



ASSESSING THE FACTORS INFLUENCING PRIVATE VEHICLE OWNERS' INTENTION TO PAY PROPOSED CONGESTION FEES IN GEORGE TOWN, PENANG: A THEORY OF PLANNED BEHAVIOUR

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Abstract

Penang was identified as the most congested city in Malaysia in 2024, primarily due to the influx of tourists in George Town, which contributed to high greenhouse gas emissions. Therefore, the Penang State government proposed becoming the first state to implement a congestion fee. However, limited information was available regarding the stakeholders' intentions towards congestion fees. Accordingly, the research aimed to determine the relationship between attitude, subjective norms (SN), perceived behavioural control (PBC), and intention to pay a congestion fee. Questionnaires were utilised to collect responses from 440 respondents through stratified sampling in George Town, involving residents of Penang and domestic tourists. The results of multiple regression analysis indicated that the constructs of the Theory of Planned Behaviour (Attitude, SN, and PBC) had significant and positive relationships. These findings provided valuable insights for the State Government and the Traffic Enforcement and Investigation Department in designing effective congestion fee implementation strategies, which were aligned with the National Transport Policy 2021-2030 and SDG11 (Sustainable Cities and Communities).

Keywords: Congestion fee, Multiple Regression Analysis, Stratified Sampling, Theory of Planned Behaviour

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INTRODUCTION

The rise in population and the increasing number of registered vehicles in major cities has been identified as key factors contributing to frequent traffic congestion (Kapoor, 2024). In 2024, George Town, the capital city of Penang, was reported to be the most congested city in Malaysia (The Sun, 2025). The growing population of Penang (Penang Institute, 2024) and the increasing number of vehicles entering George Town have contributed to overcrowding among both residents and tourists. This has resulted in persistent traffic congestion, extended travel times, and reduced traffic performance (Li-Sian et al., 2024).

During a session of the Dewan Rakyat, George Town was identified as a potential location for the initial implementation of congestion fees. Consequently, the Penang State Government proposed the introduction of congestion fees to address this ongoing issue (The Star, 2025). The implementation of this policy is still under consideration until alternative public transportation such as the LRT has been built (The Star, 2025). However, research on congestion fees in Malaysia, particularly in Penang, has remained limited. Identifying the factors that influence stakeholders' intention to pay is a critical initial step for assessing the feasibility of congestion fee policies (Ngah et al., 2020). Therefore, the Theory of Planned Behaviour was adopted as the primary theoretical framework for this study. This study aimed to determine the relationship between attitude, subjective norms (SN), perceived behavioural control (PBC), and the intention to pay a congestion fee.

LITERATURE REVIEW

Review of Past Studies Using TPB in Congestion Fees Research in Transportation

The successful implementation of congestion fees in major cities such as Singapore, London, Milan and Stockholm have attracted considerable research attention. The study by Cui et al. (2025) integrated TPB and the Norm Activation Model (NAM) to examine the public acceptance of congestion charges. The variables examined included awareness of consequences, attitudes, PBC, SN, personal norms, and behavioural intentions. Responses from 426 participants, collected through convenience sampling, were analysed using Structural Equation Modelling (SEM). The findings revealed that personal norms were significant factors influencing the acceptance of congestion fees.

Transportation-related issues have increasingly required attention to maximise environmental benefits and promote sustainable mobility practices. Consequently, the TPB has been extensively applied to examine and predict public behaviour and intentions regarding the transportation-related changes. In China, Li et al. (2025) investigated the factors influencing car owners' intention

to adopt car-sharing practices using modified TPB variables. The variables examined included behavioural attitudes, novel experience, PBC, and SN. Data were collected from 399 respondents through stratified sampling and were analysed using SEM. The findings identified behavioural attitudes, PBC, and SN as significant factors influencing the public's intention to engage in car-sharing practices. Similarly, a study conducted by Angin et al. (2024) in Northern Cyprus determined intentions to use sustainable public transport. The study employed the core TPB variables, namely attitude, SN and PBC. The data obtained from 384 respondents through convenience sampling were analysed using Multiple Linear Regression. The results indicated that SN and PBC were significant variables.

RESEARCH METHODOLOGY

Study Area

The study area was located in George Town (5.4141° N, 100.3285° E), situated in the northeast region of Penang Island and serving as the capital city of Penang. The escalating influx of tourists, coupled with rising local vehicle registrations and growth in private vehicle ownership, has contributed to recurring traffic congestion. In order to address this issue, the Penang State Government proposed the implementation of a congestion fee (Nambiar, 2025). In addition, the Dewan Rakyat identified George Town as one of the cities for the preliminary implementation of the proposed congestion fee (The Star, 2025), thereby rendering it the most relevant location for this study.

Questionnaire Design

This study employed a face-to-face questionnaire survey involving residents and domestic tourists who owned private vehicles and were aged 18 years and above. Both residents and domestic tourists were included as the proposed congestion fee applies to all vehicles entering George Town regardless of residency status, mirroring universal systems like Singapore Electronic Road Pricing (Government of Singapore, 2026). Both categories of stakeholders were included because they represent significant components of the total traffic volume causing the congestion; thus, including both groups are crucial to providing a realistic assessment of the policy's overall impact. Data collection was conducted between October 2025 and December 2025. The questionnaire was divided into six sections (A, B, C, D, E, and F). Section A comprised nine close-ended questions relating to respondents' sociodemographic characteristics, including gender, age, marital status, income, and education level. Sections B, C, D and E measured respondents' attitudes, SN, PBC, and intentions towards congestion fees, respectively, using a five-point Likert scale.

In this study, attitude is operationally defined as responses to the perceived benefits and costs of implementing the George Town congestion fee.

Subjective norm (SN) refers to the perceived social pressure regarding the fee, while perceived behavioural control (PBC) represents an individual's perceived control over their intention to accept it. Finally, intention measures their willingness to support the implementation of the congestion fee.

Data Collection

The sample size was calculated based on a population of 6.59 million, derived from the combined total population of Penang in 2023 (1.8 million) (Penang Institute, 2024) and the number of domestic hotel guests recorded in Penang during the same year (4.79 million) (Tourism Malaysia, 2024). The sample size calculation proposed by Krejcie and Morgan (1970) and Yamane (1973) yielded sample sizes of 385 and 400 respondents, respectively. The estimated sample size was determined to be 393 respondents based on the average of those two values. Assuming a 10% drop-out rate, the final sample size was calculated as 437 respondents (Sakpal 2010). Therefore, the target sample size for this study was rounded to 440 private vehicle owners in the Georgetown area.

A stratified random sampling technique was utilised to achieve an equal 50:50 distribution of the 440 participants. Specifically, local residents were randomly selected during weekdays in residential areas and recreational parks. Meanwhile, domestic tourists were randomly surveyed during weekends at popular attractions, such as the Penang Esplanade and Armenian Street. The equal sampling distribution proportion of this study follows a similar approach to those used in past studies by Ku & Mak (2017) and Ng et al. (2017). Additionally, an equal proportion ensures sufficient sample size for separate data analysis to make relevant comparisons.

Questionnaire Validation

The questionnaire was validated by five experts specialising in economic valuation research, environmental planning and management, and environmental education. Revisions were made based on the experts' feedback. The questionnaire was subsequently pre-tested among 15 road users in Malacca. Prior to the main survey, a pilot study was conducted involving 40 respondents in George Town to assess the reliability of the instruments. The Cronbach's alpha reliability test conducted using IBM SPSS Statistics produced scores of 0.448, 0.992, 0.879, 0.759 and 0.874 for awareness, attitude, SN, PBC, and intention, respectively. According to Pallant (2020), a minimum Cronbach's alpha value of 0.70 is required to establish acceptable reliability. Therefore, all constructs demonstrate acceptable reliability, except for awareness.

Data Analysis

Descriptive statistics were first used to analyse the data. Subsequently, multiple regression analysis was conducted via SPSS to determine how attitude, SN, and PBC influence private vehicle owners' intention to pay congestion fees in the city centre of George Town. The data analysed included the mean values obtained from calculations performed using SPSS Software.

ANALYSIS AND DISCUSSION

Sociodemographic Profiles

Table 1 presents the sociodemographic profiles of the respondents. The participation of residents and domestic tourists was relatively balanced between male and female respondents. Among residents, the largest age group was 26–35 years, comprising 69 respondents (31.4%). In contrast, the majority of tourists were aged 18–25 years, accounting for 96 respondents (43.6%). Overall, respondents aged 18–25 years constituted the largest age group, with 157 individuals (35.7%). More than half of the residents and tourists reported monthly incomes below RM2,500, with 128 respondents (33.2%) in each group. Consequently, the B40 represented the dominant income category in this study. Most resident respondents reported secondary school as their highest educational qualification, whereas the majority of tourists possessed higher educational qualifications. Overall, secondary school was the most frequently highest education level. Nonetheless, the cumulative number of respondents possessing pre-university, bachelor's, master's, and doctoral qualifications amounted to 280 respondents (63.6%), indicating a relatively high overall level of educational attainment.

Table 1: Sociodemographic Profiles of the Respondents

Item	Resident		Tourist		Overall	
	Freq	%	Freq	%	Freq	%
Gender						
Male	107	48.6	110	50.0	217	49.3
Female	123	51.4	110	50.0	223	50.7
Age Group						
18 - 25 years	61	27.7	96	43.6	157	35.7
26 - 35 years	69	31.4	58	26.4	127	28.9
36 - 45 years	45	20.5	35	15.9	80	18.2
46 - 55 years	19	8.6	23	10.5	42	9.5
56 years and above	26	11.8	8	3.6	34	7.7
Marital Status						
Single	87	39.5	120	54.5	207	47.0
Married	131	59.5	99	45.0	230	52.3
Others	2	0.9	1	0.5	3	0.7
Monthly Individual Gross Income						
Less than RM2,500	117	53.2	128	33.2	245	55.7
RM2,501 - RM3,169	46	20.9	34	8.8	80	18.2
RM3,170 - RM3,969	16	7.3	15	3.9	31	7.0

Item	Resident		Tourist		Overall	
	Freq	%	Freq	%	Freq	%
RM3,970 - RM4,849	13	5.9	6	1.6	19	4.3
RM4,850 - RM5,879	14	6.4	7	1.8	21	4.8
RM5,880 - RM7,099	8	3.6	13	3.4	21	4.8
RM7,100 - RM8,699	2	0.9	4	1.0	6	1.4
RM8,700 - RM10,959	3	1.4	4	1.0	7	1.6
RM10,960 - RM15,039	-	-	5	1.3	5	1.1
More than RM15,039	1	0.5	4	1.0	5	1.1
Education Level						
Primary School	14	6.4	2	0.5	16	3.6
Secondary School	89	40.5	55	14.2	144	32.7
STPM/ Foundation/ Diploma/ Matriculation	65	29.5	70	18.1	135	30.7
Bachelor's Degree	43	19.5	67	17.4	110	25.0
Master's Degree	9	4.1	24	6.2	33	7.5
Doctor of Philosophy (PhD)	0	0	2	0.5	2	.5

Visitation Characteristics

Table 2 highlights that the majority of the local respondents were road users residing on Penang Island, comprising 175 respondents (79.5%), while the remaining 45 respondents (20.5%) resided on Penang Mainland. The largest proportion of respondents, namely 106 individuals (48.2%), commuted to George Town daily for employment, educational, and recreational purposes. Most respondents were residents of George Town, which made commuting activities more frequent and necessary compared to those residing in other parts of Penang. Meanwhile, only seven respondents (3.2%) reported commuting to George Town once every few years. Some respondents attributed this pattern to a declining interest in travelling due to worsening traffic congestion, which was consistent with the findings of a previous study by Jaafar (2025).

Table 2: Visitation Characteristics among Residents

Item	Frequency	Percentage
Road User Category (n=220)		
Resident (Penang Island)	175	39.8
Resident (Penang Mainland)	45	10.2
Frequency of Commuting to George Town (n = 220)		
Daily	106	48.2
Weekly	63	28.6
Monthly	19	8.6
Several times a year	25	11.4
Once every few years	7	3.2

Table 3 indicates that most of the domestic tourists originated from Kedah, comprising 81 respondents (36.8%). In addition, most tourists, namely 166 respondents (75.4%), travelled to Penang using private vehicles. This contributed to many private vehicles in Penang, particularly during weekends and holiday periods. Furthermore, the largest proportion of tourists reported visiting George Town once every few years, accounting for 74 respondents (33.6%).

Table 3: Visitation Characteristics among Domestic Tourists

Item	Frequency	Percentage
Road User Category (n=220)		
Domestic Tourist	220	50.0
State of Origin (n = 220)		
Johor	12	5.5
Kedah	81	36.8
Kelantan	14	6.4
WP Putrajaya	8	3.6
WP Kuala Lumpur	26	11.8
Perak	21	9.5
Perlis	7	3.1
Sabah	1	0.5
Sarawak	1	0.5
Selangor	35	15.9
Terengganu	3	1.4
Negeri Sembilan	11	5.0
Mode of Transportation (n=220)		
Public Transportation	45	20.5
Private Vehicles	166	75.4
Rented Vehicles	6	2.7
Air Travel	3	1.4
Frequency of Visits to George Town (n = 220)		
Daily	11	5.0
Weekly	16	7.3
Monthly	47	21.4
A few times a year	72	32.7
Once every few years	74	33.6

Table 4 shows that 220 respondents (50.0%) were domestic tourists, while residents of Penang Island and Penang Mainland accounted for 175 respondents (39.8%) and 45 respondents (10.2%), respectively. Overall, the largest proportion of respondents travelled to George Town daily, comprising 117 respondents (26.6%).

Table 4: Visitation Characteristics among Overall Respondents

Item	Frequency	Percentage
Road Users Category (n=440)		
Resident (Penang Island)	175	39.8
Resident (Penang Mainland)	45	10.2
Domestic Tourist	220	50.0
Travel Frequency to George Town (n = 440)		
Daily	117	26.6
Weekly	79	18.0
Monthly	66	15.0
A few times a year	97	22.0
Once every few years	81	18.4

Attitude Towards the Congestion Fees

Table 5 presents the levels of attitude towards congestion fees. The first item, relating to the reduction of greenhouse gas emissions through the implementation

of a congestion fee, showed a medium level of attitude among residents, tourists, and the overall respondents. Residents and the overall respondents also demonstrated a medium level of attitude for the second item, which related to using congestion fees to ease traffic congestion, whereas tourists exhibited a high level of attitude. The third item, which assessed perception of congestion fees as a fair mechanism for managing road use, indicated a medium level of attitude across all respondent groups. This finding contrasted with a previous study, in which most respondents perceived such measures as unfair (Al-Mawajdeh, 2023). The fourth item, which examined whether congestion fees could reduce traffic congestion, showed a medium level of attitude among residents and the overall respondents, while tourists demonstrated a high level of attitude.

Table 5: Level of Attitude towards the Congestion Fee

	Item	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Mean	Total Mean	Level
Resident	Attitude Item 1	15.5	12.3	24.1	28.6	19.5	3.25	3.34	Medium
	Attitude Item 2	12.3	10.5	24.5	34.5	18.2	3.36		Medium
	Attitude Item 3	11.8	12.3	24.5	32.3	19.1	3.35		Medium
	Attitude Item 4	12.7	11.8	22.3	32.3	20.9	3.37		Medium
Tourist	Attitude Item 1	8.2	6.8	28.6	33.2	23.2	3.56	3.64	Medium
	Attitude Item 2	5.5	9.1	21.8	40.5	23.2	3.67		High
	Attitude Item 3	5.5	8.6	26.8	39.1	20.0	3.60		Medium
	Attitude Item 4	6.4	5.9	20.5	43.6	23.6	3.72		High
Overall	Attitude Item 1	11.8	9.5	26.4	30.9	21.4	3.40	3.48	Medium
	Attitude Item 2	8.9	9.8	23.2	37.5	20.7	3.51		Medium
	Attitude Item 3	8.6	10.5	25.7	35.7	19.5	3.47		Medium
	Attitude Item 4	9.5	8.9	21.4	38.0	22.3	3.55		Medium

1 = Totally Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Totally Agree
Mean scores are interpreted as Low (1.00 – 2.33), Medium (2.34 – 3.66), and High (3.67 – 5.00).
Attitude Item 1 = I feel that paying a congestion fee would reduce greenhouse gas emissions.
Attitude Item 2 = I feel that paying a congestion fee can ease traffic
Attitude Item 3 = Paying a congestion fee is a fair way to manage road use.
Attitude Item 4 = Paying a congestion fee can help reduce traffic congestion in George Town, Penang.

Subjective Norm (SN)

Table 6 presents the levels of SN towards congestion fees. The first item, which examined the perceived importance of using public transportation instead of

private vehicles among respondents' significant others, indicated a medium level of SN among residents, tourists and the overall respondents. This finding was consistent with studies by Hu et al. (2025). The second item, which assessed perceived approval from respondents' significant others regarding the payment of congestion fees, indicated a high level of SN among tourists, while residents and the overall respondents recorded medium levels. The third item, which examined family members' expectations that respondents supported congestion fees, indicated a medium level of SN across all groups. The fourth item, which assessed whether individuals whose opinions were valued would support congestion fees, showed a medium level of SN among residents and the overall respondents, whereas tourists reported a high level of SN.

Table 6: Level of Subjective Norms towards the Congestion Fee

	Item	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Mean	Total Mean	Level
Resident	SN Item 1	12.3	11.8	35.9	23.6	16.4	3.20	3.19	Medium
	SN Item 2	10.0	15.9	38.2	25.0	10.9	3.11		Medium
	SN Item 3	6.8	16.4	37.7	28.2	10.9	3.20		Medium
	SN Item 4	7.7	14.5	33.6	33.2	10.9	3.25		Medium
Tourist	SN Item 1	7.3	12.7	36.4	28.2	15.5	3.32	3.33	Medium
	SN Item 2	7.3	14.1	33.6	35.0	10.0	3.26		Medium
	SN Item 3	7.3	12.7	35.0	33.6	11.4	3.29		Medium
	SN Item 4	6.4	10.0	31.4	37.3	15.0	3.45		Medium
Overall	SN Item 1	9.8	12.3	36.1	25.9	15.9	3.26	3.26	Medium
	SN Item 2	8.6	15.0	35.9	30.0	10.5	3.19		Medium
	SN Item 3	7.0	14.5	36.4	30.9	11.1	3.25		Medium
	SN Item 4	7.0	12.3	32.5	35.2	13.0	3.35		Medium

1 = Totally Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Totally Agree

Mean scores are interpreted as Low (1.00 – 2.33), Medium (2.34 – 3.66), and High (3.67 – 5.00).

SN Item 1 = Most people who are important to me think I should use public transportation instead of driving.

SN Item 2 = People important to me would approve of me paying the congestion fee.

SN Item 3 = My family expects me to support the congestion fee aimed at reducing traffic congestion.

SN Item 4 = I believe people whose opinions I value would support congestion pricing in Penang.

Perceived Behaviour Control (PBC)

Table 7 presents the level of PBC towards the congestion fee. The first item, which assessed respondents' confidence in using public transportation during peak hours if the congestion fees were introduced, indicated a medium level of PBC among residents, tourists, and the overall respondents. The second item showed high levels of PBC across residents, tourists, and the overall respondents, which was consistent with a previous study by Moulin et al. (2025). The third item, which examined the reduction of trip frequency to George Town if the congestion fee was perceived as too expensive, indicated that tourists demonstrated a high level of PBC, whereas residents and the overall respondents

exhibited medium levels. Meanwhile, the fourth item, which assessed the perceived ease of paying the congestion fee if it were affordable, indicated high levels of PBC among tourists and the overall respondents.

Table 7: Level of Perceived Control Behaviour towards the Congestion Fee

	Item	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Mean	Total Mean	Level
Resident	PBC Item 1	10.5	15.5	28.6	26.4	19.1	3.28	3.53	Medium
	PBC Item 2	6.8	8.2	22.7	30.0	32.3	3.73		High
	PBC Item 3	9.1	14.1	26.4	23.6	26.8	3.45		Medium
	PBC Item 4	6.4	9.1	26.4	30.5	27.7	3.64		Medium
Tourist	PBC Item 1	10.9	11.4	26.4	32.7	18.6	3.37	3.67	Medium
	PBC Item 2	5.5	3.6	23.6	37.3	30.0	3.83		High
	PBC Item 3	2.7	9.1	30.9	25.0	32.3	3.75		High
	PBC Item 4	5.0	4.5	28.6	30.9	30.9	3.78		High
Overall	PBC Item 1	10.7	13.4	27.5	29.5	18.9	3.33	3.61	Medium
	PBC Item 2	6.1	5.9	23.2	33.6	31.1	3.78		High
	PBC Item 3	5.9	11.6	28.6	24.3	29.5	3.60		Medium
	PBC Item 4	5.7	6.8	27.5	30.7	29.3	3.71		High

1 = Totally Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Totally Agree

Mean scores are interpreted as Low (1.00 – 2.33), Medium (2.34 – 3.66), and High (3.67 – 5.00).

PBC Item 1 = I am confident that I would use public transportation during peak hours if the congestion fee were introduced.

PBC Item 2 = I would use private vehicles to travel to George Town during non-peak hours.

PBC Item 3 = If the congestion fee is too expensive, I will reduce trip frequencies to George Town.

PBC Item 4 = Paying the congestion fee would be easy for me if it were affordable.

Intention Towards the Congestion Fee

Table 8 presents the level of intention towards the congestion fee. The first item, which assessed the respondents' intention to support the implementation of a congestion fee, indicated a medium level of intention among residents, tourists, and the overall respondents. The second item, which examined respondents' determination to pay the congestion fee during peak hours, indicated a medium level of intention, consistent with a previous study by Aksen and Long (2025). The third item, which assessed support for the congestion fee if the revenue was allocated to public transport improvements, indicated a high level of intention among residents and the overall respondents. Tourists demonstrated a higher level of support, as improved public transportation was perceived to enhance efficiency and reliability while reducing future travel costs. Similarly, the fourth item, which assessed the perceived ease of paying the congestion fee if it were affordable, indicated a high level of intention among tourists and the overall respondents.

Table 8: The level of Intention towards the Congestion Fee

	Item	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Mean	Total Mean	Level
Resident	Intention Item 1	8.6	14.5	32.3	29.1	15.5	3.28	3.40	Medium
	Intention Item 2	11.8	14.5	29.1	30.9	13.6	3.20		Medium
	Intention Item 3	7.7	8.6	27.7	31.4	24.5	3.56		Medium
	Intention Item 4	6.8	9.1	29.5	32.3	22.3	3.55		Medium
Tourist	Intention Item 1	5.9	9.5	30.0	35.9	18.6	3.52	3.62	Medium
	Intention Item 2	7.3	13.6	28.6	35.5	15.0	3.37		Medium
	Intention Item 3	3.2	5.9	25.5	35.9	29.5	3.83		High
	Intention Item 4	5.5	5.9	23.6	39.5	25.5	3.74		High
Overall	Intention Item 1	7.3	12.0	31.1	32.5	17.0	3.40	3.51	Medium
	Intention Item 2	9.5	14.1	28.9	33.2	14.3	3.29		Medium
	Intention Item 3	5.5	7.3	26.6	33.6	27.0	3.70		High
	Intention Item 4	6.1	7.5	26.6	35.9	23.9	3.64		High

1 = Totally Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Totally Agree

Mean scores are interpreted as Low (1.00 – 2.33), Medium (2.34 – 3.66), and High (3.67 – 5.00).

Intention Item 1 = I plan to support the implementation of the congestion fee in Penang.

Intention Item 2 = I will pay a congestion fee to enter George Town during peak hours.

Intention Item 3 = If the revenue is used to improve public transportation, I would support the implementation of a congestion fee in Penang.

Intention Item 4 = I would be more likely to support the introduction of a congestion fee in Penang to address traffic congestion.

Multiple Linear Regression Analysis

Prior to conducting the multiple linear regression (MLR) analysis, the underlying assumptions were tested. The results indicated that the independent variables did not suffer from multicollinearity, with all inter-variable correlations remaining below the 0.70 threshold. Furthermore, normality testing via skewness and kurtosis values confirmed that the regression residuals were normally distributed, with skewness values falling within the acceptable range of -1.0 to 1.0 and kurtosis values within -2.0 to 2.0. Additionally, the distribution of residual values aligned with the assumption of homoscedasticity.

Table 9 presents the results of the multiple linear regression analysis. According to Hankins et al. (2000), *R* refers to multiple correlation coefficient

whereas R square is defined as the percentage of variance in intention which is influenced by the TPB variables (attitude, SN and PCB). Estimation of explained variance in this study were identified by using adjusted R square. The TPB variables, namely attitude, SN, and PBC, were found to have significant positive relationships with intention among residents, tourists, and the overall respondents. Among residents ($R^2 = 0.554$), 55.4% of the total variance in intention was explained with strong linear relationship with the TPB variables, whereas among tourists ($R^2 = 0.443$), the TPB variables accounted for the lowest total variance, indicating moderate linear relationship at 44.3%. For the overall respondents, 50.3% of the total variance in intention was explained with strong linear relationship with the TPB variables. These findings suggested that the regression model for all respondent categories (residents, tourists, and the overall respondents) demonstrated an acceptable model fit (Tranmer et al., 2020).

Table 9: Results of the Multiple Linear Regression Analysis

Item	R	R square	Adjusted R Square	Std. error of the estimate
Resident	0.744	0.554	0.548	0.702
Tourist	0.666	0.443	0.436	0.697
Overall	0.709	0.503	0.499	0.703

a. Predictors (Constant), Attitude, Subjective Norms, Perceived Control Behaviour
b. Dependent Variable: Intention

Table 10 highlights the regression coefficient analysis for residents, tourists, and the overall respondents. The regression coefficient between intention and attitude ($b=0.252$, $p<0.000$) was significant, indicating that residents' intention increased by 0.252 for every one-unit increase in attitude. Similarly, the regression coefficient between intention and SN ($b=0.409$, $p<0.000$) was significant, with intention increasing by 0.409 for every one-unit increase in SN, representing the strongest effect among the TPB variables. The regression coefficient between intention and PBC ($b=0.315$, $p<0.000$) was also significant, with respondents' intention increasing by 0.315 for every one-unit increase in PBC. Overall, the TPB independent variables, namely attitude, SN, and PBC, exerted positive effects on the intention of resident respondents. Among these variables, SN ($\beta=0.355$) demonstrated the strongest influence, followed by attitude ($\beta=0.273$) and PBC ($\beta=0.271$). The greatest influence of SN among residents may be attributed to the direct effects of congestion fee implementation on their travel behaviour, public acceptance and support. The intention score was 1.123.

The regression coefficient between intention and attitude ($b=0.351$, $p<0.000$) among tourists was significant, indicating that intention increased by

0.351 for every one-unit increase in attitude. Similarly, the regression coefficient between intention and SN ($b=0.319, p<0.000$) was also significant, with tourists' intention increasing by 0.319 for every one-unit increase in SN. However, the regression coefficient between intention and PBC ($b=0.127, p=0.057$) was not significant. Therefore, the TPB independent variables, namely attitude and SN, exerted positive effects on tourists' intention, with attitude ($\beta=0.364$) demonstrating the strongest influence, followed by SN ($\beta=0.308$). The stronger influence of attitude on tourists' intention may be attributed to the lack of social pressure in shaping their decision, as their support for the congestion fee is more likely to be influenced by personal preferences and perceptions of the anticipated outcomes or impact of the congestion fee implementation on their travel experience. The intention score was 1.603.

For the overall respondents, the regression coefficient between the intention and attitude ($b=0.301, p<0.000$) was significant, indicating that respondents' intentions increased by 0.301 for every one-unit increase in attitude. Similarly, the regression coefficient between intention and SN ($b=0.364, p<0.000$) was also significant, implying that respondents' intention increased by 0.364 for every one-unit increase in SN. The regression coefficient between intention and PBC ($b=0.229, p<0.000$) was likewise significant, with respondents' intention increasing by 0.229 for every one-unit increase in PBC. Therefore, the TPB independent variables, namely attitude, SN, and PBC, exerted positive effects on intention, with SN ($\beta=0.332$) demonstrating the strongest influence, followed by attitude ($\beta=0.321$) and PBC ($\beta=0.199$). The intention score was 1.34.

The positive relationship between attitude and intention observed in the regression model was consistent with the findings of Nguyen (2020) on entrepreneurial intention in Vietnam, in which attitude, SN, and PBC were positively associated with intention. Similarly, Gibson (2021), who examined the intention to conserve freshwater resources in the United States using TPB, reported comparable findings, demonstrating positive relationships between attitude, SN, PBC, and the dependent variable, namely intention. In conclusion, the findings indicated that attitude, SN, and PBC were significant predictors of intention and exhibited positive relationships across all regression models pertaining to residents, tourists, and overall respondents. These results were consistent with the findings of most previous studies and supported the propositions of the TPB theory by Ajzen (1991).

Table 10: Results of the Regression Coefficient Analysis

Model		Unstandardised Coefficients		Standardised Coefficient	t	p-value.
		B	Std. Error	Beta		
Resident	Constant	0.147	0.211	-	0.697	0.487
	Attitude	0.252	0.053	0.273	4.769	0.000
	Subjective Norms	0.409	0.069	0.355	5.906	0.000
	PBC	0.315	0.064	0.271	4.949	0.000
Tourist	Constant	0.806	0.242	-	3.331	0.001
	Attitude	0.351	0.062	0.364	5.636	0.000
	Subjective Norms	0.319	0.070	0.308	4.544	0.000
	PBC	0.127	0.066	0.112	1.916	0.057
Overall	Constant	0.446	0.158	-	2.823	0.005
	Attitude	0.301	0.040	0.321	7.499	0.000
	Subjective Norms	0.364	0.049	0.332	7.395	0.000
	PBC	0.229	0.046	0.199	4.971	0.000

CONCLUSION.

In overall, the analysis indicated that both residents and tourists exhibited medium to high levels of attitude, PBC, and intention towards congestion fees, whereas SN was recorded at a medium level. All the variables within the Theory of Planned Behavior (TPB) such as attitude, Subjective Norms and Perceived Behavior Control (PBC) are found to be significant with positive relationship with the intention to pay for the congestion fee in George Town, Penang. Since SN had the highest relative strength value among the TPB variables, SN was identified as the most influential factor affecting overall and residents' intention to pay the congestion fees, followed by attitude and PBC.

The implementation of a congestion fee is expected to impose an additional financial burden on all private vehicle users, particularly individuals within the B40 income group. To ensure social equity, specialised rebates should be integrated into the pricing mechanism for vulnerable groups such as students and senior citizens who commute daily within the city centre of George Town, Penang. In addition, substantial discounts targeting individuals residing inside the designated congestion fee zone could be implemented to mitigate the financial strain on daily commuters. Furthermore, targeted public transport subsidies for the B40 income group, covering buses and the future LRT system, would encourage a cost-effective behavioural shift from private vehicles to public transportation. The study recommends that the revenue generated from the congestion fee should be ring-fenced for specific uses, such as public transport upgrades, pedestrian facilities, cycling infrastructure, park-and-ride systems, and transparent fee management.

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ETHICAL APPROVAL

This study was approved by the Ethics Committee for Research Involving Human Subjects (JKEUPM), Universiti Putra Malaysia (Reference No: UPM.TNCPI.800-2/1/7) on 26 January 2026 prior to the commencement of the study. The approval was valid from 26 January 2026 to 25 January 2027.

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