

THE COACH AS AN ERGONOMIC WORKPLACE – PROBLEM ANALYSIS AND CONCEPT DEVELOPMENT WITH USER INVOLVEMENT

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The tour manager's working area in a coach has not been thoroughly studied before. A study was therefore initiated, with the aim to improve the knowledge at Volvo Bus Corporation concerning the tour managers' needs and wishes. An extensive user study was carried out to define their work tasks and to find out how the coach interiors of today support their work. Problems regarding how the coach functions as a workplace were described, listed and ranked. With knowledge of the tour managers' actual needs, suggestions for improvements were given by the development of two interior concepts.

Coach, Guide, Tour Manager, User Involvement and Workplace Design

1 Introduction

The coach is a very special kind of workplace. It is moving and the room is limited since the main priority is to fit in as many passenger seats with as much legroom as possible. Effort has been put into making the driver's seat and workplace ergonomic but little has until now been known about the needs concerning the tour manager's working situation in the coach. Volvo Bus Corporation, in cooperation with Caran, therefore initiated this study.

Close to the driver's seat there is often a seat intended for a tour manager or guide. A tour manager is, according to the European Committee for Standardization, a "person who manages and supervises the itinerary on behalf of the tour operator, ensuring the programme is carried out as described in the tour operator's literature and sold to the traveller/consumer and who gives practical information" and a tourist guide is a "person who guides visitors in the language of their choice and interprets the cultural and natural heritage of an area, which person normally possesses an area-specific qualification usually issued and/or recognised by the appropriate authority" [EN 13809:2003] (European Committee for Standardization, 2006).

The tour manager is normally active during the whole trip and travels together with the passengers from their starting point and throughout the whole tour. He or she spends days together with the passengers, both in and outside of the coach, and takes care of all practical arrangements. In some places unauthorized guides are not allowed to guide; then a local tourist guide can enter the coach and do the guiding through that specific part. To use a local tourist guide is also a good alternative if the tour manager does not

possess sufficient knowledge. In this paper the designation *tour manager* will be used, but several tasks and needs are the same for tourist guides.

The crew spends a major part of the workday in the coach. Various tasks are performed and the work area is limited which altogether results in tough demands on the workplace design. The tasks include sitting but also standing and walking, often in positions that are not optimal due to safety or ergonomics. The coach should supply quality solutions for the variety of activities performed by the crew. Furthermore the driver compartment, i.e. the space for driver and guide, is the first thing to be seen when entering the coach, and hence strongly contributes to the impression of quality.

2 Objectives

The purpose of the study was to investigate how the coach functions as a workplace, to identify the needs of the crew and the problems due to the interior in today's coaches. Proposals concerning how to improve the workplace were then to be given. The problem identification concerned both the driver's and the tour manager's situation in the whole coach. The concept development though focused on the tour manager's seat and the workplace adjacent to the seat.

The specific questions to be answered were:

- > Which are the tasks performed by the crew of the coach?
- > Which are the problem areas concerning the coach as a workplace?
- > How can the working environment of a coach be improved?

3 Methods

3.1 Problem Identification

Users were highly involved in the whole process and since insufficiently research on the topic had been made, information was mainly gathered from interviews and empirical studies. The problem identification included focus group sessions (Johannesson et al. 2004), qualitative semi-structured interviews, customer visits (McQuarrie 2005) and observation tours. In all, more than forty users with a broad range of experiences, working all over the world, were involved and coaches of different brands were examined.

A mind-map was used to visualize identified work tasks. It was considered an appropriate method since the tasks are arranged according to working area but not in any predetermined order. It was highly important to make the result useful in the product development at Volvo Bus and the problems related to the tasks were therefore analysed and organized into coach specific areas. For this purpose the KJ-method was used which is suitable when large amounts of collected data are to be organized and the grouping and structuring shall be based on the empirical material and not on a theoretical frame (KJ-Method, 2007).

An extensive list of problems regarding today's coaches was compiled and the problems and their consequences were rated based on the information from the user study and ergonomics expert knowledge. The rating was made on a three-grade scale according to safety, annoyance, physical ergonomics and frequency.

3.2 *Concept Development*

In the concept development phase the aim was to inspire and show how the workplace can be improved. The features were adapted to suit the various work tasks of the crew and to support and strengthen the tour manager's professional role. To achieve a reliable result, local guides and tour managers were also involved in the concept development process and the computer manikin Delmia V5 Human (Delmia, 2007) was used to try out and verify new ideas and to make sure that the workplace would suit users of various sizes.

The development was an iterative process where various methods were used with the aim to find inspiration and creativity to come up with new ideas. The methods used in the idea generation phase were; brainstorming, inspiration from user characters and metaphors, benchmarking, mock-ups and an own invented disposition exercise. Users, industrial designers and design engineers were involved in the development process.

The purpose with the disposition exercise was to understand the tour managers' own priorities of how to arrange the interior components adjacent to the guide seat. Post-it-notes symbolizing different features were used to illustrate preferred placements of the features within the work area. Designers were also asked to do the same exercise, with the aim to get inspiration from people with other experiences and whose minds were not limited by the coaches of today.

Ideas and concepts were continuously verified by CAD- and manikin-analyses to ensure that the two conflicting cardinal constraints clearance and reach (Ericson & Odenrick, 1997; Helander, 2006 and Pheasant, 2006) were considered. The two conflicting parameters describes that adequate room and circulation space must be provided for the tall user (usually the 95th percentile male), but still the small user (usually the 5th percentile female) must be able to reach or to see over a visual obstruction. Verification was also accomplished by listing pros and cons and by compiling SWOT-analyses (Johannesson et al. 2004) where strengths, weaknesses, opportunities and threats were determined and listed.

4 Results

4.1 Tasks performed by the crew of the coach

Both the tour managers and the drivers turned out to have a considerable amount of work tasks to fulfil during the workday and the work tasks and their complexity were visualized in a mind map to get a lucid overview. There is no certain sequence of work during the tours since each tour is unique –depending on the tour operator, the coach, the crew, the passengers and the destination etcetera. Each work task sets demands on the coach interior, and it was important to understand the tasks and the real needs to be able to find out and understand the requirements regarding the interior design. From the user study several needs that had not been known by manufacturers became apparent.

To guide during a tour is like giving a very long lecture, often several hours. A tour manager therefore needs to bring quite a lot of material into the coach, such as books, maps brochures and notebooks, as seen in figure 1. The tour manager's professional role is quite complex; except from guiding, they shall also make sure that the passengers are satisfied, and words that the tour managers' used to describe their work was also lecturer, recreation leader and welfare officer.



Figure 1, The tour manager brings a lot of working material, such as guide books and maps

4.2 Problem areas concerning the coach as a workplace

That the coach is made with the driver's and passengers' needs in mind but not really the tour manager's became apparent after listening to what the users had to say. A common opinion was that the coach interiors, regardless of brand, were not suited for the work tasks and did not support the tour manager's professional role. Several problems were highlighted and most of them were constantly recurring, for example concerning the guide seat, storage and embark/disembark. That the workplace is seen as problematic was also shown in course literature for future tour managers: "This place is not that suitable as a workplace" (Erlandsson 2005, p.105). Several tour managers felt that they did not have a place of their own; a private area with room for comfortable sitting and enough space for brought material. There was inferior storage space and inferior room for the legs, and the tour manager often felt like he or she was in the way for the passengers or the driver, since the work area usually is placed in the entrance where people pass.

A comprehensive list of problems regarding today's coaches and how they function as a workplace was put together and handed over to the designers at Volvo Bus Corporation, to take into consideration in future product development. The problems and their consequences were rated according to safety, annoyance, physical ergonomics and frequency.

4.3 Concept development

The aim of the concept development was to design a coach interior that makes the tour manager feel welcomed and equally important as the driver. The *disposition* of the workplace was in focus as it was considered crucial to optimize the workplace as a whole and not start with specific details, with the risk to sub optimize some features at the expense of others. There are several parts that are wanted close to the seat but since the area is limited and since space for stretching out legs and so forth is also required priorities had to be made. The disposition exercise was analysed and the wishes were gathered into areas where wanted features should be positioned according to the involved users. The compilation, Figure 2, was used as inspiration in the concept development.

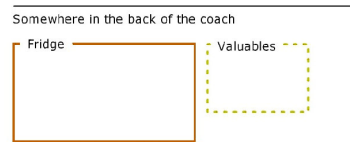
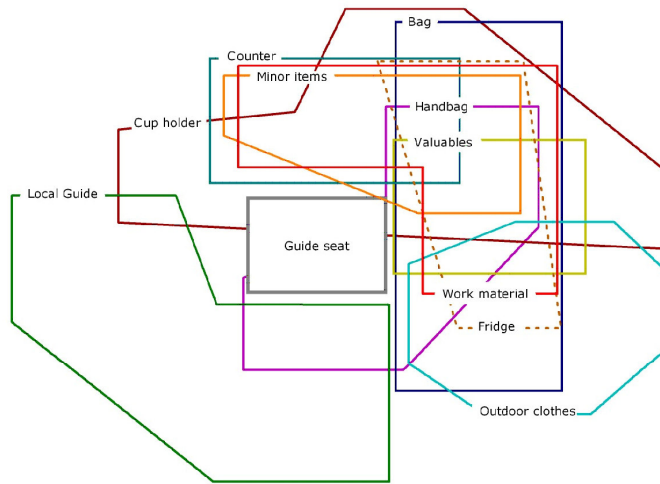


Figure 2, Result of the disposition exercise. Each finite region shows the area where the tour manager found it suitable to position respective wanted feature.

Several of the problems turned out to be consequences of the guide seat's placement in the stairway. Therefore two final concepts were developed; one with the guide seat separated from the stairway, Figure 3, and one with the two parts united in the same area, for comparison.

4.4 Conclusions

When developing future coaches, with the aim to make an ergonomic workplace for the tour manager, the following conclusions are important starting points.

- > The tour managers' working situation is somewhat neglected, and the problems reoccur in almost every coach, regardless of segment and manufacturer.
- > The professional role of the tour manager is complex, including leading, serving, entertaining and lecturing, and needs to be supported by the coach interior.
- > With knowledge about actual user requirements there are vast improvement possibilities, both regarding the disposition of the workplace and detail solutions. Even minor changes will result in great improvements for the crew of the coach.



Figure 3, One of the final concepts where the guide area is separated from the entrance. A computer manikin is used for verification.

5 Discussion

The main difference between this work and most existing cockpit designs was that the concept proposals were based on actual conditions instead of own preconceived notions. A considerable part of the time was spent on the user study to identify work tasks and actual user needs, which formed a solid foundation of knowledge and understanding that was really useful in the rest of the work. When the actual needs were identified common ergonomics methods were useful to improve the workplace, but without the user study the suggested improvements would mostly have been guesses and assumptions except from well known facts, as for instance sitting postures. The over all conclusion was that identifying work tasks and needs of the user is crucial to be able to develop an ergonomic workplace.

To achieve a reliable result, users were also involved in the development process. Listening to their arguments and opinions was very beneficial, it was though important to be aware of that they were limited by the coaches of today and found it difficult to think outside of today's limitations. The six novices all had design experience and their results were used to get new ideas and inspiration. The novices could easily adapt to the exercise. They were not limited to the coaches of today, but they did not possess the knowledge about the needs correlated to the work tasks of the tour manager.

The ranking of problems was carried out to guide the designers at Volvo in their priorities. If there was time enough, it would have been interesting to carry out a quantitative study where the listed problems could be ranked by several tour managers. It was though not considered appropriate to ask just a few users to do ratings since the result would not yield statistical significance. A ranking based on all interviews and observations and knowledge in ergonomics was judged more suitable in this case.

6 References

- Ericson, M. Odenrick, P. 1997: Arbete-Människa-Teknik, Arbetsfysiologi och belastningsergonomi. Stockholm, Arbetarskyddsnämnden. ISBN 91-7522-414-3
- Erlandsson, E. 2005: Guide och Reseledare. Malmö, Liber. ISBN 91-47-07404-3
- Helander, M. 2006: A Guide to Human Factors and Ergonomics, Second Edition. Boca Raton, Taylor & Francis Group. ISBN 0-415-28248-9
- Johannesson, H. Persson, J-G. and Pettersson, D. 2004: Produktutveckling – effektiva metoder för konstruktion och design. Stockholm, Liber AB. ISBN 91-47-05225-2
- McQuarrie, E. F. 2005: The Market Research Toolbox – A Concise Guide for Beginners, Second Edition. Sage Publications, Inc. ISBN: 9781412913195
- Pheasant, S. and Haslegrave, C. M. (2006): Bodyspace – Anthropometry, Ergonomics and the Design of Work, Third Edition. Boca Raton, Taylor & Francis Group. ISBN 0-415-28520-8
- Delmia, www.3ds.com/corporate/about-us/brands/delmia
- European Committee for Standardization, www.cenorm.be, retrieved: 2006-07-24
- KJ-method, www.mycoted.com/KJ-Method, retrieved: 2007-05-26