

# Measuring Success: Transportation Improvements along Sandy Boulevard between NE 13<sup>th</sup> and NE 47<sup>th</sup> Avenues



## FINAL REPORT

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## **I. Background**

The Portland City Council adopted the Sandy Boulevard Resurfacing and Streetscape Project Plan on April 6, 2005. The Plan recommended a variety of transportation infrastructure improvements along the section of Sandy Boulevard between NE 13<sup>th</sup> and NE 47<sup>th</sup> Avenues. Sam Adams, Commissioner in Charge of Transportation, directed project staff to “measure success” in order to evaluate the public value of capital investment in infrastructure improvements. Construction finished in June, 2007.

The Sandy Boulevard Plan is the first planned capital improvement project for which the City’s Office of Transportation attempted to measure the improvements for results. This performance measurement pilot project will test a new approach which, if successful, may be applied to an array of PDOT’s capital infrastructure projects in the future.

This report describes the purpose of the pilot project, the qualitative and quantitative data the pilot project used to evaluate the baseline and post-construction conditions within the project area, the main goals of the capital project, and the physical improvements used to achieve those goals. It includes a description of baseline conditions observed before construction began and the outcomes of the post-construction evaluation. Appendices contain more detailed information about the data collection methods and analysis.

## **II. Pilot Project Purpose and Methodology**

The purpose of the pilot project is to analyze data collected before and after the installation of infrastructure improvements along Sandy Boulevard, in order to determine whether the improvements have produced the desired results.

While the Sandy Boulevard Resurfacing and Streetscape Project was under construction, independent changes took place, such as demographic shifts, traffic volumes, and the price of fuel, making it difficult to establish a direct cause and effect relationship between infrastructure improvements and post-construction results. In designing our measurement methodology, we have attempted to take external factors into account wherever possible.

Drawing on the goals and objectives identified in the Sandy project plan, and conversations with internal subject matter experts about how and what to measure, the pilot is focused on measuring the achievement of four main goals:

- 1) Enhancing bicycle and pedestrian safety;
- 2) Improving driver’s safety and convenience and accessibility;
- 3) Strengthening and supporting the community identity; and
- 4) Increasing safety and convenience for transit users.

The pilot project gathered data to measure the achievement of these four goals in three project areas where key streetscape improvements were made. Data was gathered at: intersections at 22nd and Sandy (Project Area 5), 31<sup>st</sup> and Sandy (Project Area 10), 35<sup>th</sup> and Sandy (Project Area 13), and the portion of the project that intersects the Hollywood

business district (Sandy Boulevard between NE 37<sup>th</sup> to NE 47<sup>th</sup> Avenues). A full project map is included in Appendix G.

### **III. Baseline Conditions**

Before project construction began, both quantitative and qualitative data was collected to measure baseline conditions. Quantitative data was collected using radar analysis of auto turning speeds, pedestrian crossing gap studies, traffic volume and speed counts, and videos of pedestrian crossing behavior. Qualitative data was collected using mail-in household surveys and on-site interviews with pedestrians in the study area.

The quantitative and qualitative baseline data collected suggest that the Sandy Boulevard corridor between NE 13<sup>th</sup> and 47<sup>th</sup> Avenues is not particularly safe or accessible, especially for pedestrians and cyclists. Before construction, residents' perceptions of the project area's attractiveness, convenience and safety tended to be negative. High traffic speeds and volumes made Sandy Boulevard difficult to cross safely, and prohibited left turns made adjacent businesses and neighborhoods hard to navigate and inaccessible.

### **IV. Outcomes**

The Sandy Boulevard Resurfacing and Streetscape Project construction finished in June, 2007. Six months after completion, the pilot project gathered follow-up data using the same quantitative and qualitative methods. Several conclusions can be drawn from the post-construction data evaluation and comparison to the baseline data.

The analysis was successful in attracting a large number of residents to take surveys both before and after construction, demonstrating that Sandy Blvd is very important to the area and its residents.

Increasing pedestrian safety served as a major goal of the project. Based on traffic gap studies and pedestrian crossing behavior analysis, the new construction has successfully made pedestrians crossing Sandy Blvd safer and more comfortable. The household surveys showed a statistically significant increase in respondents' perception of safety while crossing Sandy Blvd. In addition, a slight increase in walking as the survey respondents' primary and secondary mode suggests that more residents may be utilizing the pedestrian infrastructure projects. Finally, a marked decrease in turning speeds at a transformed intersection (22<sup>nd</sup> Ave and Sandy Blvd) means pedestrians are far less likely to suffer serious or fatal injuries if a crash occurs.

Another goal of the project was to improve residents' perceptions of the Sandy Blvd project area and Hollywood District's accessibility, safety, and attractiveness. The post-project analysis revealed statistically significant increases in residents' perceptions of all subject areas tested, including accessibility, safety, attractiveness, and navigation.

An overarching goal of the capital project included balancing the needs of all modes and promoting economic development, while maintaining Sandy's function as a Major City Traffic Street. The post-project analysis was unable to definitively conclude whether the project negatively impacted transit or traffic travel times. While the data shows travel

times for transit and automobile travel have increased, other factors, including traffic counts and additional construction projects, need to be assessed to determine the project's impact on corridor travel times.

### **Measuring Pedestrian and Bicycle Safety and Access**

In order to improve pedestrian safety and access, the Sandy capital project extended sidewalks, constructed curb extensions and added new crossing areas with refuge islands at key intersections. In order to improve bicycle safety and access, the capital project installed bicycle signage, signal detection of bicycles, a covered "Bike Oasis" and a new bike lane between NE 38<sup>th</sup> and I-84 to reduce conflicts near the freeway on-ramp.

The pilot project measured the performance of these pedestrian and bicycle improvements using video analysis of pedestrian crossing behaviors, radar analysis of auto turning speed, and mail-in surveys.

Based on video analysis, pedestrians now have more opportunities to safely cross Sandy at NE 31<sup>st</sup> and 35<sup>th</sup> Avenues than before construction. In addition, pedestrians now experience shorter waiting times to cross and exhibit safer crossing behaviors. See Appendix A for more information.

Based on radar analysis, construction at Sandy and NE 22<sup>nd</sup> Avenue reduced traffic speeds for automobiles turning eastbound onto Glisan St. PDOT studies show that the likelihood of a fatal or serious injury to pedestrians falls dramatically as vehicle speeds decrease. See Appendix B for more information.

Based on mail-in surveys, residents felt safer crossing Sandy Blvd since construction took place. See Appendix C for more information.

### **Measuring Driver Safety and Access**

To improve driver safety and convenience, the capital project improved signage, consolidated driveways, provided protected left turns, and increased on-street parking by replacing bus pull-out zones with transit curb extensions.

The pilot project measured the performance of these driver improvements using a travel time analysis of the corridor. The household survey also included several questions to measure users' ability to navigate the district and drivers' ability to cross Sandy Boulevard. While travel times did increase slightly through the corridor, perceptions of safety, navigability, and convenience all increased.

### **Measuring Transit Safety and Access**

To increase safety and convenience for transit users, the capital project installed full transit curb extensions, relocated bus stops and added street trees and other amenities.

The pilot project measured the performance of these transit improvements using transit boarding information for stops along the corridor and travel time analysis for bus routes that serve Sandy Boulevard.

In the follow-up analysis travel times increased and boardings decreased slightly, however neither measurement showed statistically significant change after construction.

### **Measuring Community Identity**

In order to enhance community identity and livability, the capital project installed decorative streetlights; redesigned public spaces to create special landmarks and improved places; improved neighborhood gateways; reclaimed triangle areas for stormwater “green street” sites; and installed pedestrian way-finding signage in the Hollywood District.

The pilot project measured changes in the community’s perception of the district’s identity by analyzing the household survey responses. The pre- and post-survey respondents had very similar demographic compositions, allowing for a consistent pre/post analysis.

The household survey analysis showed increases in walking and decreases in automobile use among respondents, post-project. In addition survey respondents gave Sandy Blvd statistically significant higher marks on the convenience, attractiveness, safety, and navigability of street and the surrounding business district higher after construction.

## Appendix A. Video Analysis and Gap Study Methodology

### *Video Analysis*

Video footage of three key intersections along the corridor was used to assess the conditions before and after construction for pedestrians crossing NE Sandy. All of the areas videotaped receive upgrades aimed at improving conditions for pedestrians.

The primary goal of the video analysis was to measure changes in pedestrian and cyclist crossing behavior and safety. Videos were taken before the project began on NE Sandy at NE 31<sup>st</sup> and NE 35<sup>th</sup> Avenues for 24 hours each. PDOT staff recorded pedestrian crossing counts and behavior during the peak traffic hours of 7am to 9am, 11am to 1pm and 3pm to 5pm at NE 31<sup>st</sup> and NE 35<sup>th</sup> Avenues.

For every taped crossing during the peak hours at NE 31<sup>st</sup> and NE 35<sup>th</sup> Avenues, the amount of time each person waited to cross was recorded. In addition, each crossing was given a score on a four-point scale, based on the characteristics of the crossing. Two PDOT staff scored each crossing to confirm the validity and minimize bias for each score, as well as to increase the likelihood that this methodology can be replicated in the future. Crossing behavior was scored using the criteria below:

**Table 1: Crossing Behavior**

<p><b>1 = Most Dangerous Crossing</b></p> <ul style="list-style-type: none"> <li>• Rushed crossing pace, multiple stops en-route, darting, dodging vehicles.</li> <li>• Close calls and near misses between pedestrian and vehicles.</li> </ul>	<p><b>2 = Unsafe Crossing</b></p> <ul style="list-style-type: none"> <li>• Rushed crossing pace, stops and starts en route to avoid vehicles.</li> <li>• Cars do not slow or stop for pedestrians.</li> </ul>
<p><b>3 = Somewhat Unsafe Crossing</b></p> <ul style="list-style-type: none"> <li>• Steady crossing pace without stopping. Maybe a little rushing.</li> <li>• Cars may slow down for pedestrian but do not stop</li> </ul>	<p><b>4 = Safest Crossing</b></p> <ul style="list-style-type: none"> <li>• Steady, unhurried crossing pace, no stopping or rushing.</li> <li>• Cars stop to allow pedestrian to cross.</li> </ul>

Pre- and post-project counts provide a snapshot of the level of pedestrian usage of existing and new crossings and any change in safety.

### *Gap studies*

Pedestrian crossing gap studies were performed at both NE 31<sup>st</sup> and NE 35<sup>th</sup> Avenues. Gap studies provide information about the number of acceptable gaps in traffic during which a person could theoretically cross the entire street, or reach a safe refuge island. Using traffic hoses, data was collected on the number and size of gaps in auto traffic on NE Sandy at both intersections. Gap data was collected for both eastbound and westbound traffic lanes, as well as gaps for crossing the entire street.

The commonly used methodology for determining an acceptable gap in traffic factors in the width of the street, an average walking speed of 3.5 feet per second and a three second perception and reaction time. Dividing the width of Sandy by 3.5 feet per second, and adding in the 3 second delay, yields the total time needed to safely cross the street. If there is a refuge island, the distance needed to cross the street is measured as the distance from the curb to the island.

Gap studies were done during the AM (7 am to 9 am), noon (12 pm to 1 pm), and PM (4 pm to 6 pm) peak hours. In addition to calculating the number of gaps in traffic, the percent delay factor was also determined for each intersection. The percent delay factor indicates the percentage of time that a person trying to cross would experience some delay in crossing; a smaller percentage indicates larger gaps and lower traffic volumes. Without a percent delay factor, gap study data could yield ambiguous results. For example, a given intersection could have only two gaps over 30 seconds during an hour, but that could be due to one car coming in an hour, yielding two very large gaps, or several thousand cars coming during an hour with two gaps of 30 seconds.

### NE 31<sup>st</sup> Avenue

The project added median refuge islands at both the east and west crossings, and a transit curb extension to the southeast corner of NE 31<sup>st</sup> Ave. These changes improved the pedestrian environment at this unsignalized intersection. Table 2 below summarizes the crossing activity at NE 31<sup>st</sup> & Sandy before construction.

Comparing recorded wait times with crossing behavior before pedestrian improvement shows an interesting trend (Table 2). It appears that the longer a person waited to cross the street, the riskier their crossing behavior became.

After construction, crossing behavior and waiting times (Table 3) improved significantly at each time slot measured. Average recorded wait times decreased between 44% and 85% post-construction. The maximum recorded wait time decreased in the afternoon (11am – 1pm) and evening hours (3 – 5pm) as well. In the morning hours (7 – 9 am) the maximum recorded waiting time increased from 75 seconds to 95 seconds. However, the next

Figure 1: NE Sandy @ NE 31<sup>st</sup> Ave

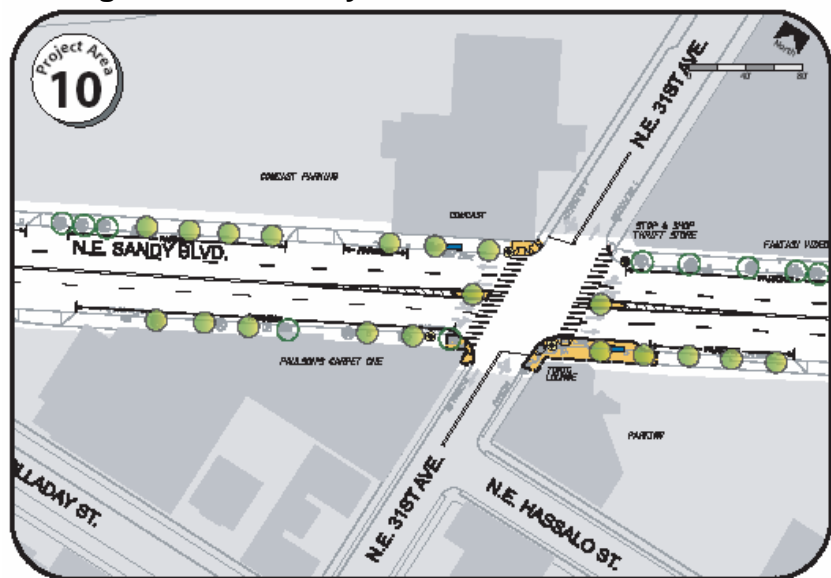


Table 2: Wait Times and Crossing Behavior, NE 31st Ave

May 3, 2004		
Recorded Wait Time	# of Observations	Crossing Behavior (1-4)
<10 Seconds	78	3.31
10-20 Seconds	28	3.04
21-30 Seconds	16	3.06
> 30 Seconds	30	2.71



longest recorded waiting time post-construction was only 30 seconds, suggesting the 95 second wait was a significant outlier. As Table 2 above depicts there may be a relationship between wait time and unsafe crossing behavior, therefore decreasing waiting times likely increases pedestrian safety.

**Table 3: Crossing Activity, NE 31<sup>st</sup> Ave**

Comparing Pre and Post Data						
Time	Pre Avg. Wait (seconds)	Post Avg. Wait (seconds)	Pre Max Wait Time (seconds)	Post Max Wait Time (seconds)	Pre Avg. Crossing Score	Post Avg. Crossing Score
7-9 AM	14.33	8.04	75	95	3.31	3.71
11-1 PM	13.14	2.00	64	15	3.16	3.70
3-5 PM	19.99	9.50	71	61	2.99	3.65

Before construction, 7% of the pedestrians observed received crossing scores of “1,” exhibiting the most dangerous behavior and 14% received crossing scores of “2,” exhibiting unsafe behavior. After construction, zero pedestrians received the lowest score and only 4% were scored a “2.” Before construction, pedestrians often grew frustrated with waiting and chose a less than optimal gap in traffic to cross Sandy. Since the project’s completion, the average crossing score has moved closer to “4,” exhibiting the safest crossing behavior, most likely due to pedestrians feeling more comfortable crossing at the improved intersection and because there are more crossing opportunities.

Sandy Boulevard is 70 feet wide at NE 31<sup>st</sup> Ave. Using the gap study methodology described above, a person needed a 23 second gap in traffic to cross Sandy Blvd comfortably pre-construction. Since the addition of curb extensions and a median island, pedestrians need only 12 or 14 seconds (depending on direction) to reach the refuge. This allows for significantly more opportunities to cross safely.

The gap study performed before construction showed a total of 2 gaps over 23 seconds during the five hours analyzed (7 am to 9 am, 12 pm to 1 pm, and 4 pm to 6 pm). The noon hour had zero gaps during which a person could comfortably cross all four lanes of Sandy Blvd (Table 4).

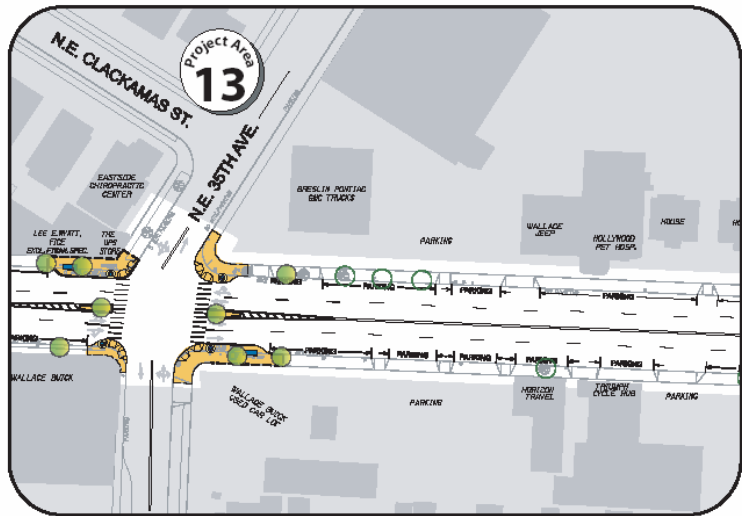
Post-project evaluations show 219 gaps of 12 seconds or more and 176 gaps of 14 seconds or more depending on direction traveling (Table 4). This allows for many more safe crossing opportunities for pedestrians. In addition to more acceptable crossing gaps, the percent delay factor decreased, indicating that a pedestrian is now less likely to wait to cross Sandy post-construction.

Table 4: Percent Delay Factor & Number of Acceptable Gaps to Cross NE Sandy @ NE 31st Ave: Pre and Post Project			
	AM	Noon	PM
<b>Pre:</b> Gaps over 23 seconds (Crossing EB and WB Traffic)	1	0	1
Percent Delay Factor	99.7%	100%	99.7%
<b>Post:</b> Gaps over 12 seconds (Crossing EB Traffic)	120	59	40
Percent Delay Factor	59.7%	63.1%	88.6%
<b>Post:</b> Gaps over 14 seconds (Crossing WB Traffic)	24	49	103
Percent Delay Factor	91.9%	70.4%	65.9%

## NE 35<sup>th</sup> Avenue

NE 35<sup>th</sup> Avenue received curb extensions at all four corners of Sandy Blvd as part of this project; the southeast and northwest corners received full transit curb extensions. In addition, median refuge islands were installed and the west-bound bus stop was moved from the east side of NE 35<sup>th</sup> to the west side. NE 35<sup>th</sup> Avenue is an un-signalized intersection. Table 5 below summarizes the pedestrian activity at this intersection, as documented by video in 2004. Again, PDOT staff recorded the number of crossings as well as the wait time and a score for each crossing before and after project construction, using the methodology described earlier.

Figure 2: NE Sandy @ NE 35<sup>th</sup> Ave



Similar to NE 31<sup>st</sup> Ave, users tended to engage in more risky crossing behavior as wait times increased at NE 35<sup>th</sup> Ave (Table 5).

As Table 6 below shows, average and maximum wait times decreased post-construction.

Average wait time decreased by at least 50% at each peak period and maximum wait times decreased between 22% and 63%. The average crossing score (see Table 1 for definition of scores) remained static in the morning and evening hours, but increased in the afternoon period.

Table 5: Wait Times and Crossing Behavior, NE 35th Ave

May 3, 2004		
Recorded Wait Time	# of Observations	Crossing Behavior (1-4)
<10 Seconds	95	3.30
10-20 Seconds	35	3.19
21-30 Seconds	6	3.00
> 30 Seconds	21	3.09

Table 6: Crossing Activity NE 35th Ave

Comparing Pre and Post Data						
Time	Pre Avg. Wait (seconds)	Post Avg. Wait (seconds)	Pre Max Wait Time (seconds)	Post Max Wait Time (seconds)	Pre Avg. Crossing Score	Post Avg. Crossing Score
7-9 AM	13.17	4.90	52	30	3.42	3.43
11-1 PM	7.46	3.50	32	25	3.17	3.64
3-5 PM	13.42	6.30	54	20	3.18	3.15

Sandy is 70 feet wide at NE 35<sup>th</sup> Avenue and pedestrians need 23 seconds to cross successfully. The pedestrian gap study performed pre-construction showed an unacceptable number of gaps during the AM (7 am to 9 am) noon (12 pm to 1 pm) and PM (4 pm to 6 pm) peaks. There were no gaps during the noon hour and only one gap during the two hour PM peak (Table 7).

The gap study performed on March 15, 2006 showed a total of 8 gaps over 23 seconds during the five hours analyzed (7 am to 9 am, 12 pm to 1 pm, and 4 pm to 6 pm). The noon hour had zero gaps during which a person could comfortably cross all four lanes of Sandy Blvd (Table 7).

**Table 7: Percent Delay Factor & Number of Acceptable Gaps to Cross NE Sandy @ NE 35st Ave: Pre and Post Project**

	AM	Noon	PM
<b>Pre:</b> Gaps over 23 seconds (Crossing EB and WB Traffic)	7	0	1
Percent Delay Factor	97.3%	100%	99.6%
<b>Post:</b> Gaps over 10 seconds (Crossing EB Traffic)	137	82	74
Percent Delay Factor	53.6%	53.5%	80.5%
<b>Post:</b> Gaps over 10 seconds (Crossing WB Traffic)	84	77	131
Percent Delay Factor	75.4%	53.6%	57.8%

Adding the island and curb extensions reduced the 23 seconds time needed to safely cross from curb-to-curb to 10 seconds to reach the refuge island. Post-project evaluations show 293 gaps crossing eastbound and 292 gaps crossing westbound of 10 seconds or more (Table 7), the amount of time needed to move from the sidewalk to the median island.

As expected, there were more gaps crossing the eastbound (outbound) traffic in the morning and more gaps for crossing the westbound (inbound) traffic in the afternoon. In addition, the percent delay factor decreases, indicating a person will likely spend less time waiting for a gap after construction.

## Appendix B. Radar Speed Study

Sandy's diagonal orientation to the street grid created large asphalt triangles and wide angled right turns onto side streets. This streetscape configuration created a situation in which vehicles were able to make right turns at very high speeds, which is dangerous for pedestrians.

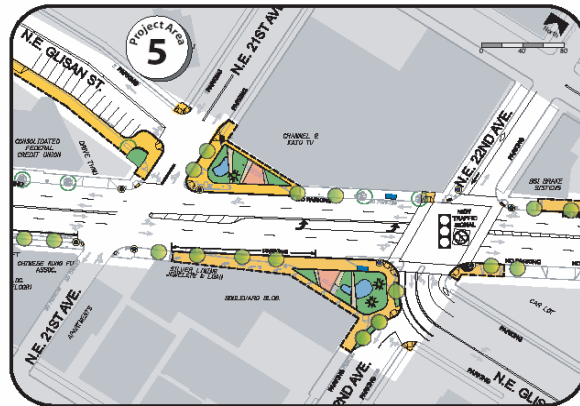
Figure 3 shows the past conditions at NE Sandy; Figure 4 shows the improvements.

On the north and south sides of the intersection, sidewalks were extended to reduce the width of the intersection. A landscaped water detention and water quality swale now occupies the new area created by the changes.

**Figure 3: NE 22<sup>nd</sup> Ave Pre Project**



**Figure 4: NE 22<sup>nd</sup> Ave Post Project**

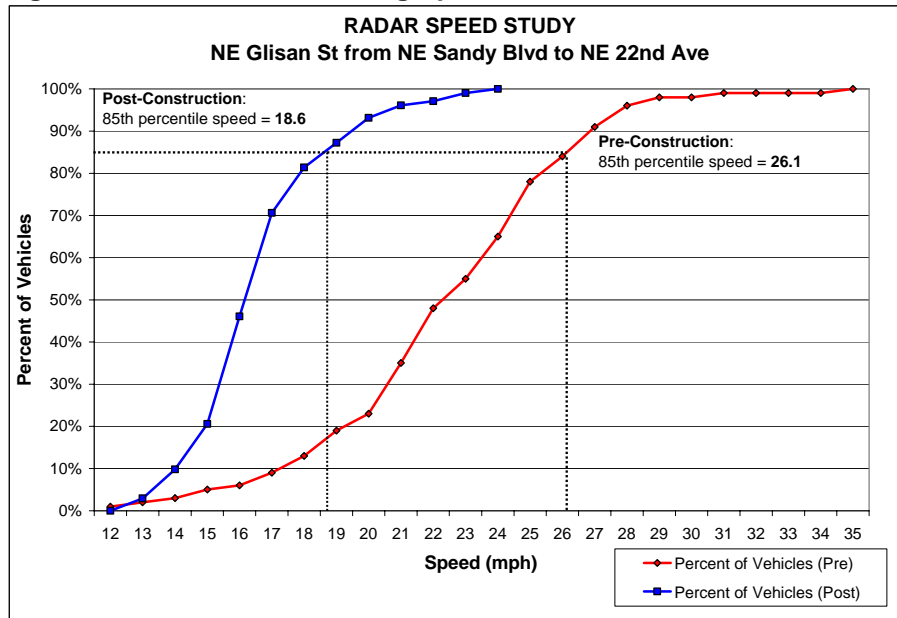


A radar speed study of vehicles turning east off Sandy Blvd. and onto NE Glisan was used to measure the new elements' effectiveness at slowing traffic. As expected, the improvements caused vehicles turning onto NE Glisan to slow down while taking the turn at a right angle. The change has also made vehicles, pedestrians and bicyclists crossing Sandy more visible to turning traffic.

The pre-project radar study shows the 85<sup>th</sup> percentile speed for vehicles turning at this intersection is 26.1 miles per hour; the post-project study shows the 85<sup>th</sup> percentile speed at 18.6 mph. Figure 5 and Table 9 below show the breakdown of speeds. Of note is that the number of drivers making the turn at twenty five miles per hour or higher dropped from 35 in the pre to zero in the post study.

Reducing vehicle speeds is essential to improving safety for pedestrians along NE Sandy Boulevard. PDOT studies show that the likelihood of a fatal or serious injury to pedestrians falls dramatically as vehicle speeds decrease. Table 8 illustrates the changes to stopping distance (based on industry standards) and likelihood of injury to a pedestrian. Reducing the 85% speed for vehicle turning off of Sandy from 26.1 mph to 18.6 mph should greatly decrease the chances of a crash resulting in serious injury for pedestrians.

**Figure 5: 85<sup>th</sup> Percentile Turning Speed at NE 22<sup>nd</sup> Ave**



**Table 8: Turning Speeds at NE 22nd Avenue Pre- and Post-Construction**

Speed (mph)	Number of Vehicles (Pre)	Cumulative Percent (Pre)	Number of Vehicles (Post)	Cumulative Percent (Post)
12	1	0.01	0	0
13	1	0.02	3	0.03
14	1	0.03	7	0.10
15	2	0.05	11	0.21
16	1	0.06	26	0.46
17	3	0.09	25	0.71
18	4	0.13	11	0.81
19	6	0.19	6	0.87
20	4	0.23	6	0.93
21	12	0.35	3	0.96
22	13	0.48	1	0.97
23	7	0.55	2	0.99
24	10	0.65	1	1
25	13	0.78	0	
26	6	0.84	0	
27	7	0.91	0	
28	5	0.96	0	
29	2	0.98	0	
30	0	0.98	0	
31	1	0.99	0	
32	0	0.99	0	
33	0	0.99	0	
34	0	0.99	0	
35	1	1	0	

**Table 9: Speed, Stopping Distance, and Likelihood of Fatal or Serious Injury**

		<b>Likelihood of Injury</b>	
<b>Speed (MPH)</b>	<b>Stopping Distance</b>	<b>% Fatal</b>	<b>% Serious Injury</b>
20	110 Feet	0%	0%
25	150	5%	65%
30	200	45%	50%
35	250	65%	33%

Source: Greg Raisman, Portland Office of Transportation

## Appendix C. Household Survey Methodology and Results

Enhancing the image of NE Sandy Boulevard and the Hollywood Business District was one of the Sandy Boulevard Streetscape Plan's key goals. Specifically, the plan called for supporting the community identity by making Sandy a safe, attractive, and comfortable place for shoppers, travelers, and residents. To this end, PDOT staff sought to measure nearby residents' perceptions and opinions about the street and its businesses, as well as how and why residents use the street in their daily lives.

PDOT staff developed a household survey to gather qualitative data about how residents perceive the street. The survey was mailed out to 4,622 households within ½ mile of NE Sandy between NE 15<sup>th</sup> and NE 47<sup>th</sup> Avenues. The pre-project survey was mailed in early April 2006, just before construction began. Over 25% or 1256 households returned the survey before June 1, 2006 when construction began. Completed surveys continued to trickle in, but were not counted in the results, since construction may have influenced respondents' responses. The post-project survey was mailed to the same 4,622 households in June, six months after construction finished. 1,141 residents responded, nearly a 25% response rate.

The survey asked for some demographic information:

**Table 10: What is your gender?**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
Male	464	40.6%	419	38%
Female	680	59.4%	683	62%

**Table 11: What age group are you in?**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
18-24 (1)	17	1.5%	8	0.7%
25-34 (2)	156	13.3%	142	12.5%
35-50 (3)	439	37.4%	424	37.3%
50-65 (4)	403	34.3%	401	35.3%
65+ (5)	159	13.5%	161	14.2%
	<b>Pre Average</b>		<b>Post Average</b>	
	<b>3.45</b>		<b>3.5</b>	

**Table 12: How many years have you lived in a neighborhood along NE Sandy Blvd?**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
0-2 (1)	164	14%	126	11.1%
3-5 (2)	163	13.9%	151	13.3%
5-10 (3)	204	17.4%	198	17.4%
10+ (4)	644	54.8%	662	58.2%
	<b>Pre Average</b>		<b>Post Average</b>	
	<b>3.13</b>		<b>3.23</b>	

Comparing the demographics of both pre- and post- surveys shows that the composition of the respondents is strikingly similar. This is important because similar demographics in each survey group translates to a higher level of confidence and credibility in comparing responses.

In the pre- and post-survey respondents tended to be women (60% pre; 62% post) who have lived more than ten years in a neighborhood along Sandy (55% pre; 58% post), and are between 35 to 50 years old (37% pre and post). These demographics reflect a slightly higher than expected return rate among women and elderly when compared to 2000 census data for the neighborhoods (see Table 13 for census data).

**Table 13: 2000 Census Demographics for Census Tracts\* Adjacent to Project Corridor**

Age	Female (52%)	Male (48%)	% of Population
18-24	767	821	8.84%
25-34	2164	2254	24.60%
35-50	3033	3166	34.52%
50-65	1900	1608	19.54%
65+	1404	839	12.49%

\* Census Tracts 19, 20, 26, 27.01, and 27.02

Table 14 below show the returns categorized by geographic area for the pre and post surveys. Residents north of Sandy were more inclined to return the survey, with residents within ¼ mile of Sandy to the north returning the survey most frequently.

**Table 14: Return Rates for Household Pre- and Post-Project Survey**

Area Description	Pre Returns	Pre Return Rate	Return Mailed	Post Returns	Post Return Rate
1/4 mile South of Sandy	180	24.7%	728	165	22.7%
1/2 mile South of Sandy	240	18.7%	1286	229	17.8%
1/4 mile North of Sandy	347	30.2%	1148	332	28.9%
1/2 mile North of Sandy	422	28.9%	1460	415	28.4%
<b>Total</b>	<b>1189</b>	<b>27.2%</b>	<b>4622</b>	<b>1141</b>	<b>24.7%</b>

The survey questions were designed to allow PDOT staff to detect measurable changes in attitudes before and after the project. Each question had a range of five answers (very safe/good to very unsafe/bad) that were coded with a score during data entry. Answers on the extreme positive end of the scale were coded “5” and answers on the extreme negative end of the scale were coded “1.” For most survey questions, an average value was calculated using the coded responses. The follow-up survey was conducted six months after the project’s completion. The results of the baseline and follow-up survey are below.

The first four survey questions deal with mode choice and trip purpose. The average score methodology described above does not apply to these questions.



**Table 15: When you travel on NE Sandy Blvd, or to destinations along NE Sandy Blvd, what is your primary mode of transportation?**

Mode	Returns Pre	% of Answers	Returns Post	% of Answers
Auto	995	84%	931	81%
Bus or MAX	46	3.9%	49	4.3%
Walk	83	7%	107	9.3%
Bicycle	56	4.7%	58	5%
Other	4	0.3%	5	0.4%
<b>Total</b>	1184		1150	

**Table 16: If you sometimes use a different mode, what is it?**

Mode	Returns Pre	% of Answers	Returns Post	% of Answers
Auto	142	13.3%	145	13.9%
Bus or MAX	214	20.1%	200	19.1%
Walk	510	47.8%	540	51.6%
Bicycle	183	17.2%	154	14.7%
Other	17	1.6%	9	0.9%
<b>Total</b>	1066		1048	

**Table 17: How often do you use NE Sandy Blvd for shopping, dining out, transportation to another part of town, or any other reason?**

Frequency	Returns Pre	% of Answers	Returns Post	% of Answers
Daily	578	48.7%	554	48.1%
A few times per week	417	35.2%	420	36.5%
Once per week	74	6.2%	77	6.7%
A few times per month	101	8.5%	83	7.2%
A few times per year	16	1.4%	14	1.2%
N/A or Never	0	0%	4	0.4%
<b>Total</b>	1186		1152	

**Table 18: What is the primary reason you use NE Sandy Blvd?**

Reason	Returns Pre	% of Answers	Returns Post	% of Answers
Shopping & errands (including medical appt)	588	49.9%	614	53.4%
Leisure (dining out, movies)	54	4.6%	45	3.9%
Exercise	45	3.8%	47	4.1%
Work (destination is on NE Sandy)	72	6.1%	59	5.1%
Traveling to another destination in the region (not in Sandy corridor)	398	33.8%	356	31%
Other	21	1.8%	29	2.5%

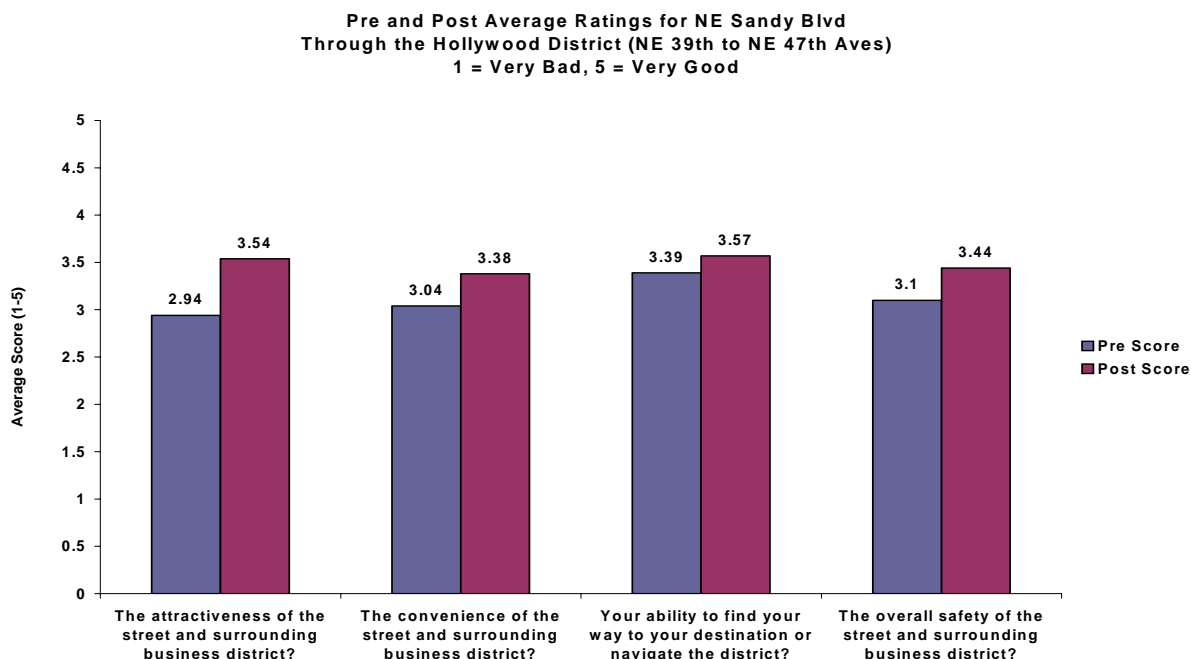
The follow-up survey reveals interesting changes in mode choice and how respondents use Sandy Blvd since construction. Respondents reporting “auto” as their primary form of transportation dropped from 84% of the respondents to just under 81%, while “walking” was selected by 9.3% of those surveyed, up from 7%. The decrease in auto use and increase in walking are worth noting because the demographics of the pre- and post-survey respondents are very similar.

Post survey results also show a slight increase in bicycling and mass transit as respondents’ primary modes of transportation. Nearly 52% of those surveyed also selected “walking” as their secondary mode, up from about 48%. The increase in walking may suggest that the pedestrian improvements to Sandy have led to more nearby residents walking as their primary (9.3%) or secondary (51.63%) mode of transportation.

About half of respondents (48%, pre and post) visit Sandy Boulevard on a daily basis for shopping, dining out, transportation to another part of town or another reason. Before construction 50% used Sandy to shop and run errands, including medical appointments. The post-project survey shows a 3.5% increase in respondents who use Sandy to shop and for errands. Pre-project surveys showed 34% used Sandy to travel to other destinations in the region, essentially using the street as a through corridor. Post-project surveys reveal a 3% decrease in respondents using Sandy as a through-fare. These findings may indicate that pedestrian improvements improved Sandy’s image as a destination rather than solely as a through street.

The next four questions dealt with the Hollywood Business District, and were prefaced with the following sentence: *Think about the last time you visited or traveled through the Hollywood Business District along NE Sandy Blvd (Between NE 39<sup>th</sup> and NE 47<sup>th</sup> Avenues). How did you feel about:*

**Figure 6: Comparing Pre- and Post-Construction Survey Responses, 39<sup>th</sup> to 47<sup>th</sup> Ave**



**Table 19: The attractiveness of the street and surrounding business district?**

<b>Answer</b>	<b>Pre Returns</b>	<b>% of Answers</b>	<b>Post Returns</b>	<b>% of Answers</b>
Very Good (5)	31	2.6%	110	9.6%
Good (4)	302	25.6%	555	48.2%
Neither good nor bad (3)	487	41.2%	347	30.1%
Bad (2)	296	25%	117	10.2%
Very Bad (1)	64	5.4%	17	1.5%
Don't Know	2	0.2%	6	0.5%
	<b>Pre Average</b>	<b>Standard Deviation</b>	<b>Post Average</b>	<b>Standard Deviation</b>
	<b>3.1</b>	0.9	<b>3.5</b>	0.89

When asked to rate the **attractiveness** of the Hollywood Business District before construction, the majority of responses (41%) were neutral, rating it neither good nor bad. Since construction, over 57% rate the streetscape’s attractiveness as either “good” or “very good.” The follow-up survey reveals that respondents had a more positive image of Sandy after project construction.

**Table 20: The convenience of the street and surrounding business district?**

<b>Answer</b>	<b>Pre Returns</b>	<b>% of Answers</b>	<b>Post Returns</b>	<b>% of Answers</b>
Very Good (5)	93	7.9%	104	9.1%
Good (4)	373	31.5%	526	45.9%
Neither good nor bad (3)	294	24.8%	276	24.1%
Bad (2)	337	28.5%	190	16.6%
Very Bad (1)	85	7.2%	50	4.4%
Don't Know	2	0.2%	1	0.1%
	<b>Pre Average</b>	<b>Standard Deviation</b>	<b>Post Average</b>	<b>Standard Deviation</b>
	<b>3</b>	1.09	<b>3.4</b>	1.01

Asked about the **convenience** of the street and surrounding business district in the follow-up 15% more respondents rated Sandy’s convenience as “good” or “very good” and nearly 15% fewer respondents rated it as “bad” or “very bad”

**Table 21: Your ability to find your way to your destination or navigate the district?**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
Very Good (5)	200	16.9%	192	16.7%
Good (4)	435	36.8%	530	46.2%
Neither good nor bad (3)	238	20.1%	208	18.1%
Bad (2)	249	21.1%	172	15%
Very Bad (1)	60	5.1%	44	3.8%
Don't Know	1	0.1%	2	0.2%
	<b>Pre Average</b>	<b>Standard Deviation</b>	<b>Post Average</b>	<b>Standard Deviation</b>
	<b>2.6</b>	1.14	<b>3.6</b>	1.06

Asked about their ability to **find their way** to their destination, or navigate the district, the majority (54%) said their experience was good or very good, while those who rated their experiences “bad” dropped from 21% before construction to 15% post-construction.

**Table 22: The overall safety of the street and surrounding business district?**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
Very Good (5)	82	6.9%	105	9.1%
Good (4)	404	34.2%	520	45.3%
Neither good nor bad (3)	397	33.6%	312	27.2%
Bad (2)	234	19.8%	151	13.2%
Very Bad (1)	51	4.3%	40	3.5%
Don't Know	13	1.1%	20	1.7%
	<b>Pre Average</b>	<b>Standard Deviation</b>	<b>Post Average</b>	<b>Standard Deviation</b>
	<b>2.8</b>	0.98	<b>3.4</b>	1.05

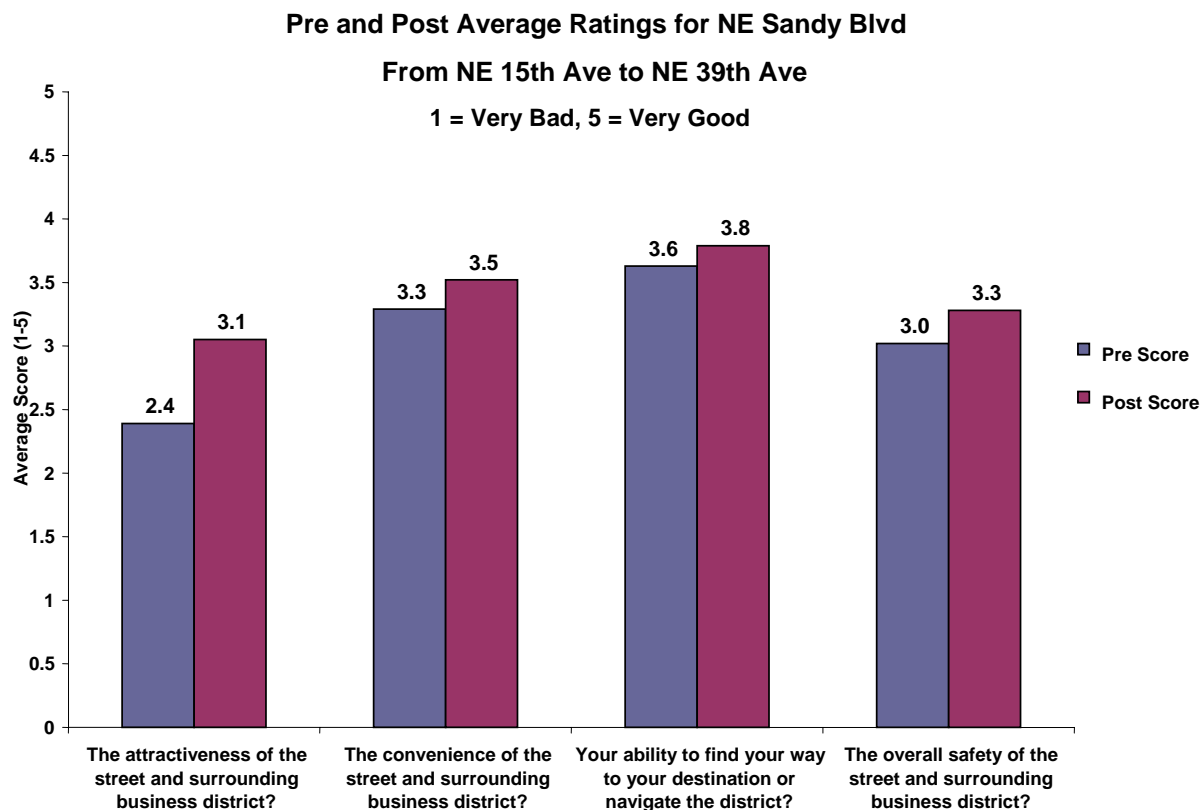
Asked about the overall **safety** of the street and business district the majority (54%) of respondents rated it “good” or “very good” in the follow-up survey, an increase of 13%. Similarly, those finding the safety of the street and business district “bad” or “very bad” dropped from 24% of the respondents before construction to 16.5% post-construction.

The next four questions dealt with the stretch of Sandy from NE 15<sup>th</sup> Avenue to NE 39<sup>th</sup> Avenue, and were prefaced with the following sentence:

*Now think about the last time you traveled along NE Sand Blvd from NE 15<sup>th</sup> to NE 39<sup>th</sup> Avenues. How would you rate your satisfaction with:*

For Sandy Blvd between 15<sup>th</sup> and 39<sup>th</sup> Avenues respondents' post-construction ratings all trended toward a more positive experience and perception. "Good" or "very good" ratings all increased, while "bad" and "very bad" ratings all decreased. We saw significant changes in certain categories such as "overall safety of the street and surrounding business district," where 47% of the respondents rated Sandy "good" or "very good" post-construction, compared to 33% pre-construction. Similarly, the percentage of respondents rating the attractiveness of the street as "good" or "very good" increased from 11% to 36% after construction.

**Figure 7: Comparing Pre- and Post-Construction Survey Responses, 15<sup>th</sup> to 39<sup>th</sup> Ave**



**Table 23: The attractiveness of the street?**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
Very Good (5)	10	0.9%	65	5.7%
Good (4)	122	10.3%	339	29.6%
Neither good nor bad (3)	357	30.2%	390	34.1%
Bad (2)	517	43.7%	273	23.9%
Very Bad (1)	169	14.3%	67	5.9%
Don't Know	7	0.6%	10	0.9%
	<b>Pre Average</b>	<b>Standard Deviation</b>	<b>Post Average</b>	<b>Standard Deviation</b>
	2.4	0.89	3.1	1.04

**Table 24: The convenience of the street?**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
Very Good (5)	79	6.7%	119	10.4%
Good (4)	465	39.4%	551	48.2%
Neither good nor bad (3)	398	33.7%	305	26.7%
Bad (2)	190	16.1%	130	11.4%
Very Bad (1)	43	3.6%	30	2.6%
Don't Know	6	0.5%	9	0.8%
	<b>Pre Average</b>	<b>Standard Deviation</b>	<b>Post Average</b>	<b>Standard Deviation</b>
	3.3	0.94	3.5	0.97

**Table 25: Your ability to find you way to your destination or navigate the street?**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
Very Good (5)	169	14.3%	195	17.1%
Good (4)	572	48.3%	618	54.1%
Neither good nor bad (3)	308	26%	225	19.7%
Bad (2)	103	8.7%	72	6.3%
Very Bad (1)	27	2.3%	21	1.8%
Don't Know	5	0.4%	11	1%
	<b>Pre Average</b>	<b>Standard Deviation</b>	<b>Post Average</b>	<b>Standard Deviation</b>
	3.6	0.91	3.8	0.94

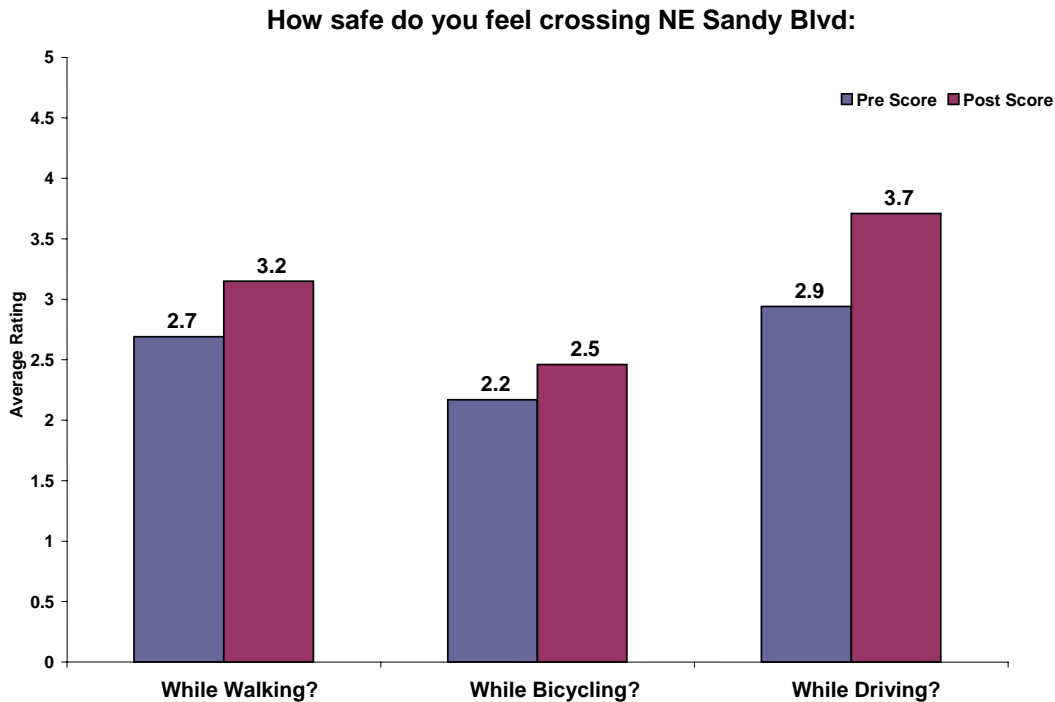
**Table 26: The overall safety of the street and surrounding business district?**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
Very Good (5)	48	4.1%	74	6.5%
Good (4)	337	28.7%	452	39.8%
Neither good nor bad (3)	422	35.9%	350	30.8%
Bad (2)	290	24.7%	177	15.6%
Very Bad (1)	55	4.7%	52	4.6%
Don't Know	23	2%	32	2.8%
	<b>Pre Average</b>	<b>Standard Deviation</b>	<b>Post Average</b>	<b>Standard Deviation</b>
	<b>3</b>	0.95	<b>3.3</b>	1.10

The next three questions dealt with a person’s perception of safety as they crossed the street using a variety of modes, and was prefaced with the following sentence:

*Now think about the entire Sandy Blvd Corridor between NE 15<sup>th</sup> and NE 47<sup>th</sup> Avenues.*

**Figure 8: Comparing Pre- and Post-Construction Survey Responses, Sandy Blvd**



**Table 27: While walking**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
Very Safe (5)	35	3%	69	6.1%
Safe (4)	290	24.7%	425	37.7%
Neither safe nor unsafe (3)	257	21.9%	258	22.9%
Unsafe (2)	411	35.1%	276	24.5%
Very unsafe (1)	148	12.6%	60	5.3%
Don't Know	31	2.7%	40	3.6%
	<b>Pre Average</b>	<b>Standard Deviation</b>	<b>Post Average</b>	<b>Standard Deviation</b>
	<b>2.7</b>	<b>1.07</b>	<b>3.2</b>	<b>1.18</b>

**Table 28: While bicycling?**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
Very Safe (5)	8	0.8%	12	1.2%
Safe (4)	94	8.9%	117	11.6%
Neither safe nor unsafe (3)	121	11.5%	175	17.3%
Unsafe (2)	339	32.2%	273	27%
Very unsafe (1)	197	18.7%	134	13.2%
Don't Know	293	27.9%	301	29.7%
	<b>Pre Average</b>	<b>Standard Deviation</b>	<b>Post Average</b>	<b>Standard Deviation</b>
	<b>2.2</b>	<b>0.99</b>	<b>2.5</b>	<b>1.88</b>

**Table 29: While driving**

Answer	Pre Returns	% of Answers	Post Returns	% of Answers
Very Safe (5)	85	7.2%	125	11%
Safe (4)	574	48.7%	668	58.5%
Neither safe nor unsafe (3)	1	0.1%	245	21.5%
Unsafe (2)	339	28.8%	85	7.4%
Very unsafe (1)	149	12.7%	9	0.8%
Don't Know	15	1.3%	10	0.9%
	<b>Pre Average</b>	<b>Standard Deviation</b>	<b>Post Average</b>	<b>Standard Deviation</b>
	<b>2.9</b>	<b>0.85</b>	<b>3.7</b>	<b>0.86</b>



Before construction, nearly half of respondents (48%) felt crossing while walking was unsafe or very unsafe, while only 27% felt it was safe or very safe. Post-construction, 43% of respondents felt safe or very safe and those who felt unsafe or very unsafe dropped from nearly half to less than 30%.

While bicycling, 51% of respondents felt crossing was unsafe or very unsafe before construction and less than 10% felt it was safe or very safe. In the follow-up survey the percentage of those feeling unsafe or very unsafe decreased from 51% to 40% of respondents. Significantly, 28% of respondents pre-project and 30% post-project said they did not know, suggesting that many people have not tried cycling in the district.

Before construction, the majority (57%) felt safe or very safe crossing in a car, but 42% felt unsafe or very unsafe. Post-construction, only 8% felt unsafe or very unsafe crossing in a car, suggesting that the street improvements significantly increased drivers and car passengers' feelings of safety.

Of 1256 pre-construction surveys received, more than 340 respondents wrote comments about the district. The comments were analyzed for content and categorized according to the stated goals of the project. The most frequently made comments focused on concerns about bicycle and pedestrian safety, support for bicycle lanes, and frustration about difficult navigation, poor signage and the inability to turn left off of Sandy when traveling eastbound.

Of the 1,141 post-construction surveys received, more than 512 respondents commented about the project and the district. While a direct comparison between comments before and after the project is difficult due to the nature of open-ended feedback, there are some interesting trends. For example, comments about unsafe conditions for bicycles and pedestrians dropped in the follow-up survey and 32 respondents commented that the project improved the bicycle and pedestrian environment. Similarly, there were 111 positive and 26 negative comments about the improvements generally. In addition, there was a marked increase of comments expressing concerns about traffic, congestion, auto safety, speed and navigation post-construction. The wide-ranging sentiments expressed in the comments in the follow-up survey may be a product of the project itself. While pedestrian enhancements and improving the appearance of the business districts were key goals, Sandy's importance as a major thoroughfare were also factors in the project. Reconciling 24,000 vehicles/day with a pedestrian, bicycle, and business friendly environment is a difficult task, one that will require more infrastructure investment to move people through the Sandy Blvd area safely and comfortably regardless of mode.

The categories of comments are summarized in Table 30 below.

<b>Table 30: Comments From Survey</b>		
<b>Category of Comment</b>	<b>Pre # of Comments</b>	<b>Post # of Comments</b>
Unsafe for bikes, or support for bike lanes / Unsafe for pedestrian, crosswalk concerns, signal timing	176	117
Improvements enhance bicycle/pedestrian safety	n/a	32
Unsafe for autos, speeding, traffic, and congestion	54	114
Unpleasant appearance, vacant store fronts, bad architecture, undesirable businesses	116	73
Streetscape / area more attractive	n/a	30
Crime	22	11
Lack of Parking	31	24
Difficult navigation	91	113
Opposed to change	17	n/a
Improvements positive (general)	n/a	111
Improvements negative (general)	n/a	26
More improvements needed	n/a	14
Slalom design negative	n/a	39
Bikes are hazardous/hassle to other road users	n/a	12
Other (i.e., comments about survey, construction phase of the project, storytelling)	n/a	39

## Appendix D. Travel Time Analysis and Traffic Count Methodology

Improving safety and convenience for both drivers and transit riders is a key goal of the Sandy Boulevard project. Sandy Boulevard carries between 20,000 and 30,000 vehicles per day; maintaining Sandy's function as a Major City Traffic Street while improving conditions for other modes was a challenging aspect of the project. Two key measures that were used to help evaluate the project's impact on vehicle traffic are corridor travel times and traffic counts on NE Sandy Boulevard and adjacent streets.

### Corridor Travel Time Analysis

PDOT's Data Collection team performed a travel time study for Sandy Boulevard between NE 14<sup>th</sup> and NE 27<sup>th</sup> Avenues on before construction on March 23, 2006 and after the project's completion on December 5, 2007. The study provides data for eastbound and westbound traffic during AM (7 am- 9 am) and PM (4 pm - 6 pm) peaks.

For each period, staff collected a minimum of seven (and a maximum of twelve) samples of travel time data on six different "nodes" or specific portions of the street. The travel times for each node were averaged. After calculating the standard deviation for each sample, outlying values were removed from the data set. The outlying values were often the result of a vehicle encountering a red light as it traveled through the corridor. Below is an example of the data tables created for this measure; outlying values are highlighted in gray on the left, the gray column on the right represents the average travel time after removing these values.

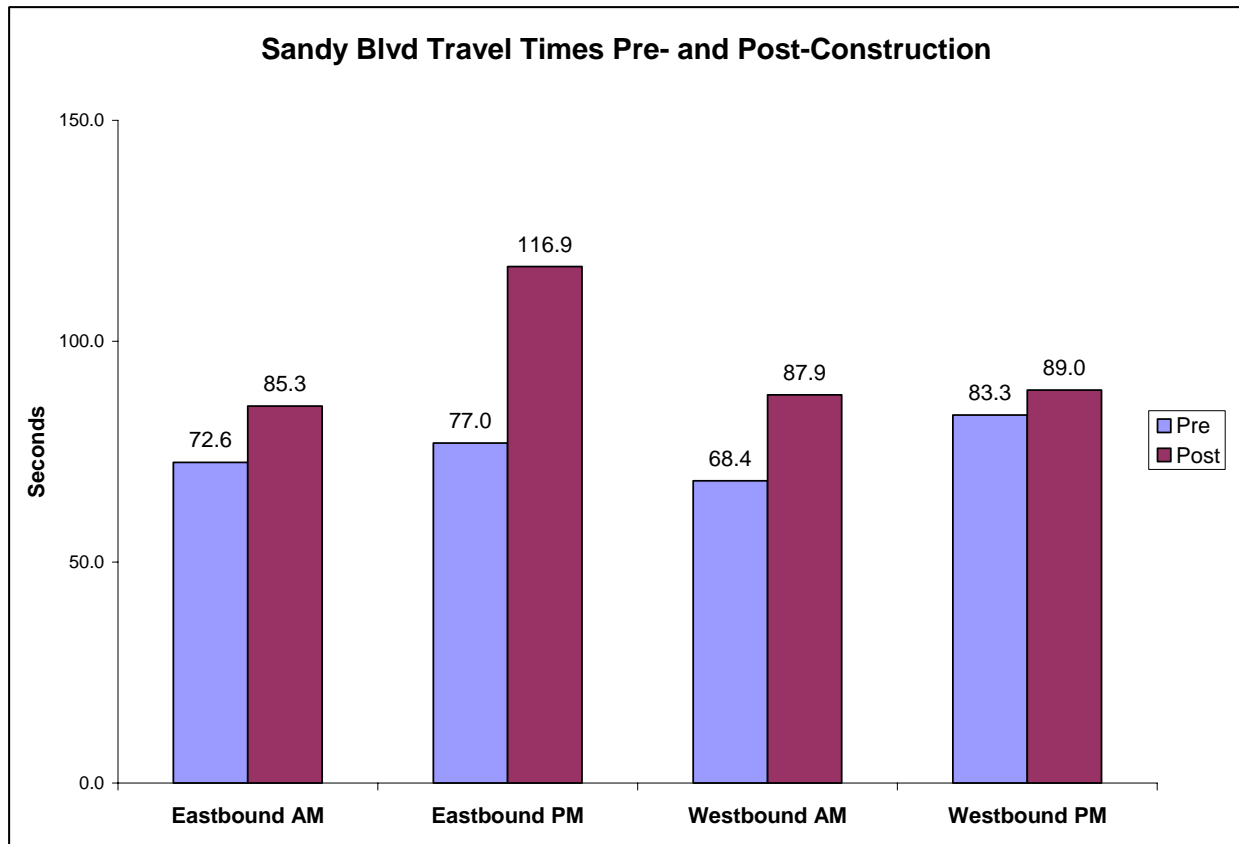
Table 31: Travel Times Westbound PM: December 5, 2007

Node	Run 1 (secs)	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Run 10	Run 11	Run 12	Avg	St. Dev.	Range +	Range -	Avg with outlying values removed
NE 27th Ave																	
NE 26th Ave	9	8	9	9	8	8	9	11	9	8	8	8	8.7	0.9	9.6	7.8	8.5
NE 24th Ave	22	13	24	13	22	14	13	31	26	26	14	13	19.3	6.6	25.8	12.7	16.4
NE 20th Ave	48	58	39	39	43	51	30	39	29	53	38	32	41.6	9.3	50.9	32.3	37.4
NE 18th Ave	13	15	16	16	15	12	13	26	12	12	13	31	16.2	6.0	22.2	10.1	12.6
NE 16th Ave	13	13	14	17	14	12	12	17	12	12	13	14	13.6	1.8	15.4	11.8	12.9

Highlighted values removed for average

Figure 9 and Tables 32 – 35 below summarize the data for each travel time study, including pre- and post-construction data.

**Figure 9: Comparing Pre- and Post-Construction Travel Times**



**Table 32: Pre- and Post-Construction Travel Times, Eastbound AM**

Node	Length (feet)	Node Name	Pre Avg with outlying values removed	Post Avg with outlying values removed	Pre Min	Pre Max	Post Min	Post Max
1	0	NE 15th Ave	(Time in Seconds)					
2	296	NE 16th Ave	7.1	7.7	6	21	6.5	15
3	600	NE 18th Ave	13.3	13.5	12	46	12	46
4	586	NE 20th Ave	15.3	17.9	11	46	12	53
5	1190	NE 24th Ave	25.4	32.5	23	31	25	56
6	540	NE 26th Ave	11.5	13.7	10	16	13	16
<b>Total</b>			<b>72.6</b>	<b>85.3</b>				

**Table 33: Pre- and Post-Construction Travel Times, Eastbound PM**

Node	Length (feet)	Node Name	Pre Avg with outlying values removed	Post Avg with outlying values removed	Pre Min	Pre Max	Post Min	Post Max	
1	0	NE 15th Ave	(Time in Seconds)						
2	296	NE 16th Ave	8.3	7.8	7	13	6.5	12.5	
3	600	NE 18th Ave	14.5	17.7	13	47	13	73	
4	586	NE 20th Ave	15.0	34.4	13	52	18	62	
5	1190	NE 24th Ave	27.4	40.5	26	29	32	89	
6	540	NE 26th Ave	11.8	16.6	10	13	14	27	
<b>Total</b>			<b>77.0</b>	<b>116.9</b>					

**Table 34: Pre- and Post-Construction Travel Times, Westbound AM**

Node	Length (feet)	Node Name	Pre Avg with outlying values removed	Post Avg with outlying values removed	Pre Min	Pre Max	Post Min	Post Max	
1	0	NE 15th Ave	(Time in Seconds)						
2	296	NE 16th Ave	6.7	8.5	6	9	8	11	
3	600	NE 18th Ave	12.0	16.4	11	22	13	31	
4	586	NE 20th Ave	24.7	37.4	23	32	29	58	
5	1190	NE 24th Ave	12.6	12.6	11	15	12	31	
6	540	NE 26th Ave	12.4	12.9	10	18	12	17	
<b>Total</b>			<b>68.4</b>	<b>87.9</b>					

**Table 35: Pre- and Post-Construction Travel Times, Westbound PM**

<b>Node</b>	<b>Length (feet)</b>	<b>Node Name</b>	<b>Pre Avg with outlying values removed</b>	<b>Post Avg with outlying values removed</b>	<b>Pre Min</b>	<b>Pre Max</b>	<b>Post Min</b>	<b>Post Max</b>
1	0	NE 15th Ave	(Time in Seconds)					
2	296	NE 16th Ave	18.2	8.6	12	42	8	21
3	600	NE 18th Ave	31.1	13.0	27	50	12	28
4	586	NE 20th Ave	14.5	37.6	13	38	30	74
5	1190	NE 24th Ave	14.2	15.9	12	27	13	87
6	540	NE 26th Ave	5.3	13.9	5	7	12	39
<b>Total</b>			<b>83.3</b>	<b>89.0</b>				

For eastbound and westbound, morning and evening average travel times increased. Some of the increase can be attributed to two new traffic signals, at NE 20<sup>th</sup> and NE 22<sup>nd</sup> Avenues, however adjusting for the traffic lights still results in a slight increase in average travel time post-construction.

## Appendix E. TriMet Boardings and Transit Travel Times

Increasing safety and convenience for transit users was a stated goal for the Sandy Boulevard project. Pre- and post-project boarding counts and actual travel times for the corridor, both provided by TriMet, were used as indicators of conditions for transit users. The #12 bus is a frequent service bus route with fifteen minute headways along Sandy Boulevard throughout the day. Before construction, buses stopping to pick up passengers were forced to pull out of traffic and pick up passengers on the curb; waiting to merge back into traffic during heavy traffic periods contributes to travel time delays. Transit curb extensions were added to allow buses to merge more easily back into traffic and to aid in passenger boarding. In addition, adding street trees, customer amenities, and conveniently spaced bus stops were included to make waiting for and riding transit a more pleasant experience for all users. Tables 36 and 37 contain boarding counts pre- and post-construction for stops in the project corridor. Table 38 summarizes travel times for the #12 before and after construction.

**Table 36: Eastbound TriMet Boardings, Pre- and Post-Construction**

Outbound	Fall 2005 Passenger Census			Fall 2007 Passenger Census					
	Ons	Offs	Total	Ons	Offs	Total	Ons % Change	Offs % Change	Total % Change
Sandy & 16th	35	46	81	30	41	71	-14.3%	-10.9%	-12.3%
Sandy & 18th	31	43	74	30	36	66	-3.2%	-16.3%	-10.8%
Sandy & Flanders	44	61	105	38	51	89	-13.6%	-16.4%	-15.2%
Sandy & 24th	44	67	111	51	77	128	15.9%	14.9%	15.3%
NE Sandy & Lawrence	6	15	21	7	17	24	16.7%	13.3%	14.3%
Sandy & 28th	32	49	81	32	55	87	0.0%	12.2%	7.4%
Sandy & 30th	13	27	40	14	23	37	7.7%	-14.8%	-7.5%
Sandy & 31st	14	36	50	17	31	48	21.4%	-13.9%	-4.0%
Sandy & 33rd	16	21	37	19	25	44	18.8%	19.0%	18.9%
NE Sandy & Imperial	5	9	14	5	12	17	0.0%	33.3%	21.4%
NE Sandy & 38th	14	42	56	11	36	47	-21.4%	-14.3%	-16.1%
NE Sandy & 40th	24	81	105	67	100	167	179.2%	23.5%	59.0%
Sandy & 42nd	176	93	269	130	59	189	-26.1%	-36.6%	-29.7%
Sandy & 44th	26	25	51	28	28	56	7.7%	12.0%	9.8%
Sandy & 47th	23	52	75	22	42	64	-4.3%	-19.2%	-14.7%
Sandy & 50th	19	30	49	17	31	48	-10.5%	3.3%	-2.0%
<b>Totals</b>	<b>522</b>	<b>697</b>	<b>1,219</b>	<b>518</b>	<b>664</b>	<b>1,182</b>	<b>-0.8%</b>	<b>-4.7%</b>	<b>-3.0%</b>

**Table 37: Westbound TriMet Boardings, Pre- and Post-Construction**

Inbound	Fall 2005 Passenger Census			Fall 2007 Passenger Census			Ons % Change	Offs % Change	Total % Change
	Ons	Offs	Total	Ons	Offs	Total			
Sandy & 16th	32	34	66	33	18	51	3.1%	-47.1%	-22.7%
Sandy & 18th	42	33	75	32	33	65	-23.8%	0.0%	-13.3%
Sandy & 20th	66	49	115	69	54	123	4.5%	10.2%	7.0%
Sandy & 24th	71	29	100	82	33	115	15.5%	13.8%	15.0%
Sandy & 26th	8	8	16	12	8	20	50.0%	0.0%	25.0%
Sandy & 28th	61	44	105	65	42	107	6.6%	-4.5%	1.9%
Sandy & 31st	41	23	64	37	26	63	-9.8%	13.0%	-1.6%
Sandy & 33rd	25	16	41	28	19	47	12.0%	18.8%	14.6%
Sandy & 35th	7	4	11	10	6	16	42.9%	50.0%	45.5%
Sandy & 37th	24	9	33	n/a	n/a	n/a	n/a	n/a	n/a
NE Sandy & 39th	54	38	92	69	34	103	27.8%	-10.5%	12.0%
NE Sandy & 42nd	28	41	69	95	92	187	239.3%	124.4%	171.0%
NE Sandy & 44th	145	126	271	76	91	167	-47.6%	-27.8%	-38.4%
Sandy & 47th	62	20	82	52	20	72	-16.1%	0.0%	-12.2%
Sandy & 50th	29	18	47	24	15	39	-17.2%	-16.7%	-17.0%
<b>Totals</b>	<b>695</b>	<b>492</b>	<b>1,187</b>	<b>684</b>	<b>491</b>	<b>1,175</b>	<b>-1.6%</b>	<b>-0.2%</b>	<b>-1.0%</b>

Boardings in the corridor decreased slightly (3% eastbound and 1% westbound) in the post-construction measurement. The decreases in boardings were not statistically significant. Overall the TriMet bus system saw a 1.6% decrease in riders and the overall system (including MAX) saw a 1.14% increase in riders over that same time period.

**Table 38: Route 12 Sandy**  
**Runtimes by Selected Time Point Segments**  
*Pre and Post Construction, Weekdays Only*

Direction	Beginning Time Point	Ending Time Point	Pre Mean Runtime	Post Mean Runtime
eastbound	Sandy/13th	Sandy/42nd	07:13	07:23
eastbound	Sandy/42nd	Sandy/57th	02:52	02:50
eastbound	Sandy/57th	Sandy/82nd	04:42	04:49
westbound	Sandy/57th	Sandy/42nd	03:09	03:22
westbound	Sandy/42nd	Sandy/12th	07:08	07:06
westbound	Sandy/12th	5th/Oak	05:58	06:24



Runtimes for the #12, Sandy Blvd bus remained fairly static. Over 4,000 runtime observations were recorded by TriMet pre- and post-construction and averaged in table 54 above. Post-construction runtimes increased 15 seconds eastbound and 37 seconds westbound, however the 26-second increase measured between Sandy/NE 12<sup>th</sup> and 5<sup>th</sup>/SW Oak heading west is outside the project area.

The data suggests that the project did not have a measurable impact on the number of passenger boardings or travel times for the #12 route. A potentially important factor that has not yet been measured since construction is traffic volumes. An increase in vehicles traveling Sandy post-construction could have an impact on corridor travel times, for transit and vehicular traffic. In addition, customer surveys of #12 route passengers may also surmise whether transit users are satisfied with the changes to Sandy Blvd.

## Appendix F PSU Student Surveys

For the pre-report, City staff were able to partner with students from Portland State University to collect a great deal of on-street survey data . Unfortunately we were unable to collect post data due to a variety of factors, however the pre data is included below for reference.

### On-street Surveys

PDOT partnered with a Portland State University Senior Capstone course to develop and administer two surveys to measure how pedestrians and other users perceive Sandy Blvd and the Hollywood business district.

### NE 31<sup>st</sup> Avenue Surveys

The first survey was administered to pedestrians after they crossed Sandy at NE 31<sup>st</sup> Avenue, where a new median island curb extension will be added. The questions were designed to provide PDOT staff with data on how often the crossings are used, how safe users feel while crossing, what an acceptable wait time is, and the distance required to cross, among other things. The actual wait time was recorded with each survey, allowing staff to compare perceived wait times with actual wait times at NE 31<sup>st</sup> Avenue.

The students surveyed 114 pedestrians during AM (7 am to 9 am) noon (11 am to 1 pm) and PM (4 pm to 6 pm) peaks. The findings suggest that most users perceive crossing Sandy Boulevard as an unpleasant and unsafe experience. Sixty six percent of respondents felt unsafe or very unsafe crossing Sandy Boulevard; 45 percent felt the wait time was long or very long; 66 percent felt vehicles were unaware or very unaware of their presence; and 58 percent rated the overall experience crossing Sandy at NE 31<sup>st</sup> Avenue as unpleasant or very unpleasant. Tables 39-44 below summarize the data for each question.

Table 39

How Often do you Cross at this Intersection?		
	# Responses	% of Total
Every day	36	31.58%
A few times per week	27	23.68%
a few times per month	25	21.93%
a few times per year	14	12.28%
This is my first time	12	10.53%

Table 40

The amount of time you a had to wait before crossing was?		
	# Responses	% of Total
Very short (1)	7	6.14%
Short (2)	13	11.40%
Average (3)	43	37.72%
long (4)	42	36.84%
Very long(5)	9	7.89%
Average Score	3.29	

Table 41

How safe do you feel crossing this intersection		
	# Responses	% of Total
Very safe (1)	0	0.00%
Safe (2)	8	7.02%
Neutral (3)	30	26.32%
Unsafe(4)	47	41.23%
Very unsafe (5)	29	25.44%
Average Score	3.85	

Table 42

The distance to cross at this intersection was?		
	# Responses	% of Total
Very short (1)	2	1.75%
Short (2)	13	11.40%
Average (3)	48	42.11%
long (4)	43	37.72%
Very long(5)	8	7.02%
Average Score	3.37	

Table 43

How do you feel vehicles reacted to you (in terms of awarness) while crossing Sandy?		
	# Responses	% of Total
Very aware (1)	4	3.51%
Aware (2)	12	10.53%
Not Sure (3)	23	20.18%
Unaware (4)	54	47.37%
Very unaware (5)	21	18.42%
Average Score	3.67	

Table 44

How would you rate your overall experience crossing at this intersection?		
	# Responses	% of Total
Good (1)	2	1.75%
Short (2)	13	11.40%
Average (3)	33	28.95%
bad (4)	48	42.11%
Very bad (5)	18	15.79%
Average Score	3.59	

Table 45 compares the recorded (actual) wait time for each crossing at NE 31<sup>st</sup> Ave with how the users perceived the wait time. Not surprisingly, as the actual wait time increased the longer the perceived time became.

**Table 45: Actual versus Perceived Wait Times @ NE 31st Ave**

June 2006		
Actual Wait Time as Recorded by Surveyor	# of Observations	Average Reported Perception of Wait Time (1= very short, 5 = very long)
< 10 Seconds	30	2.8
11-20 Second	13	3.15
21-30 Seconds	7	4.14
> 30 Seconds	5	3.4

The data in Table 46 summarizes actual wait times and observed crossing behavior. While the PSU students used a slightly different rating system for scoring individual crossings, the data mirrors the conclusions highlighted earlier in Tables 3 and 7 in Appendix A: Longer wait times tend to lead to riskier crossing behavior. The installation of curb extensions and median refuge islands should reduce the amount of risky crossing behavior by reducing wait times and crossing distances.

**Table 46: Crossing Behavior and Wait Times @ NE 31st Ave**

Jun-06		
Actual Wait Time as Recorded by Surveyor	# of Observations	Average Recorded Crossing Behavior (1-4)
< 10 Seconds	30	1.68
11-20 Second	13	1.54
21-30 Seconds	7	1.8
> 30 Seconds	5	2.2

- 1- Waited for safe gap
- 2- Partial crossing, wait in the middle
- 3- Walk through traffic
- 4- Run

### Hollywood Farmers Market Surveys

PSU students also surveyed 114 shoppers at the Hollywood Farmers Market. The purpose of the survey was to gather data about perceptions of the Hollywood business district with respect to accessibility for all modes, as well ranking of their experience shopping in Hollywood compared to comparable local districts. Generally, survey respondents visited the Hollywood business district quite frequently and perceived it to be more accessible for drivers and transit users than for cyclists or pedestrians. When asked to compare Hollywood to other business districts in the city in terms of accessibility and convenience, 50 percent of respondents perceived it as “worse than most” or “one of the worst.” However 49% rated their experience that day as “positive” or “very positive.” Tables 48-51 summarize the responses to other questions.

**Table 47**

How do you rate the Hollywood Business District's accessibility?	
	% Responding Good or Very Good
Overall	43%
For Bicyclists	17
For Pedestrians	37
For Transit Users	51
For Autos	44

**Table 48**

<b>How often do you visit the Hollywood Farmer's Market?</b>		
	<b># Responses</b>	<b>% of Total</b>
Every Saturday (1)	32	28.07%
A couple times per month (2)	38	33.33%
Several times per year (3)	21	18.42%
Rarely (4)	6	5.26%
First Time (5)	17	14.91%
<b>Average Score</b>	<b>2.45</b>	

**Table 49**

<b>How often do you visit the Hollywood Business District?</b>		
	<b># Responses</b>	<b>% of Total</b>
Every Saturday (1)	43	37.72%
A couple times per month (2)	46	40.35%
Several times per year (3)	12	10.53%
Rarely (4)	11	9.65%
First Time (5)	2	1.75%
<b>Average Score</b>	<b>1.97</b>	

**Table 50**

<b>What mode of transportation did you use to get here today?</b>		
	<b># Responses</b>	<b>% of Total</b>
Drive Alone	35	30.70%
Carpool	40	35.09%
Bike	15	13.16%
Walk	24	21.05%
Transit	1	0.88%
Other	1	0.88%

**Table 51**

<b>How far did you travel to get here today?</b>		
	<b># Responses</b>	<b>% of Total</b>
Less than 1 mile (1)	35	30.70%
Between 1 and 2 miles (2)	44	38.60%
Between 3 and 5 miles (3)	24	21.05%
Greater than five miles (4)	11	9.65%
<b>Average Score</b>	<b>2.09</b>	

