



## THE LOSS TIME OF PERSONS WITH REDUCED MOBILITY AND ORIENTATION WHEN MOVING ON STAIRS

### KEYWORDS

reduced mobility, transfer time, loss time on stairs, public transport, transport infrastructure

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**ABSTRACT** *The article is about the loss time and about measurement the loss time of chosen element traffic infrastructure. It is focused on transfer of persons with reduced mobility. The problems are mostly stairs which are almost always part of the transfer. It also affects the total transfer time. The knowledge of this loss time on the stairs is the key part of the total transfer time for each group of persons. Every group of persons has different speed of moving. Total transfer time is very useful and needed information which we can use in application Smart Cities.*

### INTRODUCTION

Currently many transfers are needed in the public transport because of the wide traffic net with many modes of public transportation. In the public transportation we can find these types of transfer places [3].

- TRAIN – TRAIN
- TRAIN – PUBLIC TRANSPORTATION
- PUBLIC TRANSPORTATION - PUBLIC TRANSPORTATION

In each transfer point there are different parts of traffic infrastructure which creates transfer road. These are

- Pavement / straight with zero gradient
- Crosswalk
- Elevator / platform
- Stairs
- Ramp
- Escalator

This article is focused on stairs. The stairs are important part of the transfer time. In our research we measured moving time of each group of persons. From these measurements we can calculate loss time on stairs.

### TRANSFER TIME

It is very important to know transfer time because there are lots of transfers in public transportation. It is important to define the groups of persons with reduced mobility and orientation. We need to analyse each part of transfer time [2]. These parts are:

- Time of getting off
- Time between getting off and on
- Time of getting on

Every person in traffic wants the shortest transfer in public transportation. So the best type of transfer is getting off and on on the same platform [4].

The loss time on the stairs which is the article about, is in the second part of analysis of transfer time.

### GROUP OF PERSONS

We defined some groups of persons. These groups are based on

the Ordinance number 398/2009 Sb. The Ordinance is about technical requirements of accessibility of the infrastructure [1]. This Ordinance defines persons with reduced mobility (persons in wheelchairs, persons using walking aid tools), older seniors, blind and visually impaired with remnants of sight, mentally impaired, pregnant women, persons accompanying children younger than three years.

Final groups are (letter in brackets identifies the group):

- **(P)** persons without any apparent movement restrictions
- **(L)** persons with oversize luggage
- **(S)** older seniors
- **(C)** persons using walking aid tools
- **(3)** persons accompanying children younger than three years
- **(B)** blind and visually impaired with remnants of sight

To the group L we added persons with bicycle, suitcase, big backpack also person with baby-carriage.

### PARAMETERS AFFECTING LOSS TIME (SPEED) ON STAIRS

The loss time on stairs is affected by lots of parameters. The important one is direction of the movement. Another parameter is type of the stairs, especially number of stairs and their width.

The speed of moving on stairs is affected by intensity. This is important when vehicle arrives to the station or when it is significant transfer point. In this time many passengers get out and everybody wants use the stairs. The intensity is growing and the speed decreases. The loss time on the stairs is higher. The capacity of throughput on the stairs is another parameter which affects the speed of movement.

The loss time on the stairs is influenced by subjective impacts. These are different for each person and we cannot measure them. These impacts are:

- Physical ability
- Psychological impacts
  - Stress of the stairs
  - Fear of the crowd
  - Etc.
- Weather

These impacts are not taken into consideration in our measurement.

## MEASUREMENT

We did the research at two places. The first place was station Praha hlavní nádraží. We focused on the stairs which direct to the platforms. The second one was subway station Florenc (line C). We chose the stairs from the platform to the vestibule. Next to the stairs an elevator is placed, so person with reduced mobility mainly used the elevator. We had the accurate process of measurement.

When the person goes up the measurement starts on the first step and it ends on the top floor. When the person goes down, the measurement starts on the second step and it ends on the bottom floor. When there is a flat floor between the stairs shorter than one meter it is counted as one step.

During the measuring we realised, that the number of people going down is also very important. We created three groups of intensity.

I. Low intensity – the capacity is not fully filled up

II. Medium intensity – the capacity is fully filled up, but there are no clues in front of the stairs

III. High intensity – the capacity is fully filled up, there are clues in front of the stairs

Intensity groups II. and III. affect the speed down. Later we realised, that the group III does not affect the speed more than group II. That was why we reduced our system into only two groups.

We were trying to collect as many dates as possible to be able to calculate approximate loss time. The results we can see in the table below. There are the direction of movement, its intensity and time converted for one step.

TABLE – 1 THE LOSS TIME ON STAIRS FOR ONE STEP

Group of person	Median of time for one step [s]		
	up	down I-1	down I-2
P	0.535	0.401	0.585
S	0.687	0.623	0.648
L	0.602	0.489	0.651
3	0.669	0.598	0.682
C	0.878	0.806	0.890
B	0.693	0.655	-

From loss times Table - 1 shows that the times for these groups is quite different and sometimes very significantly. The highest median of loss time have persons using walking aid tools, where it seems that when they are moving very slow on stairs. In table shows obvious difference between the intensity I and the intensity II.

We must add that it was not possible to collect data for group of person blind and visually impaired with remnants of sight in direction down with intensity II. Group of person blind and visually impaired with remnants of sight was very little.

## CONCLUSION

From the measured dates we can see, that we need to analyse each part of loss time for each group of persons with reduces mobility and orientation. The approximate loss times say that a person without any apparent movement restrictions is much faster at stairs than a person using walking aid tools. Also persons with oversize luggage and older seniors are slower than person without any apparent movement restrictions. We can also see that movement speed of people going downstairs is lower during the intensity group II than during intensity group I. So we should calculate with these two groups of intensity.

At the station Florenc there are stairs with 25 steps. There is a

big difference between speed of persons without any apparent movement restrictions and persons using walking aid tools. The first one had approximate loss time when going up 13.38 s and the second group had approximate loss time 21.19 s.

During the research we will continue in measuring loss times on the other elements of traffic infrastructure. It will be a ramp, and a straight with zero gradient. We assume that the speed of movement will be there also different for each group of persons. Now we think that the total transfer time will be dissimilar for each group of persons. The difference will be depended on parts of transfer road.

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