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GEORGE BUSH INTERCONTINENTAL (IAH) 2023 GROUND ACCESS TRANSPORTATION SURVEY

April 2024

Prepared for Houston-Galveston Area Council

Report Title:

George Bush Intercontinental (IAH) 2023 Ground Access Transportation Survey

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Report Prepared for:

Houston-Galveston Area Council

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1.0 INTRODUCTION

The Houston-Galveston Area Council (H-GAC), in collaboration with the ETC Institute and RSG, undertook an airport ground access survey to quantitatively assess the transportation choices and behaviors of departing and arriving passengers at George Bush Intercontinental Airport (IAH). The survey of IAH ground access behaviors serves as a critical input for travel demand model forecasts, which require these data to accurately portray airport passenger and employee travel segments.

This report presents the methodology and results of ETC's survey, administered to airport employees and airline travelers in November 2023. Data collection for airline travelers occurred through an intercept effort at IAH, where trained surveyors distributed the survey via tablet computers to passengers in secured and non-secured spaces, including departure gates, concession areas, baggage claims, and taxi pick-up locations. Data collection was guided by a sampling plan designed to collect data from a representative sample of IAH travelers. The sample plan targeted 3,200 completed surveys and 3,467 completed surveys were collected. Following data cleaning and outlier analysis, the final database of travelers included 2,953 records. Prior to analysis the survey data were weighted to match non-connecting flight departure patterns by day of week and time of day.

The survey gathered details of a respondent's most recent ground access trip to arrive at IAH or a ground access trip to depart IAH. Respondents were asked to describe the details of their ground access trip, including the primary purpose of flying in or out of IAH, travel mode, departure/arrival times, use of parking facilities, as well as basic sociodemographic details.

The effort also included interviewing IAH employees about their travel to/from the airport. This report documents the design and results of the air passenger survey. The appendix includes a complete record of survey screenshots, tabulations of all survey questions, a detailed memo that describes the steps for weighting and expansion, as well as the results of the employee version of the survey.

2.0 QUESTIONNAIRE

ETC collaborated with the project team to develop a questionnaire aligned with the study objectives. These objectives aimed to identify access and egress behaviors while establishing the travel patterns of departing passengers and employees at George Bush Intercontinental Airport (IAH). The questionnaire was tailored to gather essential information for accurately depicting arrival/departure mode behaviors and ground access distributions for IAH customers. This section describes the design of the survey instrument used to collect ground access behavioral data.

For clarity in this report, unless noted, the terms 'departing passengers' or 'departures' denote individual respondents or travel parties arriving at the airport using ground transportation, typically to catch a flight. Conversely, 'arriving passengers' or 'arrivals' signify individual respondents or travel parties departing the airport using ground transportation, typically after arriving on a flight. The term ‘ground access’ is used to refer to the land portion of travel used to access or egress the airport.

2.1 DATA RETRIEVAL

Tablet Intercept Survey

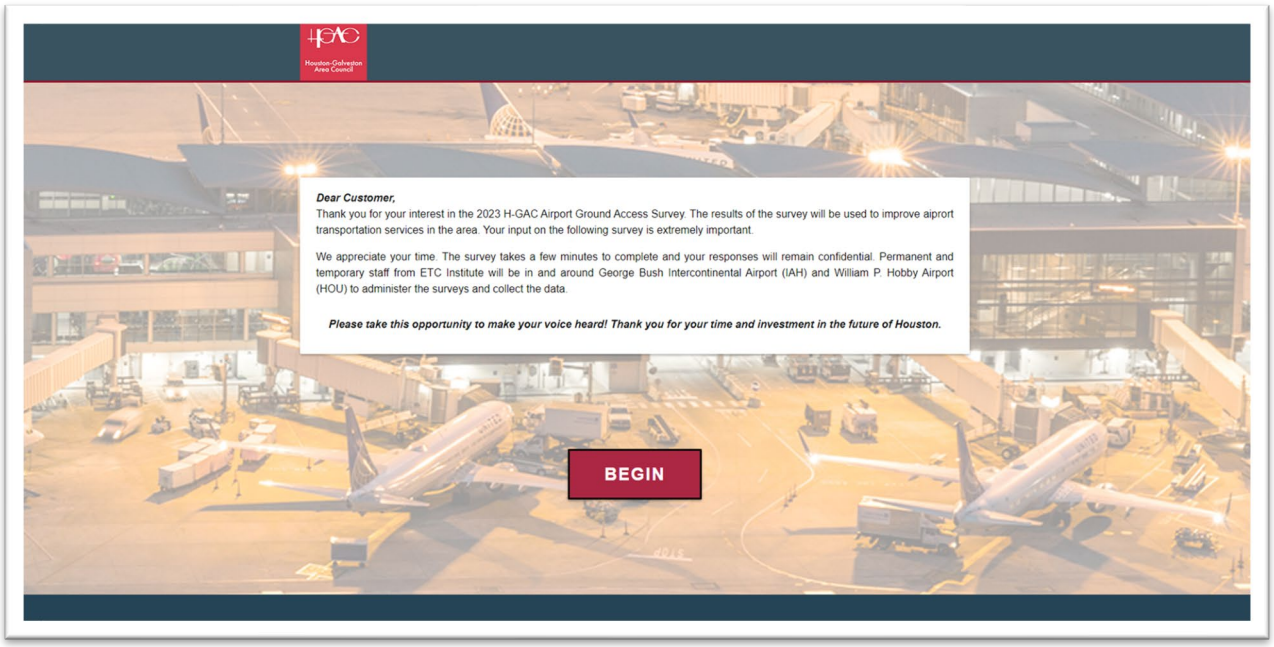
Tablet intercept surveys served as the primary method for conducting the passenger survey. Trained interviewers equipped with tablets preloaded with the survey were stationed within designated areas of the airport, as determined by the sampling plan. Interviewers randomly approached individuals to invite them to participate in the survey. Sampled individuals who agreed to participate were provided with a brief explanation about the study, after which the interviewer guided the respondent through the survey. This method accounted for approximately 90% of completed surveys.

Controlled Access Self-Administered Survey

ETC offered two additional methods for passengers to access the questionnaire, allowing respondents to complete the survey independently, without the assistance of an interviewer. Firstly, all individuals who logged onto the IAH public Wi-Fi system encountered a pop-up allowing them to access the survey. Alternatively, travelers who preferred to complete the survey on their own device instead of using the tablet could scan a QR code provided on each interviewer's lanyard. Approximately 10% of completed surveys were collected using the controlled access self-administered survey method.

These exclusive access methods were designed to restrict survey participation to airport passengers only, ensuring the integrity of the collected data. Upon scanning the QR code, passengers were directed to a dedicated landing page for survey completion, shown in Figure 1.

FIGURE 1: SAS LANDING PAGE



2.2 SURVEY SECTIONS

The survey instrument comprised four primary sections: qualifying questions and background information, ground access departure/arrival inquiries, parking queries (where applicable), and demographic information. A complete set of screenshots for both versions of the survey are provided in the report's appendix.

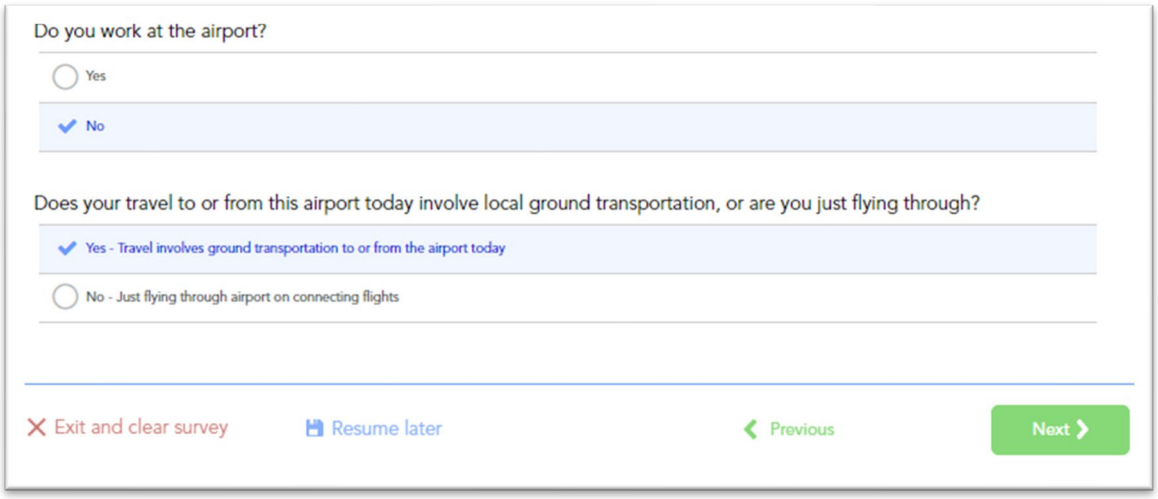
Qualification Questions and Background Questions

Figure 2 illustrates examples of qualifying questions used in the survey. Several qualification criteria were implemented to ascertain eligibility for participation:

- Participants must be airport passengers utilizing ground transportation within the Houston area on the survey day.
- Exclusion criteria applied to passengers on layovers or connecting flights, as they do not utilize ground transportation in Houston.
- Exclusions also applied to Houston Airport System (HAS) employees and vendors unless they are present at the airport for personal travel.

- Participants must have been at least sixteen years old to participate in the survey.

FIGURE 2: EXAMPLE OF QUALIFYING QUESTIONS



Upon confirmation of eligibility, participants were required to answer a series of background questions. Those residing in the Greater Houston Area were directed to input their home address or the nearest intersection streets, as illustrated in Figure 3. The survey tool featured a mapping visualization function enabling participants to verify the accuracy of their provided information as depicted in Figure 4. Participants outside the Greater Houston Area were prompted to provide their home ZIP code. These responses shaped the text formulation of the subsequent set of questions.

FIGURE 3: HOME ADDRESS FOR RESIDENTS

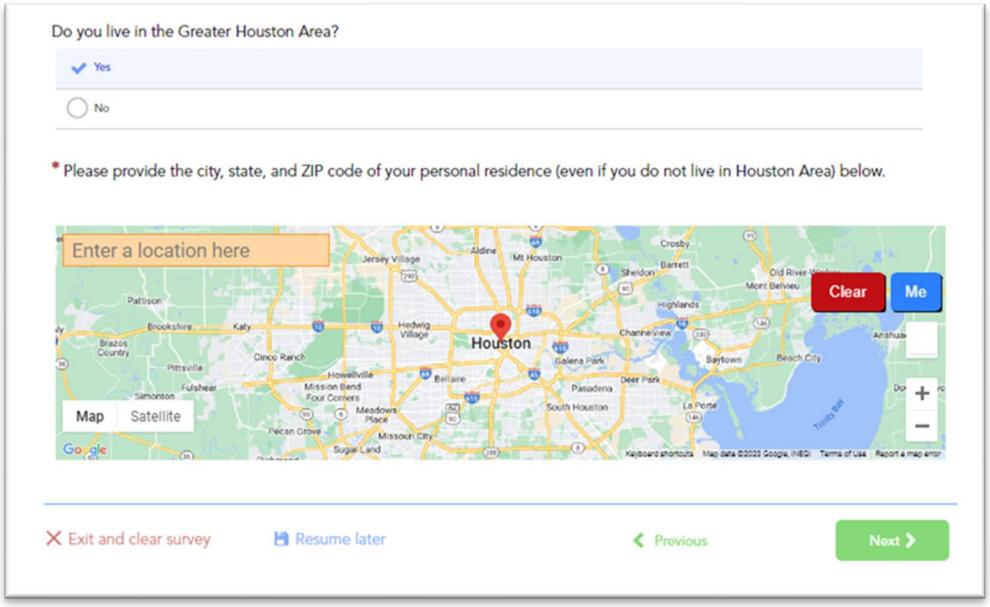
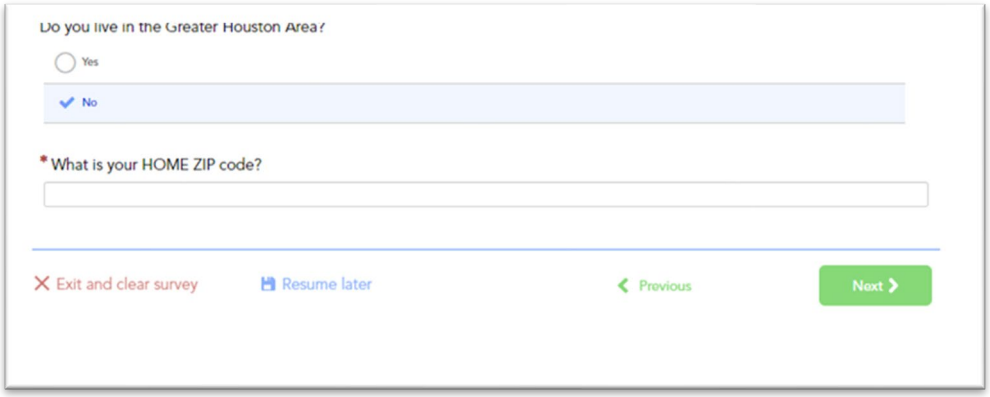


FIGURE 4: ZIP CODE IF RESPONDENT RESIDES OUTSIDE THE GREATER HOUSTON AREA



Ground Access Departure/Arrival Questions

The subsequent questions pertained to the method and specifics of transportation utilized by departing passengers to reach IAH or by arriving passengers to depart from the airport. These questions included:

- Trip purpose, origin location, departure time, and stops made along the way
- Travel time
- Ground access mode

- Trip duration
- Size of travel party
- Travel mode and vehicle occupants.

Parking Questions

If a respondent arrived or would depart in a personal vehicle (as a driver or passenger) or through an arranged carpool, they were queried about whether they parked in a paid lot or garage. If affirmative, this was succeeded by several subsequent questions outlined below:

- Parking lot location
- Parking cost and duration
- Parking recommendation
- Parking choice factors

Demographic Questions

To ensure the sample was representative of H-GAC region air passengers, the final section of the survey asked about the participant's demographic details and if they would participate in the incentive raffle. These questions included:

- Employment status
- Household vehicles
- Age
- Planned trips at IAH
- Race/ethnicity
- Household income
- Incentive raffle
- Contact info for incentive raffle

3.0 SURVEY SAMPLING AND ADMINISTRATION

This chapter delineates the sampling methodology and administration strategy employed for the passenger survey conducted at IAH. The sample plan was crafted to capture a representative sample of departing passengers at IAH by day of the week and time of day. Flight departure data, utilized in designing the sample plan, covered September 2023 and was sourced from OAG Aviation, a third-party provider of airport and flight data analytics. Leveraging information about departing flights, ETC developed the sample plan to inform decisions regarding the deployment of survey administration staff, ensuring proper coverage and the collection of a valid sample of travelers.

It should be noted that while the survey administration encompassed data collection from both departing and arriving passengers, the sample plan itself was constructed using target data solely from flights departing IAH. The choice to interview both arriving and departing passengers aimed to maximize the number of completed surveys. Additionally, since the distribution of ground egress travel characteristics likely mirrors ground access travel characteristics, the effects of this decision do not compromise the overall validity of the sample.

IAH Passenger Survey Sample Plan

ETC developed the sampling plan by using seat capacity on departing flights as the basis for estimating the distribution of departing passengers by time of day and day of the week. Table 1 shows the percentage of seats for all flights by day of week (weekday vs weekend) and time of day, respectively.

TABLE 1: SUMMARY OF DEPARTING SEATS ON ALL FLIGHTS BY TIME OF DAY AND DAY OF WEEK

TIME OF DAY	DAY OF WEEK							WEEKDAYS		WEEKEND	
	Mon	Tues	Wed	Thurs	Fri	Weekend	Total Seats	Avg Seats Per Hour	% of Seats Per Hour	Avg Seats per Hour	% of Seats Per Hour
Before 9:00AM	13,813	14,585	13,298	13,639	12,565	10,771	**89,442**	13,580	17.7%	10,771	15.9%
9:00-11:59AM	16,760	16,529	17,940	16,065	14,144	13,009	**107,455**	16,288	21.2%	13,009	19.2%
12:00-2:59PM	15,242	13,388	14,091	19,929	11,339	10,007	**94,002**	14,798	19.3%	10,007	14.8%
3:00-5:59PM	9,620	8,549	8,549	10,048	9,204	11,929	**69,828**	9,194	12.0%	11,929	17.6%
6:00-8:59PM	20,351	20,124	20,470	22,131	19,013	19,750	**141,588**	20,418	26.6%	19,750	29.2%
After 9pm	2,540	2,540	2,616	2,782	1,946	2,238	**16,899**	2,485	3.2%	2,238	3.3%
Total	**78,326**	**75,715**	**76,964**	**84,594**	**68,211**	**67,702**	**519,214**	**76,763**	**100%**	**67,704**	**100%**

Source: OAG Aviation

Table 2 displays the survey sampling targets for both weekdays and weekends, with a total sample target of 3,200. Utilizing the seat percentages outlined in Table 2 sample goals were established for 2,600 completed surveys on weekdays and 600 on the weekend. The table shows the minimum number of completed surveys required to achieve statistical precision of 90%.

TABLE 2: SURVEY TARGETS BY WEEKDAY AND WEEKEND FLIGHTS

WEEKDAY VS WEEKEND	PERCENT OF SEATS	MINIMUM NEEDED FOR STATISTICAL VALIDITY	GOAL AFTER ALL SAMPLING TARGETS WERE SET
Weekday	73.9%	600	2,600
Weekend	26.1%	600	600
Total	**100.0%**	**1,200**	**3,200**

A comparable methodology was utilized to determine the survey targets by time of day, as demonstrated in Table 3. Targets by time of day were developed by taking the weighted average of weekday and weekend departing seats by time of day, as shown in Table 1. The table shows the minimum number of completed surveys required to achieve statistical precision of +/- 5% at a 95% confidence interval for all segments before 9PM. Because only a small proportion of departing seats departed after 9:00PM, a much smaller sample target was selected that has a lower level of statistical precision.

TABL12 3: SURVEY TARGETS BY TIME OF DAY

SURVEY BY TIME OF DAY	PERCENT SEATS	MINIMUM NEEDED FOR STATISTICAL VALIDITY	GOAL AFTER ALL SAMPLING TARGETS WERE SET
Before 9:00AM	17.2%	400	412
9 to 11:59am	20.7%	400	778
12 to 2:59pm	18.1%	400	648
3 to 5:59pm	13.4%	400	424
6 to 8:59pm	27.3%	400	835
After 9pm	3.3%	100	103
Total	**100%**	**2,100**	**3,200**

After considering both the day of the week and the time of day, Tuesday, Wednesday, and Thursday were designated as survey administration days, representing the weekday sampling. Saturday was selected to represent the weekend sampling. The sampling goals for each day are shown in Table 4.

TABLE 4: SURVEY TARGETS BY DAY OF WEEK AND TIME OF DAY

	TIME PERIOD						
Day of Week	Before 9:00AM	9-1159am	12-259pm	3-559pm	6-859pm	after 9pm	Grand Total
Tuesday	140	184	214	128	154	47	**867**
Wednesday	117	169	201	92	219	19	**816**
Thursday	98	249	146	76	330	16	**915**
Saturday	57	176	88	127	131	22	**600**
Total	**412**	**778**	**649**	**423**	**834**	**104**	**3,200**

In addition to factoring in the day of the week and time of day, the sampling plan also took into consideration other trip specific elements, such as trip purpose and mode used to arrive at the airport. Table 5 presents an overview of the minimum sampling goals based on trip purpose and airport arrival modes. The table shows the minimum number of completed surveys required to achieve statistical precision of +/- 5% at a 95% confidence interval.

TABLE 5: TRIP PURPOSE AND ARRIVAL SAMPLE TARGETS

SAMPLING CATEGORY		MINIMUM SAMPLE SIZE
Trip Purpose	Vacation/Pleasure/Visting	400
	Business or Business Related	400
	Subtotal Goals by Trip Purpose	**800**
Airport Ground Access Arrival Mode	Driver of Personal Vehicle/Parked (including Parking shuttle)	400
	Passenger - Dropoff personal car (including Parking shuttle)	400
	Rental Vehicle (including passengers dropped off by Rental Shuttle)	400
	Rideshare Service (Uber, Lyft, etc.)	400
	Transit/Hotel Shuttle (excluding Rental and Parking Shuttle)	160
	Subtotal Goals by Mode of Arrival	**1,760**
	Minimum Total Goals	**2,560**

Survey Administration

The survey was primarily administered between Monday, November 6th through Saturday, November 11th, the ETC Institute led the initiative to collect 3,200 passenger surveys at IAH Airport. Additionally, surveys were conducted among airport and vendor employees to aid traffic modeling efforts.

Interviewing Staff and Training

Interviewing staff comprised employees from ETC, Vesta Rea & Associates, and ANIK International. Up to 33 interviewers participated in intercept survey collection, with the majority possessing prior experience surveying passengers in airports. Training on November 6th encompassed survey familiarization, team identification, and action planning. Interview teams

were divided into secured and non-secured area teams, each consisting of two to six individuals.

Secured area teams included at least one member who had undergone IAH's badging process, serving as an escort to several un-badged interviewers. Each team member wore a high-visibility blue vest over business casual attire and carried a letter of authorization signed by all relevant parties, explaining their purpose and the survey's approval of their tablet devices. Every interviewer and supervisor consistently wore a Houston Airport Survey badge.

Intercept Locations

Secured interview locations encompassed gates, food courts, and concession areas, while non-secured interview locations included baggage claim, carpool drop-off/pickup zones, rideshare drop-off/pickup zones, transit/shuttle drop-off/pickup zones, and airline check-in areas.

These zones were designated by comparing the flight level sampling plan to the active list of inbound and outbound flights. Larger survey teams were assigned to zones with the highest number of upcoming outbound flights. Supervisors consistently monitored the list of outbound flights to determine when and where survey teams should move or rotate.

During periods of peak traffic volume, each of the five terminals had at least one survey team operating within the secured area of the airport.

Random Sampling Methods

To ensure statistically valid data, interviewers utilized random sampling methods to mitigate unintentional biases in the data. Upon entering a surveying zone, each interviewer positioned themselves within a section of the passenger group and then approached the third nearest passenger, inquiring if they had used or would use ground transportation and if they were willing to participate in the survey. After completing a survey or encountering a refusal, the interviewer proceeded to the third passenger from that individual. If a non-randomly selected passenger expressed a desire to participate, the interviewer would explain the random sampling method and include them once the random sampling in that area was complete. Throughout this process, all team members-maintained line-of-sight contact with one another. The team leader oversaw the relocation of their team from one location to another after consulting with a project supervisor.

For potentially sensitive questions, such as household income, interviewers were instructed to provide the participant with answer options to select, ensuring privacy.

Supervisors closely monitored flight boards throughout the day to continuously adjust schedules for interviewers in secured and non-secured areas. As gates populated, teams were scheduled to zones for optimal sampling time periods for each flight within the area. During peak periods, when interviewing at gates, survey teams were dispatched to each terminal to cover their

designated survey zone 30 minutes before the earliest scheduled boarding within that zone. Most secured area zones contained 3-8 gates for coverage. Once enough randomly selected passengers participated at the gates within one zone for each flight, the survey team moved on to the next zone scheduled by their supervisor.

IAH had several designated areas for different types of drop-offs and shuttles. Interviewers were stationed in small teams at these zones during peak traffic periods to ensure adequate distribution of surveys by mode of ground access arrival/departure. During periods of low airport traffic, approximately one-third of the survey teams roved throughout food courts and concession areas to intercept both employees and passengers.

Table 6 displays the number of completed surveys collected by date. The table presents only cleaned records, with outlier responses removed. Although the sampling design did not specifically direct for data collection on Monday or Tuesday, a small number of surveys were collected on these days to help meet the overall sample goals.

TABLE 6: NUMBER OF PASSENGER RESPONSES, BY DATE

DATE	COMPLETE SURVEYS (POST CLEANING)
Monday, November 6, 2023	24
Tuesday, November 7, 2023	812
Wednesday, November 8, 2023	736
Thursday, November 9, 2023	732
Friday, November 10, 2023	19
Saturday, November 11, 2023	630
Total	**2,953**

4.0 DATA ANALYSIS

4.1 DATA CHECKS AND OUTLIERS

Field Oversight

ETC employed a real-time dashboard tool to monitor survey progress towards each level goal, as well as individual surveyor production and quality. Supervisors conducted several oversight steps regularly for each interviewer using the dashboard. These steps included checks on demographic percentages, average survey duration, number of surveys conducted per hour of work, number of surveys conducted by mode of ground access arrival/departure, number of surveys conducted per flight, and percentage of primary trip purposes.

Furthermore, supervisors acted as roving interviewers to regularly monitor different survey teams throughout a terminal or section. This ensured the utilization of random sampling and allowed for observation of other interviewer performances.

Passenger Data Cleaning

Before analyzing the data, ETC conducted data cleaning procedures, which involved removing incomplete and potentially inaccurate responses. The data collection phase of the project garnered 3,457 complete survey responses. These additional validations are vital in ensuring the reliability of the dataset for analysis. The following conditions were applied to determine which respondents to exclude from survey analysis or modeling. It is important to note that these categories are not mutually exclusive, meaning a respondent's data could have been flagged for more than one of these reasons:

- **Response Time Analysis**: Respondents who completed the survey in two and half minutes or less, leading to the exclusion of 37 responses. This criterion assumed that a minimum amount of time is necessary to thoughtfully answer the survey questions, and faster responses might indicate insufficient attention.
- **Travel Time and Distance Analysis**: Responses were scrutinized for travel times and distances that deviate significantly from expected norms, flagging any physically improbable travel scenarios. This step aids in detecting inaccuracies or erroneous entries, leading to the exclusion of 467 responses.
- **Flight details Screening**: Another set of 20 respondents reported incomplete flight details, such as missing valid flight numbers or departure times. Although this raised concerns about the completeness of their data, these entries were reviewed further. Upon closer examination, it was decided that these records, despite the missing

information, were still valid for the purposes of the survey and thus were retained for the final analysis.

The total number of usable responses was reduced to 2,953 for weighting, analysis, and modeling.

4.2 DATA WEIGHTING

This section documents the five main steps used to expand the air passenger ground access to reflect average weekday and weekend day non-connecting passengers at IAH. A more-detailed discussion of statistical precision and level of confidence can be found in the Data Weighting and Expansion Memorandum prepared by ETC Institute and included in the Appendix.

Step 1: Determine the Number of Non-Connecting Passengers Departing IAH During November 2023.

ETC Institute used passenger data from the Houston Airport Statistics (HAS) dashboard as the source of data for the population to which the survey sample was expanded[1]. According to the HAS dashboard, the total number of passengers, excluding connections, that departed from IAH between November 1-30, 2023 was 1,199,932 passengers.

Step 2: Determine the Seating Capacity on All Flights Departing IAH on an Average Weekday and Weekend Day.

Since the actual number of passengers on flights can vary significantly on any given day, ETC Institute used available seating capacity on departing flights as the basis for estimating the distribution of departing passengers by time of day and day of the week.

The total number of seats on all flights departing IAH during an average week in November 2023 was 519,214. The average number of seats per weekday was 76,763 (73.9% of all seats). The average number of seats per weekend day was 67,704 (26.1% of all seats). Details are provided in Table 1 and Table 2.

Step 3: Developing Weight Factors for Expanding the Survey Sample to the Average Number of Non-Connecting Departing Passengers on a Typical Weekday and Weekend Day

Using the data from Steps 1 and 2, ETC Institute developed weight factors for expanding the survey sample to the average number of weekday and weekend non-connecting departures at each of the two airports.

[1] Dashboard available at: https://app.powerbigov.us/view?r=eyJrIjoiMWMxMDkxNWMtZWI2Ny00NmNmLThhZDktMjc5ZjdiYjM1N2E5IiwidCI6IjU3YTg1YTEwLTI1OGItNDViNC1hNTE5LWM5NmM3NzIxMDk0YyJ9

Using the total number of non-connecting departing passengers in November 2024 of 1,199,932 from Step 1 and the estimated percentage of passengers departing on weekdays of 73.9% from Step 2, it was estimated that there were 887,006 non-connecting departing passengers on weekdays between November 1-30, 2024. Since there were 22 weekdays in November 2024, the average number of non-connecting departing passengers per weekday was 40,318.

Table 7 shows the methodology behind the development of weight factors for the weekday sample at IAH, the process involved applying the estimated percentage of seat capacity by time of day (derived from Step 2) to the estimated number of non-connecting departing passengers per weekday. This estimation was conducted for each of the six designated time periods. Subsequently, the weight factor for each time period was established by dividing the estimated number of departing passengers during that period by the number of surveys completed for passengers on flights departing during the same time period.

TABLE 7: WEIGHT FACTORS FOR IAH AIRPORT FOR WEEKDAYS

TIME OF DAY	% SEATS DEPARTING	ESTIMATED AVG WEEKDAY PASSENGER DEPARTURES	NUMBER OF COMPLETED SURVEYS	WEIGHT FACTORS
Before 9:00AM	17.7%	7,133	198	36.02
9:00-11:59AM	21.2%	8,555	562	15.22
12:00-02:59PM	19.3%	7,772	548	14.18
03:00-5:59PM	12.0%	4,829	440	10.97
6:00-8:59PM	26.6%	10,724	488	21.97
After 9:00PM	3.2%	1,305	87	15.00
Total	**100.00%**	**40,318**	**2,323**	**N/A**

Using the total number of non-connecting departing passengers in November 2024 of 1,199,932 from Step 1 and the estimated percentage of passengers departing on weekend days of 26.1% from Step 2, ETC Institute estimated that there were 312,926 non-connecting departing passengers on weekends between November 1-30, 2024. Since there were 8 weekend days in November 2023, ETC Institute determined that the average number of non-connecting departing passengers per weekend day was 39,116.

Table 8 shows the development of weight factors for the weekend sample at IAH.

TABLE 8: WEIGHT FACTORS FOR IAH AIRPORT FOR A WEEKENDS

TIME OF DAY	% SEATS DEPARTING	ESTIMATED AVG WEEKEND PASSENGER DEPARTURES	NUMBER OF COMPLETED SURVEYS	WEIGHT FACTORS
Before 9:00AM	15.9%	6,223	64	97.23
9:00-11:59AM	19.2%	7,516	151	49.77
12:00-02:59PM	14.8%	5,781	138	41.89
03:00-5:59PM	17.6%	6,892	100	68.92
6:00-8:59PM	29.2%	11,411	131	87.10
After 9:00PM	3.3%	1,293	46	28.10
Total	**100.00%**	**39,116**	**630**	**N/A**

4.3 SURVEY ANALYSIS

This section provides summaries and statistics for selected survey questions, drawing from responses collected from 2,953 IAH air passengers, with a weighted total representing average weekday and weekend day non-connecting passengers of 79,434. For a detailed breakdown of survey tabulations for each question, please consult Appendix B, and for the outcomes of the employee survey, refer to Appendix D.

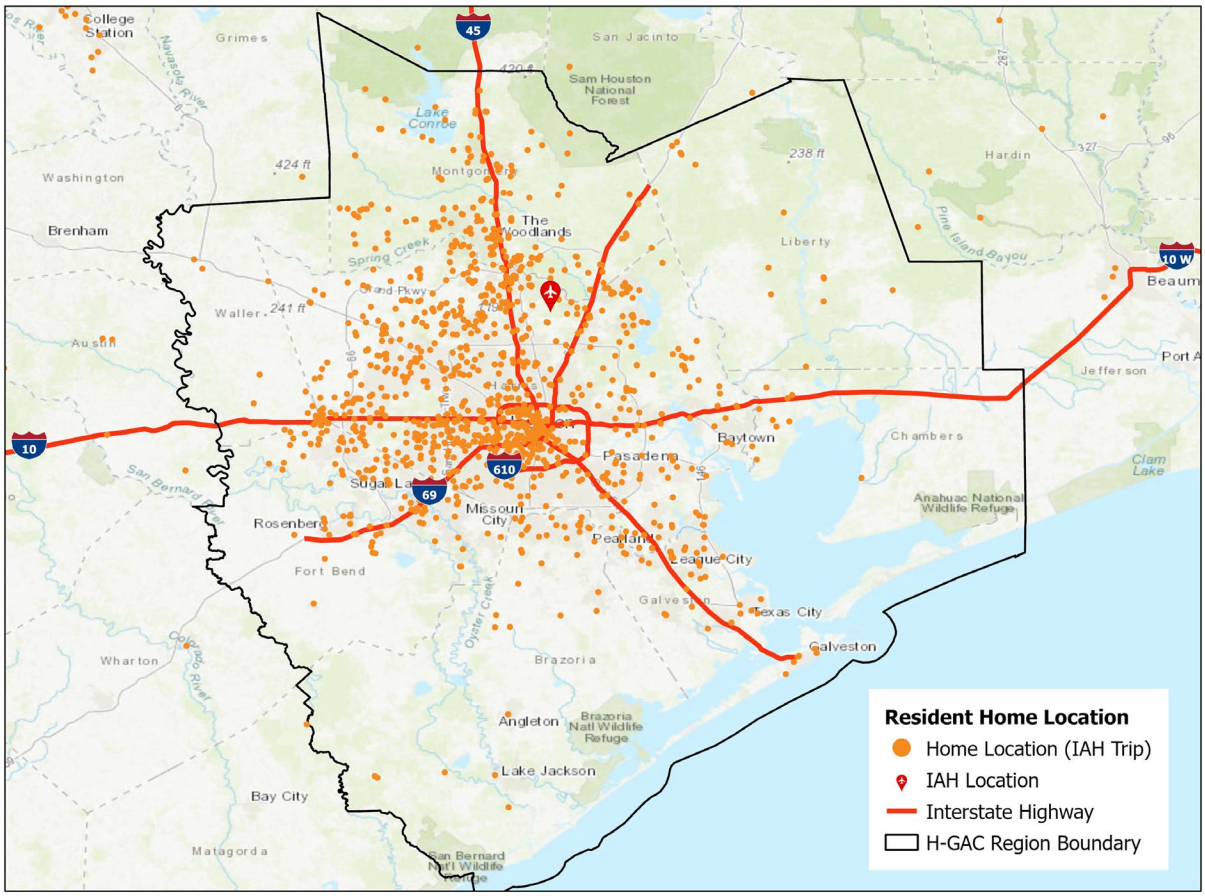
Table 9 presents the weighted and unweighted count and percentage categorized by resident status. Residents are defined as respondents who indicated they reside in the eight county H-GAC region (see Figure 5 for the regional boundary). According to the weighted data, approximately 52% of respondents are residents of the H-GAC region.

TABLE 9: RESIDENT STATUS

RESIDENT STATUS	COUNT	PERCENT	WEIGHTED COUNT	WEIGHTED %
Yes	1,553	52.6%	41,140	51.8%
No	1,400	47.4%	38,295	48.2%
Total	**2,953**	**100.0%**	**79,434**	**100.0%**

Of the 1,553 respondents who indicated they live in the H-GAC regio, they were asked to provide their home location. Figure 5 illustrates that the home locations of these respondents are primarily concentrated within the central business district (CBD) districts, with smaller distributions extending to the north and west.

FIGURE 5: RESIDENT HOME LOCATION AND H-GAC REGION



4.4 GROUND ACCESS DEPARTURE/ARRIVAL QUESTIONS

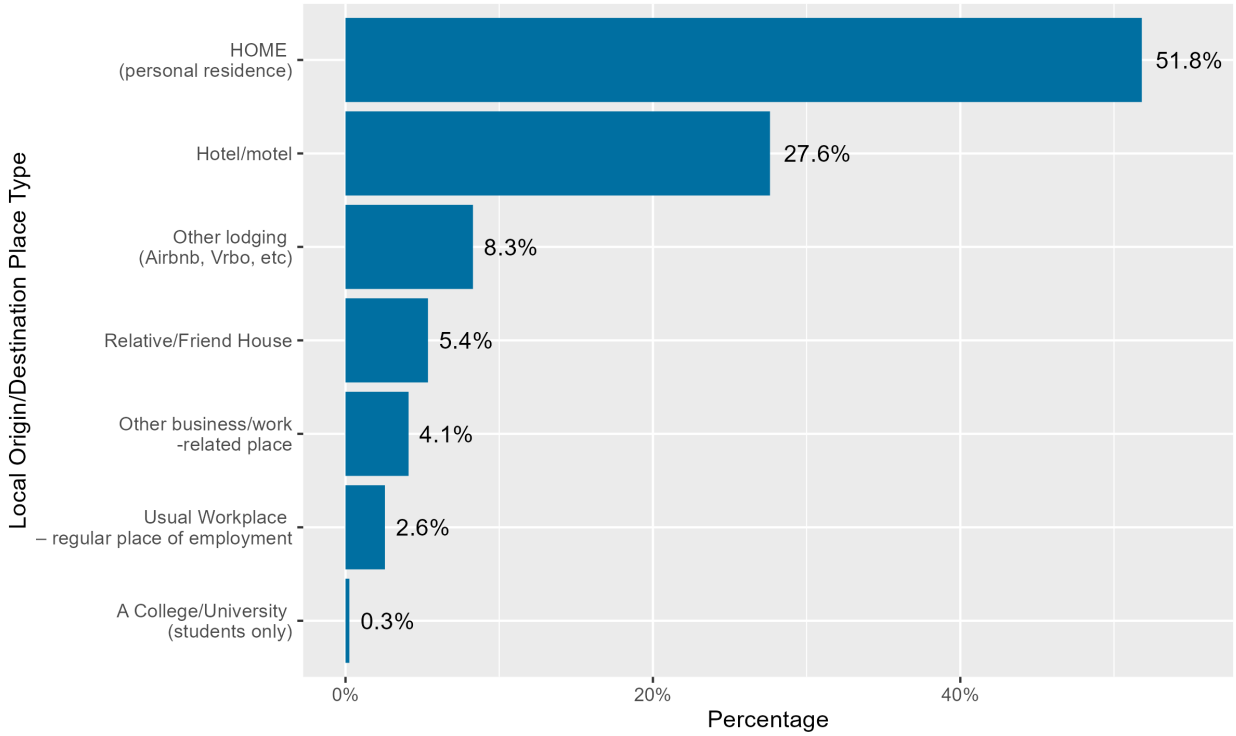
ETC designed the administration effort to collect data from both departing and arriving passengers; however, deplaned respondents might have been less inclined to participate in surveys upon landing due to various factors such as time constraints and the urgency to reach their destinations. Table 10 provides data on completed surveys that were arrivals and departures at IAH airport, showing that there were 386 arrivals and 2,567 departures, totaling 2,953 instances. When weighted, arrivals account for 12% of the total, while departures account for 88%.

TABLE 10: NUMBER OF TRAVEL PARTY BY ARRIVALS/DEPARTURES

ARRIVALS/DEPARTURES	COUNT	PERCENT	WEIGHTED COUNT	WEIGHTED PERCENT
Arrivals	386	13.1%	9,322	11.7%
Departures	2,567	86.9%	70,113	88.3%
Total	**2,953**	**100.0%**	**79,434**	**100.0%**

To render a complete characterization of all types of IAH trips, departing respondents (n = 2,567) were asked about the origin of their trip to the airport, while arriving respondents (n = 386) were queried regarding the destination of their trip from the airport. As shown in Figure 6, around 52% of respondents indicated that their trip either originated from or ended at home.

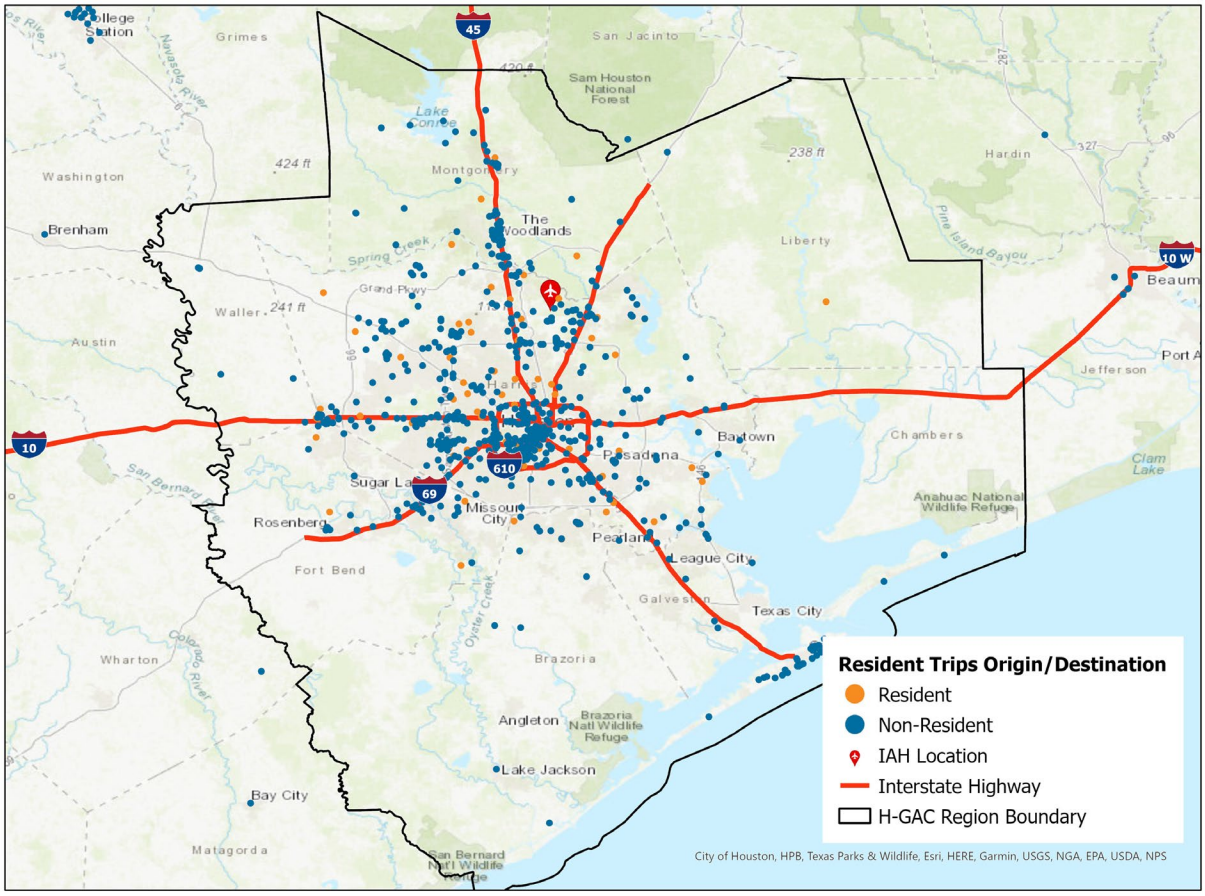
FIGURE 6: LOCAL ORIGIN/DESTINATION PLACE TYPE



Source: 2023 HGAC IAH Passenger Survey, Weighted

For the approximately 48% of respondents who did not start or end their trip at home, specific details about their trip's origin or destination were requested. Figure 7 shows the non-home-based trips that arrived at or departed from IAH. These locations are predominantly concentrated within the central business district (CBD), with smaller numbers occurring north of Houston in suburbs like The Woodlands.

FIGURE 7: NON-HOME-BASED ORIGIN/DESTINATION LOCATIONS



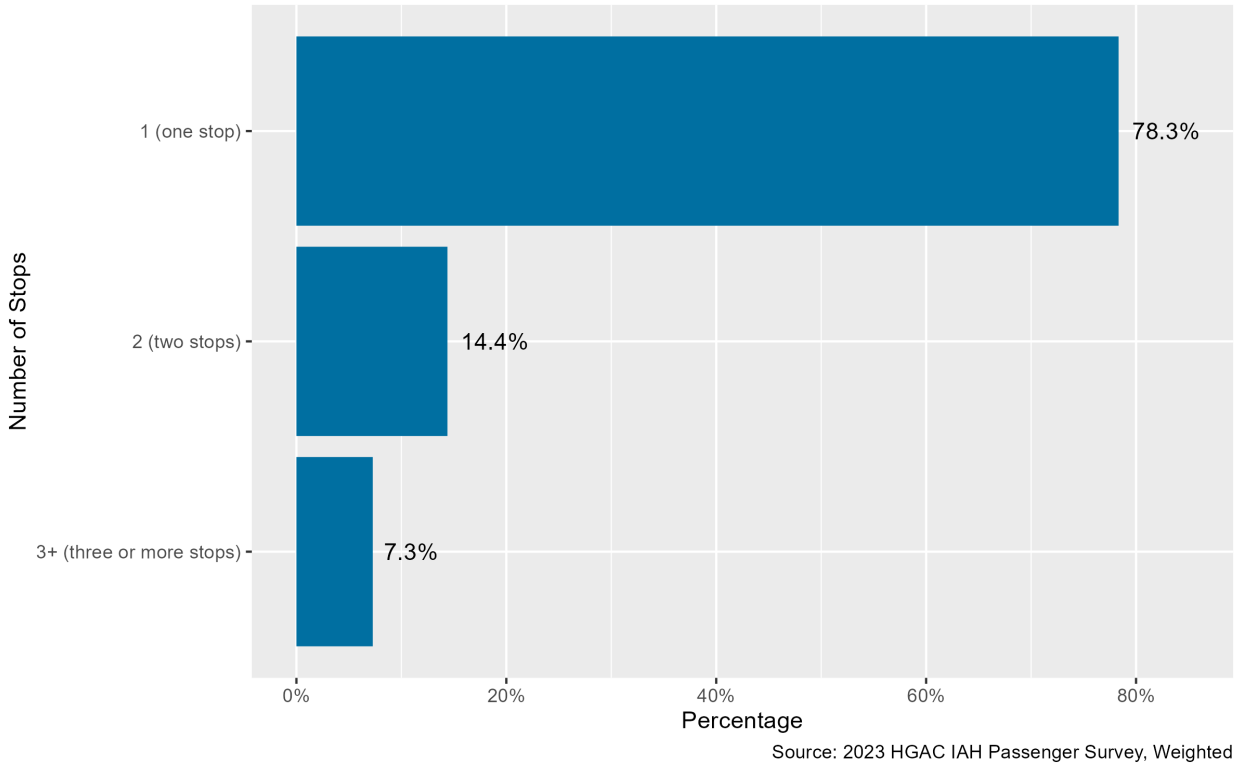
To ascertain whether respondents made intermediate stops while traveling to or from IAH, departing respondents were asked if they traveled directly from their origin location to the airport without any stops, while arriving respondents were queried if they would travel directly from the airport to their destination without any stops. Table 11 shows that approximately 90% of respondents (weighted) did not or will not make any stops.

TABLE 11: INTERMEDIATE STOPS

TRAVEL DIRECTLY TO/FROM LOCAL ADDRESS	COUNT	PERCENT	WEIGHTED COUNT	WEIGHTED PERCENT
Yes	2,619	88.7%	71,246	89.7%
No, I made other stops	313	10.6%	7,753	9.8%
No, I will make stops	21	0.7%	434	0.5%
Total	**2,953**	**100.0%**	**79,434**	**100.0%**

The 10% of respondents who indicated making an intermediate stop were asked to provide the number of stops made and the location of the last stop for departing respondents, or the number they will make and the location of the first egress stop for arriving respondents. Figure 8 illustrates the number of stops between local addresses and the airport, with approximately 78% of respondents reporting making just one stop.

FIGURE 8: NUMBER OF STOPS BETWEEN LOCAL ADDRESS AND AIRPORT



Source: 2023 HGAC IAH Passenger Survey, Weighted

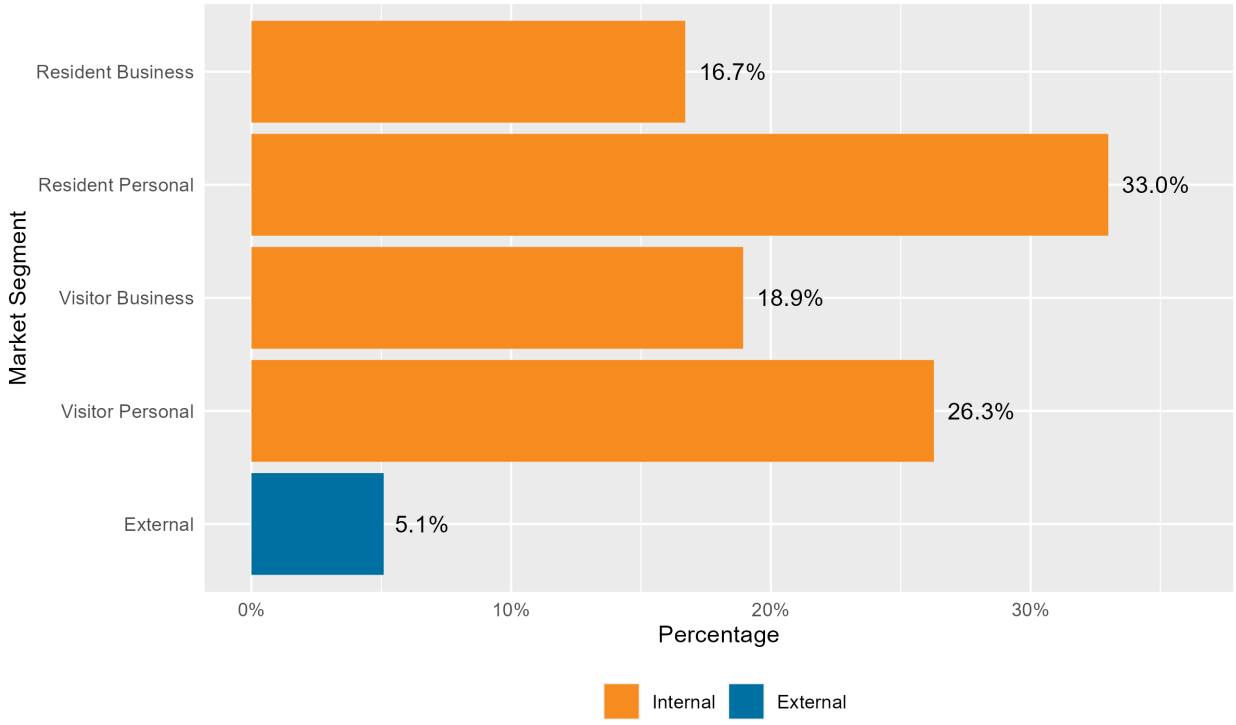
The airport ground access survey serves as quantitative input for the regional travel demand model. For modeling purposes, trips are typically categorized into market segments that characterize primary trip behaviors to and from IAH. For this application, five market segments were developed. First, trips were classified as either internal or external based on the non-airport trip end that fall either within or outside the H-GAC region (boundaries are shown in Figure 5). An external air passenger was defined as an individual whose origin/last access or destination/first egress was located outside the H-GAC region. Subsequently, we assigned resident or visitor status to internal air passengers and identified their trip purpose (business or personal) to the airport. The resulting market segments are defined as follows:

1. **Resident Business**: Resides within the H-GAC region; primary trip purpose was business related.

2. **Resident Personal**: Resides within the H-GAC region; primary trip purpose was non-business related.
3. **Visitor Business**: Resides outside of the H-GAC region; primary trip purpose was business related.
4. **Visitor Personal**: Resides outside of the H-GAC region; primary trip purpose was non-business related.
5. **External**: Resident or visitor making a trip for any purpose, with a trip origin or destination that was outside of the H-GAC region.

Figure 9 shows the distribution of primary market segments for travel parties arriving or departing at IAH. A travel party refers to air travelers who journey to/from the airport together. Approximately 5% of travel parties made a trip that was classified external, while the remaining 95% were internal. Among the internal trips, personal travel exceeded business travel for both residents and visitors.

FIGURE 9: AIRPORT TRAVEL PARTIES BY MARKET SEGMENT

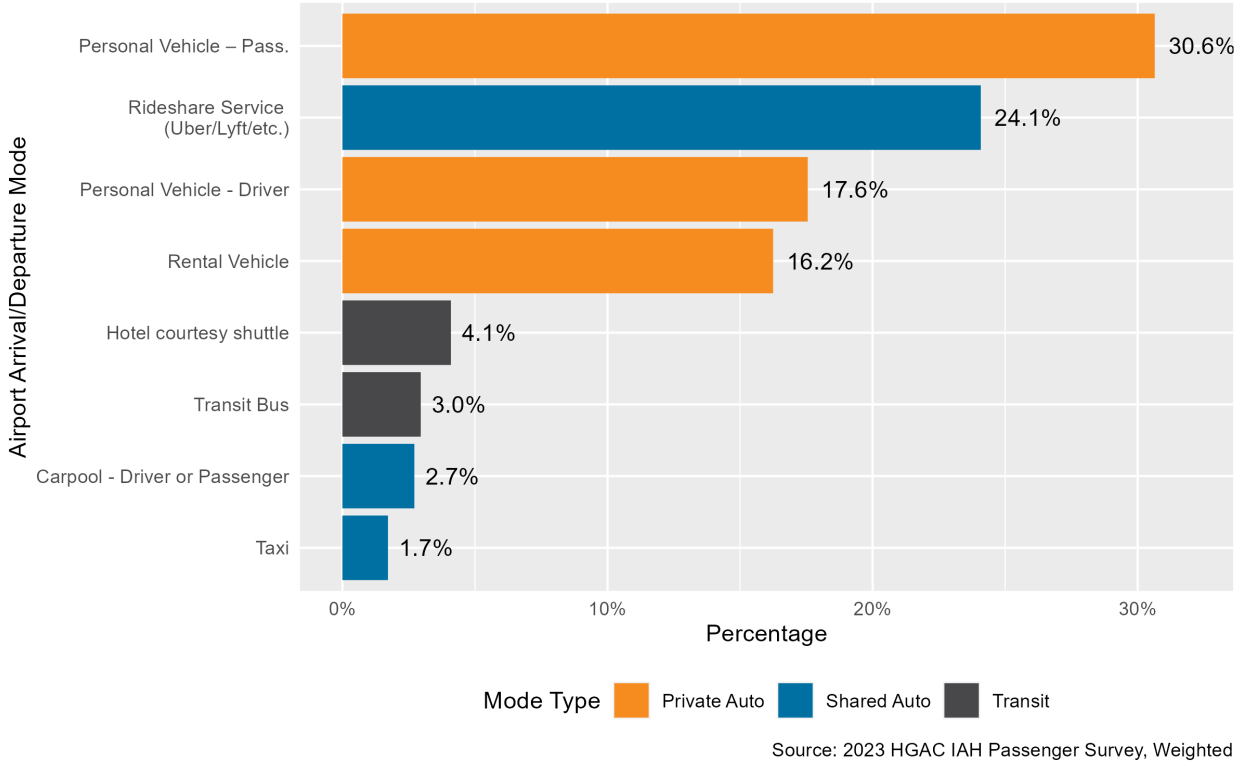


Source: 2023 HGAC IAH Passenger Survey, Weighted

Respondents were asked about the transportation mode their group used to access or egress IAH. As seen in Figure 10 below, personal vehicles were the primary mode of transportation, followed by rideshare services like Uber or Lyft. Overall, automobiles were the predominant

mode, constituting approximately 93% of all access and egress trips. In contrast, only a small fraction (around 7%) utilized transit options such as hotel courtesy shuttles or public transit.

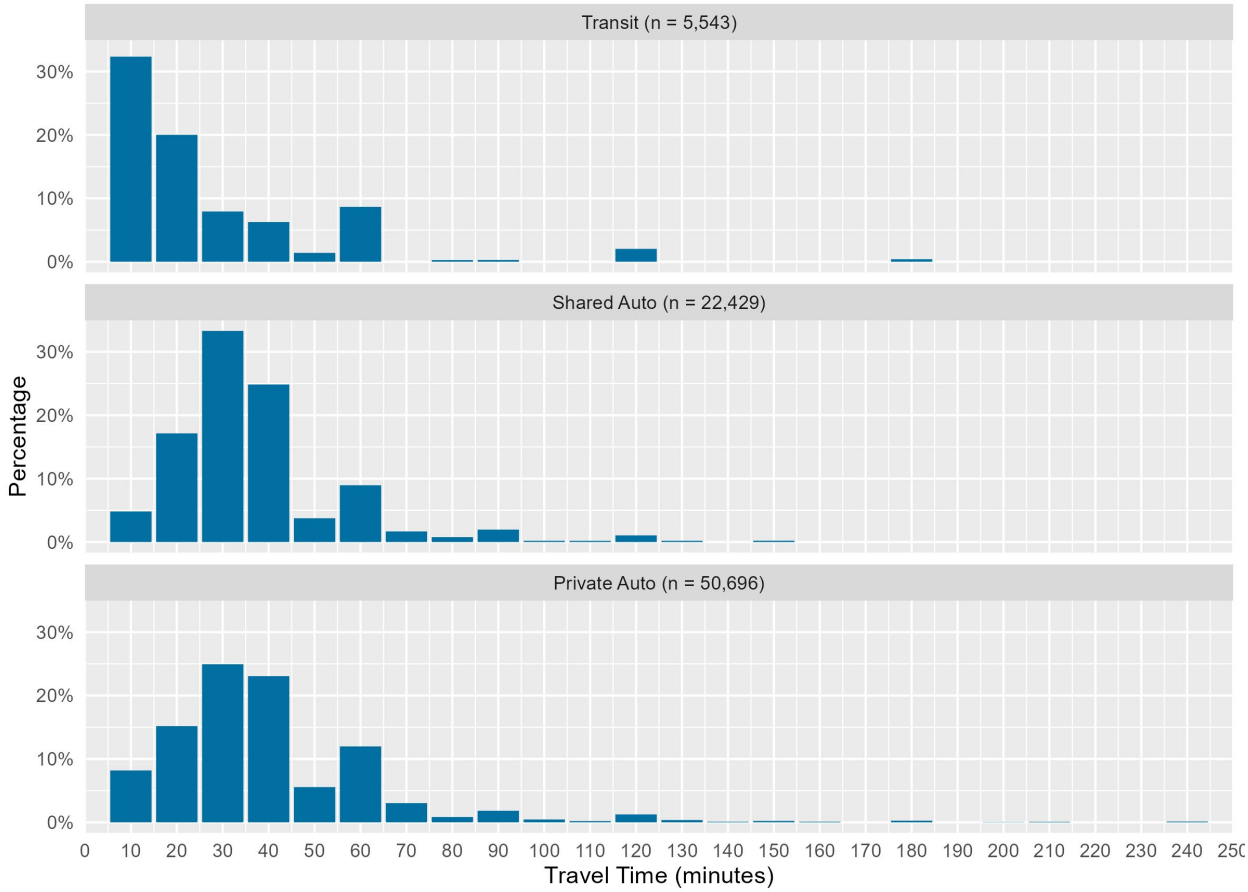
FIGURE 10: AIRPORT ARRIVAL/DEPARTURE MODE



Source: 2023 HGAC IAH Passenger Survey, Weighted

Figure 11 illustrates the distribution of total travel time that elapsed while respondents accessed or egressed the airport by private auto or transit modes. A small portion of all respondents reported an access trip of greater than 60 minutes, but the majority of trips were completed within 60 minutes.

FIGURE 11: TRAVEL TIME FROM ORIGIN/LAST ACCESS OR DESTINATION/FIRST EGRESS



Source: 2023 HGAC IAH Passenger Survey, Weighted

Table 12 shows travel time statistics by mode group. The weighted average travel times were approximately equal for private auto and shared auto, both totaling around 40 minutes, while transit had an average travel time of 24 minutes.

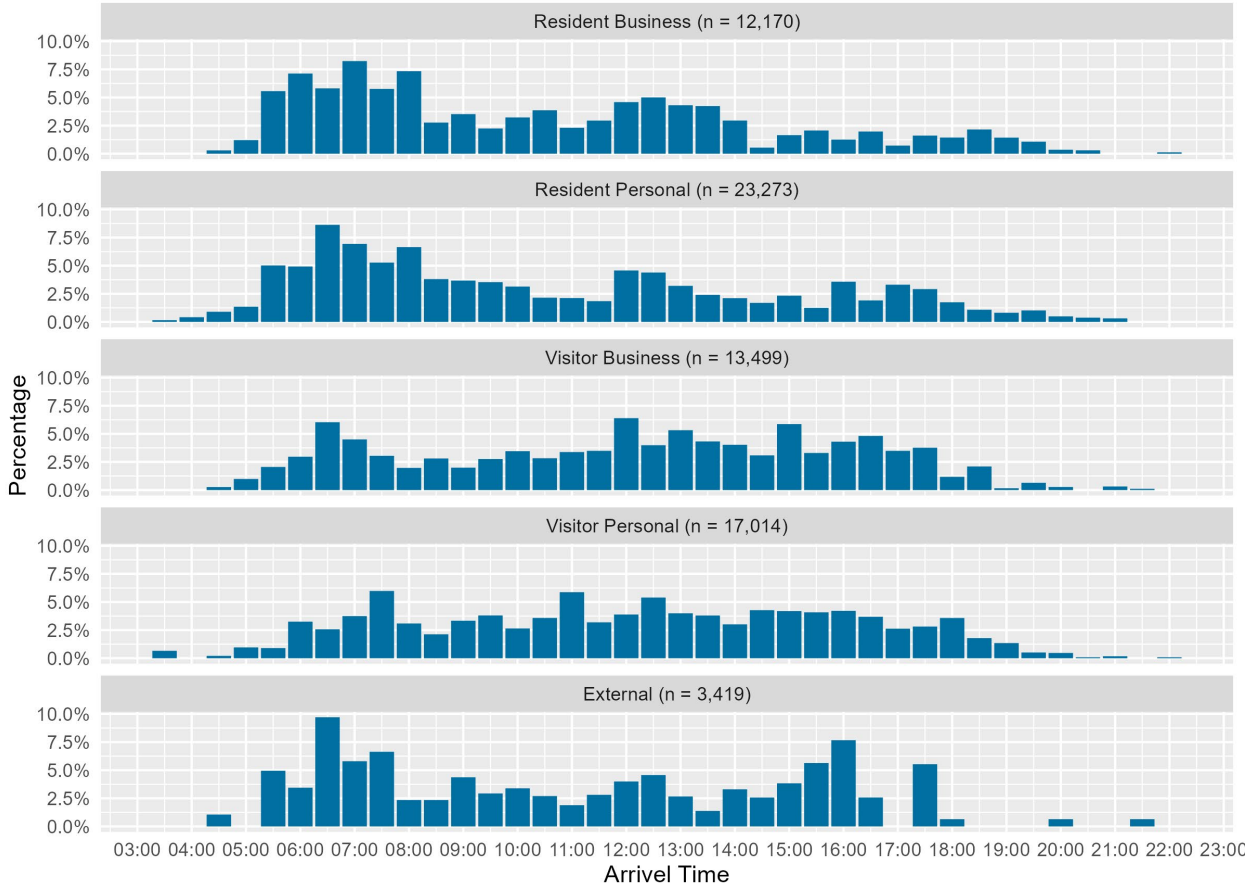
TABLE 12: TRIP DISTANCE AND TRAVEL TIME STATISTICS BY MODE GROUP

TRAVEL MODE	TRAVEL TIME MEDIAN	TRAVEL TIME AVERAGE	TRAVEL TIME AVERAGE (WEIGHTED)
Private Auto	40	42	41
Shared Auto	35	40	39
Transit	18	26	24
Total	**35**	**40**	**39**

Figure 12 shows the distribution of airport ground access arrival times by market segment for all departing travel parties. Time intervals begin at 3:00 AM and proceed at 30-minute increments

to 10:30PM. Since very few flights depart after 10PM, the sampling plan did not collect surveys from travelers arriving after this time. Residents tended to arrive at the airport earlier than visitors, regardless of the trip purpose.

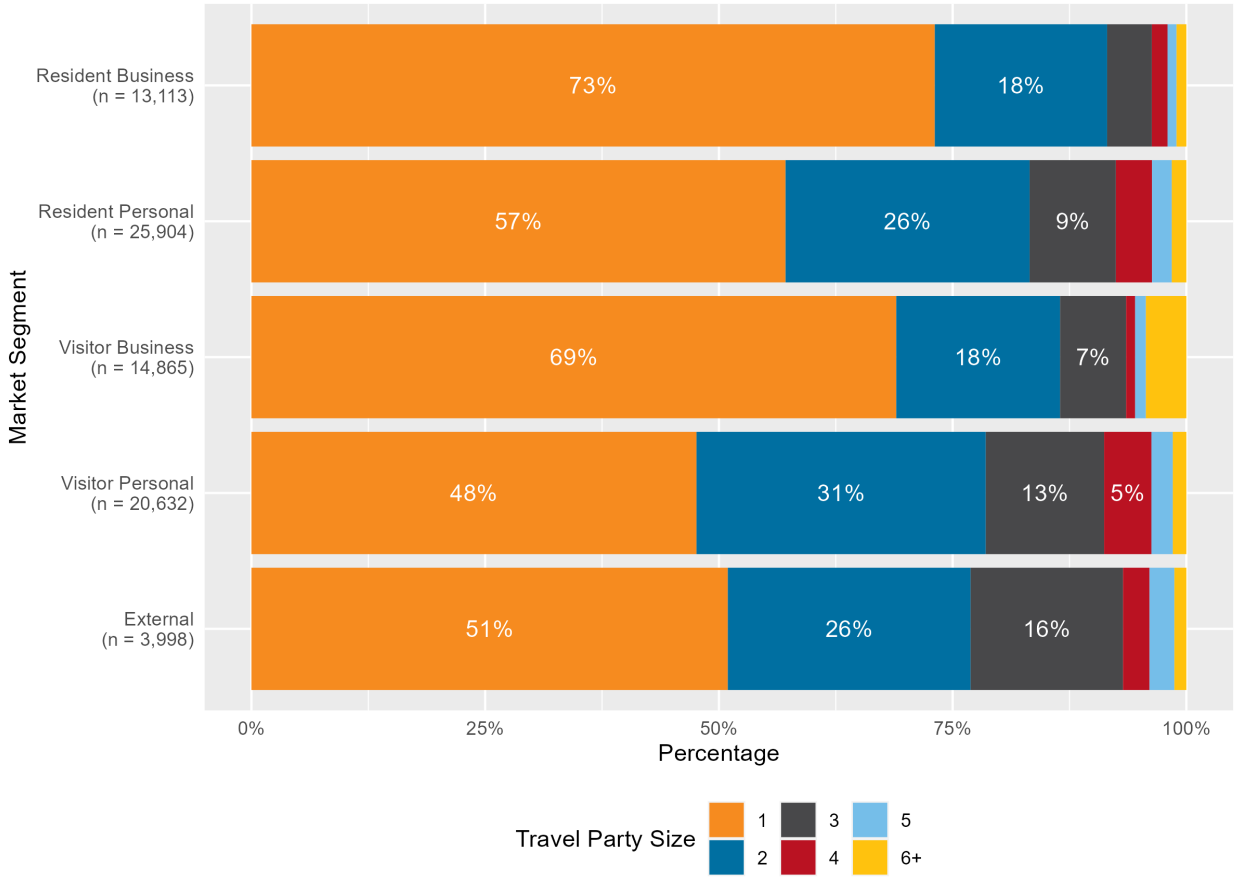
FIGURE 12: DISTRIBUTION OF AIRPORT GROUND ACCESS ARRIVAL TIME BY MARKET SEGMENT



Source: 2023 HGAC IAH Passenger Survey, Weighted

Figure 13 illustrates the distribution of airport travel party size by market segment. Party sizes range from 1 (individual travelers) to groups of 6 or more. Business trips predominantly consist of individual travelers, whereas trips for other purposes are more commonly undertaken in groups. Party sizes of three or more people are more prevalent among the external and visitor personal market segments.

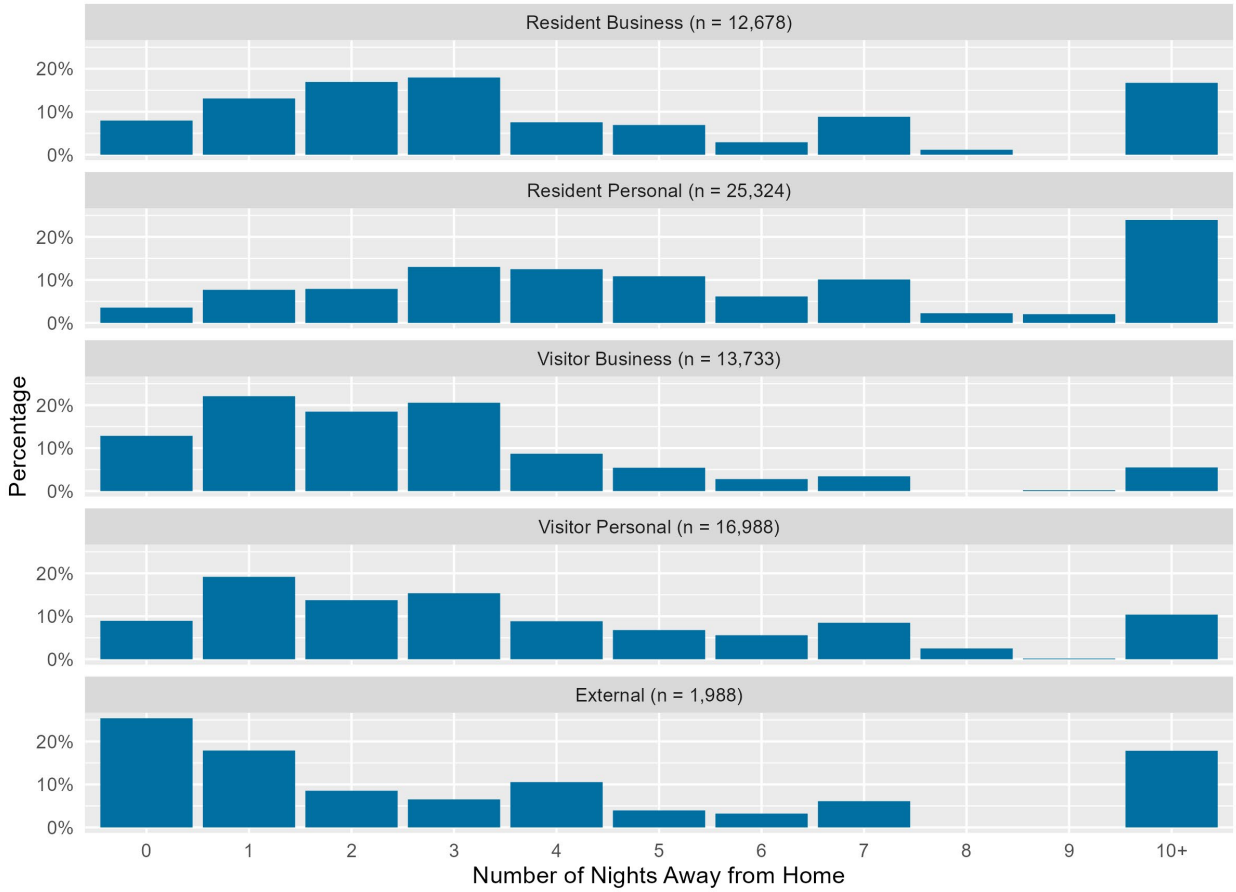
FIGURE 13: DISTRIBUTION OF TRAVEL PARTY SIZE BY MARKET SEGMENT



Source: 2023 HGAC IAH Passenger Survey, Weighted

Figure 14 illustrates the distribution of nights spent away from home by traveler party market segment. Respondents who refused or did not provide an answer to this question are excluded from the analysis. Most travel parties spent more than 3 nights away from home, with resident groups more commonly reporting trips lasting 10 or more nights. A small portion of all segments reported same-day trips. For external trips, the most common duration was less than one day, accounting for approximately 25% of external trips, followed by trips lasting 10 or more days, representing approximately 18% of the total external trips.

FIGURE 14: NUMBER OF NIGHTS AWAY FROM HOME BY MARKET SEGMENT



Source: 2023 HGAC IAH Passenger Survey, Weighted

4.5 PARKING QUESTIONS

Travel parties accessing the airport by personal vehicle (either as a driver or passenger) or carpool (as a driver or passenger) were surveyed regarding their parking arrangements. As Table 13 indicates that approximately 36% of travel parties utilized paid lots or garages across all market segments. Over 40% of both resident business and personal trips utilized paid parking.

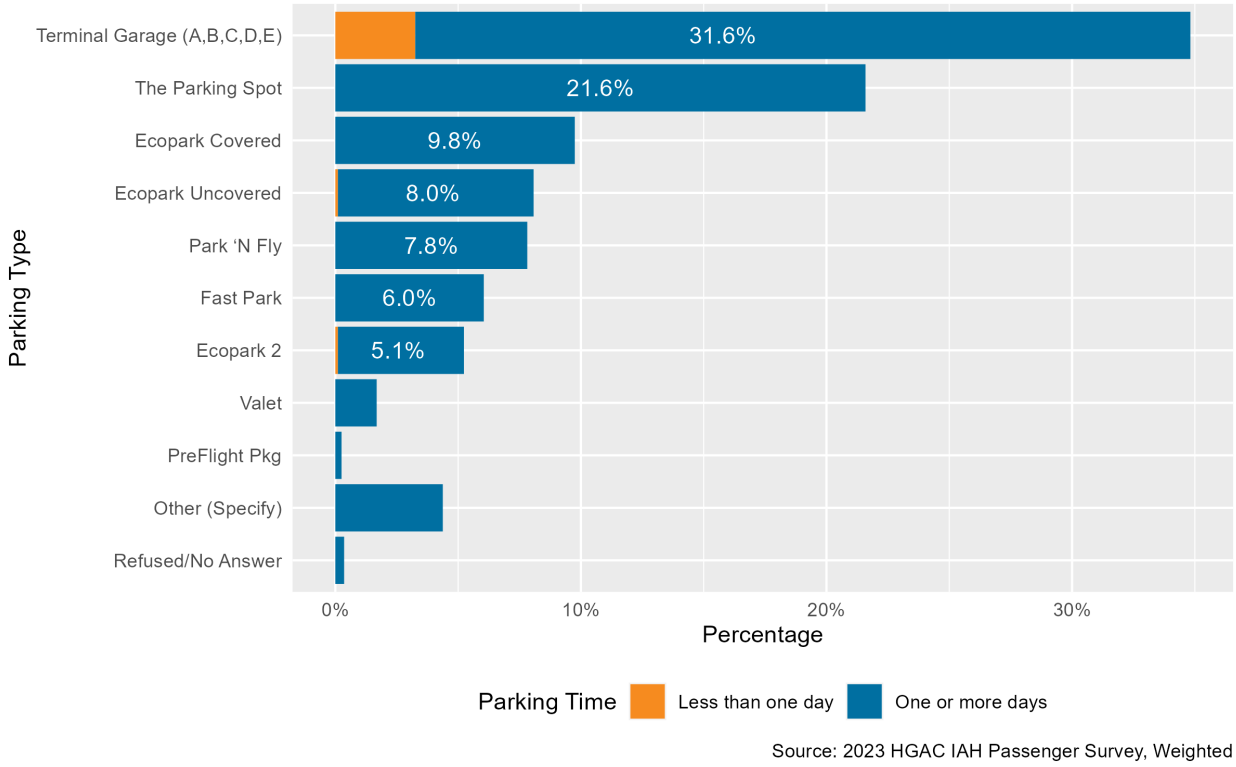
Those who opted for paid parking were further questioned about the specific lot or garage they utilized, the duration of their parking, the associated cost, and the three primary factors they deemed most important when selecting a parking lot or garage.

TABLE 13: USED PAID LOT/GARAGE (WEIGHTED)

Used paid lot/garage	RESIDENT BUSINESS		RESIDENT PERSONAL		VISITOR BUSINESS		VISITOR PERSONAL		EXTERNAL		TOTAL	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Yes	4,297	49.3%	8,573	42.6%	65	4.3%	167	2.4%	1,208	52.4%	14,310	36.18%
No	4,195	48.1%	10,897	54.2%	1,348	89.0%	6,297	91.3%	894	38.7%	23,631	59.74%
Other	165	1.9%	569	2.8%	64	4.2%	143	2.1%	175	7.6%	1,116	2.82%
No Answer	65	0.8%	72	0.4%	37	2.5%	293	4.2%	30	1.3%	497	1.26%
Total	**8,723**	**100.0%**	**20,111**	**100.0%**	**1,514**	**100.0%**	**6,899**	**100.0%**	**2,308**	**100.0%**	**39,555**	**100.0%**

Figure 15 displays the lots or garages utilized by parties parking for varying durations—either less than a day or two or more days. The most used parking garages are Terminal Garage (A, B, C, D, E) and The Parking Spot, accounting for 35% and 22% of parking, respectively. Concerning parking duration, a minority of travel parties (about 3%) parked for less than one day, with Terminal Garage (A, B, C, D, E) being the preferred option for short-term parking needs.

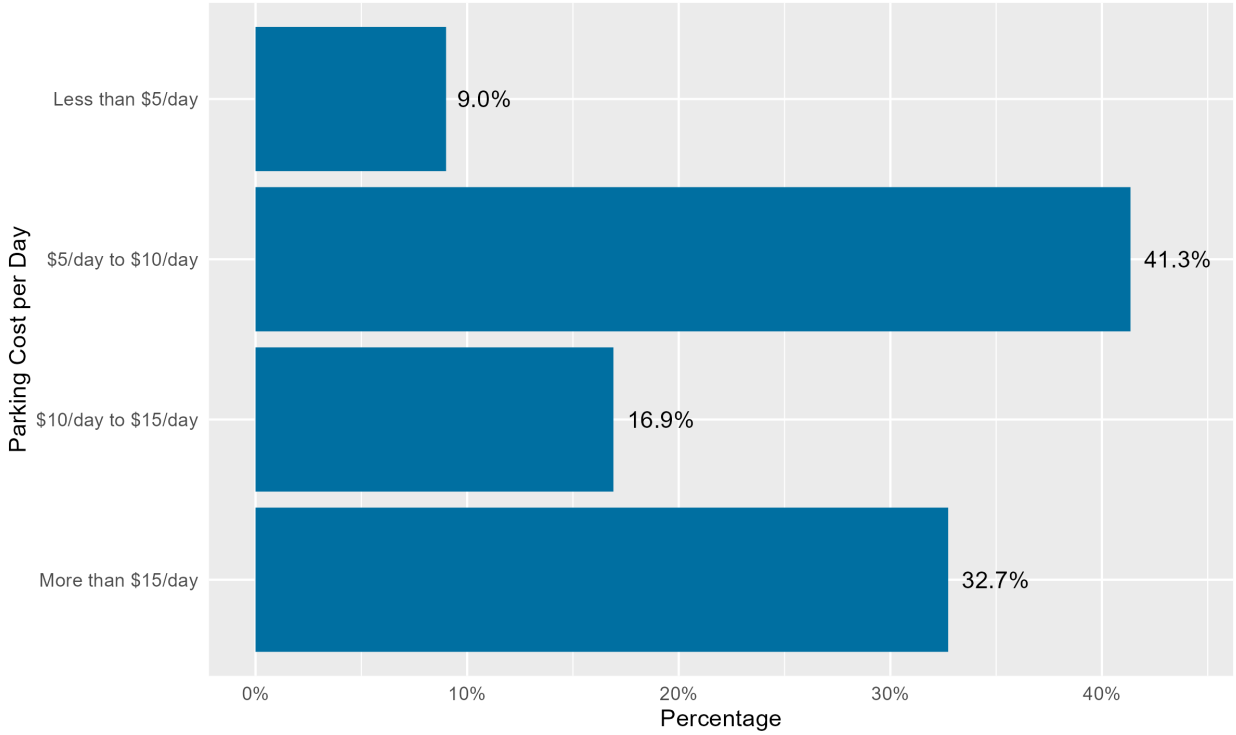
FIGURE 15: PARKING TYPE BY PARKING TIME



Source: 2023 HGAC IAH Passenger Survey, Weighted

Figure 16 displays the distribution of parking reported costs per day. Most of the parking costs were $5 to $10 per day, followed by more than $15 per day. Note that for respondents who parked for less than one day, the parking cost for less than 24 hours counts as the cost for one day.

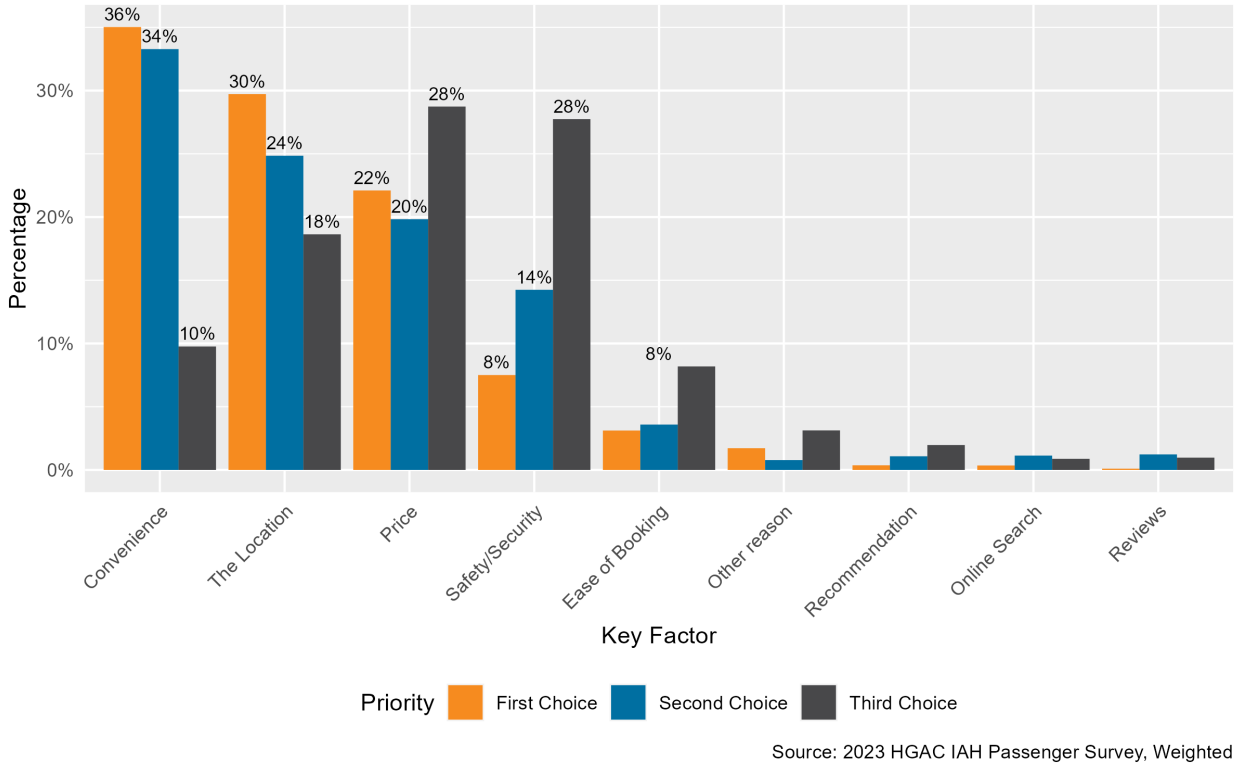
FIGURE 16: PER DAY PARKING COST



Source: 2023 HGAC IAH Passenger Survey, Weighted

Figure 17 illustrates the primary factors deemed most significant when selecting a parking lot or garage. Respondents prioritized convenience, location and price, in that sequence. Notably, convenience emerged as the first choice, favored by approximately 35% of respondents. Additionally, location was the second most important factor, with roughly 30% of participants emphasizing its importance.

FIGURE 17: THREE KEY PARKING LOCATION FACTORS CONSIDERED MOST IMPORTANT WHEN CHOOSING A PARKING LOT/GARAGE

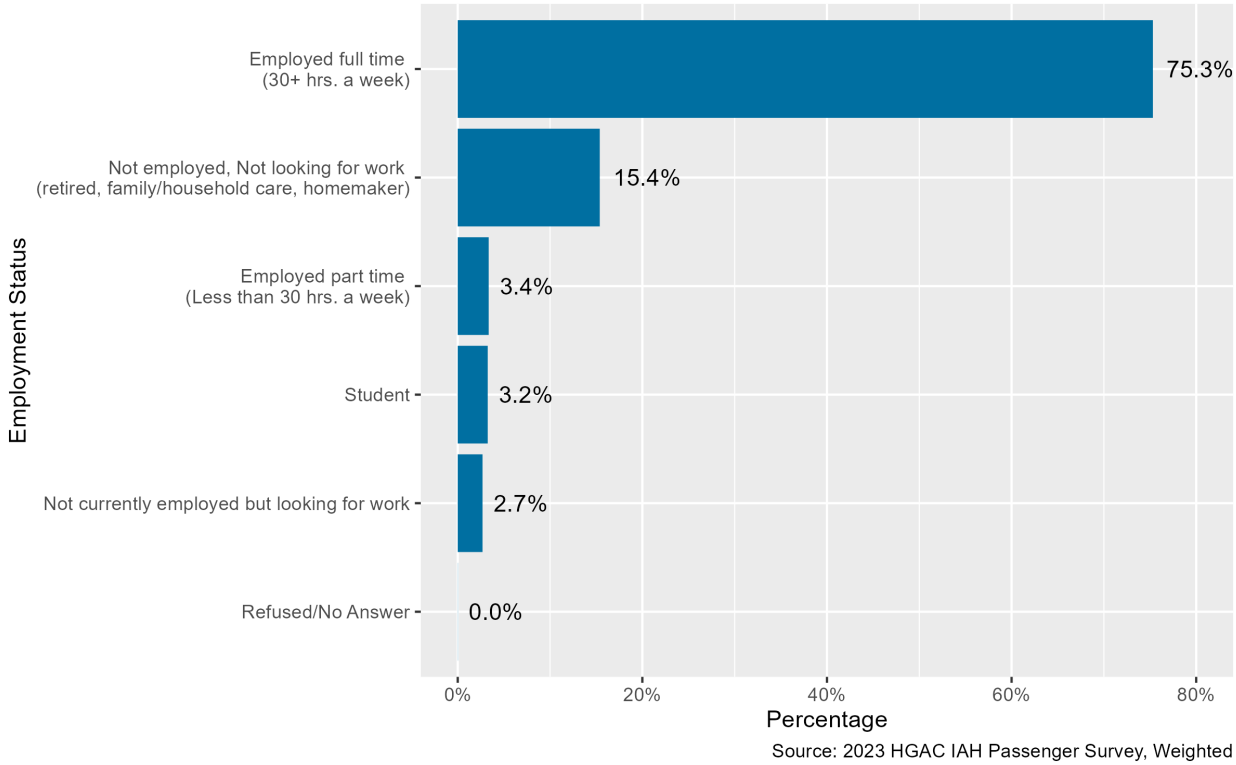


Source: 2023 HGAC IAH Passenger Survey, Weighted

4.6 DEMOGRAPHIC QUESTIONS

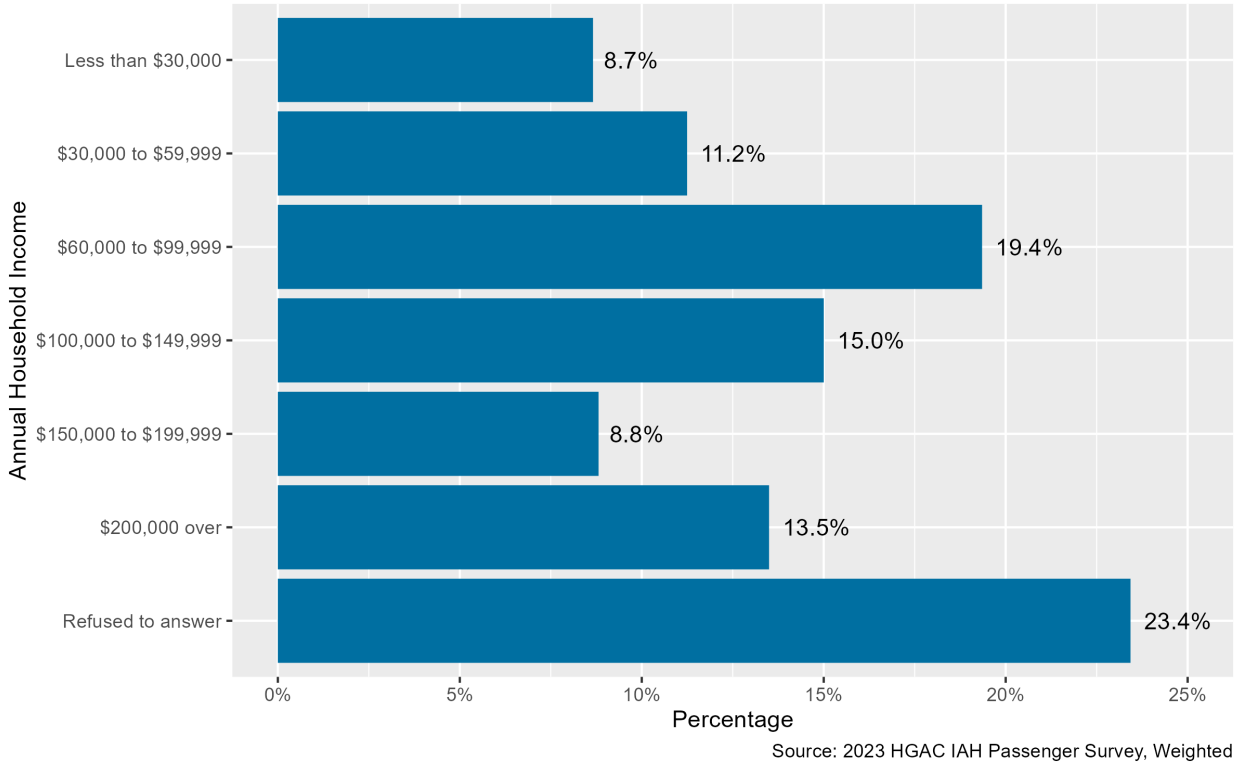
The final section of the survey collected demographic information to confirm that the sample contained a diverse cross section of travelers. About 75% of respondents were employed full time (Figure 18) and the median household income category for those who provided a response was $60,000–$99,999 (Figure 19).

FIGURE 18: EMPLOYMENT STATUS



Source: 2023 HGAC IAH Passenger Survey, Weighted

FIGURE 19: ANNUAL HOUSEHOLD INCOME



Source: 2023 HGAC IAH Passenger Survey, Weighted

Respondents were asked to select their ethnic or racial group they identify with.

TABLE 14: RACE/ETHNICITY (SELECT ALL THAT APPLY)

RACE/ETHNICITY	COUNT	PERCENT	WEIGHTED COUNT	WEIGHTED PERCENT
American Indian or Alaska Native	35	1.2%	925	1.1%
Native Hawaiian or Pacific Islander	19	0.6%	440	0.5%
Asian	229	7.6%	6,441	8.0%
White/Caucasian	1,597	52.9%	40,293	49.8%
Black/African/African American	436	14.4%	13,299	16.5%
Hispanic/Latino	648	21.5%	17,965	22.2%
Other	55	1.8%	1,483	1.8%
Total	**2,953**	**N/A**	**79,434**	**N/A**

5.0 CONCLUSION

In the autumn of 2023, the Houston-Galveston Area Council (H-GAC), in collaboration with the ETC and RSG, conducted a comprehensive passenger survey at George Bush Intercontinental Airport (IAH). This survey aimed to capture various aspects of passenger travel, including their mode of accessing the airport, arrival or departure times, trip purposes, as well as origin and destination details.

The objective of the survey was to collect data from 3,200 arriving passengers. Following outlier analysis, the final dataset comprised 2,953 completed surveys.

The data acquired through this survey will be utilized for the airport passenger ground access model. This model explicitly accounts for all passenger-related ground-access travel to and from the airports, including trips made by both residents and visitors, as well as those made to and from the airports to serve the passengers. It encompasses all ground modes of travel, such as transit, rental cars, hotel shuttles, taxis, and ride-hailing services.