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COMMUTRICS

2022 ANNUAL COMMUTING SURVEY

COMMUTING DATA ANALYSIS

# Introduction

The Downtown Denver Partnership (DDP) is committed to promoting sustainable and efficient transportation options for commuters in downtown Denver. To achieve this goal, DDP conducted a travel survey to gather data on the commuting patterns and preferences of downtown Denver employees. The survey was designed to provide insights into the factors that influence commuting behavior and to identify opportunities for promoting sustainable transportation options. This report presents the results of the data analysis of the commuter travel survey conducted by DDP. The analysis includes a descriptive summary of the survey data, as well as a statistical analysis of the relationships between commuting behavior and various demographic and behavioral factors. The findings of this report provide valuable insights into the commuting patterns and preferences of downtown Denver employees and can be used to inform transportation policy and planning decisions.

# Survey

The survey consisted of 47 questions that aimed to collect information on various aspects of commuters' transportation behavior and attitudes. Respondents were asked to provide demographic information such as their home location, work location, employer name, age, gender, and race, as well as their annual gross income and job type. In addition to demographic information, the survey collected data on respondents' commuting behaviors, including the frequency of their use of different transportation modes, including telecommuting, walking, transit, driving alone, carpooling, bike or e-bike, scooter or bike share, and ride-sharing services like Lyft or Uber. Respondents were also asked about their use of transportation programs such as carpool or vanpool programs, free transit passes, and secure bike parking, as well as their access to various transportation benefits offered by their employer. Finally, respondents were also asked to rank influential factors including time, cost, safety, flexibility, and etc., on their commute mode choice, as well as top three reasons of using drive. Overall, the survey aimed to collect comprehensive data on the commuting behaviors and attitudes of individuals in the Downtown Denver area, with a particular focus on sustainable transportation options and the availability and use of transportation programs and benefits.

The survey received a total of 3,668 responses from commuters in the Downtown Denver area. Of these respondents, 3,133 (85.4%) provided complete answers to all survey questions. Gender breakdown of the respondents reveals that 1,193 (38.1%) identified as male and 1,940 (61.9%) identified as female. The majority of respondents who completed the survey were female, with women accounting for nearly two-thirds of the total number of respondents. These statistics provide insight into the representativeness of the survey sample and can be used to inform the analysis of the survey data. It is important to note that the sample may not be entirely representative of the broader population of commuters in the Downtown Denver area, and caution should be taken when generalizing the findings to the wider population. However, the large number of responses and the high completion rate suggest that the survey provides a valuable source of information on the commuting behaviors and attitudes of individuals in the Downtown Denver area.

# Analysis and Results

## Data Processing, Cleaning, and Feature Engineering

Data processing involves transforming raw data into a usable format for analysis, while data cleaning involves identifying and correcting errors and inconsistencies in the data. These steps are important to ensure that the data used in analysis is accurate, consistent, and complete. Feature engineering is the process of selecting, creating, and transforming variables in a dataset to improve machine learning model performance. Features should be informative, discriminative, and independent, capturing important patterns and relationships in the data. Tables below show how ordinal and nominal data are transformed.

|  |  |
| --- | --- |
| **age** | **ordinal category** |
| Under 25 | 1 |
| 25 to 29 | 2 |
| 30 to 34 | 3 |
| 35 to 39 | 4 |
| 40 to 44 | 5 |
| 45 to 49 | 6 |
| 50 to 54 | 7 |
| 55 to 59 | 8 |
| 60 to 64 | 9 |
| 65 or older | 10 |

|  |  |
| --- | --- |
| **income** | **ordinal category** |
| Less than $24,999 | 1 |
| $25,000 to 49,999 | 2 |
| $50,000 to 74,999 | 3 |
| $75,000 to 99,999 | 4 |
| $100,000 to 149,999 | 5 |
| Over $150,000 | 6 |

|  |  |
| --- | --- |
| GENDER | nominal category |
| Female | 0 |
| Male | 1 |

|  |  |
| --- | --- |
| YEARS OF COMMUTING BY BIKE | ordinal category |
| Less than 1 year | 0 |
| 1 to 2 years | 1 |
| 2 to 4 years | 2 |
| More than 4 years | 3 |

|  |  |
| --- | --- |
| REMOTE WORK POLICY | ordinal category |
| Must be in the workplace every day | 0 |
| Can work from home 1-2 days a week | 1 |
| Can work from home 3-4 days a week | 2 |
| Totally flexible: can work from home every day | 3 |

|  |  |
| --- | --- |
| INTERSTOP | ordinal category |
| Never | 0 |
| Sometimes | 1 |
| About half the time | 2 |
| Most of the time | 3 |
| Always | 4 |

# Modal Shares

Figure 1 presents the modal share of transportation modes for businesses with more than 50 survey respondents. The data shows the percentage of respondents who reported using each mode of transportation to commute to work, including driving alone, telecommute, carpooling, walking, biking, public transit, and others. These findings can be used to inform DDP's efforts to promote sustainable transportation options and reduce reliance on single-occupancy vehicles.

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Figure 1. Modal Share for Businesses with More than 50 Respondents

# Employer Provided Transportation Programs

Figure 2 shows the percentage of survey respondents who reported having access to various transportation programs offered by their employers including free transit passes, secure bike parking, flexible work schedules, free or subsidized parking, subsidized transit fares or passes, and other programs. The table below also shows the number of respondents who reported having access to each program.

The data shows that the most commonly reported transportation program was the free transit pass (EcoPass), with 48% of respondents reporting having access to this program. Secure bike parking was the second most commonly reported program, with 45% of respondents reporting having access. Flexible work schedules and free or subsidized parking were also popular programs, with 43% and 27% of respondents, respectively. Other programs, such as bike commuting stipends and carshare memberships, were reported by fewer respondents. Finally, E-scooter membership or credits, and private employer shuttle were reported by eight and one employees only, respectively.

|  |  |  |
| --- | --- | --- |
| TRANSPORTATION PROGRAMS | NUMBER OF RESPONDENTS | PERCENTAGE (%) |
| Free transit pass (EcoPass) | 1505 | 48.00% |
| Secure bike parking | 1431 | 45.68% |
| Flexible work schedule | 1364 | 43.54% |
| Free or subsidized parking space | 859 | 27.42% |
| Subsidized transit fair or pass (EcoPass) | 847 | 27.03% |
| business provide off-street bike parking spaces | 326 | 10.41% |
| Not knowing if the employer provides any transportation programs | 263 | 8.39% |
| Flexible transportation benefit | 252 | 8.04% |
| Use of company vehicle during workday | 187 | 5.97% |
| Guaranteed ride home | 185 | 5.90% |
| Compressed work week (4 workdays per week) | 170 | 5.43% |
| Bike routes/maps and safety information/seminars | 101 | 3.22% |
| Bike commuting stipend | 61 | 1.95% |
| Carpool or Vanpool program | 33 | 1.05% |
| Carshare membership or credits | 20 | 0.64% |
| Preferred parking for carpool | 16 | 0.51% |
| Prizes/drawings/contests for cash | 15 | 0.48% |
| E-scooter membership or credits | 8 | 0.26% |
| Private employer shuttle | 1 | 0.03% |

To ensure the statistical significance of our correlation analysis, we excluded programs with less than 5% of respondents. Therefore, the programs Bike routes/maps and safety information/seminars, Bike commuting stipend, Carpool or Vanpool program, Carshare membership or credits, Preferred parking for carpool, Prizes/drawings/contests for cash, E-scooter membership or credits, and Private employer shuttle were not considered in our analysis of the impact of these programs on commuters' mode choices. Excluding these programs allowed us to focus on transportation programs that had a more significant impact on mode choices. However, further analysis is necessary to determine the effectiveness of these programs in promoting sustainable transportation modes. Additionally, barriers to the implementation of less popular programs should be investigated to understand why they are not widely adopted and to identify potential solutions to increase their usage.

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Figure 2. Percentage of respondents having access to employer-provided transportation programs.



# Bike Mode Choice

The table above shows the ordinal categories used to define frequency of bike mode choice based on the number of days commuters responded that they use a bike to commute to work.

|  |  |
| --- | --- |
| BIKE MODE CHOICE | ORDINAL category |
| No biking | 0 |
| Once a week | 1 |
| Twice a week | 2 |
| three times a week | 3 |
| Four times a week | 4 |
| Five times a week | 5 |

Figure 3 shows the Spearman correlation coefficients between various factors and frequency of bike mode choice, as well as the corresponding p-values. The correlation coefficients indicate the strength and direction of the relationship between each factor and bike mode choice, with values ranging from -1 to 1. The factors included in the analysis are demographic and behavioral factors such as age, gender, income, commute time, availability of bike infrastructure, and employer provided transportation programs. The p-values indicate the level of statistical significance of the correlation coefficients, with values less than 0.05 considered statistically significant. A significant p-value indicates that the observed correlation coefficient is unlikely to have occurred by chance and suggests a real relationship between the two variables. The correlations reveal several interesting findings. For example, there is a significant positive correlation between bike mode choice and secure bike parking, as well as a significant negative correlation between bike mode choice and free/subsidized parking space at workplace.

The results suggest that several transportation programs have a statistically significant impact on the bike mode choice. For example, business provide off-street bike parking spaces, Secure bike parking, Gender: male, Use of company vehicle during workday, and annual gross income have extremely low p-values (less than 0.001), indicating that they have a highly significant impact on the bike mode choice. On the other hand, remote work policy, additional commute time of biking compared to drive alone, flexible transportation benefit, and interstop have p-values greater than 0.05, suggesting that they are not statistically significant in predicting the bike mode choice.

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Figure 3. Spearman Correlation of Factors on Bike Mode Choice

The chi-square test is used to evaluate the association between transportation programs and frequency of biking. It is a statistical method that helps to determine whether the observed data is significantly different from the expected data and provides a measure of the strength of the association between the variables. Based on the results, it is evident that certain transportation programs are strongly associated with a higher frequency of bike or e-bike use.

Based on the results presented above, it is evident that several transportation programs are significantly associated with commuter mode choice. Secure bike parking is the program with the highest association, with a chi-square value of 271 and a p-value of 1.92E-56. Other significant programs with high chi-square values and low p-values include Gender: male, remote work policy, use of company vehicle during workday, interstop, compressed work week, flexible work schedule, and not knowing if the employer provides any transportation benefit.

However, it is important to note that the results also show that the program business provides off-street bike parking spaces has a high chi-square value of 2852 and a p-value of 0. This result is likely due to the way the question was asked. Individuals who selected biking as their mode of transportation were only asked to specify their mode, resulting in a potential bias towards those who bike and have access to off-street parking. Therefore, caution should be taken when interpreting the results of this program and additional research is needed to fully understand its impact on commuter mode choice. It is also worth noting that several programs, such as subsidized transit fair or pass (Eco-pass), free transit pass (Eco-pass), and flexible transportation benefit, were not found to be significantly associated with commuter mode choice, based on the p-values.

|  |  |  |
| --- | --- | --- |
| **TRANSPORTATION PROGRAMS** | CHI2 | **P-VALUE** |
| Business provides off-street bike parking spaces | 2852 | 0 |
| Secure bike parking | 271 | 1.92E-56 |
| Gender: male | 113 | 1.04E-22 |
| Remote work policy | 124 | 3.42E-19 |
| Use of company vehicle during workday | 66 | 7.39E-13 |
| Interstop | 63 | 2.06E-06 |
| Compressed work week | 28 | 2.92E-05 |
| Flexible work schedule | 24 | 0.000199 |
| Not knowing if the employer provides any transportation benefit | 23 | 0.000358 |
| Free or subsidized parking space | 23 | 0.000381 |
| Guaranteed ride home | 20 | 0.001166 |
| Annual gross income | 43 | 0.013165 |
| Age | 65 | 0.025649 |
| Subsidized transit fair or pass (Eco-pass) | 10 | 0.077686 |
| Free transit pass (Eco-pass) | 8 | 0.143426 |
| Flexible transportation benefit | 4 | 0.591689 |

Figure 4 displays the percentage change in odds ratios for bike mode choice due to identified corralled factors. Odds ratios represent the likelihood of choosing bike mode over other modes of transportation, and are commonly used in statistical modeling to estimate the effect of different factors on a binary outcome variable. The figure provides insights into the relative importance of different factors in predicting bike mode choice and can be used to identify key target areas for interventions to promote biking as a sustainable transportation option in the Downtown Denver area.

The results show that secure bike parking has the highest impact on bike commuting, with an 720% increase in the odds of choosing to bike to work. This suggests that providing secure bike parking is a highly effective way of promoting bike commuting. However, it should be noted that this may be biased, as those who already bike to work is more likely to be aware of whether or not secure bike parking is provided by their employer, and therefore may be more likely to report its availability.

Gender also has a significant impact, with males having a 217% increase in the odds of choosing to bike to work. This means that males are 2.17 times more likely than females to choose biking as their commuting mode to work. This suggests that there may be gender-specific barriers or preferences that influence mode choice, which should be further explored and addressed in transportation planning and policy. Other programs that positively impact bike commuting include the use of a company vehicle during workday, compressed work week, guaranteed ride home, and subsidized transit fair or pass. However, the percentage change in odds ratio for these programs is relatively lower compared to secure bike parking and gender. On the other hand, the programs with a negative impact on bike commuting include free or subsidized parking space and not knowing if the employer provides any transportation benefit. These programs show a decrease of 63% and 55% in the odds of choosing to bike to work, respectively. This indicates that providing free or subsidized parking space is likely to discourage bike commuting, while lack of information about transportation programs is also a barrier.

It is important to note that the results above do not necessarily indicate causation, and further research is needed to explore the underlying reasons for the observed associations between transportation programs and bike commuting. Nevertheless, the results provide valuable insights for employers and policymakers seeking to promote sustainable transportation choices among their employees.

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Figure 4. Percentage Change of Odds Ratios for Bike Mode Choice



# Transit Mode Choice

The table below shows the ordinal categories used to define transit mode choice based on the number of days commuters responded that they use transit to commute to work.

|  |  |
| --- | --- |
| TRANSIT MODE CHOICE | Ordinal category |
| No transit use | 0 |
| Once a week | 1 |
| Twice a week | 2 |
| three times a week | 3 |
| Four times a week | 4 |
| Five times a week | 5 |

Figure 5 shows the Spearman correlation coefficients between various factors and transit mode choice, as well as the corresponding p-values. The factor with the lowest p-value is free transit pass (EcoPass), indicating a significant impact on transit use. This is followed by gender, with males having a higher likelihood of using transit than females. Guaranteed ride home and subsidized transit fair or pass (EcoPass) also have significant impacts on transit use, albeit to a lesser extent compared to free transit pass and gender. Interestingly, some factors such as the use of company vehicle during workday, flexible work schedule, and remote work policy do not show a significant impact on transit use, despite being frequently implemented by employers to encourage sustainable commuting. This suggests that further research is needed to explore the effectiveness of these programs in promoting transit use. In addition, the p-values suggest that programs such as annual gross income, not knowing if the employer provides any transportation benefit, and free or subsidized parking space have a significant negative impact on transit use. These results indicate that providing transportation benefits, such as free or subsidized parking space, is likely to discourage transit use among employees.

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Figure 5. Spearman Correlation of Factors on Transit Mode Choice

The table below shows the chi-squared values and associated p-values for transportation programs and their impact on transit use among employees. The program with the highest chi-squared value and the most significant impact on transit use is Interstop, with a chi-squared value of 298 and a p-value of 3.52E-63. This indicates that Interstop has a strong association with transit use among employees. Other programs with a significant impact on transit use include free or subsidized parking space, free transit pass (Eco-Pass), not knowing if the employer provides any transportation benefit, remote work policy, annual gross income, and gender (male). The chi-squared values and p-values for these programs range from 88 to 11 and 5.1E-21 to 0.000831, respectively. However, the chi-squared values and p-values for programs such as compressed work week (4 workdays per week), flexible work schedule, and flexible transportation benefit are not significant, suggesting that these programs may not have a strong impact on transit use among employees. Similarly, the chi-squared values and p-values for additional commute time of transit compared to drive alone and time transit are also not significant.

|  |  |  |
| --- | --- | --- |
| TRANSPORTATION PROGRAMS | **CHI2** | P-VALUE |
| Interstop | 298 | 3.52E-63 |
| Free or subsidized parking space | 88 | 5.1E-21 |
| Free transit pass (Eco-Pass) | 54 | 2.4E-13 |
| Not knowing if the employer provides any transportation benefit | 23 | 1.58E-06 |
| Remote work policy | 21 | 0.000111 |
| Annual gross income | 23 | 0.000283 |
| Gender: male | 11 | 0.000831 |
| Guaranteed ride home | 9 | 0.002408 |
| Subsidized transit fair or pass (Eco-Pass) | 6 | 0.015459 |
| Use of company vehicle during workday | 5 | 0.023597 |
| Age | 18 | 0.037508 |
| Transit time | 2276 | 0.177894 |
| Flexible transportation benefit | 1 | 0.467165 |
| Flexible work schedule | 0 | 0.485225 |
| Additional commute time of transit compared to drive alone | 2758 | 0.529131 |
| Compressed work week (4 workdays per week) | 0 | 0.993424 |

Figure 6 displays the percentage change in odds ratios for transit mode choice due to the identified correlated factors. These percentage change in odds ratio reveals interesting findings. Free transit pass (EcoPass) has the highest percentage change in odds ratio with a 94% increase in the odds of choosing to use transit. This suggests that offering free transit passes to employees is an effective strategy to promote transit use. Subsidized transit fair or pass (EcoPass) and guaranteed ride home also have a positive impact on transit use with a 55% and 36% increase in the odds of choosing to use transit, respectively. Gender also has a significant impact on transit use, with males having a 27% increase in the odds of choosing to use transit. Use of company vehicle during workday and age also have a positive impact on transit use, although the percentage change in odds ratio is relatively lower compared to the other programs. On the other hand, the programs with a negative impact on transit use include free or subsidized parking space, not knowing if the employer provides any transportation benefit, and Interstop. These programs show a decrease of 63%, 60%, and 49%, respectively, in the odds of choosing to use transit. This suggests that providing free or subsidized parking space is likely to discourage transit use, while lack of information about transportation programs and Interstop are also barriers.

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Figure 6. Percentage Change of Odds Ratios for Transit Mode Choice



# Drive Alone Mode Choice

The table above shows the ordinal categories used to define driving mode choice based on the number of days commuters reported that they drive alone to commute to work.

|  |  |
| --- | --- |
| DrivING MODE CHOICE | Ordinal category |
| No driving | 0 |
| Once a week | 1 |
| Twice a week | 2 |
| three times a week | 3 |
| Four times a week | 4 |
| Five times a week | 5 |

Figure 7 shows the Spearman correlation coefficients between various factors and drive alone mode choice, as well as the corresponding p-values. The program with the highest impact on the choice of driving alone is Interstop, with an extremely low p-value of 2.83e-162, indicating a very strong negative correlation between the program and driving alone. The second most significant program is free or subsidized parking space, with a p-value of 3.51e-41. This suggests that providing free or subsidized parking space is likely to encourage driving alone, and thus it can be considered as a barrier to promoting other modes of transportation.

The programs with a positive impact on drive-alone mode choice include driving time, additional commute time of transit compared to drive alone, annual gross income, and age. This suggests that people with higher incomes and older age groups are more likely to drive alone, and those with longer commute times of using public transit are more likely to choose to drive alone.

On the other hand, the programs with a negative impact on drive-alone mode choice include remote work policy, gender: male, use of company vehicle during day, guaranteed ride home, and compressed work week. These programs show a decrease in the odds of choosing to drive alone, suggesting that providing alternative modes of transportation can encourage people to use other modes besides driving alone.

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Figure 7. Spearman Correlation of Factors on Drive Alone Mode Choice

The table below shows the chi-square test results that provide insight into the impact of various selected features on drive alone mode choice. The feature with the highest chi-square value is Interstop, with a value of 914 and an extremely low p-value of 1.267E-196. This indicates a strong correlation between Interstop and drive alone mode choice, suggesting that commuters with intermediate stops are more likely to use drive alone. The second feature with a significant impact is free or subsidized parking space, with a chi-square value of 175 and a p-value of 7.31645E-40. This suggests that providing free or subsidized parking space has a negative impact on sustainable transportation mode choices, which could be attributed to the fact that it encourages people to drive alone rather than using alternative modes of transportation. Other features that have a positive impact on sustainable transportation mode choice include remote work policy, gender (male), use of company vehicle during workday, annual gross income, age, flexible work schedule, and guaranteed ride home. It is interesting to note that gender has a significant impact on mode choice, with males having a higher likelihood of using driving alone mode. On the other hand, features with a lower impact on mode choice include compressed workweek, free transit pass, subsidized transit fair or pass, and flexible transportation benefits. Additionally, the commute time of bike and additional commute time of transit compared to driving alone have no significant impact on mode choice.

|  |  |  |
| --- | --- | --- |
| TRANSPORTATION PROGRAMS | **CHI2** | P-VALUE |
| Interstop | 914 | 1.267E-196 |
| Free or subsidized parking space | 175 | 7.31645E-40 |
| Remote work policy | 71 | 3.08528E-15 |
| Gender: male | 54 | 1.95965E-13 |
| Use of company vehicle during workday | 25 | 4.57849E-07 |
| Annual gross income | 33 | 4.33998E-06 |
| Age | 40 | 8.62663E-06 |
| Flexible work schedule | 14 | 0.000207553 |
| Guaranteed ride home | 9 | 0.003535178 |
| Compressed work week (4 workdays per week) | 5 | 0.028467567 |
| Free transit pass (EcoPass) | 3 | 0.067797167 |
| Flexible transportation benefit | 3 | 0.078879754 |
| Subsidized transit fair or pass (EcoPass) | 3 | 0.099299044 |
| Additional commute time of bike compared to drive alone | 2928 | 0.253857164 |
| Not knowing if the employer provides any transportation benefit | 1 | 0.264734028 |
| Drive time | 2464 | 0.287870576 |
| Additional commute time of transit compared to drive alone | 2800 | 0.313241628 |
| Additional commute time of walk compared to drive alone | 3078 | 0.384514584 |

Figure 8 shows the percentage change in odds ratios for drive alone mode choice due to the identified factors. The program with the highest increase in odds ratio is Interstop, with a 366% increase in the odds of choosing to drive alone. This indicates that commuters with intermediate stop on their commute to work are more likely to use drive alone. Similarly, free, or subsidized parking space has a significant impact on drive alone mode choice, with a 219% increase in the odds of choosing to drive alone. This suggests that providing free or subsidized parking space has a negative impact on sustainable transportation mode choice. Other programs that have a negative impact on sustainable transportation mode choice include guaranteed ride home, gender (male), use of company vehicle during workday, compressed workweek, remote work policy, and flexible work schedule. Conversely, the odds ratio analysis indicates that older commuters and those with higher annual gross income have 7% and 2% increase in the likelihood of driving alone, respectively. This suggests that these factors are associated with a higher preference for driving alone over alternative modes of transportation.

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Figure 8. Percentage Change of Odds Ratios for Drive Alone Mode Choice



# Telecommute Mode Choice

The table above shows the ordinal categories used to define telecommute mode choice based on the number of days commuters responded that they telecommute for work.

|  |  |
| --- | --- |
| Telecommute MODE CHOICE | Ordinal category |
| No telecommuting | 0 |
| Once a week | 1 |
| Twice a week | 2 |
| three times a week | 3 |
| Four times a week | 4 |
| Five times a week | 5 |

Figure 9 shows the Spearman correlation coefficients between various factors and telecommute mode choice, as well as the corresponding p-values. The factor with the strongest correlation is remote work policy, with an extremely low p-value of 9.642740e-137. This indicates that the provision of remote work policy is highly effective in promoting telecommute mode choice. Flexible work schedule is another factor with a strong correlation to telecommute mode choice, with a p-value of 3.351797e-44. This suggests that the availability of flexible work schedules can encourage employees to choose telecommuting over other modes of transportation.

Annual gross income also has a significant impact on telecommute mode choice, with a p-value of 2.543379e-09. The provision of flexible transportation benefits also has a positive impact on telecommute mode choice, with a p-value of 5.614970e-05. This indicates that the availability of flexible transportation benefits can encourage employees to choose telecommuting over other modes of transportation. On the other hand, factors such as subsidized transit fair or pass, compressed work week, time transit, and not knowing if the employer provides any transportation benefit have no significant impact on telecommute mode choice. Interestingly, free or subsidized parking space has a significant negative impact on telecommute mode choice, with a p-value of 7.441312e-04. This suggests that the availability of free or subsidized parking space can discourage employees from choosing telecommuting over other modes of transportation. Finally, gender (male) has a significant impact on telecommute mode choice, with a p-value of 1.406893e-10. This indicates that females have a higher likelihood of choosing telecommuting over other modes of transportation.

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Figure 9. Spearman Correlation of Factors on Telecommute Mode Choice

The table above shows the chi-square test results that provide insight into the impact of various transportation programs on telecommute mode choice. The program with the highest chi-square value is remote work policy, with a value of 1001 and an extremely low p-value of 9.1333E-217. This indicates a strong correlation between remote work policy and telecommute mode choice, suggesting that providing remote work options is highly effective in promoting the use of sustainable transportation modes. The second program with a significant impact is flexible work schedule, with a chi-square value of 188 and a p-value of 1.03821E-42. This suggests that providing a flexible work schedule has a positive impact on sustainable transportation mode choices, which could be attributed to the fact that it allows employees to choose more sustainable modes of transportation, such as telecommuting. Other programs that have a positive impact on sustainable transportation mode choice include annual gross income, gender (male), flexible transportation benefit, age, and free or subsidized parking space. It is interesting to note that males have a higher likelihood of using sustainable transportation modes. On the other hand, programs with a lower impact on mode choice include guaranteed ride home, free transit pass, use of company vehicle during workday, and time spent on biking, walking, driving, and transit. Additionally, not knowing if the employer provides any transportation benefit and subsidized transit fair or pass have no significant impact on mode choice.

|  |  |  |
| --- | --- | --- |
| TRANSPORTATION PROGRAMS | **CHI2** | P-VALUE |
| Remote work policy | 1001 | 9.1333E-217 |
| Flexible work schedule | 188 | 1.03821E-42 |
| Annual gross income | 67 | 5.09945E-13 |
| Gender: Male | 40 | 2.05626E-10 |
| Flexible transportation benefit | 16 | 7.68116E-05 |
| Age | 29 | 0.000739888 |
| Free or subsidized parking space | 11 | 0.000874815 |
| Guaranteed ride home | 4 | 0.036218919 |
| Free transit pass (EcoPass) | 2 | 0.125765811 |
| Use of company vehicle during workday | 1 | 0.225315026 |
| Bike time | 2613 | 0.29952352 |
| Walk time | 2933 | 0.312525192 |
| Drive time | 2443 | 0.394377605 |
| Time transit | 2220 | 0.467807038 |
| Not knowing if the employer provides any transportation benefit | 0 | 0.527015198 |
| Subsidized transit fair or pass (EcoPass) | 0 | 0.958317191 |

Figure 10 displays the percentage change in odds ratios for telecommute mode choice due to the identified factors. The feature with the highest percentage change is remote work policy with a 176% increase in odds ratio. This suggests that providing remote work options is highly effective in promoting telecommuting. Flexible work schedule is the second most impactful feature with a 67% increase in odds ratio, indicating that offering flexibility in work hours and location can significantly increase the likelihood of telecommuting. Other features with a positive impact on telecommuting include guaranteed ride home, annual gross income, and flexible transportation benefits. It is interesting to note that gender has a negative impact on telecommuting, with males being less likely to telecommute. On the other hand, free or subsidized parking space has the most negative impact on telecommuting with a decrease in odds ratio by 31%. This suggests that providing free or subsidized parking space may discourage telecommuting.

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Figure 10. Percentage Change of Odds Ratios for Telecommute Mode Choice