

CETRA²⁰¹⁴

3rd International Conference on Road and Rail Infrastructure
28–30 April 2014, Split, Croatia

Road and Rail Infrastructure III

Stjepan Lakušić – EDITOR

Organizer
University of Zagreb
Faculty of Civil Engineering
Department of Transportation



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Proceedings of the
3rd International Conference on Road and Rail Infrastructures – CETRA 2014
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CETRA²⁰¹⁴

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FOREWORD

The 3rd International Conference on Road and Rail Infrastructure – CETRA 2014 was organized by the University of Zagreb - Faculty of Civil Engineering, Department for Transportation Engineering. The Conference was held in Split, Croatia. Split is the largest city in Dalmatia and the second largest city in Croatia, and it is also one of “Croatian Champions of Tourism”. The 1st International Conference on Road and Rail Infrastructure (CETRA 2010) was held on 17-18 May 2010 in Opatija. The 2nd International Conference on Road and Rail Infrastructure (CETRA 2012) was held on 7-9 May 2012 in Dubrovnik. A great interest of participants in topics and themes from the field of road and rail infrastructure, as shown during the CETRA 2010 conference (140 papers from 29 countries) and CETRA 2012 conference (142 papers from 39 countries), justified the Department of Transportation Engineering's decision to organise once again an international event of such great significance. Positive comments received from participants in past conferences motivated the Department for Transportation Engineering of the Faculty of Civil Engineering - University of Zagreb to continue with the organization of this international event.

The CETRA conference has established itself as a venue where scientific and professional information from the field of road and rail infrastructure is exchanged. The idea on linking research organisations and economic operators has been the guiding concept for the realisation of this conference. Conferences of this kind are undoubtedly a proper place for bringing closer together the economy and university operators, and for facilitating communication and establishing greater confidence that might result in cooperation on new projects, especially those that contribute to greater competition. Lectures organized in the scope of the conference are based on interesting technical solutions and on new knowledge from the field of transport infrastructure as gained on already realised projects, projects currently at the planning stage, and those now under construction, in all parts of the world. In addition to authors from the academic community, lectures were also presented by practical authors, the idea being to ensure the best possible synergy between the theory and practice. Because of a great interest for the themes from the field of road and rail infrastructure, as shown during the past two conferences (CETRA 2010 and CETRA 2012), the Department for Transportation Engineering of the Faculty of Civil Engineering – Zagreb assumed the responsibility to organise the CETRA conference in this year as well.

Our goal for the International Conference on Road and Rail Infrastructure – CETRA is to have all published papers indexed in scientific databases in order to achieve greater recognition for the conference itself, for published papers, and for their authors. As the serial publication entitled Road and Rail Infrastructure has been achieved with this third conference, the precondition has been fulfilled to obtain the International Standard Serial Number (ISSN), which was the condition for starting procedure for registering this publication in scientific databases. The procedure has already been initiated.

The third International Conference on Road and Rail Infrastructure – CETRA 2014 - is organised in this year in order to bring together scientists and experts from the fields of road and railway engineering, and to present them with yet another opportunity to share results of their research, findings and innovations, analyze problems encountered in everyday engineering practice, and offer possible solutions for a more efficient planning, design, construction, and maintenance of various transport infrastructure facilities and projects.

CETRA 2014 covers many areas: traffic planning and modelling, infrastructure projects, infrastructure management, road pavements, rail track superstructure, construction and

maintenance, transport geotechnics, tunnels and bridges, structural monitoring and maintenance, computer techniques and simulations, noise and vibration, innovation and new technology, urban transport, integrated timetables on railways, rail traffic management systems, vehicle dynamics, traffic safety, and bicycle traffic.

CETRA 2014 attracted a large number of papers and presentations from 35 countries and 47 universities. More than 146 papers were presented at the conference and are grouped together in these proceedings entitled Road and Rail Infrastructure III. The papers are conveniently divided into twelve chapters: Rail Infrastructure Projects Design, Construction, Maintenance and Management, Road Infrastructure Projects Construction, Maintenance and Management, Road Traffic Planning and Modelling, Road Pavements, Rail Vehicle-Track Interaction, Structural Monitoring and Maintenance, Transport Geotechnics, Integrated Timetables on Railways, Traffic Safety, Environmental Protection, Urban Transport and Passenger services: baggage storage and boarding.

The organizers of the conference wish to express their thanks to all businesses and institutions that provided their valuable support to this Conference. Special thanks are extended to the University of Zagreb, Croatian Railways – HŽ Infrastruktura, and Ministry of Maritime Affairs, Transport and Infrastructure, for their assistance in organizing the workshop on Implementation of European Rail Traffic Management System (ERTMS) in South and East Europe. The Editor commends all authors for excellent papers contributed to these proceedings, and wishes to thank members of the International Academic Scientific Committee, and numerous experts who participated in the review process. The gratitude is also extended to all participants for deciding to come to Split and take part in CETRA 2014. We believe that these CETRA 2014 proceedings entitled Road and Rail Infrastructure III will be, just like the preceding two proceedings from the CETRA cycle, highly interesting and useful to all experts exhibiting a scientific and professional interest in road and rail infrastructure.

THE EDITOR
Prof. Stjepan Lakušić
April, 2014.

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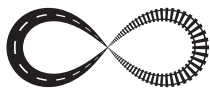
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REQUIREMENTS ON FUTURE RAILWAY INTERIORS

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Abstract

Within the project FLEXICOACH in cooperation with Technische Universität Wien, Fachhochschule St. Pölten, Fachhochschule Joanneum, Siemens, netwiss and ÖBB Personenverkehr AG, passenger opinion surveys regarding their wants and needs were conducted. The aim of those surveys was to obtain information about everything a passenger requires; in order to get all information needed various subjects such as duration and frequency of journeys, activities during journey, well-being, stress factors, age, gender and group dimensions, were interrogated.

Keywords: railways, passenger requires, baggage, journey time

1 Introduction

Overall 3.826 questionnaires were analyzed. All questionnaires were conducted in summer 2012 on the Austrian Westbahn-line between Vienna and Linz. Due to the summer holidays a lower participation of students must be considered methodically. Furthermore and also due to summer vacations less rides to or from work are expected.

Approximately 50% of travellers undertake a trip lasting several days, around 10% are free time trips without an overnight-stay. Journeys in connection with education or work (rides from / to work, rides from / to education facilities, business trips either one-day or with a several day's duration) account for 25% of all journeys. The remaining 10% are to be allotted to private settlements.

Rail travellers mostly are young, approximately 12% are aged between 13 and 18 years, almost half of all interviewees are between 19 and 39 years old. 27% are part of the "40 to 60 years of age" group and around 12% are older than 60 years. The fact that children under the age of 12 are underrepresented is simply because they rarely fill in questionnaires.

54% of travellers are female, 46% are male. With the exception of people older than 60 years, in all age-groups female passengers form the majority.

Approximately one third of the passengers travel alone. Another third travels in a group of two persons. Around 11% travel in a group of three, 7% in a group of four and 12% in a group of five or more people. The journeys were classified in journeys up to 30 minutes, 30-60 minutes, 60-90 minutes, 90-120 minutes, 2-3 hours, 3-4 hours, 4-5 hours and more than 5 hours. Most journeys (respectively 20-30%) in all age-groups last between two and three hours. With increasing age the duration of journey as well increases slightly, short-term rides mostly are done by younger people. Summing up all general information gained, elderly people take the train less frequently, but if they do, they go for longer free time rides. In opposition, younger people take the train more often, and mostly for short business trips.

The better part of all interviewees quoted "comfort" as the major reason to take the train, around 40 % of all passengers declared "environment", "no car" and "price" as their major reasons to choose the train (see Fig. 1). "Safety" and "duration of journey" are an inferior aspect.

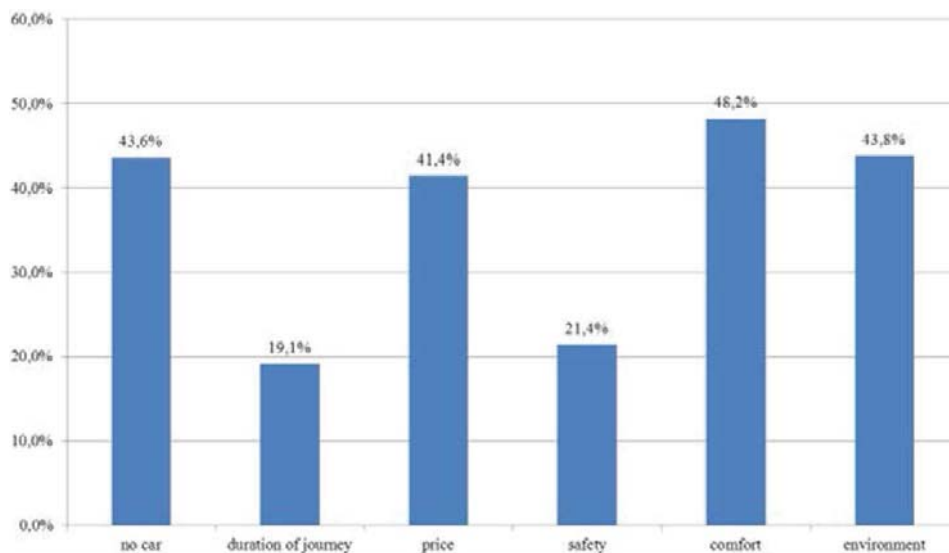


Figure 1 Reasons to take the train

2 Baggage

Regarding baggage, most information were attained from a diploma thesis [1], which treats issues of baggage transport on an extensive data basis. Amongst other things, various pieces of luggage were weight and measured. The accumulated x-, y- and z-dimensions of all luggage measured (not included is carry-on baggage) are demonstrated in Fig. 2.

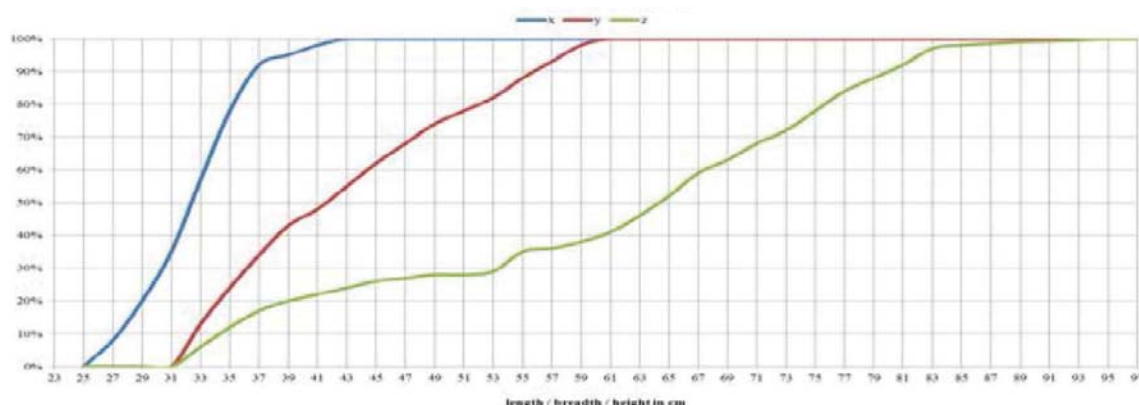


Figure 2 Dimensions of luggage

Those accumulated measurements can be used in order to design adequate storage between the seat backs or baggage racks. Analysis show that there are two main issues regarding baggage room. First passengers do not want to lift their luggage, and especially not to the height of overhead storage. This attitude is more common amongst women and increases with age. Second and due to security reasons, passengers wish to have their luggage in visual range. If these requirements are not met, passengers are very willing to store their luggage in not-intended place, like seats or corridors. This behaviour leads to a lower quality level and to a loss in capacity due to occupied seats.

3 Actual use of journey time

A major aspect was the purpose of the journey (business trip or free time ride). Every other business traveller declares to use his laptop, smart phone or tablet while travelling, while only one quarter of travellers on a free time ride uses those devices. Fig. 3 shows the details.

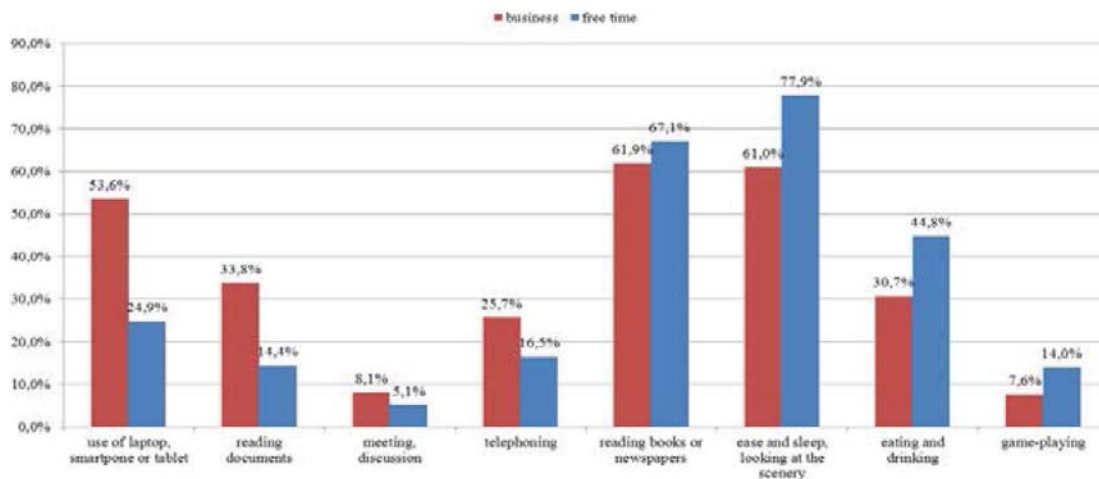


Figure 3 Actual use of journey time – influence of the purpose of the journey

Another major aspect regarding the use of the journey time is the age of the traveller. Generally speaking there is a slight decrease regarding actually performed activities with rising age. However activities need to be considered separately, while using electronic devices decreases with increasing age, activities like “looking at the scenery” or “reading a book / the newspaper” increase with increasing age.

4 Exercises on the train

The longer the journey the higher is need to move. Around 20% of passengers travelling up to an hour wish to exercise during their journey. The percentage rises to 40% when the duration of the journey rises up to five hours or more.

5 Desired use of journey time

Analysis (Fig. 4) shows that there is a connection between the use of journey time and the purpose of the journey. All too often (around 20% of all interviewees) passengers criticize missing mobile services. Because of several comments it is obvious that a missing WLAN-connection is intended.

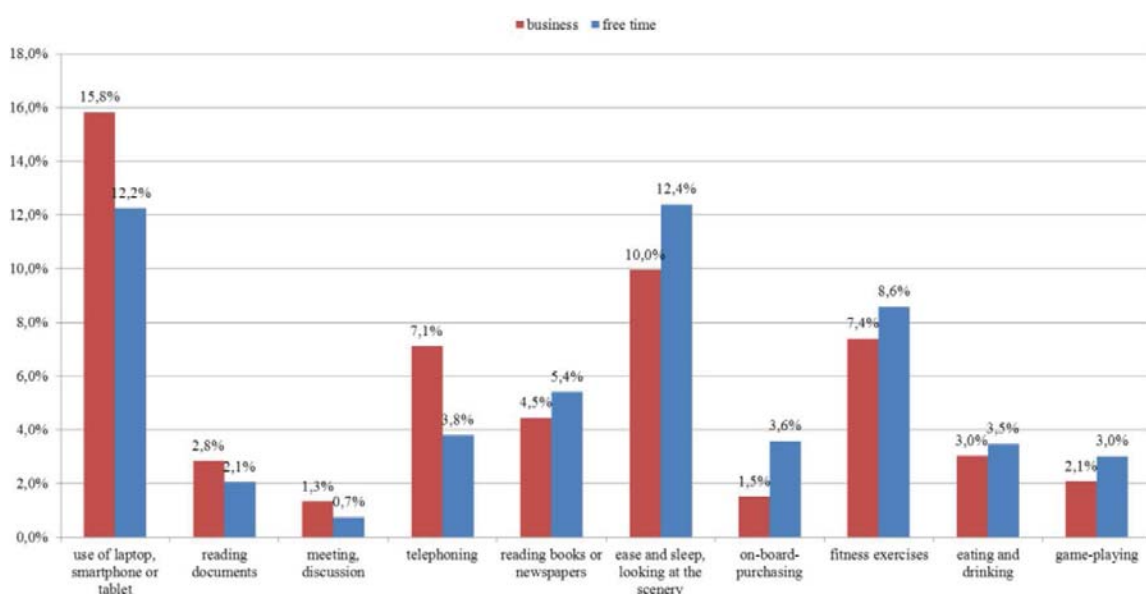


Figure 4 Desired use of journey time: influence of the purpose of the journey

Together with the absences of tables (respond 12% of all interviewees), this is the biggest obstacle when it comes to using tablet, smartphones and laptops. Around 17% of all interviewees criticize uncomfortable and fixed seats as well as absent silence, which holds them from their desired activity “ease and sleep”. The need to move reflects in the desire for a possibility to exercise. The age has significant influence regarding the desired use of travel time. The younger the interviewee, the more non accomplishable activities are quoted. Anterior passengers are significantly more satisfied with the possibilities offered, respectively less frequently express a wish to use the time in another way. In Fig. 5, every desired activity is marked in a different colour (the lowest layer indicates “using the laptop”, the second lowest “using tablet or smartphone” and so on).

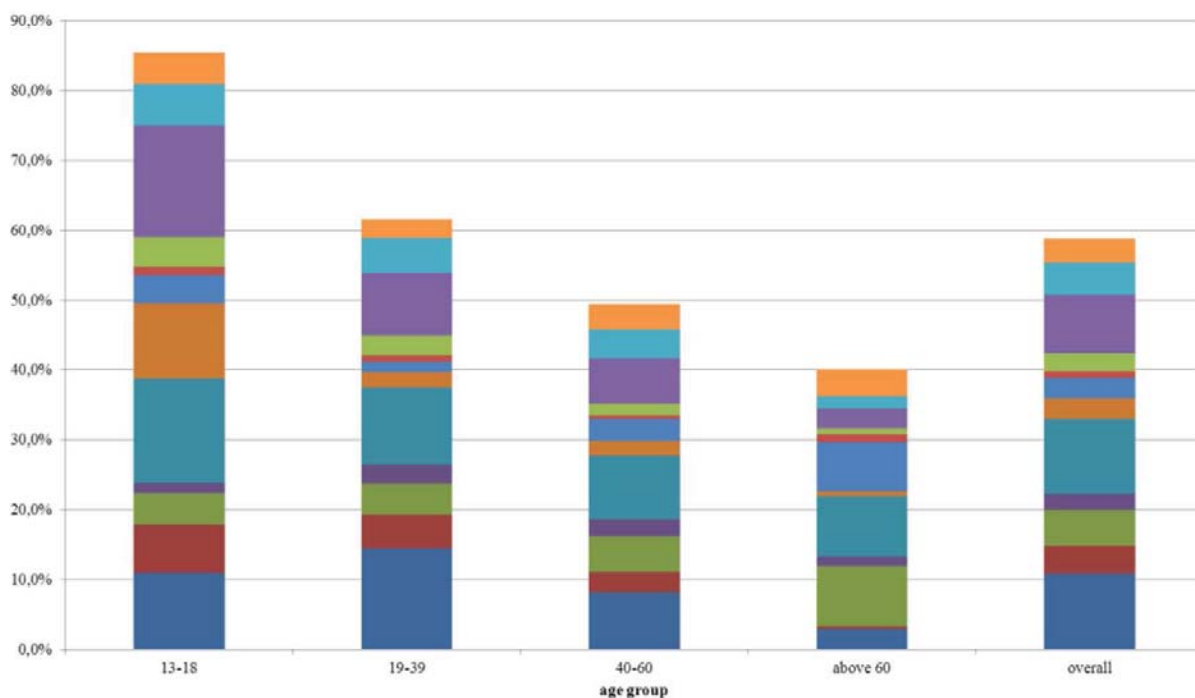


Figure 5 Desired use of journey time: factor age, cumulative percentage

Similar images with heavy age-related variation often occurred in the course of the examination, for instance regarding questions about well-being, stress factors, activities, etc. The journey time is a major aspect when it comes to desirable use of time. The longer the journey time, the more requirements were quoted, in particular if the duration exceeds two hours.

6 Well-being

Around 33% of the interviewees feel “very well” when travelling by train, about 52% feel “rather good”, 14 % feel “rather bad” and only 1 % of the passengers do not feel well during train journeys. The assumption that those outcomes correspond with the fact that younger passengers mostly are on business trips, while anterior passengers use the train prevailing for free time trips, is unfounded. Around 50% of all train journeys are leisure time trips, lasting several days. Interviewees between 13-18 years, the group that feels most uncomfortable during train journeys, mostly goes on free time rides without an overnight stay. Thus there is no obvious connection between the purpose of the journey and the well-being.

Passengers travelling first class are feeling better than passengers travelling second class. Furthermore there is a strong connection between the well-being of the passengers and the degree of capacity. Therefore on weekdays from Monday to Thursday passengers mostly feel “rather well” or “very well”, while travellers on Fridays and weekend feel “rather bad” or “not

well”. The higher degree of capacity during weekends leads to an oftener nomination of stress factors like “high degree of capacity”, “search for seat”, “noise” and “fellow passengers”.

7 Stress factors

The stress factor most frequently nominated was “search for a seat”, around 20% of the passengers feel stressed (see Fig. 6). Also sensed as stress factors were “high degree of capacity”, “noise” and “fellow passengers”. The factors most frequently mentioned are those which appear at a high degree of capacity and obviously lead to a deterioration of the well-being.

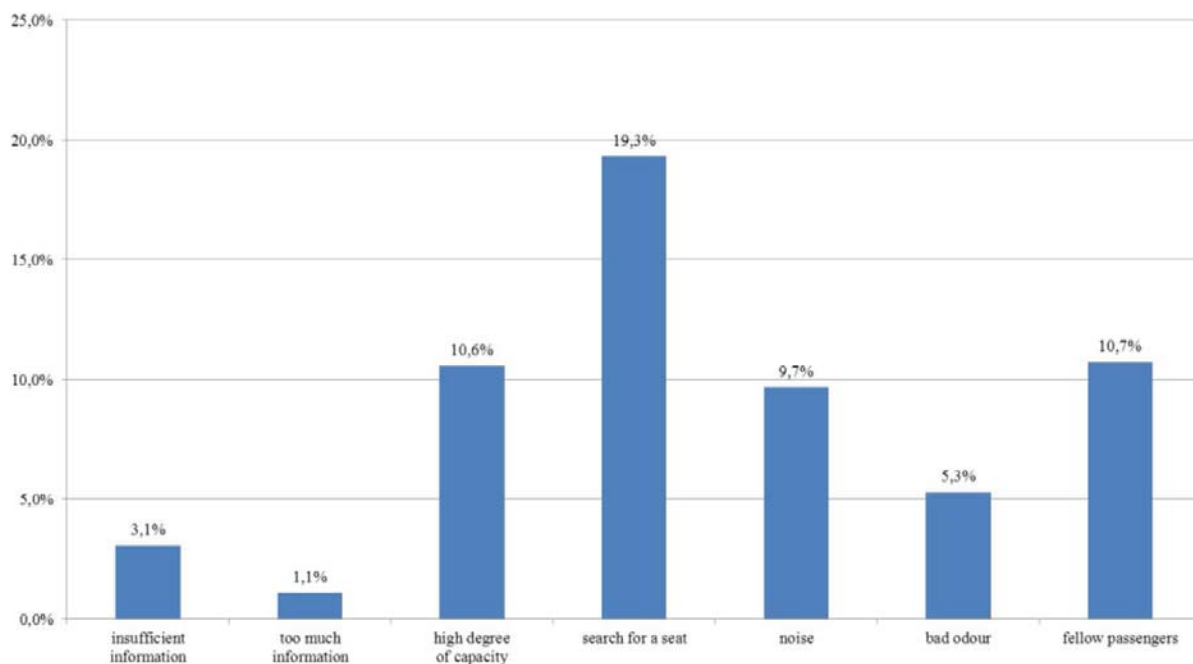


Figure 6 Stress factors during the current journey

Analogue to the well-being, the age of the passengers is crucial when it comes to cognition of stress. Younger passengers are more stressed than anterior passengers, at least they quote it more often. With increasing age (groups from 13-18 years, till 60 years) the nomination of arising stress factors during an actual train journey decreases under 50%. Considering the most frequently quoted stress factor “search for seat”, the nominations in the age group “over 60 years” decrease even to a third of those from passengers between 13-18 years. This is a very notable fact, because precisely this stress factor was assumed to arise with increasing age, also in terms of luggage. Generally speaking, anterior passengers are more satisfied with the frame conditions than younger ones.

8 Service features

Most frequently nominated when it comes to service features were “reasonable priced meals” (31%), “purchase of newspapers” (24%), “transmission of knowledge” (23%), “entertainment” (20%), “possibilities to exercise” (18%), “relaxation practises” (17%). With increasing age the interest in service features heavily decreases.

With increasing journey duration, the interest in service features increases as well. Passengers on a free time ride show more interest in service features than travellers on a business trip. Around two-thirds of all respondents show interest in healthy nutrition during their train journey. This desire is more common under female passengers than under male ones.

9 Atmospheric environment

The outcomes of this particular subject won't be discussed any further. Generally speaking, the nominations made by the passengers are very subjective and do not always refer to any comprehensible objective criteria. For instance, in every sort of train the temperature was between 25 and 26 °C, nevertheless there are different sensations and evaluations regarding the temperature, which can be connected to the sort of train. The highest percentage of satisfied passengers is to be found in trains of the private operator Westbahn (over 80% satisfaction). The average registered temperature is exactly identical to the temperature registered in the Railjet-trains of ÖBB. However, Railjet was evaluated ten percentage points less than Westbahn. It is obvious that not only the temperature, but rather the general well-being or the consciousness of a deliberately taken decision to travel with a new operator (Westbahn was operating only eight months at the moment of the opinion survey) contributed to this outcome.

The opposite way around also Railjet was not only evaluated regarding temperature, but rather general well-being (for that matter Railjet scores rather low). There is a similar effect notable when it comes to train categories (first or second class). Passengers travelling first class rated the atmospheric environment higher than passengers travelling second class, there was no objective difference however.

It has to be considered that subjective sensations had a great influence also on questions regarding well-being, illumination and stress factors. Advanced studies would be very helpful in order to interpret the outcomes in the right way.

10 Conclusion

Compared to other modes of transportation the railway system has got the big advantage that passengers are able to use the travel time efficiently. This is one of the biggest advantages of competition. Unfortunately today's vehicles hardly offer the requested equipment which allows the best possible time use. Train passengers are very interested in using the travel time for working, mostly on technical devices like one note books or tablets, for reading or for relaxing. For efficient time use the investigations have shown that the individualisation of the space in the train is essential. It is important that all passengers can follow their requested activities without affecting other passengers. For example people who are working may produce noise but on the other hand need calm for concentration. Additionally they need light whereas people who want to sleep need it dark and calm. So further investigation must focus on how the space in the vehicle can be individualized in a best possible way.

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