Is the customer always right? Analyzing bus rider complaints and linking them to real-world operations data in Portland, OR

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ABSTRACT

Public transport agencies collect customer satisfaction surveys to evaluate service quality. These surveys can often yield misleading results due to poor design or conceal specific service-related issues by failing to elicit responses regarding matters not directly asked in the questions. Some researchers and professionals argue that customer complaints are a better indicator of service quality as they directly reveal deficiencies. Our study analyzes customer complaint, commendation, and comment data from Portland, Oregon's TriMet transport agency and links it to automatic vehicle location (AVL) and automatic passenger counters (APC) data. Overall, we found that the most common complaints were related to reliability, customer service, and safety and security. Several commendations were also noted, with most praising the courteousness and performance of bus operators. By examining operations data captured by AVL/APC from the four routes with the highest volume of complaints over the studied period, we discovered that complaints regarding pass ups, late arrivals/departures and reckless driving were significantly associated with higher maximum and average trip loads, faster maximum segment speed, and longer average stop delay. Our study thus demonstrates the potential value of analyzing and linking customer complaints to operations data to help in identifying and addressing problems with a meaningful connection to rider satisfaction.

Keywords: customer complaints, customer satisfaction, public transport, travel survey

1. INTRODUCTION

In recent years, public transport agencies have come to value the benefits of incorporating customer satisfaction in their decision-making process (*1*). Among other things, customer satisfaction is an important indicator of customer loyalty (*2*). Understanding the determinants of customer satisfaction can therefore help agencies determine how best to retain the existing riders—and attract new ones—that will shape the growth and profitability of the system (*3*).

Public transport agencies regularly collect surveys to gauge customer satisfaction. But the process of designing a survey is time-consuming and expensive due, in part, to the caution that must be exercised to minimize response biases. In particular, changes in question order or wording can systematically affect the way respondents answer questions related to satisfaction in travel surveys (*4*). Moreover, poorly designed or closed-ended surveys may cause policymakers to overlook important aspects of real or perceived service quality by failing to elicit information about unforeseen topics (*5*). In response to this, researchers have recommended user-oriented, qualitative methods to assess perceived quality of service. These methods include the use of open-ended questions that allow respondents to express their satisfaction or—more often—dissatisfaction freely (*6; 7*).

Several public transport agencies use the number of complaints received in a certain period of time by their customer service centers as an indicator of customer satisfaction levels. Whilst, a disconnect might exist between the service quality captured in satisfaction surveys or complaint data and objectively measured state of service (*8*). Sometimes, the disconnect is to the transport agencies' benefit. For example, riders tend to overestimate their actual time savings from new services (*9*). At other times, the disconnect is to the agencies' detriment: perceived waiting time is often longer than measured unless real-time information is available (*10*). Therefore, it is prudent to validate the satisfaction surveys or complaints received with actual service data. Doing so will provide a more complete picture of the performance of the public transport system enabling it to target service problems more effectively.

To our knowledge, this is the first study that analyzes customer complaints regarding services provided by a public transport agency and linking them to real-world operations data. In this study, we analyzed data provided by the Tri-County Metropolitan Transportation District of Oregon (TriMet) agency operating in the Portland, Oregon, metropolitan region. TriMet provided complaint data for the period between August 2018 and January 2019 for the 84 regular and two night bus routes shown in **Figure 1** (*11*). We conducted our analysis in two steps. First, we classified and summarized customer comments and suggestions (referred to collectively as "complaints" for brevity's sake). Here, we see that complaints data can reveal instances of negative critical incidents (*12*), which include, among other things the four categories of complaints we analyzed in greater detail: (1) pass-ups, (2) late arrivals/departures (3) early arrivals/departures and (4) perceived dangerous driving behavior. It is also important to note that the complaint database included several comments praising the service, although these were not the primary focus of this study. Second, we used route, date, time, and location information recorded with each complaint to link it with bus operations data for the four lines with the highest volume of complaints. This approach enabled us to evaluate the validity of feedback received. In carrying out the present research, we hope to accomplish two goals: first, to develop a novel method for organizing and analyzing customer complaint data to better identify problems in service provision not normally captured in satisfaction surveys and, second, to confirm that customer complaints are in fact tied to deficiencies in system performance. This will help establish the use of complaint data as an important first step to evaluate route level performance and inform policy decisions.

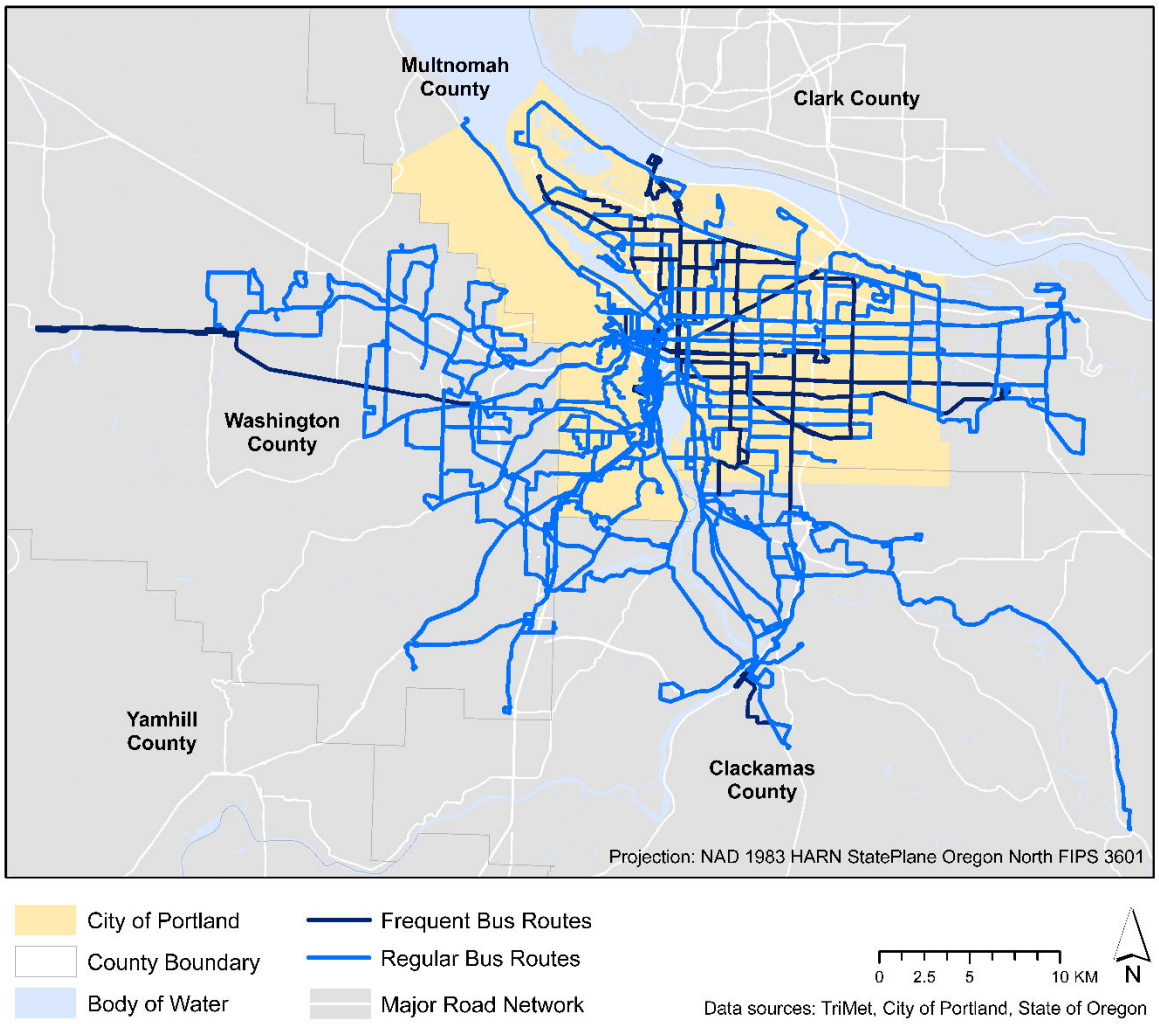

Figure 1: Bus routes operated by TriMet

2. LITERATURE REVIEW

2.1 Customer satisfaction

Public transport professionals have tended to focus on the technical aspects of service provision where the common belief is that improvements made to measurable characteristics such as travel time, cost, and frequency would directly lead to increased ridership. However, it has been shown that it is the perceived quality of service, conveyed through riders' level of satisfaction (*13*), which actually dictates their behavioral intentions (*14*). Furthermore, satisfaction has also been found to positively influence customer loyalty, or whether existing users of a particular public transport system will continue using and/or recommend it to others (*2; 15*). While satisfaction with public transport is dependent on the attitude and personal characteristics of the rider, the quality of both quantitative and qualitative, off-board and on-board service attributes nonetheless still has an impact (*16-19*). For example, van Lierop and El-Geneidy (*8*) found that the overall satisfaction of passengers on an express bus route in Vancouver, Canada, is largely dependent on their satisfaction with crowding, service frequency, onboard safety and cleanliness.

2.2 Satisfaction and objective service quality

While understanding riders' satisfaction levels regarding various service attributes is a critical first step in understanding where investments should go to improve the quality of the public transport system, researchers argue that without linking satisfaction with objective service performance measures, the process is incomplete (*20-22*). Firstly, knowing that riders are dissatisfied with a particular service does not tell us how they will react to changes in service. Secondly, it has been shown that there is a marked difference between perceived and actual quality of service (*8; 23*), with waiting time being an example. It is important to understand the reasons behind this difference for the purpose of identifying the appropriate policy intervention. For example, Watkins et al. (*10)* found that the provision of real-time information mediated the difference between perceived and actual waiting times, emphasizing the importance of real-time information on user satisfaction. More recently, Carrel et al. (*20)* used surveys, automatic vehicle location (AVL), and smartphone tracking data to connect survey responses with respondents' on-route experience to understand how they experienced unreliability throughout the duration of their trips. A clear link between reported satisfaction with delays and measured delays was established where satisfaction decreased as travel time increased.

2.3 Critical incidents (CIs)

Other researchers have approached customer satisfaction differently, using the critical incident technique which states that *critical incidents* (CIs) (*24*) are the main factors determining customer satisfaction and thus perceived service quality. Specifically, Friman, Edvardsson and Garling (*25)* argued that in the delivery of public transport service, dissatisfying or negative critical incidents (NCIs), such as perceived dangerous driving, are more impactful than positive ones. Therefore, they concluded that the frequency of NCIs, which directly affects satisfaction with a specific service attributes (e.g. delays are attributed to unreliability of service), has an indirect impact on overall satisfaction. This hypothesis has since been confirmed by researchers through the use of structural equation modelling (*26*).

2.4 Measuring perceived service quality

In most studies examining customer satisfaction, including those that were mentioned earlier in this literature review, satisfaction was measured quantitatively where respondents were asked to rate their satisfaction based on the Likert or similar numerical scales. However, researchers argue that these strictly formulated (i.e. closed-ended) survey questions can be problematic in two ways: first, they can result in misleading responses due to poor survey or question design and, second, they can limit the opportunity of customers to express concerns about aspects of the service not addressed in the questions (*5; 6*). Also, they can be impacted by a recall bias based a previous NCI not related to the questions being asked.

In the realm of transport planning, researchers have observed (*4; 27*) that the effects of question order and/or question wording do impact survey responses. Specifically, Grise et al. (*4)* found when asking satisfaction with regards to respondents' typical and last commute trips, there were significant systematic differences in the way respondents answered these questions due to a change in the order in which these two questions appeared as well as the way they were worded. Question order effects were also observed by dell'Olio, Ibeas and Cecín (*27)*.

As there is no best practice in place for the design of customer satisfaction surveys, researchers studying patient satisfaction in the healthcare field (*5; 28*) have suggested that more attention should be placed on qualitative methods. These methods may include using responses from open-ended questions where customers can provide their input directly, especially concerning events that resulted in dissatisfaction (*29*) such as NCIs. Some examiners of the impact

of NCIs on perceived quality of public transport service used customer complaints, both archived and from face-to-face interviews, which were categorized and analyzed. They found that, in addition to service unreliability, users also complain frequently about employee behavior (*12*).

On the other hand, researchers studying customer complaint behavior have recognized that there is a variety of internal factors that determine whether a customer would report a complaint (*30; 31*). In addition, it has been reported that up to two-thirds of dissatisfied customers do not complain, but instead cope with their dissatisfaction by quietly exiting the system or communicating negative word-of-mouth assessments (*32*).

To address these shortcomings of customer complaint data, some have advocated that quantitative (i.e. customer ratings obtained from all survey respondents) and qualitative methods (i.e. customer complaints from willing respondents) be used together to measure perceived quality (*33*). However, no study has examined public transport customer complaints alongside objective measures of system performance, similar to what has been done by Carrel et al. (*20)* where they used ratings instead of complaints.

3. CUSTOMER COMPLAINTS DATA

3.1 Complaints data

To better understand the types of bus related public transit CIs that users feel most strongly about, our paper analyzes user complaint data obtained from the TriMet transport agency in Portland, Oregon. In total, 4,021 complaints were received from August 2018 to January 2019. It is important to mention that complaints were recorded or entered into the database anywhere from the same day as the reported event to five or more days after. It is also important to note that TriMet, served 43,704,000 unlinked trips in 2018. In other words, TriMet received one complaint for every 5,434 trips being served in the study period. For our analysis, the data required additional collation and cleaning. First, the complaints were collected through multiple sources (e.g. phone, text, online, twitter) (*34*) and then entered into a database. As such, no standard procedure was followed regarding their initial categorization. Second, several records were entered as duplicates under the same category.

3.2 Categorization of complaints

To analyze the user complaints and link them directly to system performance, they were first reclassified into standard categories and unnecessary duplicates were removed. We relied on the non-standardized categories entered by TriMet customer service representatives to guide our development of standard categories. Each complaint record was then reclassified into the appropriate category or categories if they addressed multiple issues. **Table 1** presents the 18 final categories, the number and percentage of records within each category as well as an example of the text that accompanied each complaint. Duplicate records of the same category were removed, however those that spanned multiple categories, for example a complaint concerning a rude operator (Personnel Complaint) who was also speeding (Vehicle Operation), were kept as multiple records for analysis. A total of 3,838 complaint records were left for analysis. Subcategory descriptions were also created to further isolate different types of complaints to facilitate analysis if needed. For example, ‘Failure to deploy ramp/kneel’ under ‘ADA Complaint’.

Table 1. Number and percentage of complaints by category with examples.

Category of Complaint	Number of Complaints	% of Complaints	Example Complaint
ADA Related Complaint	41	1.1%	xxxx bus xx just got to BTC and then was leaving 03:30am. When the driver got to BTC, who is a tall slender man, he was hurrying people off the bus. I asked for the ramp and he refused to put the ramp down. I need it to get off with my cart safely.
Personnel Complaint	514	13.4%	I was waiting at the bus stop the driver said that I should be more attentive I had my head phones in and I was looking at my phone she honked she almost left the stop
Personnel Commendation	284	7.4%	I was just calling to compliment one of your drivers. I got on the xx at Tanasbourne and it was the first xx that comes from the Hillsboro TC towards Sunset and I just got off at Sunset. He was an excellent driver and provided great customer service. He was friendly to all of the passengers and if every driver was like him, wow, you'd be in great shape then! Please send my kudos to him and his manager.
General Commendation	1	0.0%	You guys put in a bench at the first stop after the Clackamas Community College at Stop ID xxxx and I just wanted to say you guys did a great job. It took a lot to get that bench put in and it feels really nice to be able to sit while waiting for the bus so good job!
Vehicle Operation	481	12.5%	Bus xx 11-28-18 xxxx scheduled to arrive at 2:41 at stop ID xxxx. 3 mins late. Driver driving fast to make up time and hitting brakes too abrubtly after speeding up too fast before reaching the next stop.
Pass-up	982	25.6%	I just had a bus driver pass me up. He looked at me and then just kept going. I waved at him so he would stop but he just left!
Overload	19	0.5%	the bus pulled up to the stop and said she is too full to accommodate the three of us waiting the buses coming out of downtown are as full as ever
Deviation from Schedule	702	18.3%	I am upset because the xxx bus is never on time. It has passed time twice when I was there 5 minutes early and I have missed it numerous times because it does 5 minutes early.
Reroute Issue/Concern	18	0.5%	The bus stop at 102nd & Halsey is temporarily closed but the sign alerting passengers to this is several feet PAST the bus stop and shelter. I almost missed my bus as I didn't see the sign because there was no reason to go past the shelter. I'm curious why the closure sign isn't INSIDE the shelter? Seems to me it would be more visible there.
Accident Report	14	0.4%	We aren't from here and one of your xx buses hit our car mirror. We were on 41st and we were turning right on Fremont and the bus was headed the opposite direction and it hit our mirror and kept going.
Safety Issue/Suggestion	68	1.8%	I was on the MAX last night going to Gresham and there were a couple of guys trying to start a fight with me.
Policies and Procedures	41	1.1%	I planned my trip and I was here 10 minutes early and the bus was in Drop Off Only. That's not customer service. You can't tell riders that they don't get to ride just because your bus was late. Maybe if you had enough buses on the road, this wouldn't happen.
Fare System	64	1.7%	I'm sitting on the xx and three people got on and just sat down without paying fare. The bus number is xxxx and it's parked right now at 5th & Burnside. It's not fair to the rest of us who pay.
Information	42	1.1%	The display at the park ave max station for the xx bus is not working - wrong time/date and not reporting correct arrival times. Stop ID xxxx
Signage	63	1.6%	The bus stop sign at High & 1st is down on the ground. I tried to pick it up but it won't stay. Can you please fix this?
Service Request/Complaint	91	2.4%	There are a lot of us downtown that work from 6am to 2pm and it would be nice if you had more frequent service in the early morning on the weekends.
Stop Request/Complaint	399	10.4%	Via TriMet Text on 09-14-2018 at 8:24am There is broken glass in the bus shelter on Southeast Powell and 69th Avenue Westbound. Could someone come clean it up
Vehicle Request/Complaint	14	0.4%	The reader board inside the bus isn't working
Total	**3,838**	**100.0%**	

3.3 Complaints analysis

3.3.1 Time of Complaint

Of the 3,838 records, 3,643 complaints were associated with a particular event date and time. The other records were the result of either the event being non time-specific (e.g. bus shelter cleanliness), recurring, or details being omitted when they were submitted or entered into the database. The distribution of the number of complaints by time and period of day can be seen in **Figure 2**. Complaints were most frequently reported during peak periods (between 6 and 9 a.m. and 3 and 6 p.m.), when commute ridership is highest. This is presumably due to users being under greater time pressure on their journey to and from work and, therefore, more likely to be negatively impacted by poor service performance.

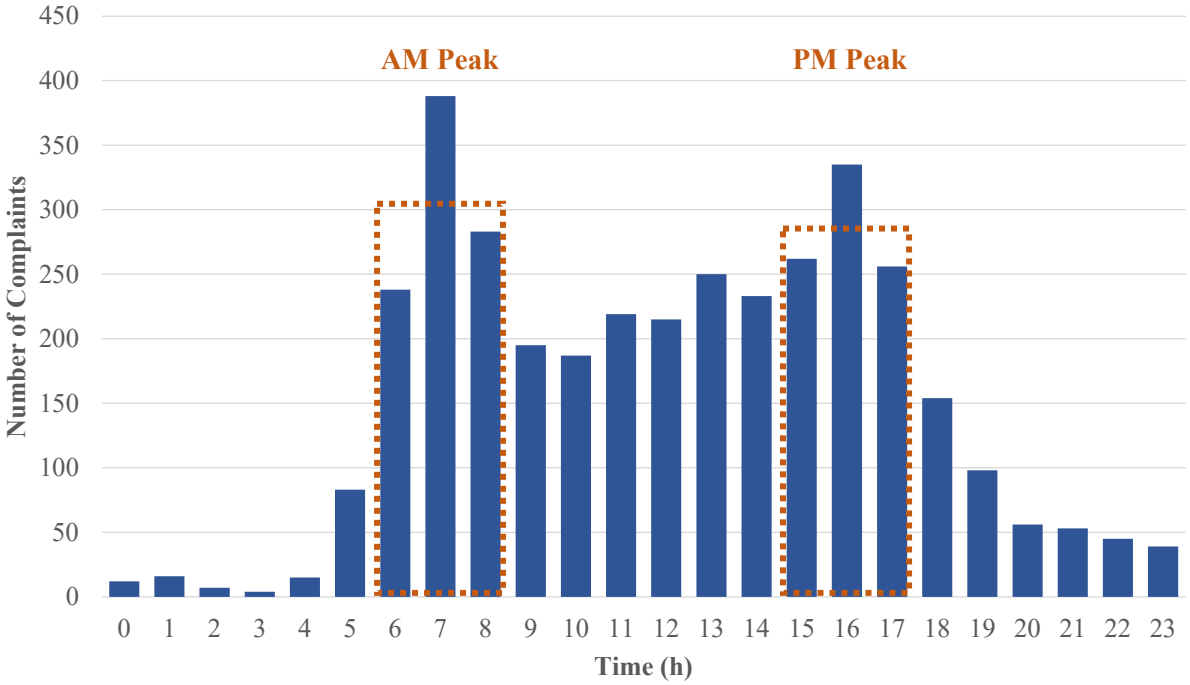

Figure 2. Distribution of the number of complaints by event time.

3.2.2 Complaint topics

To generate standardized classifications, we were guided both by the existing unstandardized descriptors in the data and the broad categories adopted in other studies of public transport satisfaction and operations. See for example (*35-37*). The top-level classifications related to different aspects of customer satisfaction included information, safety, service, and travel environment. Within these higher-level classifications, we nested more specific categories of complaints derived from the data itself. The complaints in **Table 1** fall under the following topics: ADA Compliance, Comfort, Customer Service, Fare, Information, Physical Facilities, Policy, Reliability, Safety and Security, and Service. Similar to previous studies that looked at satisfaction with public transport (*8; 12*), the most common topics (making up 80% of total complaints) concerned Reliability, Customer Service, and Safety and Security (see **Figure 3**).

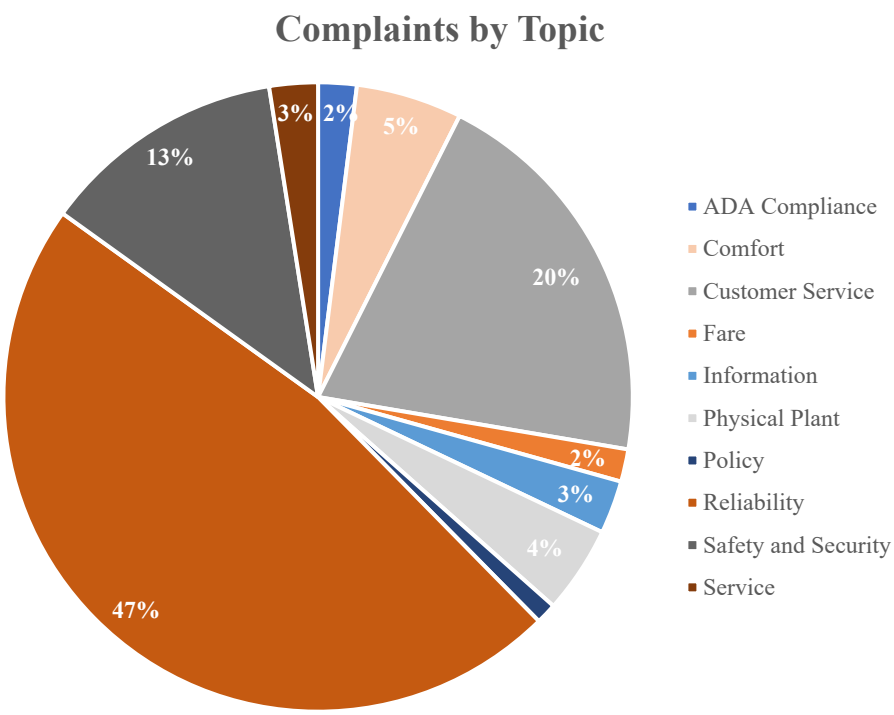

Figure 3. Percentage of complaints by topic.

Nearly half (47%) of complaints concerned the reliability of TriMet's bus service. Complaints that fall under Reliability include: Deviation from Schedule, Overload, Pass-up, Vehicle Operations, and Reroute Issues/Concerns. A majority of these complaints (54%) were about vehicle pass-ups, where the operator failed to pick up a waiting passenger or stop at the proper location when requested. This was followed by 39% of complaints concerning deviations from schedule (e.g. late/early arrivals, no show buses). As expected, this suggests that being able to plan and rely on the service to get to their destination on time is a priority for passengers (*23*). If users are unable to do so, they may look to other options as demonstrated by the following complaint:

> *This morning 10/12/18 at bus stop xxxx the "7:00 am" bus drove right by us at a high rate of speed. They stopped at the next stop down the street and picked up the people there but did not pick us up. There were 3 of us waiting. The next bus (according to your app) never showed up and the 3rd bus was late, so I ended up taking an Uber to work. I was late.*

Complaints about customer service make up 20% of total complaints and consist of two categories: Personnel Complaints (66%) and Personnel Commendations (34%). While the majority of customer service comments received were negative, having over a third being unprompted positive feedback about personnel is significant. In fact, nearly all positive comments received were regarding personnel specifically. This indicates that interactions between operators and the public, both positive and negative, are an important component of user opinion of the service.

Safety and Security is another topic that users feel strongly about, with 13% of complaints on the topic. This includes Accident Reports, Vehicle Operation, Safety Issues/Suggestions, Stop Requests/Complaints, and Vehicle Requests/Complaints. An overwhelming majority (80%) of these complaints reported reckless driving by the operator, including distracted driving, erratic or aggressive driving, failing to yield, running red lights, conflicts with other road users, rough rides, speeding, unsafe lane changes, and other poor driving behaviour. Collecting the appropriate information regarding the time of day when the incident occurred as well as the location is critical for the public transport agency to verify the situation and conduct any actions related to training and monitoring of a driver.

4. LINK BETWEEN COMPLAINTS AND SYSTEM PERFORMANCE

4.1 Data and methodology

The paper also seeks to understand the association between passenger complaints and real-world system performance measures. To do so, four of the routes with the highest total number of complaints were identified for analysis (see **Figure 4**). Many complaints, such as those regarding cleanliness, vandalism, emergencies, and violence, were not logically related to service operations and were excluded from our analysis. This left a total of 382 complaints spanning the high-level classifications of Vehicle Operations, Deviations from Schedule, and Pass-ups. Within the remaining complaints, we identified the four subcategories that (1) displayed the highest individual frequencies and (2) could be associated with particular times, locations and event data. These subcategories encompassed 315 individual complaints with the following distribution: Pass-ups (200 complaints), Late Arrival/Departure (56 complaints), Early Arrival/Departure (30 complaints), and Rough Ride/Driving Behaviour (29 complaints).

Bus service operational data from TriMet's bus dispatch system which includes detailed AVL and automatic passenger counting (APC) systems were acquired for these four routes for the period between August 1, 2018 and Jan 31, 2019. All TriMet buses are equipped with such systems, allowing us to obtain a detailed picture of operations for each route and its constituent trips during the study period.

We used the complaints' date and hour to isolate the AVL/APC data for all trips operating on the four routes of interest during the complete hour of a complaint. By doing so, we were able to reduce the size of the operations data while retaining the data for complete trips, from first departure to last arrival, necessary for calculation of performance measures. From the original operations dataset containing more than 94 million individual records, we were able to refine our scope of analysis to just 2.6 million individual stop records, covering around 10,000 trips. Using the AVL/APC data, we estimated several performance measures for each trip: travel time, average and maximum passenger load and average and maximum stop delay. TriMet's AVL/APC data also provides the maximum speed reached between every two consecutive stops (i.e., stop-to-stop segment). We further calculated the average maximum speed for every single trip using this information. Trips with incomplete records, a malfunctioning APC system or missing stop information were removed from the analysis.

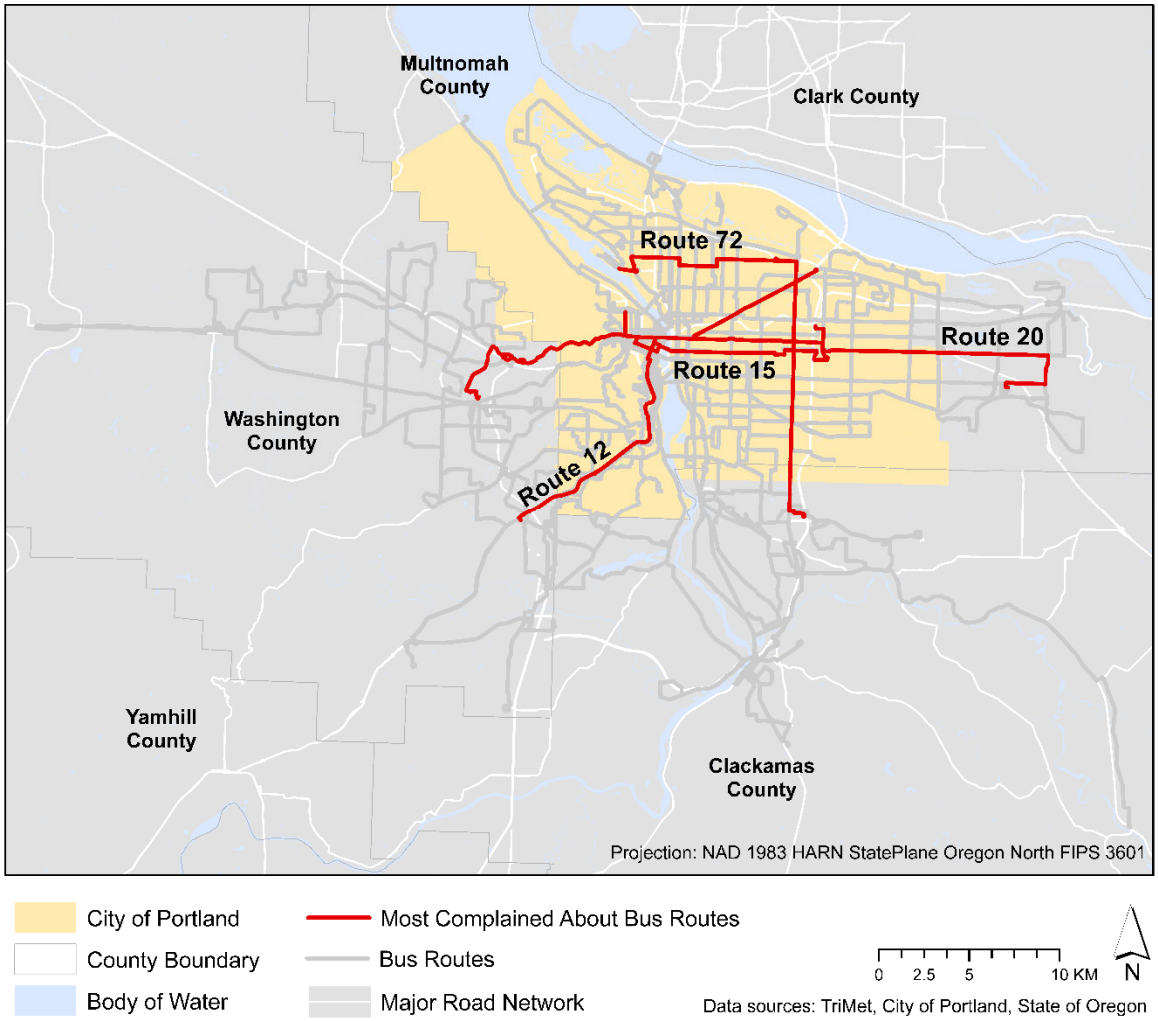

Figure 4. Routes with the most complaints

Errors in reported time and location of complaints can be expected with self-reported complaints. Therefore, the two datasets (i.e. complaints dataset and AVL/APC data) were linked using two approaches. The first is based on route number, vehicle number, hour of the day, and stop ID. The second is based on route number, vehicle number, hour of the day and minute. Due to the high frequency of the routes included in the study, the results from these two approaches were combined in order to maximize the accuracy of linking each complaint to its represented trip. After this process, a total of 205 complaints were successfully linked. For each trip in question (trip with a complaint), we also retained the trip immediately before and the one after for analysis to better understand the causes and impacts of the CI. As some CIs might cause operational problems not just to the bus in question but to the one after. Also, the CI can be caused by a problem in operating the bus before, including these two trips will enable to isolate impacts and causes of CIs. Additionally, a random sample of trips (925 trips, about 10% of trips) from the four routes was kept for comparison purposes.

4.2 System performance results

4.2.1 Complaints association with performance measures

Table 2 summarizes the physical characteristics, ridership, and number of complaints for the four routes included in this part of the analysis. All routes, except for Route 20, have a headway of less than 10 minutes during peak hours. The routes vary considerably in terms of total distance. For example, Route 20 extends for 43.0 km, serving 135 stops, while Route 72 extends for 27.0 km, serving 106 stops. According to recent TriMet ridership estimates (*38*), these routes have the highest daily ridership in the region. Route 72 enjoys the highest ridership with a total of 14,750 boardings per day, followed by Route 20 with 11,020 boardings, and Route 12 and 15 with around 8,200 boardings each. The number of complaints received for these routes ranged between 69 and 104 per route. The highest number of operational complaints occurred along Route 20 (104 complaints), followed by Route 15 (73 complaints), and Route 12 and Route 72 (69 complaints each) (**Figure 5**).

Table 2. Route included in this part of the analysis.

Route	Length (km)	Number of stops	Peak headway (minute)	Daily Ridership (2018)	Filtered operational complaints
Route 12-Barbur/Sandy Blvd	25.29	82	<10	8,200	69
Route 15-Belmont/NW 23rd	19.76	72	<10	8,160	73
Route 20-Burnside/Stark	43.05	135	<1	11,00	104
Route 72-Killingsworth/82nd	27.13	106	<10	14,70	69

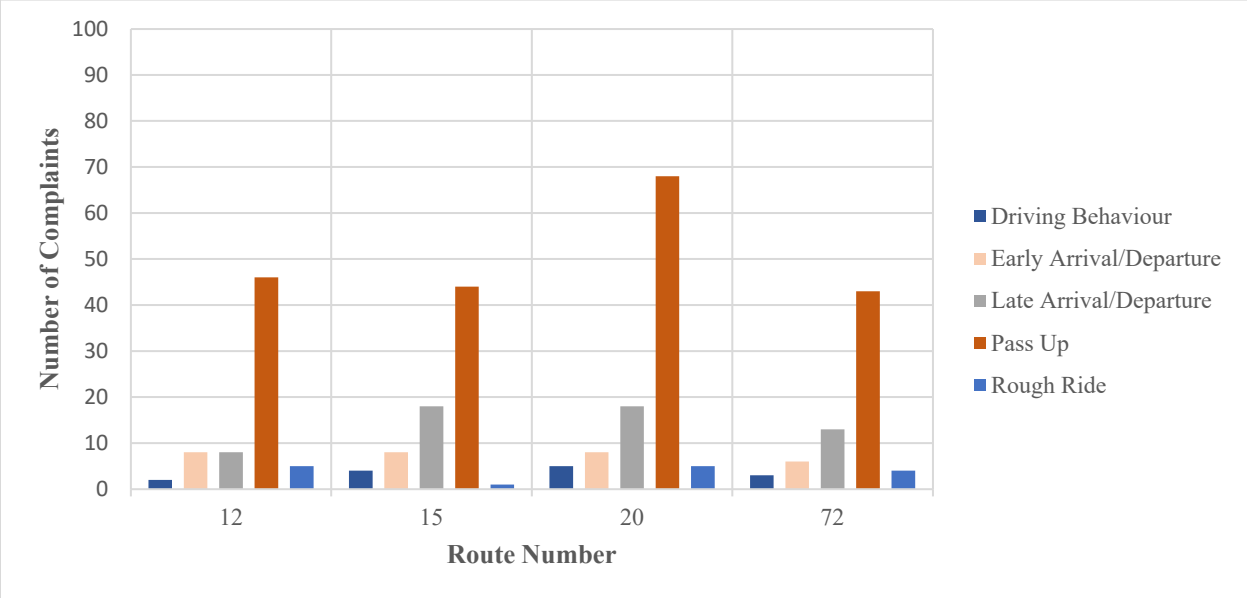

Figure 5. Number of complaints by operations subcategories.

Table 3 shows the mean performance measure values for all trips included in this analysis for the four routes which are broken down by the type and the trip order. The table also provides the mean values for the same set of measures for randomly selected trips. Independent-samples t-tests were used to compare the mean of every group with the mean of the randomly selected trips to determine whether there is a statistically significant difference between them.

As seen in **Table 3**, the maximum and average trip loads of trips with pass-up complaints were slightly higher compared to random trips and to one trip before and one trip after but not significant. This shows that while these trips have slightly higher loads, these higher loads were not consistent along all trips. In contrast, trips with pass-up complaints had statistically significant higher maximum speed between stops, as well as higher average stop delays compared to the random trips. This suggests that pass-up-associated trips were usually late and overcrowded compared to other trips, which may have caused operators to drive faster and fail to pick up passengers at stops, resulting in pass-up complaints. Trips before and after pass-up complaints did not have significantly different average stop delays compared to random trips. Interestingly, they did have higher average maximum speed.

Trips associated with Late Arrival/Departure complaints had significantly higher loads and greater delays at stops compared to random trips. This may reflect that these trips were usually late, capturing more passengers than they should have. In contrast, subsequent trips stopped less frequently to serve passengers, with statistically significant higher average speed and less passenger load. This indicates a typical bunching situation (*39*), with late buses capturing more riders leading to further delays, making the following buses faster, with fewer passengers.

Table 3: Trip performance measures broken down by complaint types.

	# of trips	Max. trip load	Avg. trip load	% of stops made	Max. segment speed	Avg. stop delay
Random trips	925.00	23.84	10.73	0.49	24.64	122.62
Pass-up						
Trip with complaint	141.00	24.11	11.24	0.49	**25.48**	**154.29**
One trip after complaint	133.00	22.27	10.34	0.48	**25.24**	128.82
One trip before complaint	138.00	22.64	10.19	0.48	**25.33**	116.75
Late Arrival/Departure						
Trip with complaint	28.00	**28.25**	**12.80**	0.48	25.17	**497.06**
One trip after complaint	28.00	**19.96**	9.48	**0.43**	**25.87**	117.04
One trip before complaint	25.00	25.24	11.68	0.47	25.12	107.45
Early Arrival/Departure						
Trip with complaint	14.00	26.57	11.43	0.50	24.42	102.51
One trip after complaint	14.00	16.79	8.27	0.49	23.34	156.22
One trip before complaint	14.00	24.00	10.22	0.51	23.55	119.55
Rough Ride/Driving Behavior						
Trip with complaint	22.00	**27.27**	**12.11**	0.50	**26.14**	138.18
One trip after complaint	21.00	20.14	9.09	0.46	25.08	103.64
One trip before complaint	22.00	24.73	10.12	0.47	25.17	92.08

* **Bold** indicates significance at 95%

Trips with complaints about Early Arrival/Departure did not show any significant difference compared to random trips which may be attributed to the small sample size of these trips. Finally, trips with Rough Ride/Driving Behaviour complaints had significantly higher average passenger load and speed. Numerous explanations are possible. For example, drivers with

heavily-loaded buses could perhaps feel greater pressure, causing them to increase their driving speed. It is also conceivable that higher passenger loads, corresponding to a greater number of people standing, could render passengers more susceptible to a rough ride. Future research with a larger database of complaints could allow for greater disaggregation in the analysis, which might better explain the results for this category.

5. LIMITATIONS AND RECOMMENDATIONS

5.1 Data Limitations

Customer complaints provide a useful indication of perceived service quality, particularly when verified using system performance data. There are limitations to the use of customer complaints compared to other sources of satisfaction data. The primary being the lack of standardization in terms of how they are collected, recorded, and stored within and across agencies. This makes it difficult for researchers to be able to compare the results between transit systems and for agencies to be able to analyze and use the feedback received to improve service with the amount of data cleaning that is involved. Additionally, complaint data represents a very small sample of users, so it is difficult to make generalizations based off comments and suggestions that may not be representative of the entire ridership base. However, complaints provide useful insight regarding potential deficiencies in service that can be further investigated through comparison with actual system performance.

5.2 Recommendations for public transit agencies

To facilitate data tabulation and improve the usefulness of comments and suggestions collected, we recommend that public transit agencies adopt the following standards when recording customer complaints:

1) Adopt standard categories for complaints while including ‘Other’ as an option; this both streamlines the entry process and reduces the need for data cleaning later and, to the extent possible, align time, date and location stamps with formatting in AVL/APC data,
2) Create separate fields describing whether comments/suggestions submitted were for a particular event or recurring issue and similarly,
3) Implement fields for whether complaints were submitted by the user or by a third party; for example, some complaints were also entered under the category of ‘Witness’ or ‘Third Party’ to describe a complaint made on the behalf of another user (e.g. someone witnessing a pass-up); these duplicate records were excluded from our analysis as they do not describe the type of complaint and would best be included as a separate field for data filtering purposes, and
4) List how the complaint was reported; since the level of complaint detail seemed to vary depending on the method it was submitted, this would inform agencies which platforms are best for collecting more detailed and useful feedback.

6. CONCLUSION

Our paper used self-reported customer complaints and objective bus service operations data in an attempt to better understand the actual factors that led to the complaint. Knowing these factors and using archived AVL and APC data public transit agencies can set some criteria to highlight routes with potential problems, even if complaints are not received, and do some diagnostic analysis to evaluate the quality of service provided and introduce a set policy and/or procedural changes that can avoid receiving a complaint in the future for a particular route.

It was found that a majority of complaints were reported during peak periods, with more complaints associated with the morning peak. This is perhaps unsurprising since these are the periods with most ridership. These complaints mostly concerned reliability, customer service, and safety and security. A total of 205 complaints concerning vehicle pass-ups, early or late arrivals and departures, and rough bus rides and poor driving behaviour were successfully linked to trip operations data. This represents 65% of the reported complaints, in other words, around 35% of the complaints did not include the appropriate information to be linked back to operations data. Compared to random trips, those associated with pass-up complaints operated at higher maximum speeds but also had longer stop delays confirming that these buses were speeding and skipping stops. While not statistically significant, these trips were also found to have higher maximum and mean passenger loads compared to random trips. Trips associated with complaints about late bus arrivals or departures had higher loads and longer delays at stops, confirming that they were running late and therefore picked up more passengers than they should have, with the following trip capturing fewer riders. Finally, trips that were linked to complaints about a rough ride and poor driver behaviour were found to have a higher-than-average passenger load and speed, confirming complaints about quick accelerations while also indicating that riders on buses operating at a higher capacity are more susceptible to more reckless driving due to crowding and having to stand.

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AUTHOR CONTRIBUTIONS

The authors confirm contribution to the paper as follows: study conception and design: Harreman-Fernandes, DeWeese, Crumley, Diab & El-Geneidy; data collection and/or cleaning: Harreman-Fernandes, DeWeese, Crumley, Diab, & El-Geneidy; analysis and interpretation of results: Harreman-Fernandes, Cui, Diab, & El-Geneidy; draft manuscript preparation, Cui, Harreman-Fernandes, DeWeese, Crumley, Diab, & El-Geneidy. All authors reviewed the results and approved the final version of the manuscript.

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