Acta Polytechnica CTU Proceedings **51**:94–108, 2024
https://doi.org/10.14311/APP.2024.51.0094

Published by the Czech Technical University in Prague

ASSESSING TIME AND FINANCIAL COSTS OF BUS DELAYS IN THE ÚSTÍ NAD LABEM REGION, CZECH REPUBLIC

Martin Scháno[a,*], Alexandra Dvořáčková[b], Ondřej Smíšek[c]

[a] *Czech Technical University in Prague, Faculty of Transportation Sciences, Department of Forensic Experts in Transportation, Horská 3, 128 03 Praha 2, Czech Republic*

[b] *Czech Technical University in Prague, Faculty of Transportation Sciences, Department of Logistics and Management of Transport, Horská 3, 128 03 Praha 2, Czech Republic*

[c] *Czech Technical University in Prague, Faculty of Transportation Sciences, Department of Vehicle Technology, Horská 3, 128 03 Praha 2, Czech Republic*

[*] corresponding author: schano@fd.cvut.cz

Abstract. This publication focuses on the development of a regional system for monitoring and evaluating public bus delays in the Ústí nad Labem Region in the Czech Republic.

The case study, through a questionnaire survey, addresses the issue of the value of time loss caused by delays in regional public bus transport in the Ústí nad Labem Region from both a societal and individual passenger perspective. The survey includes, in addition to opportunity costs, the necessity to use earlier buses due to uncertainty and the potential real financial loss of passengers, for instance, due to late arrival to work and p otential employer sanctions. Routes for the questionnaire survey were selected based on an analysis of the movement of the bus fleet to represent typical situations applicable to the entire bus transport network.

The result is a financial evaluation of the losses caused by bus delays in relation to the number of passengers, the purpose of their journeys, and the value of their time. The findings reveal relatively high costs of time losses, which, when applying a co st benefit approach, allow for the return on larger infrastructure investments aimed at reducing these delays. The research results will contribute to the development of issues evaluating the economic efficiency of investments in transport infrastructure.

Keywords: Value of travel time, bus delay.

1. Introduction

Urban transport is integral to the vitality of cities and regions, catering to the diverse mobility needs of their inhabitants. Yet, contemporary cities grapple with an overpowering influx of private vehicles, epitomizing the allure of unfettered mobility for many.

However, the surging numbers of cars are straining road infrastructure capacities. The resultant issues encompass reduced traffic speed, prevalent congestion, compromised safety, and escalated environmental concerns [1, 2]. In some cities, the number of cars on the roads affects the quality of traffic to such a great extent that some parts of the city are at certain times completely cut off [3]. Often, expanding the existing road networks isn't feasible due to the constraints imposed by urban structures. As highlighted by [4], excessive reliance on private vehicles poses formidable barriers to fostering sustainable urban mobility.

Unfortunately, the global trend in the intensity of use of public transport is in decline. [3] present partially positive statistics suggesting stabilization of the use of public transport in Europe at around 11 % in Western Europe and 16 % in Eastern Europe. Based on this, addressing the dwindling public transport patronage isn't just desirable; it's essential for a balanced mobility ecosystem.

Low usage of public transport, especially when compared to private car travel, is often linked to the quality of public transit or the perceived quality of private vehicles in relation to public options. In these instances, the criteria for judging quality aren't always objective. Sometimes, people make decisions based on incomplete or inaccurate information [5].

Quality of service in public transport also deeply affects vulnerable populations. Low-income groups, the elderly, and persons with disabilities are especially reliant on efficient public transport. Their mobility, and by extension their quality of life, hinges on the accessibility and reliability of these systems [6, 7].

By analysing travel time data, it is possible to determine if the system is meeting its scheduled times. Improving reliability often has a positive impact on the user experience of passengers [8]. However, certain public transport delays may not necessarily pose a problem for users, in terms of time or financial loss, and might not even be subjectively perceived as an issue that needs addressing. Yet, where the threshold of acceptability lies is not clear and likely varies for different population segments in various parts of the world. This study presents responses to these questions from bus transport users within the integrated transport system of the Ústí nad Labem Region, the northern part of the Czech Republic.

2. Literature review

As noted, it is clear there is an obligation to seek what can be done about the unpopularity of public transport. Hence, it is essential to understand what affects users' decision to use public transport. An extensive body of literature identifying key priorities for public transport users was published in recent years.

[9] presented study of user loyalty to public transport identified different types of users with different motivations and satisfaction. They also identified the heavy impacts of policies improving service quality, reliability, safety, information, and cleanliness on increasing loyalty among transit users. Generally, as customer satisfaction rises, so does customer loyalty, meaning that satisfied customers are more likely to continue using a service and also recommend the service to others. Therefore transit agencies need to keep their users satisfied, as these are the users who are likely to positively affect the growth and profitability of the agency.

[4] conducted a study to identify factors that influence public transport competitiveness by analyzing current passenger loyalty. They explored the relationships between service quality, passenger satisfaction, switching costs, the appeal of alternative transport, and passenger loyalty and applied their model in a case study in Shanghai PT in China. They concluded that PT service quality was a dominant factor in motivating respondents to choose PT as their travel method. Comparing the degrees of influence it was determined that service quality has a much higher total effect than car attractiveness and switching costs. Their research additionally used seven factors to reflect PT quality. In order of importance to the user, these were: comfort, safety, convenience, timeliness, reliability, economics, and freedom.

Even decades ago, authors such as [10] and [11] generally recognized the concept that retaining existing clients and working to gain their loyalty is more beneficial than investing in attracting new users. Recent authors like [12] or [13] continue to confirm the validity of this perspective in today's context.

Numerous other authors pointed out that when the public transport service is unreliable, has a low frequency, or lacks comfort people are likely to switch to using cars as the unsatisfied users not perceiving public transport as a viable alternative [14, 15].

Extensive research was also conducted on the satisfaction of public transit users and the factors influencing people's motivation to use public transport. One of the most important is timeliness [4, 9, 14].

The travel time value is increasingly playing a significant role in decisions about public transport and transportation infrastructure. International studies have focused on this issue since the 1960s when travel time was included as part of the utility function. The widely accepted discrete choice model bases the value of travel time on the willingness to pay for its reduction, expressed as a ratio of sensitivity to travel time changes and costs. This model is further modified by additional parameters, with meta-analyses summarizing European and overseas studies [16, 17] most commonly citing parameters characterizing the specific journey (its purpose, transportation means used, length, quality), the traveler (age and gender, income category, etc.), and the broader economic context (most often GDP per capita, average wage rate, etc.).

In the Czech Republic, the value of travel time is considered when evaluating externalities in the field of transportation infrastructure. Among the most significant are the certified Methodology for Quantification of Transport Externalities (2013) [18] and the Sectoral Methodology for Evaluating the Economic Efficiency of Transport Construction Projects (2017) [19].

However, there is no consensus on how much time actually costs and how significant a delay becomes problematic. For this reason, we decided to investigate this question as part of broader activities focused on evaluating the state of the Integrated Transport System.

3. Methods

The objective of this paper is to demonstrate the possibilities of using delay data collected by the DÚK dispatcher system, utilizing financial valuation of the societal costs of delays. As evident from a review of both foreign and domestic professional publications, this valuation is influenced by various factors, the quantification of which is not entirely trivial. One such factor is the purpose of the trip, which led us to conduct a pilot survey on selected lines and connections within the Ústí nad Labem Region Transport (Doprava Ústeckého kraje, hereafter DÚK).

The pilot survey aimed to verify the feasibility of obtaining relevant information about the purpose of travel by personally questioning passengers on designated connections, to test the method of their utilization, and to prepare recommendations for a possible subsequent larger-scale survey. The traffic survey was conducted on buses of the integrated transport system of the Ústí nad Labem Region (Doprava Ústeckého kraje, hereafter DÚK). The DÚK system has approximately 250–350 buses active during an average weekday, covering the entire area of the Ústí nad Labem Region, which is approximately 5 400 km^2.

The method for processing this article involved analyzing the positional data of DÚK buses and based on it, selecting representative suburban lines for conducting a questionnaire survey. The questionnaire survey was intended to provide a sufficient amount of data about passengers to quantify the cost of delays for specific buses and simultaneously verify the willingness of passengers to share information for further related work.

Attribute	Description of attribute
payload_id	A unique identifier of the data payload delivery resulting from the query.
payload_time	The date and time of the payload receipt.
payload_topic	The identifier of the task. In this case, /traffic_status.
ArrivalDt	The date and time of arrival at the stop.
CISLineID	Long name of the bus line.
Delay	Delay generated by dispatching software.
finalNode	The final stop on the line.
GPSPositionDt	The date and time of the GPS position collection.
HasLowfloor	Whether the bus has a low-floor.
ID	The identifier of the bus.
LastActivityDt	The date and time of the last activity of the bus.
Latitude	The bus's position.
LineID	The identifier of the bus line.
Longitude	The bus's position.
RouteID	The identifier of the bus route within the line.
StationNode	The last stop passed.
tODepartureDt	The date and time of departure.

Table 1. Description of individual attributes of the bus position database.

3.1. Bus fleet movement and delay data acquisition and processing

The project works with data exports from the DÚK's dispatching software over the period of one month. During this time, about 30 million records of individual bus locations were collected, which were recorded every 15 seconds. The content of the data can be seen in the Table 1. From this data, a total of 4.4 million passages through inter-stop segments were reconstructed.

The passages through stops are manually recorded by the driver in DÚK buses. For this reason, the data on passages were validated through linkage with the passport of bus stops. If the onboard computer reported a stop at a station, the location of that station was compared with the reported location of the bus. If these locations differed significantly, the record of the passage was excluded from subsequent analysis. Such cases are mainly due to a driver's error, for example in setting the onboard computer or in its proper operation. The number of such excluded records fluctuated daily, but generally ranged between 15–20 %. The rest of the data was temporally and spatially consistent with the timetables and was thus used for delay analysis.

The onboard computer is connected to the timetables, and information about planned and actual bus arrivals is thus contained in the processed data. This offers the possibility to evaluate the spatiotemporal delays of individual buses.

For the purposes of this survey, only delays at the time of arrival at the stop were relevant, as only such delays have a direct impact on passengers. The result was statistically processed to obtain a comprehensive overview of the formation and behavior of bus delays in the heterogeneous environment of the Ústí nad Labem Region.

Based on the visualization of various delay parameters on the map (see Figure 1), representative bus lines were subsequentlyselected to evaluate passengers' perceptions of different levels of delay. Generally, it's understood that if a passenger chooses to use a DÚK bus, they can anticipate arrival to be on time or with a minor delay. The average delay upon arrival at the stop across all bus lines is 3.1 minutes, and as observed in the aforementioned heatmaps, this delay is relatively consistently distributed throughout the day. To identify extreme delays for selecting suitable lines for surveys, the 95^{th} percentile was utilized. This percentile signifies a delay that a daily public transport user might encounter about 1–2 times a month. The 95^{th} percentile value for all DÚK bus arrivals' delays during the surveyed period is 9 minutes.

Lines 402, 432, and 455 were chosen for the questionnaire survey. These lines intersect the functions of commuting to work, school, and leisure activities. The distribution of delays during weekdays is illustrated in Figures 2–7 (average values for the entire network can be seen for comparison in Figures 8–9).

Line 402 has an average daily delay of 3.8 minutes and a 95^{th} percentile of 10 minutes. Specifically, during the morning and forenoon hours, when the survey was conducted, these statistics are 2.6 and 7 minutes, respectively. Therefore, this line has a medium average delay but high extremes.

Line 432 has an average daily delay of 1.9 minutes and a 95^{th} percentile of 6 minutes. Specifically, in the morning and forenoon hours, when the survey was conducted, these statistics are 1.5 and 7 minutes, respectively. Thus, this line has a low average delay and low extremes.

Line 455 has an average daily delay of 5.0 minutes and a 95^{th} percentile of 9 minutes. Specifically, in the morning and forenoon hours, when the survey

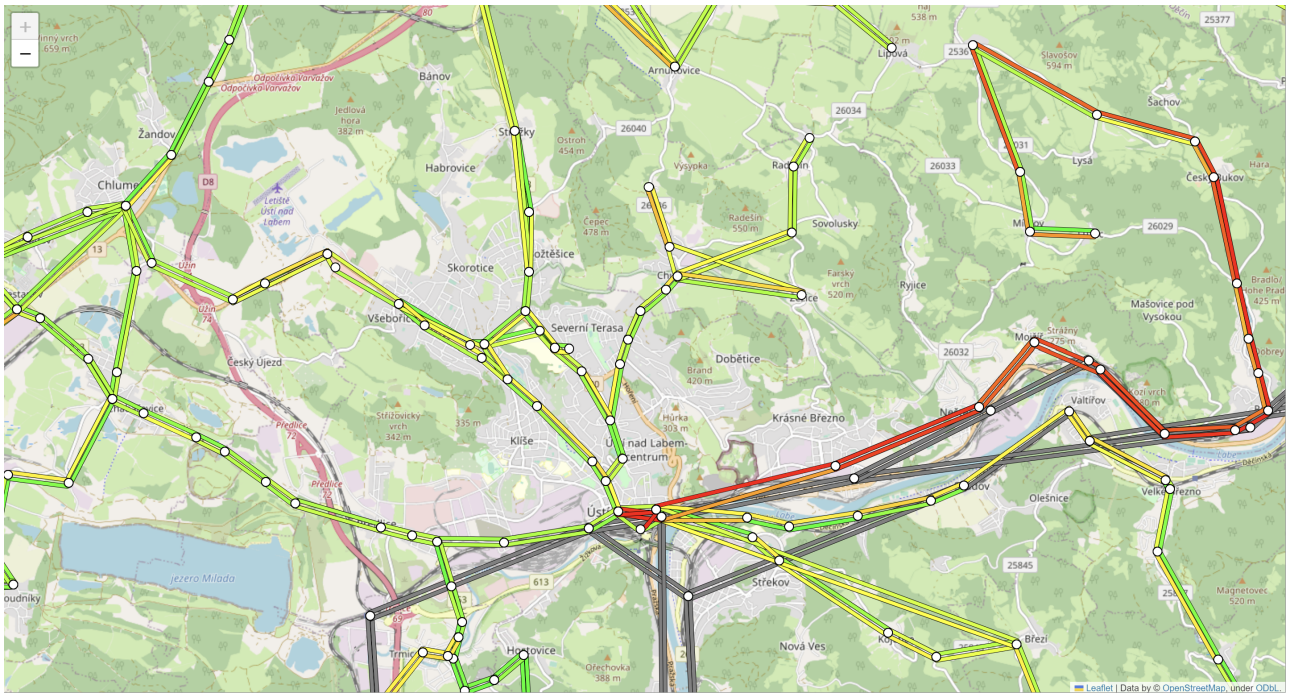

FIGURE 1. Delays of individual lines on the map.

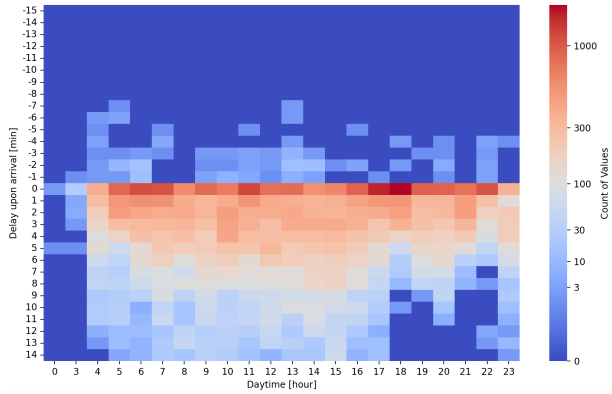

FIGURE 2. Absolute delays on arrival at stops on bus line 402.

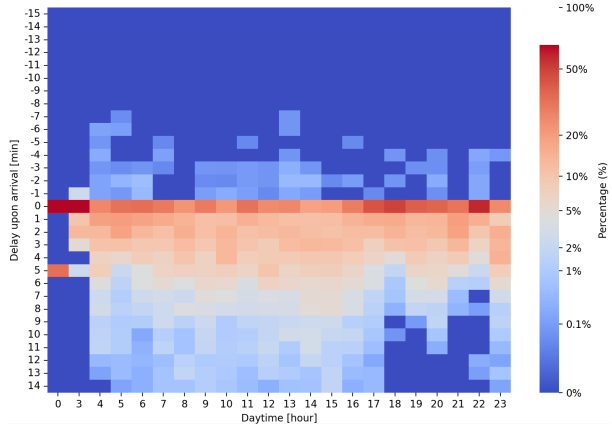

FIGURE 3. Relative delays on arrival at stops on bus line 402.

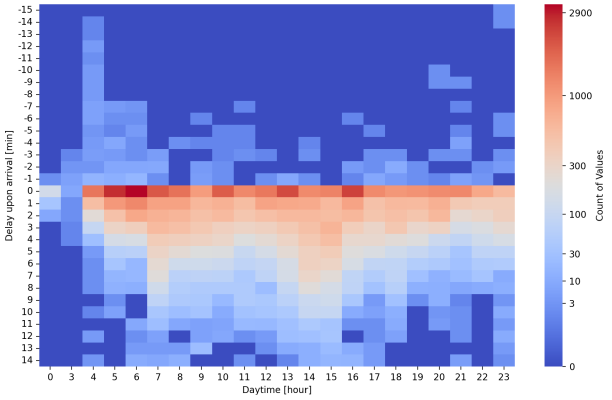

FIGURE 4. Absolute delays on arrival at stops on bus line 432.

was conducted, these statistics are 2.7 and 9 minutes, respectively. Therefore, this line has a high average delay and high extremes.

3.2. BUS DELAY COST EVALUATION

On the selected lines, a total of 15 journeys were chosen at times that covered all required functions of suburban bus transport, i.e., corresponding to regular commutes to work, school, and for occasional trips. On these services, passenger counts for those boarding and alighting were conducted, along with a survey using closed questions.

The questionnaire was designed to ensure that sufficient responses could be gathered in short inter-stop sections (typically involving 2–4 minute drives between stops). It was also structured to be fully anonymous, not containing any personal queries about the passenger (such as gender, age, residence, employment,

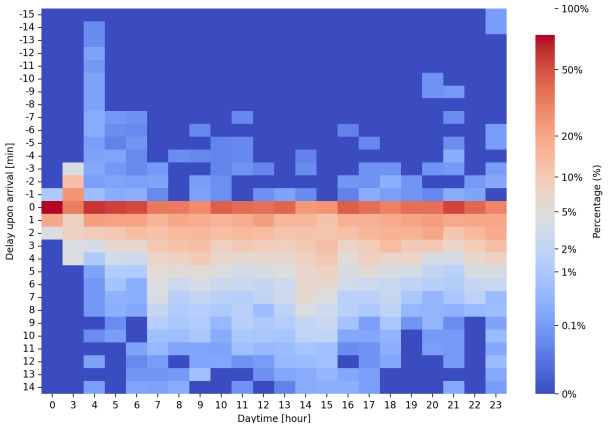

Figure 5. Relative delays on arrival at stops on bus line 432.

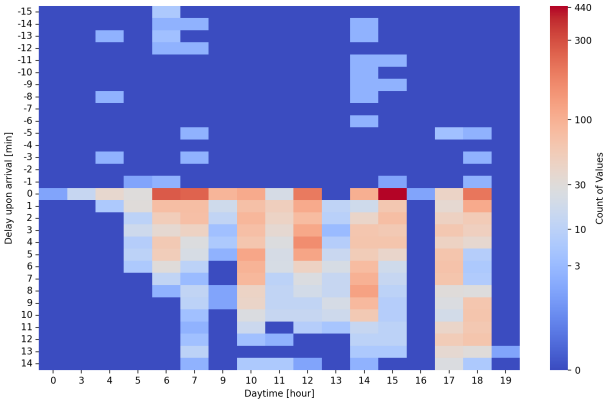

Figure 6. Absolute delays on arrival at stops on bus line 455.

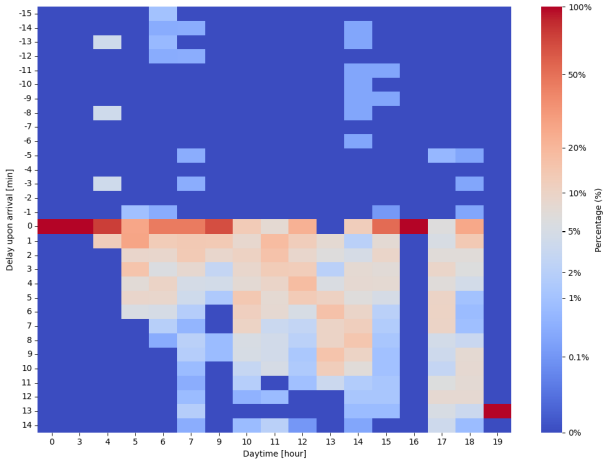

Figure 7. Relative delays on arrival at stops on bus line 455.

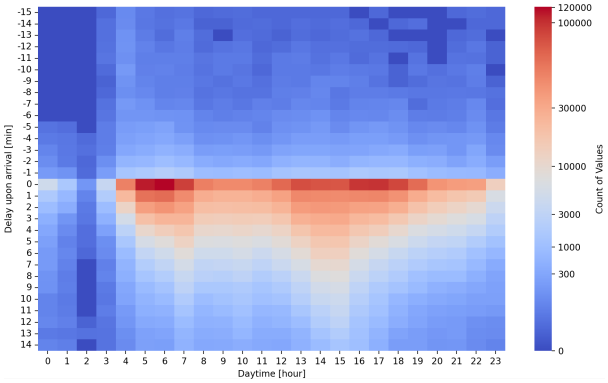

Figure 8. Absolute delays on arrival at stops throughout the region.

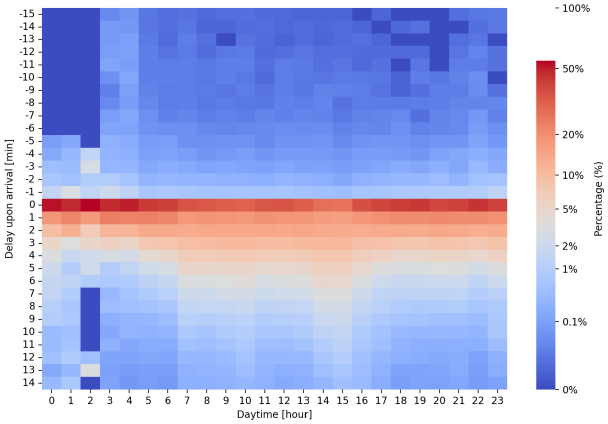

Figure 9. Relative delays on arrival at stops throughout the region.

income, etc.). This approach was taken to minimize any resistance from passengers towards completing it. Consequently, it was anticipated that the passengers' responses would be honest, devoid of any inclination to conceal information or provide inaccurate or false answers.

The questions were asked by trained personnel directly on specific buses over a period of 3 days from 31.10.2023 to 2.11.2023. Overall, mainly considering the length of time taken to fill out the questionnaire, it was possible to obtain answers to all the questions from 191 passengers, which represents approximately 47 % of passengers present on the specific buses. Three passengers refused to answer.

These outputs were subsequently linked with statistical information from the previous section to obtain a more comprehensive picture of the subjective perception of bus delays from the passengers' perspective.

For the financial valuation of delays, a procedure according to the "Sectoral Methodology for Evaluating the Economic Efficiency of Transport Construction Projects" (updated version 2023) was chosen. For declared travel purposes to work and school, time values were used as determined by the Sectoral Methodology for the category BUS non-working – short commute, and for other purposes, the value for the category BUS other-short distance was used. These time val-

Question	Description of the question
Where are you traveling from? Where are you traveling to?	For the purposes of determining the relationship of responses with statistical data on delays.
Purpose of the trip?	To identify the anticipated negative effects of possible delays. Options were (1) To work, (2) To school, (3) Other.
Do you ride the bus regularly?	To determine the weight of the response. Severe negative consequences of delay for a passenger who uses the bus once a month carry a different weight than minor consequences for a passenger who uses buses every day. Options were (1) Every (work) day, (2) Several times a week, (3) Several times a month, and (4) Once a month or less.
Does the bus delay cause you harm?	To determine tolerance for delay and its potential consequences. Options were (1) Yes, it causes direct or indirect financial damage (fine, need to buy a new ticket, penalty by employer, ...), (2) Yes, it causes inconvenience (absence or late arrival at school/work), and (3) No.
If the delay causes you financial harm, how much?	Specific value in case of direct financial loss or description of indirect financial loss (e.g., need to compensate for bus delay with longer time at work).
If the delay causes you financial harm or inconvenience, how significant is the delay?	Specific value – for example, 6 minutes for a transfer. If a bus is delayed less than 6 minutes in such a case, no inconvenience occurs. If it's more than 6 minutes, inconvenience occurs.
If buses were to run with absolute reliability on time, could you travel by a later service?	A question aimed at the cost of delay variability. A passenger may be so intolerant to delay that even if a bus is late only once a month, potential losses outweigh the daily benefits of a later departure.
Do you have the option to use a personal car or another alternative mode of transport (bike, ...) for this journey?	A question aimed at the potential for changing the mode of transport, specifically to distinguish between captive riders (users who are dependent on transit), choice riders (car owners who choose to take transit), and captive-by-choice riders as presented by [9].

TABLE 2. List of survey questions.

ues, stated at the 2017 price level, were recalculated to the 2023 price level (considering inflation, GDP growth, and the elasticity of GDP growth for non-working journeys). For travel to work, this value was increased by 16 % following the recommendation of the "Methodology for Quantification of Transport Externalities". This recommendation is based on a meta-analysis ([17]) that generally agrees on a higher time value for commuting compared to other travel purposes. The following values were used for the financial valuation of delays.

The Value of Travel Time (VOTT) for the observed purposes was determined as follows:

- VOTT work = 198.2 CZK/person-hour (approximately 7.7 EUR/person-hour),
- VOTT school = 170.87 CZK/person-hour (approximately 6.6 EUR/person-hour), and
- VOTT other = 143.62 CZK/person-hour (approximately 5.6 EUR/person-hour).

The Sectoral Methodology procedure respects the necessity to work with the so-called perceived value of time and to value time for individual phases of the journey with the corresponding coefficient, therefore time values were further adjusted by a coefficient of 2.5, which the Methodology determines for the duration of delays. The determined values of delay (Value of Delay) according to the purpose of the journey were thus valued at rates

- VOD work = 495.50 CZK/person-hour (approximately 19.2 EUR/person-hour),
- VOD school = 427.18 CZK/person-hour (approximately 16.6 EUR/person-hour), and
- VOD other = 359.05 CZK/person-hour (approximately 13.9 EUR/person-hour).

4. RESULTS

The questionnaire survey results reveal the purposes of the journeys. In the early morning hours, travel to work predominated, followed by school trips between 6:32 and 8:21 am, and later hours saw a majority of other journeys, mainly for shopping, medical appointments, etc., as shown in Figure 10.

Figure 11 illustrates the responses regarding the regularity of public transport use. Most morning travellers commute daily or several times a week. However, there were also passengers who travel 2–4 times a month or less than once a month.

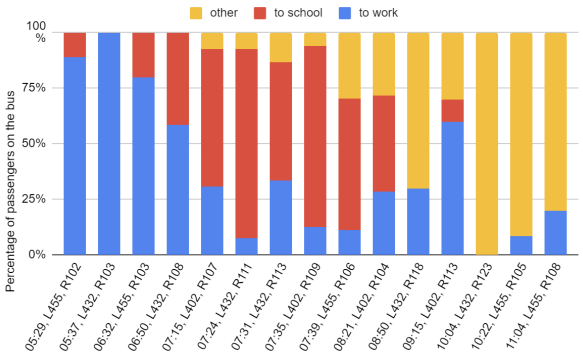

Figure 10. The purpose of the trip.

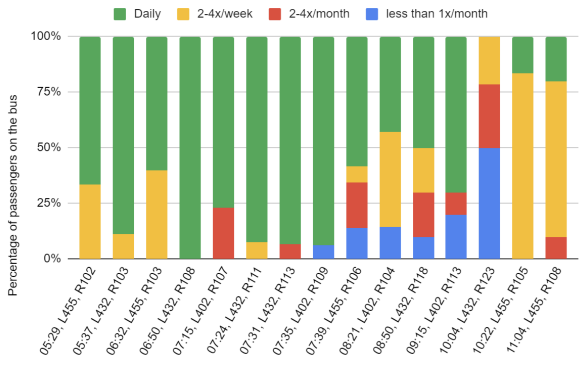

Figure 11. How often respondents use PT.

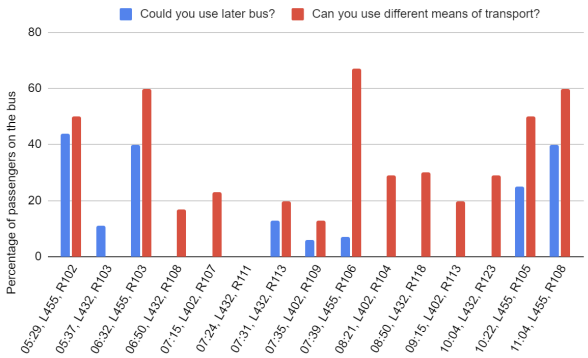

Figure 12. The alternative route or means.

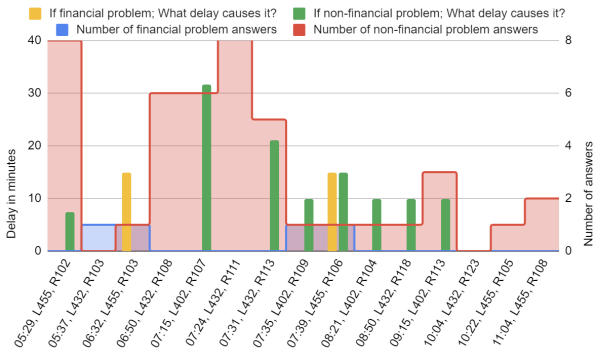

Figure 13. What delay causes problems.

Figure 12 presents the responses to whether passengers could use a later bus if they were 100 % certain that the next bus would not be delayed. A considerable number of positive responses to this question were observed, especially in the early morning hours on line 455, which shows statistically the highest delays. High values were also observed on line 455 during the morning hours.

Figure 12 also reveals answers to whether passengers have the option to use a different mode of transport for their journey. The responses indicate that a significant number of passengers have this option but still choose to use public transport, which is a highly positive outcome.

Figure 13 displays responses regarding the problems caused by delays, whether financial or non-financial. As the graph indicates, passengers' tolerance is relatively high, and financial or non-financial consequences occur, except in one case, only after 10 minutes or more. Financial consequences arise after 15 minutes of delay. It should be noted, however, that the number of respondents with financial consequences is negligible (only 4 responses) out of the total sample of 191 respondents.

From the results of the passenger count in the pilot survey, tables were created for stops where passengers exited the buses. Based on the percentage representation of declared travel purposes in the questionnaire survey, the presumed purposes of all passengers travelling in the monitored section of the line were calculated. If no corresponding data from the questionnaire survey were available for a given stop or were obviously unrepresentative, then the proportions of travel purposes were determined based on local knowledge (location of schools, companies, shopping centres, etc.). For line 455 Český Bukov – Ústí nad Labem, due to low occupancy, the survey was conducted for all three monitored trips twice on two consecutive days, and the average of the determined values was used for each trip. Tables 3 and 4 present examples of such processed data for line 432 and trip 113.

For each stop with recorded passenger alighting, the cumulative value of delay in person-hours for each presumed travel purpose and in total was determined based on the average value of delay at the stop on weekdays of the last month (for the respective line and trip).

The comprehensive results for all 10 trips on the 3 selected lines are presented in Table 5.

The total value of delays on the monitored trips was 18.97 person-hours, representing societal costs of 8 181.80 CZK (EUR 336 per day). If this value were considered typical, the annual total for these trips alone would amount to 2 045 450 CZK (EUR 83 863 per year).

5. Discussion

While the results are intriguing, it is important to note that the scope of the survey was considerably limited by its 191 respondents. Nonetheless, it was possible to discern general trends among passengers.

Libouchec - Děčín - Janov		Number of passangers exiting the bus		Survey - Number of passangers exiting based on trip purpose							Number of passangers exiting the bus by purpose (based on survey)			
Line ID	Bus stop name	Route ID	exiting	work		school		other		total	work	school	other	total
432	Jílové, Kamenec	113	2	2	100%	0	0%	0	0%	2	2	0	0	2
432	Jílové, náměstí	113	4	0	0%	1	50%	1	50%	2	0	2	2	4
432	Jílové, papírny	113	2	2	100%	0	0%	0	0%	2	2	0	0	2
432	Děčín, Bynov, škola	113	4	0	0%	1	50%	1	50%	2	0	2	2	4
432	Děčín, U Zámečku	113	1	0	100%	0	0%	0	0%	0	1	0	0	1
432	Děčín, Kovočas	113	3	0	100%	0	0%	0	0%	0	3	0	0	3
432	Děčín, Růžek	113	3	0	100%	0	0%	0	0%	0	3	0	0	3
432	Děčín, Teplická	113	4	0	0%	4	100%	0	0%	4	0	4	0	4
432	Děčín, hlavní nádraží	113	9	0	0%	1	100%	0	0%	1	0	9	0	9
432	Děčín, Tyršova	113	3	0	0%	1	100%	0	0%	1	0	3	0	3
432	Děčín, Myslbekova	113	17	1	5%	19	95%	0	0%	20	1	16	0	17
Libouchec - Děčín - Janov		432/113	52	5	19%	27	104%	2	8%	26	12	36	4	52

TABLE 3. Travel purposes for line 432, trip 113.

Libouchec - Děčín - Janov		Number of passangers exiting the bus		Average delay [mins]	Sum of passangers delay [person-minute]			Financial loss from the passangers delay [CZK]			Sum of financial loss [CZK]
Line ID	Bus stop name	Route ID	exiting		work	school	other	work	school	other	
432	Jílové, Kamenec	113	2	1,19	0,04	0,00	0,00	19,65	0,00	0,00	19,65
432	Jílové, náměstí	113	4	1,86	0,00	0,06	0,06	0,00	26,49	22,26	48,75
432	Jílové, papírny	113	2	1,98	0,07	0,00	0,00	32,70	0,00	0,00	32,70
432	Děčín, Bynov, škola	113	4	3,51	0,00	0,12	0,12	0,00	49,98	42,01	91,99
432	Děčín, U Zámečku	113	1	3,24	0,05	0,00	0,00	26,76	0,00	0,00	26,76
432	Děčín, Kovočas	113	3	3,07	0,15	0,00	0,00	76,06	0,00	0,00	76,06
432	Děčín, Růžek	113	3	2,99	0,15	0,00	0,00	74,08	0,00	0,00	74,08
432	Děčín, Teplická	113	4	2,96	0,00	0,20	0,00	0,00	84,30	0,00	84,30
432	Děčín, hlavní nádraží	113	9	3,26	0,00	0,49	0,00	0,00	208,89	0,00	208,89
432	Děčín, Tyršova	113	3	3,09	0,00	0,15	0,00	0,00	66,00	0,00	66,00
432	Děčín, Myslbekova	113	17	3,86	0,06	1,03	0,00	31,88	439,72	0,00	471,59
Libouchec - Děčín - Janov		432/113	52		0,53	2,05	0,18	261,13	875,37	64,27	1200,77

TABLE 4. Financial value of delay for line 432, trip 113.

Line	Route	Time of arrival	Delay based on trip purpose			Average delay at stop [min]		Total delay per route		Financial cost of delay per day based on trip purpose [CZK]			Sum of financial costs per day per route	
			to work	to school	other	min	max	[pers.hour]	[pers.min]	to work	to school	other	[CZK]	[EUR]
402 Varnsdorf - Chřibská - Č.Kamenice - Děčín	107	7:15	0,21	0,61	0,05	0,00	2,10	0,87	52,00	104,39	260,87	16,28	381,52	15,64
	109	7:41	0,40	1,78	0,38	0,13	2,96	2,56	153,54	196,80	760,60	136,92	1 094,31	44,87
	113	9:17	0,83	1,49	0,41	2,58	6,11	2,74	164,28	412,83	636,86	148,65	1 198,34	49,13
432 Libouchec - Jílové - Děčín - Janov	103	5:37	0,41	0,00	0,00	0,45	1,28	0,41	24,60	204,97	0,00	0,00	204,98	8,40
	111	7:24	0,82	0,89	0,43	2,55	3,46	2,14	128,38	406,31	379,63	154,75	940,69	38,57
	113	7:42	0,53	2,05	0,18	1,19	3,86	2,76	165,31	261,13	875,37	64,27	1 200,77	49,23
	123	9:39	0,03	0,18	1,39	1,78	3,96	1,60	95,90	14,70	77,75	497,88	590,34	24,20
455 Povrly, Český Bukov - Ústí n.L.	102	5:31	2,23	0,16	0,00	3,36	5,33	2,39	143,32	1 105,09	67,64	0,00	1 172,73	48,08
	106	7:39	0,19	0,42	0,40	0,00	5,68	1,02	60,92	93,81	179,99	145,30	419,10	17,18
	108	11:06	0,59	0,00	1,91	10,04	12,43	2,50	150,13	292,76	0,00	686,26	979,02	40,14
										Sum of financial costs per day			8 181,80	335,45

TABLE 5. Financial value of delay for the observed trips on lines 402, 432, and 455.

The most significant finding is the discrepancy between perceived losses and actual losses from bus delays. As seen in the differences between Figures 2–7 and Figure 13, perceptible problems caused by delays do not occur in most real cases. The majority of reported delay problems were observed from 10 minutes onwards. However, there were instances with delays of 21 minutes or even 32 minutes. Thus, the overall perception of the timeliness of public transport in the Ústí nad Labem Region is high. Nevertheless, losses still occur, albeit unnoticed.

The second key finding is that the losses from public transport bus delays are substantial enough to cover investments in infrastructure (e.g., intersection reconstruction or traffic light priority) and still be cost-effective. That is, merely from reducing delays, it is possible to cover the entire or a significant part of the costs of measures to reduce delays. This finding adds motivation to create analytical tools for identifying and locating causes of bus delays, as their elimination will be financially efficient.

6. Conclusions

In conclusion, it can be stated that users of public transport in the Ústí nad Labem Region are more than willing to participate in activities aimed at improving public transport services, even if they are not necessarily daily users. Only a very small number of people (∼1 %) refused to respond.

The survey showed that approximately 33 % of public transport users have the option of using another mode of transportation for their journey. This is a significant proportion and indicates that bus delays in the region (average of 2–3 minutes) are not perceived as problematic enough for users to widely change their mode of transport.

On the other hand, an average of 12 % of respondents stated that if they were 100 % certain that the bus would not be delayed, they could use a later connection for their journey. This points to high time investments forced by potential delays and suggests a quite promising direction for improving the quality of bus services.

In total, only about 2 % of public transport users stated that bus delays cause them financial losses. Most of them mentioned the obligation to stay longer at work and make up for the delayed time. On the other hand, a total of 25 % of public transport users stated that bus delays cause them non-financial losses or problems. This group of users can significantly influence the perceived quality of service and affect the popularity of public transport.

References

[1] D. Banister. *Unsustainable Transport: City Transport in the New Century*. Routledge, London, 2005. ISBN 9780203003886. https://doi.org/10.4324/9780203003886

[2] E. Nedeliakova, J. Sekulova, I. Nedeliak, B. Abramovic. Application of Raymond Fisk model in research of service quality. *Communications – Scientific Letters of the University of Zilina* **18**(2):11–14, 2016. https://doi.org/10.26552/com.C.2016.2.11-14

[3] M. Poliak, A. Poliaková, M. Mrníková, et al. The competitiveness of public transport. *Journal of Competitiveness* **9**(3):81–97, 2017. https://doi.org/10.7441/joc.2017.03.06

[4] L. Li, Y. Bai, Z. Song, et al. Public transportation competitiveness analysis based on current passenger loyalty. *Transportation Research Part A: Policy and Practice* **113**:213–226, 2018. https://doi.org/10.1016/j.tra.2018.04.016

[5] G. Beirão, J. A. Sarsfield Cabral. Understanding attitudes towards public transport and private car: A qualitative study. *Transport Policy* **14**(6):478–489, 2007. https://doi.org/10.1016/j.tranpol.2007.04.009

[6] D. Lin, J. Cui. Transport and mobility needs for an ageing society from a policy perspective: Review and implications. *International Journal of Environmental Research and Public Health* **18**(22):11802, 2021. https://doi.org/10.3390/ijerph182211802

[7] N. N. Sze, K. M. Christensen. Access to urban transportation system for individuals with disabilities. *IATSS Research* **41**(2):66–73, 2017. Safe and Sustainable Transport for All. https://doi.org/10.1016/j.iatssr.2017.05.002

[8] S. Nesmachnow, R. Massobrio, S. Guridi, et al. Big data analysis for travel time characterization in public transportation systems. *Sustainability* **15**(19):14561, 2023. https://doi.org/10.3390/su151914561

[9] D. van Lierop, A. El-Geneidy. Enjoying loyalty: The relationship between service quality, customer satisfaction, and behavioral intentions in public transit. *Research in Transportation Economics* **59**:50–59, 2016. Competition and Ownership in Land Passenger Transport (selected papers from the Thredbo 14 conference). https://doi.org/10.1016/j.retrec.2016.04.001

[10] B. Verplanken, H. Aarts, A. Van Knippenberg. Habit, information acquisition, and the process of making travel mode choices. *European Journal of Social Psychology* **27**(5):539–560, 1997. https://doi.org/10.1002/(SICI)1099-0992(199709/10)27:5<539::AID-EJSP831>3.0.CO;2-A

[11] F. F. Reichheld. Loyalty-based management. *Harvard Business Review* **71**(2):64–73, 1993.

[12] J. de Oña. Service quality, satisfaction and behavioral intentions towards public transport from the point of view of private vehicle users. *Transportation* **49**:237–269, 2022. https://doi.org/10.1007/s11116-021-10175-7

[13] S. Sun, H. Zhang, L. Zhou, K. Wang. Is the relationship between the perceived service quality and passenger loyalty linear or non-linear? A novel model-independent interpretation method is applied. *Transport Policy* **144**:65–79, 2023. https://doi.org/10.1016/j.tranpol.2023.10.003

[14] G. Monchambert, A. de Palma. Public transport reliability and commuter strategy. *Journal of Urban Economics* **81**:14–29, 2014. https://doi.org/10.1016/j.jue.2014.02.001

[15] L. Redman, M. Friman, T. Gärling, T. Hartig. Quality attributes of public transport that attract car users: A research review. *Transport Policy* **25**:119–127, 2013. https://doi.org/10.1016/j.tranpol.2012.11.005

[16] J. D. Shires, G. C. de Jong. An international meta-analysis of values of travel time savings. *Evaluation and Program Planning* **32**(4):315–325, 2009. Evaluating the Impact of Transport Projects: Lessons for Other Disciplines. https://doi.org/10.1016/j.evalprogplan.2009.06.010

[17] M. Wardman, V. P. K. Chintakayala, G. de Jong. Values of travel time in Europe: Review and meta-analysis. *Transportation Research Part A: Policy and Practice* **94**:93–111, 2016. https://doi.org/10.1016/j.tra.2016.08.019

[18] V. Máca, J. Melichar. Metodika kvantifikace externalit z dopravy [In Czech; Methodology for the quantification of transport externalities], 2013. [2023-11-19]. https://www.tacr.cz/dokums_raw/metodiky/TB0100MD020_metodika.pdf

[19] Státní fond dopravní infrastruktury. Rezortní metodika pro hodnocení ekonomické efektivnosti projektů dopravních staveb (10/2017, aktualizace 06/2023) [In Czech; Sectoral methodology for evaluating the economic efficiency of transport infrastructure projects], 2023. [2023-11-19]. https://sfdi.gov.cz/pravidla-a-metodiky/rezortni-metodika-pro-hodnoceni-ekonomicke-efektivnosti-projektu/

A. Appendices – Tables for calculation of cost of delay for each line and route

Varnsdorf - Chřibská - Č.Kamenice - Děčín		Number of passangers exiting the bus		Survey - Number of passangers exiting based on trip purpose							Number of passangers exiting the bus by purpose (based on survey)			
Line ID	Bus stop name	Route ID	exiting	work		school		other		total	work	school	other	total
402	Chřibská náměstí	107	1	1	100%	0	0%	0	0%	1	1	0	0	1
402	Česká Kamenice, Horní Kamenice	107	2	0	0%	1	100%	0	0%	1	0	2	0	2
402	Markvartice	107	1	1	100%	0	0%	0	0%	1	1	0	0	1
402	Děčín, Myslbekova	107	21	0	0%	7	100%	0	0%	7	0	21	0	21
402	Děčín, hlavní nádraží	107	39	4	80%	0	0%	1	20%	5	31	0	8	39
Varnsdorf - Chřibská - Č.Kamenice - Děčín		402/107	64	6	40%	8	53%	1	7%	15	33	23	8	64

Table 6. Travel purposes for line 402, trip 107.

Varnsdorf - Chřibská - Č.Kamenice - Děčín		Number of passangers exiting the bus		Average delay [mins]	Sum of passangers delay [person-minute]			Financial loss from the passangers delay [CZK]			Sum of financial loss [CZK]
Line ID	Bus stop name	Route ID	exiting		work	school	other	work	school	other	
402	Chřibská náměstí	107	1	0	0,00	0,00	0,00	0,00	0,00	0,00	0,00
402	Česká Kamenice, Horní Kamenice	107	2	1,73	0,00	0,06	0,00	0,00	24,63	0,00	24,63
402	Markvartice	107	1	2,1	0,04	0,00	0,00	17,34	0,00	0,00	17,34
402	Děčín, Myslbekova	107	21	1,58	0,00	0,55	0,00	0,00	236,23	0,00	236,23
402	Děčín, hlavní nádraží	107	39	0,34	0,18	0,00	0,05	87,04	0,00	16,28	103,32
Varnsdorf - Chřibská - Č.Kamenice - Děčín		402/107	64		0,21	0,61	0,05	104,39	260,87	16,28	381,52

Table 7. Financial value of delay for line 402, trip 107.

Varnsdorf - Chřibská - Č.Kamenice - Děčín		Number of passangers exiting the bus		Survey - Number of passangers exiting based on trip purpose							Number of passangers exiting the bus by purpose (based on survey)			
Line ID	Bus stop name	Route ID	exiting	work		school		other		total	work	school	other	total
402	Česká Kamenice, Pražská	109	8	1	33%	2	67%	0	0%	3	3	5	0	8
402	Markvartice	109	2	0	0%	0	100%	0	0%	0	0	2	0	2
402	Ludvíkovice	109	1	0	100%	0	0%	0	0%	0	1	0	0	1
402	Děčín, škola	109	5	0	0%	0	100%	0	0%	0	0	5	0	5
402	Děčín, Myslbekova	109	30	0	0%	11	100%	0	0%	11	0	30	0	30
402	Děčín, hlavní nádraží	109	25	1	50%	0	0%	1	50%	2	12	0	13	25
Varnsdorf - Chřibská - Č.Kamenice - Děčín		402/109	71	2	13%	13	81%	1	6%	16	16	42	13	71

Table 8. Travel purposes for line 402, trip 109.

Varnsdorf - Chřibská - Č.Kamenice - Děčín		Number of passangers exiting the bus		Average delay [mins]	Sum of passangers delay [person-minute]			Financial loss from the passangers delay [CZK]			Sum of financial loss [CZK]
Line ID	Bus stop name	Route ID	exiting		work	school	other	work	school	other	
402	Česká Kamenice, Pražská	109	8	0,13	0,01	0,01	0,00	3,22	4,63	0,00	7,85
402	Markvartice	109	2	1,29	0,00	0,04	0,00	0,00	18,37	0,00	18,37
402	Ludvíkovice	109	1	2,32	0,04	0,00	0,00	19,16	0,00	0,00	19,16
402	Děčín, škola	109	5	2,96	0,00	0,25	0,00	0,00	105,37	0,00	105,37
402	Děčín, Myslbekova	109	30	2,96	0,00	1,48	0,00	0,00	632,23	0,00	632,23
402	Děčín, hlavní nádraží	109	25	1,76	0,35	0,00	0,38	174,42	0,00	136,92	311,33
Varnsdorf - Chřibská - Č.Kamenice - Děčín		402/109	71		0,40	1,78	0,38	196,80	760,60	136,92	1094,31

Table 9. Financial value of delay for line 402, trip 109.

Varnsdorf - Chřibská - Č.Kamenice - Děčín		Number of passangers exiting the bus		Survey - Number of passangers exiting based on trip purpose							Number of passangers exiting the bus by purpose (based on survey)			
Line ID	Bus stop name	Route ID	exiting	work		school		other		total	work	school	other	total
402	Česká Kamenice, Pražská	113	3	0	0%	0	100%	0	0%	0	0	3	0	3
402	Česká Kamenice, Dol.Kamenice, Děčínská	113	1	0	100%	0	0%	0	0%	0	1	0	0	1
402	Děčín, škola	113	1	0	0%	0	100%	0	0%	0	0	1	0	1
402	Děčín, Myslbekova	113	15	0	0%	1	100%	0	0%	1	0	15	0	15
402	Děčín, hlavní nádraží	113	26	6	67%	0	0%	3	33%	9	17	0	9	26
Varnsdorf - Chřibská - Č.Kamenice - Děčín		402/113	46	6	60%	1	10%	3	30%	10	18	19	9	46

TABLE 10. Travel purposes for line 402, trip 113.

Varnsdorf - Chřibská - Č.Kamenice - Děčín		Number of passangers exiting the bus		Average delay [mins]	Sum of passangers delay [person-minute]			Financial loss from the passangers delay [CZK]			Sum of financial loss [CZK]
Line ID	Bus stop name	Route ID	exiting		work	school	other	work	school	other	
402	Česká Kamenice, Pražská	113	3	2,58	0,00	0,13	0,00	0,00	55,11	0,00	55,11
402	Česká Kamenice, Dol.Kamenice, Děčínská	113	1	3,07	0,05	0,00	0,00	25,35	0,00	0,00	25,35
402	Děčín, škola	113	1	6,11	0,00	0,10	0,00	0,00	43,50	0,00	43,50
402	Děčín, Myslbekova	113	15	5,04	0,00	1,26	0,00	0,00	538,25	0,00	538,25
402	Děčín, hlavní nádraží	113	26	2,76	0,78	0,00	0,41	387,48	0,00	148,65	536,13
Varnsdorf - Chřibská - Č.Kamenice - Děčín		402/113	46		0,83	1,49	0,41	412,83	636,86	148,65	1198,34

TABLE 11. Financial value of delay for line 402, trip 113.

Libouchec - Děčín - Janov		Number of passangers exiting the bus		Survey - Number of passangers exiting based on trip purpose							Number of passangers exiting the bus by purpose (based on survey)			
Line ID	Bus stop name	Route ID	exiting	work		school		other		total	work	school	other	total
432	Jílové, náměstí	103	1	1	100%	0	0%	0	0%	1	1	0	0	1
432	Děčín, Bynov, škola	103	5	4	100%	0	0%	0	0%	4	5	0	0	5
432	Děčín, Růžek	103	2	0	100%	0	0%	0	0%	0	2	0	0	2
432	Děčín, hlavní nádraží	103	11	3	100%	0	0%	0	0%	3	11	0	0	11
432	Děčín, Tyršova	103	2	0	100%	0	0%	0	0%	0	2	0	0	2
432	Děčín, Myslbekova	103	5	0	100%	0	0%	0	0%	0	5	0	0	5
Libouchec - Děčín - Janov		432/103	26	8	100%	0	0%	0	0%	8	26	0	0	26

TABLE 12. Travel purposes for line 432, trip 103.

Libouchec - Děčín - Janov		Number of passangers exiting the bus		Average delay [mins]	Sum of passangers delay [person-minute]			Financial loss from the passangers delay [CZK]			Sum of financial loss [CZK]
Line ID	Bus stop name	Route ID	exiting		work	school	other	work	school	other	
432	Jílové, náměstí	103	1	0,73	0,01	0	0	6,03	0	0	6,03
432	Děčín, Bynov, škola	103	5	0,95	0,08	0	0	39,23	0	0	39,23
432	Děčín, Růžek	103	2	0,45	0,02	0	0	7,43	0	0	7,43
432	Děčín, hlavní nádraží	103	11	1,28	0,23	0	0	116,28	0	0	116,28
432	Děčín, Tyršova	103	2	0,83	0,03	0	0	13,71	0	0	13,71
432	Děčín, Myslbekova	103	5	0,54	0,05	0	0	22,30	0	0	22,30
Libouchec - Děčín - Janov		432/103	26		0,41	0,00	0,00	204,97	0,00	0,00	204,98

TABLE 13. Financial value of delay for line 432, trip 103.

Libouchec - Děčín - Janov		Number of passangers exiting the bus		Survey - Number of passangers exiting based on trip purpose							Number of passangers exiting the bus by purpose (based on survey)			
Line ID	Bus stop name	Route ID	exiting	work		school		other		total	work	school	other	total
432	Jílové, Martiněves, rozcestí	111	1	0	100%	0	0%	0	0%	0	1	0	0	0
432	Děčín, Bynov, škola	111	2	0	0%	0	100%	0	0%	0	0	2	0	2
432	Děčín, U Zámečku	111	1	0	100%	0	0%	0	0%	0	1	0	0	1
432	Děčín, Růžek	111	2	0	100%	0	0%	0	0%	0	2	0	0	2
432	Děčín, Teplická	111	6	0	66%	0	0%	0	33%	0	4	0	2	6
432	Děčín, hlavní nádraží	111	8	1	50%	0	0%	1	50%	2	4	0	4	8
432	Děčín, Tyršova	111	6	0	66%	0	0%	0	33%	0	4	0	2	6
432	Děčín, Myslbekova	111	16	0	0%	11	100%	0	0%	11	0	16	0	16
Libouchec - Děčín - Janov		432/111	42	1	8%	11	85%	1	8%	13	16	18	8	41

Table 14. Travel purposes for line 432, trip 111.

Libouchec - Děčín - Janov		Number of passangers exiting the bus		Average delay [mins]	Sum of passangers delay [person-minute]			Financial loss from the passangers delay [CZK]			Sum of financial loss [CZK]
Line ID	Bus stop name	Route ID	exiting		work	school	other	work	school	other	
432	Jílové, Martiněves, rozcestí	111	1	2,92	0,05	0,00	0,00	24,11	0,00	0,00	24,11
432	Děčín, Bynov, škola	111	2	3,38	0,00	0,11	0,00	0,00	48,13	0,00	48,13
432	Děčín, U Zámečku	111	1	3,3	0,06	0,00	0,00	27,25	0,00	0,00	27,25
432	Děčín, Růžek	111	2	2,55	0,09	0,00	0,00	42,12	0,00	0,00	42,12
432	Děčín, Teplická	111	6	2,95	0,20	0,00	0,10	97,45	0,00	35,31	132,75
432	Děčín, hlavní nádraží	111	8	3,46	0,23	0,00	0,23	114,30	0,00	82,82	197,12
432	Děčín, Tyršova	111	6	3,06	0,20	0,00	0,10	101,08	0,00	36,62	137,71
432	Děčín, Myslbekova	111	16	2,91	0,00	0,78	0,00	0,00	331,50	0,00	331,50
Libouchec - Děčín - Janov		432/111	42		0,82	0,89	0,43	406,31	379,63	154,75	940,69

Table 15. Financial value of delay for line 432, trip 111.

Libouchec - Děčín - Janov		Number of passangers exiting the bus		Survey - Number of passangers exiting based on trip purpose							Number of passangers exiting the bus by purpose (based on survey)			
Line ID	Bus stop name	Route ID	exiting	work		school		other		total	work	school	other	total
432	Jílové, Kamenec	113	2	2	100%	0	0%	0	0%	2	2	0	0	2
432	Jílové, náměstí	113	4	0	0%	1	50%	1	50%	2	0	2	2	4
432	Jílové, papírny	113	2	2	100%	0	0%	0	0%	2	2	0	0	2
432	Děčín, Bynov, škola	113	4	0	0%	1	50%	1	50%	2	0	2	2	4
432	Děčín, U Zámečku	113	1	0	100%	0	0%	0	0%	0	1	0	0	1
432	Děčín, Kovočas	113	3	0	100%	0	0%	0	0%	0	3	0	0	3
432	Děčín, Růžek	113	3	0	100%	0	0%	0	0%	0	3	0	0	3
432	Děčín, Teplická	113	4	0	0%	4	100%	0	0%	4	0	4	0	4
432	Děčín, hlavní nádraží	113	9	0	0%	1	100%	0	0%	1	0	9	0	9
432	Děčín, Tyršova	113	3	0	0%	1	100%	0	0%	1	0	3	0	3
432	Děčín, Myslbekova	113	17	1	5%	19	95%	0	0%	20	1	16	0	17
Libouchec - Děčín - Janov		432/113	52	5	19%	27	104%	2	8%	26	12	36	4	52

Table 16. Travel purposes for line 432, trip 113.

Libouchec - Děčín - Janov		Number of passangers exiting the bus		Average delay [mins]	Sum of passangers delay [person-minute]			Financial loss from the passangers delay [CZK]			Sum of financial loss [CZK]
Line ID	Bus stop name	Route ID	exiting		work	school	other	work	school	other	
432	Jílové, Kamenec	113	2	1,19	0,04	0,00	0,00	19,65	0,00	0,00	19,65
432	Jílové, náměstí	113	4	1,86	0,00	0,06	0,06	0,00	26,49	22,26	48,75
432	Jílové, papírny	113	2	1,98	0,07	0,00	0,00	32,70	0,00	0,00	32,70
432	Děčín, Bynov, škola	113	4	3,51	0,00	0,12	0,12	0,00	49,98	42,01	91,99
432	Děčín, U Zámečku	113	1	3,24	0,05	0,00	0,00	26,76	0,00	0,00	26,76
432	Děčín, Kovočas	113	3	3,07	0,15	0,00	0,00	76,06	0,00	0,00	76,06
432	Děčín, Růžek	113	3	2,99	0,15	0,00	0,00	74,08	0,00	0,00	74,08
432	Děčín, Teplická	113	4	2,96	0,00	0,20	0,00	0,00	84,30	0,00	84,30
432	Děčín, hlavní nádraží	113	9	3,26	0,00	0,49	0,00	0,00	208,89	0,00	208,89
432	Děčín, Tyršova	113	3	3,09	0,00	0,15	0,00	0,00	66,00	0,00	66,00
432	Děčín, Myslbekova	113	17	3,86	0,06	1,03	0,00	31,88	439,72	0,00	471,59
Libouchec - Děčín - Janov		432/113	52		0,53	2,05	0,18	261,13	875,37	64,27	1200,77

TABLE 17. Financial value of delay for line 432, trip 113.

Libouchec - Děčín - Janov		Number of passangers exiting the bus		Survey - Number of passangers exiting based on trip purpose								Number of passangers exiting the bus by purpose (based on survey)			
Line ID	Bus stop name	Route ID	exiting	work		school		other		total		work	school	other	total
432	Jílové, náměstí	123	1	0	0%	0	0%	2	100%	2		0	0	1	1
432	Jílové, papírny	123	1	0	100%	0	0%	0	0%	0		1	0	0	1
432	Děčín, Teplická	123	4	0	0%	0	0%	0	100%	0		0	0	4	4
432	Děčín, hlavní nádraží	123	15	0	0%	0	0%	8	100%	8		0	0	15	15
432	Děčín, Tyršova	123	5	0	0%	0	0%	0	100%	0		0	0	5	5
432	Děčín, Myslbekova	123	4	0	0%	0	100%	0	0%	0		0	4	0	4
Libouchec - Děčín - Janov		432/123	30	0	0%	0	0%	10	100%	10		1	4	25	30

TABLE 18. Travel purposes for line 432, trip 123.

Libouchec - Děčín - Janov		Number of passangers exiting the bus		Average delay [mins]	Sum of passangers delay [person-minute]			Financial loss from the passangers delay [CZK]			Sum of financial loss [CZK]
Line ID	Bus stop name	Route ID	exiting		work	school	other	work	school	other	
432	Jílové, náměstí	123	1	1,81	0,00	0,00	0,03	0,00	0,00	10,83	10,83
432	Jílové, papírny	123	1	1,78	0,03	0,00	0,00	14,70	0,00	0,00	14,70
432	Děčín, Teplická	123	4	3,06	0,00	0,00	0,20	0,00	0,00	73,25	73,25
432	Děčín, hlavní nádraží	123	15	3,96	0,00	0,00	0,99	0,00	0,00	355,46	355,46
432	Děčín, Tyršova	123	5	1,95	0,00	0,00	0,16	0,00	0,00	58,35	58,35
432	Děčín, Myslbekova	123	4	2,73	0,00	0,18	0,00	0,00	77,75	0,00	77,75
Libouchec - Děčín - Janov		432/123	30		0,03	0,18	1,39	14,70	77,75	497,88	590,34

TABLE 19. Financial value of delay for line 432, trip 123.

Povrly, Český Bukov - Ústí n.L.		Number of passangers exiting the bus		Survey - Number of passangers exiting based on trip purpose								Number of passangers exiting the bus by purpose (based on survey)			
Line ID	Bus stop name	Route ID	exiting	work		school		other		total		work	school	other	total
455	Ústí n.L., Neštěmice,Květ x pivovar	102	1	0	100%	0	0%	0	0%	0		1	0	0	1
455	Ústí n.L., Mírové nám.	102	16	6	86%	1	14%	0	0%	7		14	2	0	16
455	Ústí n.L., divadlo	102	12	3	100%	0	0%	0	0%	3		12	0	0	12
Povrly, Český Bukov - Ústí n.L.		455/102	29	9	90%	1	10%	0	0%	10		27	2	0	29

TABLE 20. Travel purposes for line 455, trip 102.

Povrly, Český Bukov - Ústí n.L.		Number of passangers exiting the bus		Average delay [mins]	Sum of passangers delay [person-minute]			Financial loss from the passangers delay [CZK]			Sum of financial loss [CZK]
Line ID	Bus stop name	Route ID	exiting		work	school	other	work	school	other	
455	Ústí n.L., Neštěmice,Květ x pivovar	102	1	3,355	0,06	0,00	0,00	27,71	0,00	0,00	27,71
455	Ústí n.L., Mírové nám.	102	16	4,75	1,11	0,16	0,00	549,18	67,64	0,00	616,82
455	Ústí n.L., divadlo	102	12	5,33	1,07	0,00	0,00	528,20	0,00	0,00	528,20
Povrly, Český Bukov - Ústí n.L.		455/102	29		2,23	0,16	0,00	1105,09	67,64	0,00	1172,73

Table 21. Financial value of delay for line 455, trip 102.

Povrly, Český Bukov - Ústí n.L.		Number of passangers exiting the bus		Survey - Number of passangers exiting based on trip purpose							Number of passangers exiting the bus by purpose (based on survey)			
Line ID	Bus stop name	Route ID	exiting	work		school		other		total	work	school	other	total
455	Povrly, sídliště	106	8	0	0%	7	100%	0	0%	7	0	8	0	8
455	Ústí n.L., Neštěmice, Květ	106	2	0	0%	0	50%	0	50%	0	0	1	1	2
455	Ústí n.L., pivovar	106	4	0	0%	1	100%	0	0%	1	0	4	0	4
455	Ústí n.L., Mírové nám.	106	7	2	33%	1	17%	3	50%	6	2	1	4	7
455	Ústí n.L., divadlo	106	15	0	0%	0	0%	1	100%	1	0	0	15	15
Povrly, Český Bukov - Ústí n.L.		455/106	36	2	13%	9	60%	4	27%	15	2	14	20	36

Table 22. Travel purposes for line 455, trip 106.

Povrly, Český Bukov - Ústí n.L.		Number of passangers exiting the bus		Average delay [mins]	Sum of passangers delay [person-minute]			Financial loss from the passangers delay [CZK]			Sum of financial loss [CZK]
Line ID	Bus stop name	Route ID	exiting		work	school	other	work	school	other	
455	Povrly, sídliště	106	8	0,06	0,00	0,01	0,00	0,00	3,42	0,00	3,42
455	Ústí n.L., Neštěmice, Květ	106	2	1,56	0,00	0,03	0,03	0,00	11,11	9,34	20,44
455	Ústí n.L., pivovar	106	4	4,39	0,00	0,29	0,00	0,00	125,02	0,00	125,02
455	Ústí n.L., Mírové nám.	106	7	5,68	0,19	0,09	0,38	93,81	40,44	135,96	270,22
455	Ústí n.L., divadlo	106	15	0	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Povrly, Český Bukov - Ústí n.L.		455/106	36		0,19	0,42	0,40	93,81	179,99	145,30	419,10

Table 23. Financial value of delay for line 455, trip 106.

Povrly, Český Bukov - Ústí n.L.		Number of passangers exiting the bus		Survey - Number of passangers exiting based on trip purpose							Number of passangers exiting the bus by purpose (based on survey)			
Line ID	Bus stop name	Route ID	exiting	work		school		other		total	work	school	other	total
455	Ústí n.L., Neštěmice, Květ	108	2	0	0%	0	0%	0	100%	0	0	0	2	2
455	Ústí n.L., pivovar	108	2	0	50%	0	0%	0	50%	0	1	0	1	2
455	Ústí n.L., Mírové nám.	108	7	1	33%	0	0%	2	67%	3	2	0	5	7
455	Ústí n.L., divadlo	108	2	0	0%	0	0%	2	100%	2	0	0	2	2
Povrly, Český Bukov - Ústí n.L.		455/108	13	1	20%	0	0%	4	80%	5	3	0	10	13

Table 24. Travel purposes for line 455, trip 108.

Povrly, Český Bukov - Ústí n.L.		Number of passangers exiting the bus		Average delay [mins]	Sum of passangers delay [person-minute]			Financial loss from the passangers delay [CZK]			Sum of financial loss [CZK]
Line ID	Bus stop name	Route ID	exiting		work	school	other	work	school	other	
455	Ústí n.L., Neštěmice, Květ	108	2	10,04	0,00	0,00	0,33	0,00	0,00	120,16	120,16
455	Ústí n.L., pivovar	108	2	10,59	0,18	0,00	0,18	87,46	0,00	63,37	150,83
455	Ústí n.L., Mírové nám.	108	7	12,43	0,41	0,00	1,04	205,30	0,00	371,92	577,22
455	Ústí n.L., divadlo	108	2	10,93	0,00	0,00	0,36	0,00	0,00	130,81	130,81
Povrly, Český Bukov - Ústí n.L.		455/108	13		0,59	0,00	1,91	292,76	0,00	686,26	979,02

Table 25. Financial value of delay for line 455, trip 108.