried out with a minimal frequency. The primary purpose of the trip is to go to work or the office. Based on this, it is known that users only travel to work on weekdays. The frequency of trips on weekdays is very high compared to other categories. The frequency of trips made on weekdays reaches 5-10 times/working day/week. Based on this frequency, this typology is a worker who works in a Work From Office (WFO) or shift. The average distance traveled in this typology ranges from 2 km - 21 km; for work, the average is 16 km. The location of the distribution of community activities is in the DKI Jakarta and Bekasi City areas.

At the economic level, this typology is a typology with high economic status. Based on access to private cars, this typology has good access. Ownership of private cars is two units, while for other vehicles are three units of motorcycles. Based on this description, it can be seen that typology 3 is a typology dominated by workers in their 30s, with a high economic level, and using a private car as the primary vehicle to travel on weekdays to go to work during the Covid-19 Pandemic.

**Typology 3 Regular Weekdays, Medium Economy, Long Distance**

Private car users in typology 3 are women aged between 30-39 years, have a small family size, namely one family member with two children. Private car users actively use private cars to travel to work. The frequency of trips made by private car users in this typology reaches 5-10 times on weekdays and three times on weekends s. Based on this frequency, it is known that private car users are active in traveling on weekdays, weekends. The majority of trips are made to work on weekdays and socially on weekends s. Typology 3 is a private car user who does Work From Office (WFO) or Shift work.

The distance traveled by private car users in this cluster ranges from 1 km - 30 km. Based on this, it can be identified the location of typology one activities spread across the Bekasi City and DKI Jakarta areas, especially in the Tanah Abang and Gambir sub-districts. This typology has the characteristics of a medium economy, where most users are BUMN workers who earn Rp. 5,000,000 – Rp. 6,000,000,- / month or more. Private car users have several modes to travel, which are dominated by motorbike ownership with 2 vehicles. This typology is a typology where users are dominated by working women with middle economic levels who have a fairly high contribution to weekday trips, the main purpose of which is to go to meeting places for social activities.

**Table 2.** Cluster Profiling

| Variable | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 | Cluster 6 | Cluster 7 | Cluster 8 |
|---|---|---|---|---|---|---|---|---|
| Age | 50-59 | 30-39 | 50-59 | 50-59 | 30-39 | 20-29 | 40-49 | 30-39 |
| Gender | Male | Female | Male | Male | Male | Male | Male | Female |
| Chlidren | 3 kids | 2 kids | 3 kids | 3 kids | 2 kids | 2 kids | 3 kids | 2 kids |
| Family members | 5 members | 4 members | 4 members | 5 members | 5 members | 4 members | Five members | 4 members |
| Education | Bachelor (S1) | Bachelor (S1) | Bachelor (S1) | Bachelor (S1) | Bachelor (S1) | Bachelor (S1) | Highschool (SMA) | Bachelor (S1) |
| Profession | Police/Military service | State-owned enterprises | Private employees | Civil servant | Civil servant | State-owned enterprises | Civil servant | Private employees |
| Income | More than Rp. 6.000.000-, | Rp. 5.000.000 – Rp. 6.000.000,- | Lebih dari Rp. 6.000.000, | More than Rp. 6.000.000-, | More than Rp. 6.000.000-, | More than Rp. 6.000.000-, | More than Rp. 6.000.000-, | Rp. 5.000.000 – Rp. 6.000.000,- |
| Household travel cost | Rp. 500.000 – Rp. 1.000.000,- | Rp. 500.000 – Rp. 1.000.000,- | Rp. 500.000 – Rp. 1.000.000,- | Rp. 500.000 – Rp. 1.000.000,- | Rp. 500.000 – Rp. 1.000.000,- | Rp. 500.000 – Rp. 1.000.000,- | Rp. 500.000 – Rp. 1.000.000,- | Rp. 500.000 – Rp. 1.000.000,- |
| House Building Area | 40 m² -150 m² | 150 m² -260 m² | 490 m² - 600 m² | 40 m² -150 m² | 40 m² -150 m² | 40 m² -150 m² | 150 m² -260 m² | 40 m² -150 m² |
| House Ownership | Owned House | Owned House | Owned House | Owned House | Owned House | Owned House | Owned House | Owned House |
| Car ownership | 1 Unit | 1 Unit | 1 Unit | 1 Unit | 2 Unit | 1 Unit | 1 Unit | 1 Unit |
| Motorcycle Ownership | 2 Unit | 2 Unit | 2 Unit | 1 Unit | 3 Unit | 2 Unit | 2 Unit | 2 Unit |
| Bicycle Ownership | 2 Unit | 1 Unit | 2 Unit | 1 Unit | 0 | 1 Unit | 2Unit | 1 Unit |
| Distance to Office | 10 Km | 30 Km | 12 Km | 68,5 Km | 16 Km | 15 Km | 56 Km | 6 Km |
| Distance to School | 4 Km | 25 Km | More than 100 Km | 15 Km | 6 Km | 3,4Km | 25 Km | 40 Km |
| Distance to worship place | 700 m | 300 m | 300 m | 200 m | 200 m | 500 m | 200 m | 200 m |
| Distance to market | 1,5 Km | 4 Km | 2 Km | 3 Km | 2 Km | 2 Km | 4 Km | 2,5 Km |
| Distance to hospital | 2,5 Km | 17,6 Km | 2,5 Km | 68,5 Km | 21 Km | 2,5 Km | 5 Km | 3 Km |
| Distance to Pt. station | 800 m | 1,5 Km | 2 Km | 1 Km | 1 Km | 1,5 Km | 3 Km | 2 Km |
| Distance to park | 1,2 KM | 2 Km | 2 Km | 8 Km | 1,3 Km | 1,5 Km | 3 Km | 400 m |
| Weekday Frequency | 5-10 Times | 5-10 Times | 1-5 Times | 1-5 Times | 5-10 Times | 5-10 Times | 1-5 Times | 1-5 Times |
| Weekend Frequency | 2 Times | 3 Times | 2 Times | 2 Times | 2 Times | More than 5 Times | More than 5 Times | 2 Times |
| Monthly Frequency | 15 times | 15 times | 15 times | Less than 15 times | 15 times | 25 times | 20 times | Less than 15 times |
| Travel Origin | Home | Home | Home | Home | Home | Home | Home | Home |
| Travel Destination | Office | Meeting place | Market | Meeting place | Office | Office | Office | Market |
| Travel Purpose | Economic | Social | Economic | Social | Economic | Economic | Economic | Economic |

### Typology 4 Regular Users Medium Economy Weekdays, Short Mileage

Private car users in this typology are private car users who use private cars only on weekdays (Monday to Friday). As for holidays, travel can be said to be infrequent or with a minimal frequency. The frequency of trips made on weekdays reaches 5-10 times/working day/week. If it is associated with the distance included in the close category, private car users choose other modes such as motorbikes, bicycles, or public transportation. The use of private cars is only used for certain activities. Travel distance in this cluster ranges from 0-10 km. The location of the activities of private car users in this typology is only in the Bekasi City area. Daily routine travel purposes such as work are mainly carried out by private car users and with economic intent in this typology. Private car users in this typology are generally workers who do Work From Office or work shifts in the office. Economically, private car users who are in cluster 1 have a medium economic level. The use of private cars by middle-income people is lower than those of higher economies (Abdullah, 2021). Typology 4 is a typology dominated by male users aged 50 to 59 years and has an average family size of 5 members. This typology is where old male workers dominate users with middle economic levels who only travel weekdays to work.

### Typology 5 Regular users holiday, High Economy, Long mileage

Typology 5 is a private car user in this typology is a private car user who uses a private car only for activities on holidays/weekends (Saturday and Sunday). Private car users in typology five are dominated by private car users aged 40-49 years, who are the working class. Based on the frequency of trips, private car users travel on holidays more than five times, while users travel 1-5 times on weekdays/week. Private car users travel on holidays with the aim of work or office, most of the trips made by users are for economic purposes both work and shopping. The distance traveled by private car users ranges from 2 km to 56 km, with the furthest journey being to work. The distribution of locations is estimated to be in Bekasi City, DKI Jakarta, and Cikarang.

Economically, this typology is a user with a high economic level. Ownership of private vehicles in this typology has a choice of other modes of transportation. Day trips/weekdays mostly use motorbikes or bicycles, while private cars are often used for weekends s. This typology is dominated by male workers with middle economic level who travel using private cars for economic purposes. Private cars are not the primary mode for daily trips, especially weekdays, but are more often used on weekends

### Typology 6 Irregular / Infrequent Users, High Economy, Close mileage

This typology is a typology that is dominated by private car users aged between 50-59 years. In terms of age, private car users in this typology are classified as elderly workers or retirees. Based on socio-economic, this typology has high economic characteristics, which are identified based on several variables. Private car users have various choices of modes for other trips. According to Das 2020, people with higher economic levels travel more than those with lower economic classes. However, based on the results of this typology analysis, the number of trips is minimal, namely 15 trips in 1 month.

Trips made by private car users in this typology are usually used for market/supermarket purposes. Based on the distance traveled to these locations and other locations, private car users have a fairly close distance. The average distance to the market/supermarket is only 2 km. Private car users are more active in the Bekasi City area. Short mileage and having other vehicle options, resulting in less car use. This typology is where users are dominated by elderly workers or retirees with a high economic level who only use private cars for short-distance trips and not for work purposes. In addition, the use of private cars is not the user's primary choice for travel.

### Typology 7 Irregular / Infrequent Users, Low Economy, Long Mileage

Typology 7 has similarities with typology six, which is dominated by 50-59 years. Private car users in this typology are classified as senior workers or nearing retirement age. Based on the economic level, this typology is included in the low economic typology. Low economic level, often associated with low travel frequency. The contribution of typology seven trips is very low, which is less than

15 times a month. Travel is carried out to meet places with social purposes such as family gatherings or other activities that are not routine.

Users of this car tend to spend time at home because they are a vulnerable group of Covid-19. Based on the distance traveled, the distance traveled by the user is included in the category of a long trip. Mileage reaches 2 km to 68.5 km, but more often travel short distances. Private car users do more activities in the Bekasi City area and work in the Karawang Regency area. This typology is a typology where users are dominated by elderly workers or retirees who have a low economic level who only use private cars for trips that are not routine and are only done a few times a month.

### Typology 8 Irregular/Infrequent Users, Low Economy, Medium Mileage

Private car users in typology eight are dominated by female users aged 30 to 39 years. Private car users are working women. Based on the economic level, typology 8 is a user with a low economic level. Vehicle ownership in typology 8, on average, only has 1 unit of a private car, so that private car users use private cars less often for daily activities or are more often used together with partners, especially during the Covid-19 Pandemic. Private car users have a low frequency of trips, less than 15 trips in 1 month. Based on this, private car users do work from home (WFH). The low frequency is because the primary purpose of travelers is to go to shopping activities. This trip is not routine and is only made a few times a month.

In addition, the distance traveled by private car users is 200 m – 40 km, for the distance to the shopping center that is often visited is 2.5 Km. Based on the distance, private car users are more active in the Bekasi City area for shopping and the DKI Jakarta area for work and school activities. This typology is a typology where users are dominated by female workers who work online, who only use private cars to travel to shopping centers, have a low economic level, and private cars are not the main vehicle for traveling during the Covid-19 Pandemic.

### Private Car Users During Covid-19 Pandemic

Based on the research results on the typology of private car users during the Covid-19 period in the Kayuringin Jaya Village. Thus, eight typologies of private car users were obtained during the Covid-19 Pandemic, which was identified based on socio-economic characteristics, mobility of private car users during the Covid-19 Pandemic, and travel patterns of private car users.

Typology 1 has the largest number of members, about 51% of the total respondents, and dominates the journey of private car users during the Covid-19 Pandemic with travel contributions of 40% of the total number of trips made and 23% of trips at Weekends s(Fig.2). Therefore, typology 1 dominates the socio-economic characteristics and movement patterns of private car users in Kayuringin Jaya Village. Private car users' characteristics are dominated by young aged men around 20 – 30 years, high to medium economic level, with 1 unit car, the purpose of the trip to go to work with economic intent, and the average distance traveled is 1 unit. The average is 15 km. Compared with conditions before the Covid-19 Pandemic, the typology used more private cars or public transportation. They were in a higher age group or retired, ranging from (more than 35 years), live in a spouse's household or alone with the decentralized environment, and have high access to private cars. This difference is caused by the Covid-19 Pandemic, which has changed the pattern of people's activities.
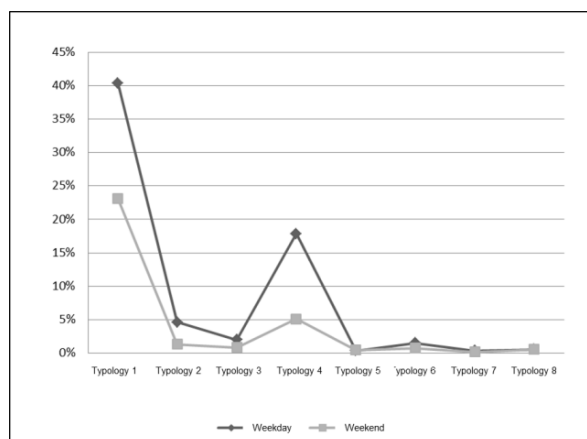
**Figure 2.** Typology's contribution to travel

The Covid-19 Pandemic has significantly impacted changes in private car users' characteristics and travel patterns. Workers dominate the typology of private cars. During the Pandemic, the government took a policy to limit the number and the age of workers. The approach is related to health factors and also several health protocols that must be adhered. As a result, typology with characteristics of 20-40 years of age dominates the frequency of private car use compared to typology with characteristics of over 50 years of age.

Work activities dominate the typology, especially for intensive users and weekdays. This activity affects trips on weekdays which are higher than holidays. However, there are regulations for Work From Home during the Pandemic. In this period, with 2-3 times working from office a week. Most companies start doing shifts (work alternately). Trips dominate weekday is out of Bekasi City to DKI Jakarta with short to medium travel distances and an average of 2 to 15 km. Typology with close and medium distances has a high frequency of travel when compared to longer distances. In addition to convenience and security reasons during the Covid-19 Pandemic, private cars are widely used due to the lack of availability of public transportation in the Kayuringin Jaya Village.

**CONCLUSION**

The use of private cars during the Covid-19 Pandemic has decreased compared to the period before Covid-19. However, the possibility of increasing the use of private cars during the Covid-19 Pandemic is very large. The increase is due to the policies taken by the government during the Pandemic, which affected the increase in vehicle ownership and people's preferences to use private vehicles. Based on the research results on the typology of private car users during the Covid-19 period in the Kayuringin Jaya Village. Thus, eight typologies of private car users were obtained during the Covid-19 Pandemic, which was identified based on socio-economic characteristics. Income and private car ownership become the most decisive characteristic of the socio-economic variable—mobility of private car users during the Covid-19 Pandemic. The frequency of using a private car in one week divided into weekdays and weekends distinguishes the mobility of users on this variable. Travel patterns of private car users, the dominant travel pattern is the trip from home to the office. Typology 1 has the largest number of members, about 51% of the total respondents, and dominates the journey of private car users during the Covid-19 Pandemic with travel contributions of 40% of the total number of trips made and 23% of trips at the end of the week. Weekends s. Therefore, typology 1 dominates the socio-economic characteristics and movement patterns of private car users in Kayuringin Jaya Village. Private car user's characteristics dominated with men, young aged around 20 – 30 years, high to medium economic level, has 1 unit car, the destination of the trip is to go to the office with economic intent, and the average distance traveled is 15 km. Compared with conditions before the Covid-19 Pandemic, the typology that used more private cars or using with public transportation, the characteristics were in a higher age group or retired ranged from (more than 35 years), live in a spouse's household or alone, in a decentralized environment with high access to private cars. This difference is caused by the Covid-19 Pandemic, which has changed the pattern of people's activities. The Covid-19 Pandemic has significantly

impacted changes in private car users' characteristics and travel patterns. Workers dominate the typology of private cars. During the Pandemic, the government took a policy to limit the number and age of workers for each company Pandemic. This policy is related to health factors and also several health protocols that must be adhered. As a result, typology with characteristics of 20-40 years of age dominates the frequency of private car use compared to typology with characteristics of over 50 years of age. Work activities dominate the typology, especially for intensive users and weekdays. This affects trips on weekdays which are higher than holidays. However, there are regulations for Work From Home during the Pandemic. Most companies start doing shifts (work alternately). In this period, with 2-3 times working in the office in 1 week. Trips dominate weekday trips out of Bekasi City to DKI Jakarta with short to medium travel distances and an average of 2 to 15 km. Typology with close and medium distances has a high frequency of travel when compared to longer distances. In addition to convenience and security reasons during the Covid-19 Pandemic, private cars are widely used due to the lack of availability of public transportation in the Kayuringin Jaya Village. This study is the starting point for further research related to private vehicle users and their relation to Sustainable Urban Mobility during the Covid-19 Pandemic. Information on user typology generated in this study can be elaborate with the spatial distribution of every typology and mobility frequencies based on a specific time to determine the private car user's peak hours and duration of car usage.

## ACKNOWLEDGEMENT

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