

Beyond Operational Improvement: A Qualitative Study on User Preferences for Public Transport in Singapore

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Abstract

In order to increase user satisfaction with public transport, some solutions are linked with system level planning and operations (frequency, network coverage), while others are concerned with system usage (vehicle- or infrastructure-related). Designers can mainly contribute to increasing user satisfaction regarding direct system usage, e.g. by improving station comfort or wheelchair accessibility on buses. This paper aims to determine which indicators are important for increasing user satisfaction with public transport at a vehicular and infrastructural level. A survey was conducted in Singapore to investigate people's perceptions of the current public transport system and evaluate indicators. Beyond operational indicators, results showed that 'Information', 'Comfort', 'Physical Condition' and 'Leisure' were the most important indicators for survey participants (n=87). Further work can investigate the relationship between travel habits, demographics and indicator importance. Through an understanding of the qualities people value in today's public transport systems, designers and engineers can develop future mobility solutions.

Keywords: Public transport, user perceptions, service quality indicators

Introduction

The wheels of change have been set in motion towards Singapore's Smart Nation vision [1]. Autonomous vehicles, evolving business models (e.g. ride-hailing, mobility on demand) and big data will drastically change the mobility landscape, giving rise to a need for new approaches to plan and evaluate future mobility systems. Participants in user research studies on public transportation tend to think of their experiences in terms of instrumental indicators, i.e. functional elements affecting operations, such as service frequency and reliability, mode choice and connectivity [2]. From a designer's perspective, it can be difficult to develop solutions to increase public satisfaction on operational aspects. At the same time, commuters are concerned about issues such as comfort, customer service and ease [3], with social environment possibly playing a role in shaping travel behaviour and satisfaction [4], [5]. Hence, the aim is to find out which indicators are important for increasing user satisfaction with public transport at a vehicular and infrastructural level. This work is

based on a master’s thesis by C. Landesvatter [6], whose aim was to develop a set of indicators for human-centred impact assessments of future mobility technologies in public transport. The goal was to assess public satisfaction and identify to what extent the new mobility technology fulfils the needs and wants of users. After developing an indicator set, a survey was conducted in Singapore to investigate people’s perceptions of the current public transport system and determine which indicators were most important to improve user satisfaction. This paper presents the main findings from that survey.

Methodology

The Indicator Set

An indicator set was developed based on the European Standard EN 13816 [7] as well as studies in the field of sustainable transportation [8]–[10]. Indicators were identified on system, vehicular and infrastructural, as well as societal levels for a comprehensive micro-macro perspective. Three modules were defined to categorise the indicators based on different timescales of evaluation and foci:

- i. Module 1 covers the *planning* phase from the perspectives of the operator and user on a system level.
- ii. Module 2 covers the *usage of the public transport system* from a user perspective on the vehicular and infrastructural level.
- iii. Module 3 measures the long-term impact of the system on a *city and societal* level.

The selection of indicators followed a criteria catalogue based on [11], considering the relevance and the functional relationship of indicators to the system, i.e. ‘public transport’, and to ensure comprehensibility for lay-persons. The indicators are presented in Table 1.

Table 1: Indicators for evaluation of public transport system.

Indicators	Short explanation
Module 1: Planning – System level	
Operation & connectivity	Reliability of the system, distance to first stop or station, transfers
Journey & time	Preparation time, waiting time, travel time and walking time
Module 2: Usage of the public transport system – Vehicular and infrastructural levels	
Accessibility	Access of the stations and transportation mode, ticket availability
Comfort	Availability and quality of space, equipment, facilities and ambient conditions
Customer care	Availability and quality of customer service
Information	Availability and quality of information
Identity	Ability to decide for oneself, privacy
Leisure	Ability to spend time satisfactorily, perception of time
Physical conditions	Physical efforts, safety and security

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Module 3: Socio-economics – Societal & city level	
Well-being and safety	Health, safety and security
Social	Community and social relations, cultural values
Environmental quality	Ability to enjoy natural landscapes, appearance of the city
Economics	Employment, tickets costs and affordability

Survey Design

The survey consisted of three segments. The first segment was about participants’ background and travel habits. Demographic information such as gender, age, ethnicity, education and income were collected. Subsequently, four questions were asked about participants’ public transportation habits. For example, ‘Which is your regular mode of transportation?’ with options such as bus, Mass Rapid Transit (MRT) and private car. The second segment queried participants’ satisfaction with the current public transport system in Singapore. Subjects indicated their satisfaction on a Likert scale ranging from ‘Very satisfying’ to ‘Very dissatisfying’ and answered two open-ended questions (‘What do you value most about the public transportation system in Singapore?’ and ‘What should be improved about the transportation system in Singapore?’).

Since one goal of the study was to focus on aspects that designers can act on, segment three asked subjects to rank indicators about the usage of the public transport system (i.e. indicators of Module 2, cf. Table 1). Several statements were formulated under each of the seven indicators in Module 2 (Table 2). For example, ‘Customer Care’ was represented by ‘Quality of handling customer care’, ‘Sufficient physical presence of staff’, ‘Customer service support’ and ‘Helpfulness of public transport staff’. Respondents were first asked to rate the importance of each statement on a Likert scale ranging from ‘(1) Very important’ to ‘(5) Not important’. The statements were grouped into four sections such that each section contained statements representing all seven indicator categories, i.e. statements numbered 1 from each indicator category formed one section, e.g. INF1, ACC1, CUS1, and so on. Subsequently, subjects were asked to pick the statement which was the most important to them from each section. The results from these two methods were then compared to conclude passenger perceptions of important indicators.

Table 2 Survey statements by category.

Indicators	Section	Item No.	Statement
Accessibility	1	ACC1	Availability of escalators/lifts at stations
	2	ACC2	Sufficient ticket validation options (e.g. contactless)
	3	ACC3	Step free access to stations
	4	ACC4	Ease of boarding/alighting the transportation mode
Comfort	1	COM1	Availability of equipment at stations/stops (e.g. benches, shelter)
	2	COM2	Enough space on the vehicle to avoid crowding
	3	COM3	Quality of ambient conditions in vehicle (e.g. cleanliness,

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			air quality, noise)
	4	COM4	Availability of facilities at stations
Customer	1	CUS1	Sufficient physical presence of staff
Care	2	CUS2	Quality of handling customer concerns
	3	CUS3	Customer service support in case of emergency
	4	CUS4	Helpfulness of public transportation staff
Information	1	INF1	Availability of announcements on transportation mode
	2	INF2	Availability of guidance system within the station
	3	INF3	Real time information about the traffic situation
	4	INF4	Ease of planning a trip from point to point
Identity	1	IDY1	Feeling of independence using public transportation
	2	IDY2	Importance of status symbol aspects
	3	IDY3	Enjoying interpersonal interactions with other passengers
	4	IDY4	Enough privacy and personal space on vehicle
Leisure	1	LEI1	Ability to spend time satisfactorily during traveling (e.g. on-board WiFi)
	2	LEI2	Easiness of reaching favourite destinations by public transport
	3	LEI3	Public transportation fits to personal lifestyle
	4	LEI4	Enjoying the surroundings during traveling
Physical	1	PHY1	Perception of security at MRT / Bus stations
Condition	2	PHY2	Short walking distance to MRT/Bus station and interchanges
	3	PHY3	Living in a safe environment (freedom of crime)
	4	PHY4	Minimal physical effort needed to use public transportation

Quantitative data was analysed with IBM SPSS Version 25. A two-way ANOVA test and cross tabulations were performed on the travel statements under each indicator category to determine how demographics and travel habits influence results. The open-ended questions were evaluated with a thematic analysis. These answers were coded according to the categories defined in the indicator set. Some answers fell under more than one category.

Study Participants

A total of 87 subjects (46 male, 41 female) were recruited through random sampling by approaching people at different locations in Singapore: Kent Ridge MRT station and nearby bus stops, Buona Vista MRT station, the Central Business District (CBD), National University of Singapore (NUS) campus, and the Singapore Botanic Gardens. The variety of locations provided a diverse demographic mix. The distribution of participants across demographics is presented in Figure 1. Most young people (aged 15-24 years) were recruited on the NUS campus, while the majority of older people (aged 55 and

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above) were recruited at the Botanic Gardens. The survey took an average of five to 10 minutes to complete, though older participants tended to spend more time (20-30 minutes) on the survey. Subjects received a study information sheet and briefing prior to giving their written consent following research ethics guidelines on informed consent and voluntary participation. Participants could withdraw from the study at any time without penalty.

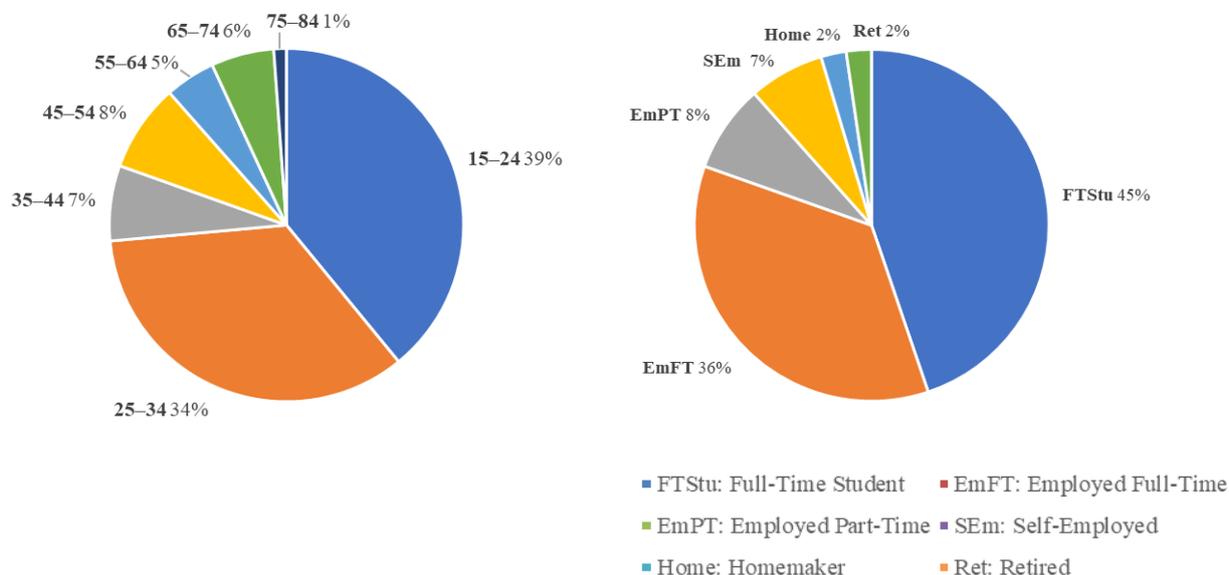


Figure 1 Age group (left) and occupation (right) distribution of participants.

Results

Segment 1: Background and travel habits

The 28 statements in the survey reached a Cronbach's Alpha of 0.925, indicating good reliability among questions. No significant correlations were found between demographic characteristics and the importance of each travel statement in the two-way ANOVA test. Results show that the majority of respondents (n=81, 93%) use public transport, i.e. 'bus', 'MRT', or 'bus and MRT', as their regular mode of transportation (Table 3). The minority who relied mainly on private cars or ride-hailing/taxi services were full-time employees (n=5) or homemakers (n=1).

Table 3 Single-trip durations and mode choice.

Mode Choice	Typical Travel Duration (One-Way)					Total	Mode Choice %
	< 10 min	10-30 min	30-60 min	60-90 min	> 90 min		
Bus		1	8	1		10	11%
MRT	1	10	5	6	4	26	30%
MRT & Bus		10	21	10	4	45	52%
Grab/Taxi	1	1	2			4	5%
Private Car	1	1				2	2%
Total	3	23	36	17	8	87	100%
Duration %	3%	26%	41%	20%	9%	100%	

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Participants in this study rely more on public transport compared to the general population, where 47% rely on either one or a combination of bus and MRT as their usual transport mode [12]. As a large proportion of subjects were students, this is not an unexpected result. Most single-trip journeys take 30-90 minutes (n=53, 61%). 1 in 4 participants' trip duration lasted 10-30 minutes.

Segment 2: Satisfaction about the current public transport system

Most participants were satisfied with the public transport system in Singapore (Figure 2).

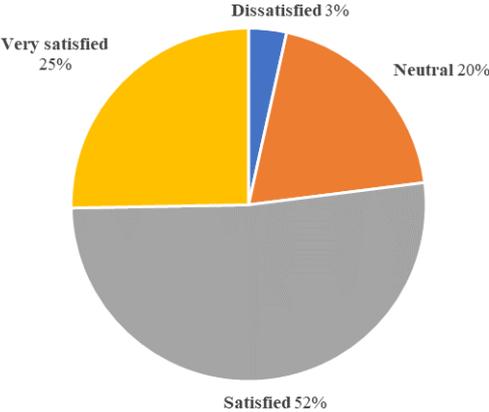


Figure 2 Satisfaction with public transport.

Figure 3 displays the top three categories for answers to the question ‘What should be improved about the transportation system in Singapore?’. Ranked first is ‘Operation and Connectivity’ (48 mentions), followed by ‘Comfort’ (11 mentions) in second place, and ‘Information’ (6 mentions) and ‘Cost’ (6 mentions) tied in third place.

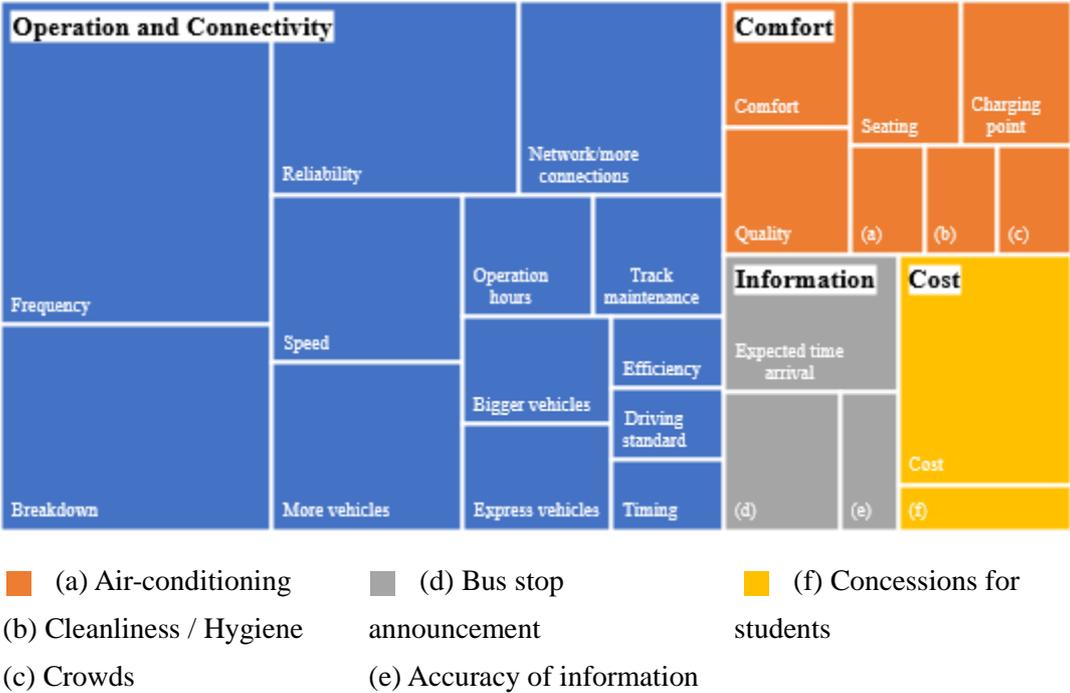


Figure 3 Participants’ coded answers on areas which need the most improvement in Singapore’s public transport system corresponded with four main categories.

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Segment 3: Preferences on vehicular and infrastructure levels

Two types of questions were posed to participants to find out which indicators were more important to generate satisfaction on public transport. The first was the Likert scale rating – (1) ‘Very important’ to (5) ‘Not important’ – of the 28 statements. Participants rated all 28 statements 2.0 on average. Figure 4 averages the rating for each category, with ‘Information’, ‘Physical Condition’ and ‘Comfort’ ranked the most important.

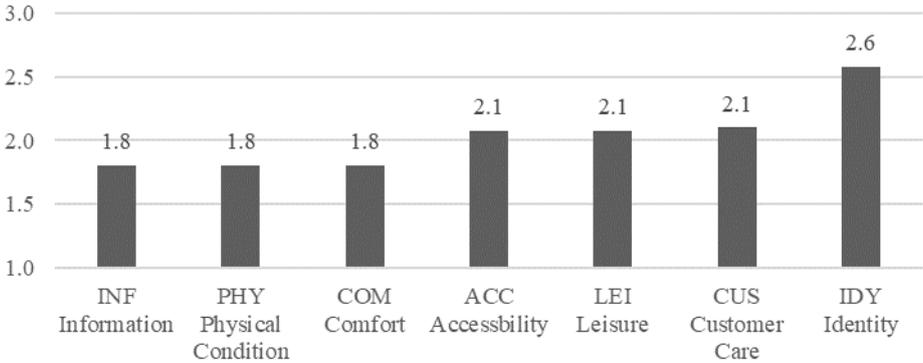


Figure 4 Mean rating per indicator in order of descending importance.

After ranking the 28 statements, participants were asked to pick one item representing the most important statement for them per section. Figure 5 to Figure 8 display the results per section in descending order beginning with the most frequently selected statement. The rankings in Figure 5 do not show a clear preference for one indicator over another, except for a distinct rejection of CUS1 ‘Sufficient physical presence of staff’. Figure 6 shows that participants had a greater preference for statements representing the indicator categories ‘Comfort’, ‘Leisure’ and ‘Physical Condition’. Figure 7 again shows ‘Comfort’ as the preferred category, followed by ‘Physical Condition’. Figure 8 is the only permutation showing a distinct preference for one statement: INF4 ‘Ease of planning a trip from point to point’.

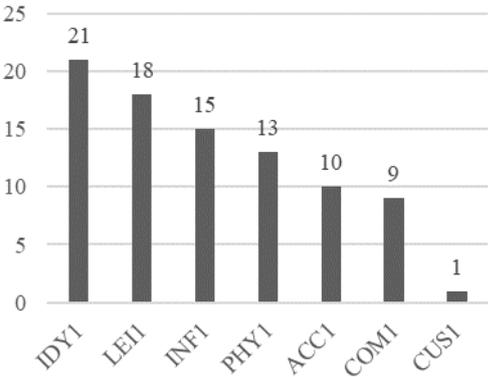


Figure 5 The most important item in section 1 as selected by participants.

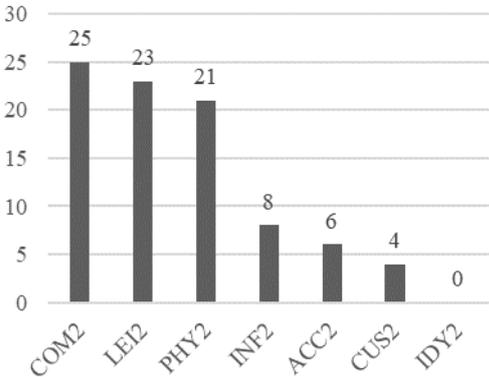


Figure 6 The most important item in section 2 as selected by participants.

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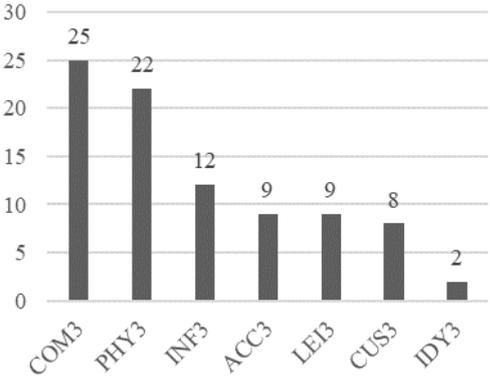


Figure 7 The most important item in section 3 as selected by participants.

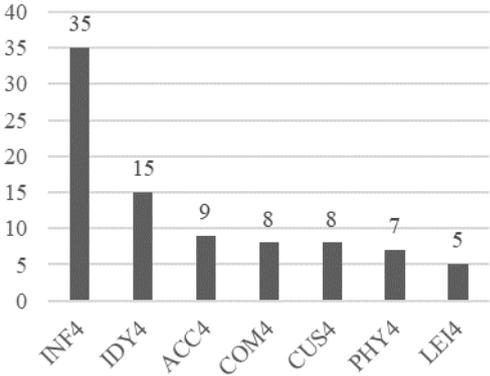


Figure 8 The most important item in section 4 as selected by participants.

Based on the selection in each section, each statement was ranked from 1 to 7 within its section. Then, the scores were averaged according to the category the statement was in. For example, the rank for all the ‘Comfort’ statements was averaged to obtain a final score representing the category’s overall rank across the four sections. Figure 9 displays the results, which show that the top three categories in terms of importance are ‘Information’, ‘Comfort’ and ‘Leisure’.

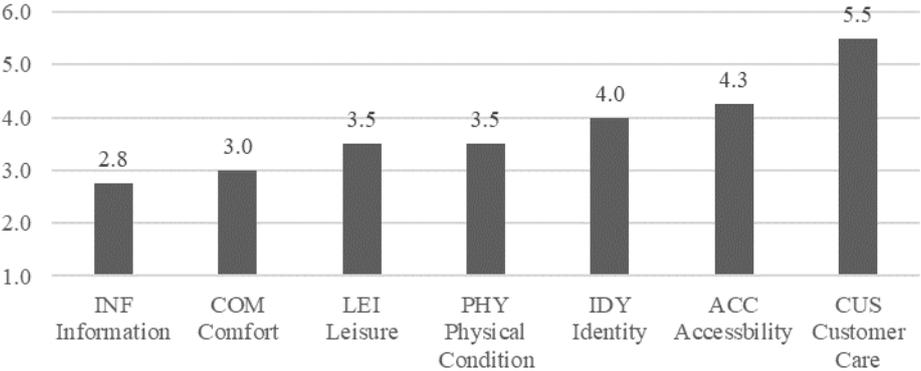


Figure 9 Indicator scores in descending order of importance based on participants’ selection of statements.

The Influence of Public Transport Habits

The selection of the most important statement per section was analysed against participants’ travel habits to determine if there was any relationship. Figure 10 shows the breakdown of participants’ statements according to their typical trip durations. Subjects who take 30-60 minute trips have a slight preference for ACC1 ‘Availability of escalators/lifts at stations’, while participants who take trips lasting over 60 minutes tend to choose IDY1 ‘Feeling of independence using public transportation’ and LEI1 ‘Ability to spend time satisfactorily during traveling’.

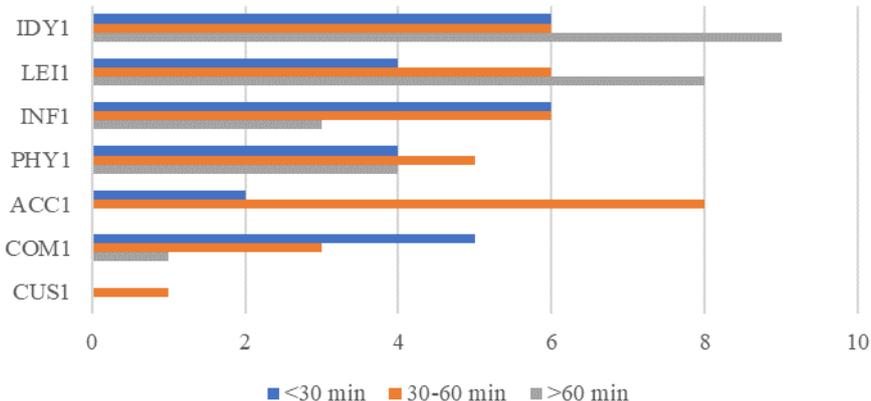


Figure 10 section 1 statement selection by travel duration.

Figure 11 shows that COM2 ‘Enough space on the vehicle to avoid crowding’ and LEI2 ‘Ease of reaching favourite destinations by public transportation’ are the most important statements for subjects who typically travel 30-60 minutes or more. For subjects who take shorter trips of less than 30 minutes, the most important item is PHY2 ‘Short walking distance to MRT/Bus stations and interchanges’, followed by LEI2.

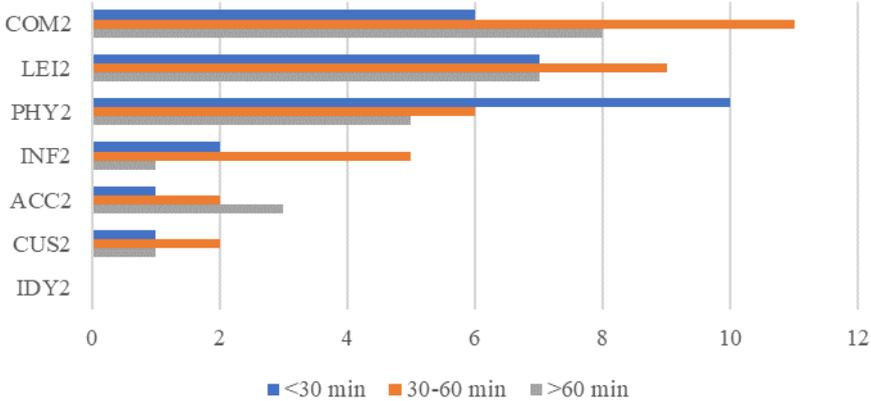


Figure 11 section 2 statement selection by travel duration.

Discussion and Conclusion

Both methods of determining the importance of indicator categories resulted in ‘Information’ and ‘Comfort’ in the top three places. ‘Physical Condition’ and ‘Leisure’ placed second and third place in each respective ranking method, i.e. by averaging the individual statement ratings and by scoring the statements from each section. However, as the ranking and selection of statements was only done in one iteration, i.e. one permutation of each section, no firm conclusion can be drawn yet regarding the importance of indicator categories. Further rounds of the survey with the statements randomised into several different permutations would help to validate the presented results. Travel characteristics such as trip duration seem to affect how participants ranked the importance of statements. Non-instrumental indicators should be further investigated as they have significant influence on passengers’ travel satisfaction [13]. Additionally, demographic characteristics were found to have no relationship with participants’ ratings. Future work could prove or disprove this lack of a relationship.

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