
Comfortable earth moving machinery

Knowledge and experiences from the Eurocabin project

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13 Future demands on comfort in construction vehicles' interiors according to manufacturers

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13.1 Comfort, a key issue

To be competitive in the market of construction vehicles attention should be paid to the interior comfort. Operators of wheel loaders, cranes and other construction equipment demand this comfort, not in the least because at home and in automobile cars they are used to high comfort levels. On the other hand construction companies need their operator to feel comfortable to increase health and productivity. To understand more on the future demands on vehicle interiors the vision of different manufacturers on comfort is asked in this study.

13.2 Question of this study

What are important comfort aspects in vehicle interiors of construction equipment according to manufacturers?

13.3 Approach

To get an answer on above mentioned question 84 persons from manufacturing companies were interviewed. The interviews took place at the 2001 edition of Bauma, the world's most important trade fair for construction machinery, building material machines, construction vehicles and construction equipment (see figure 13.1). The most important question in the interview is shown in table 13.1. In averaging the data a value of 10



Figure 13.1 The 'Bauma' is the largest trade fair for construction equipment in the world

was given to the most important issue and a value of 7 to the second important issue. In case more issues were mentioned the points were equally divided over the issues. The results of the interviews were discussed with some manufacturers in two workshops during the Bauma.

Table 13.1 Example of one of the questions asked at the Bauma

Which comfort aspects will be the most important in the coming years?		
	1st most important	2nd most important
seat	☐	☐
steering wheel	☐	☐
controls/pedals	☐	☐
cab dimensions	☐	☐
climate	☐	☐
noise	☐	☐
vibration	☐	☐
vision	☐	☐
other	☐	☐

13.4 Results of the interviews

Four persons (5%) of four different manufacturers reported that comfort was not a key issue and were not able or willing to answer the question. Of the other 80 persons 22 were active in design and engineering and the other 58 subjects were active in sales and marketing.

In figure 13.2 the results are summarized. The most important aspect in the future will be the seat according to the manufacturers. The second most important aspect will be noise and the third vision. The steering wheel is an aspect which will not get much attention the coming years.

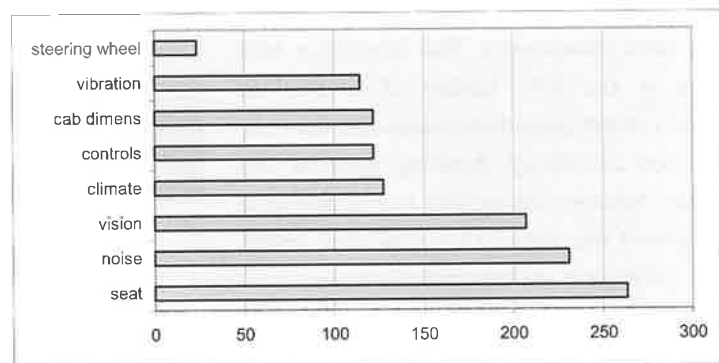


Figure 13.2 Total score of 80 subjects regarding the most important aspect the coming years. A high score is more important

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The group sales/marketing and the group design/engineering had a different opinion (see figure 13.3). More than 30% of the scores of design/engineering representatives indicate that the seat is the most important comfort aspect the coming years, while this percentage is 18% for the sales/marketing group. Another difference can be found with respect to controls/pedals. According to design/engineering controls/pedals are the second most important aspect while for sales/marketing vision, noise, climate, vibration and cab dimensions are more important.

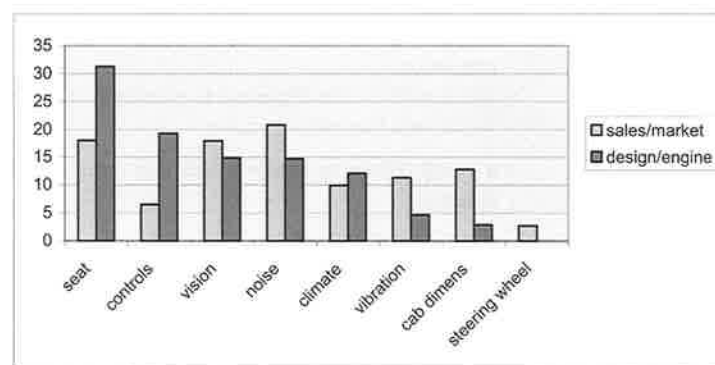


Figure 13.3 Percentage of the total score of 58 sales/marketing representatives and 22 design/engineering representatives. A high score means more important

13.5 Results of the workshop

The first workshop was attended by representatives from Ljungby Maskin, Man Wolfkran, O&K and Liebherr. Some comments on the results of the interviews were:

aspect	comment
seat	• of course the seat will still be important because long periods of sitting will still occur in the future • improvement is still possible - just have a look at the office seat market - and manufacturers will have to stay close to these developments leading to new standards, so they can maintain a competitive position in the market • mobility in the seat, passive as well as active, could be a future issue • adjustability is important to anticipate on growing length of the population • adjustability is important to anticipate on growing length of the population • adjustability is also important to anticipate on more female drivers and drivers from other cultures
vision	• it is still difficult to design a cab with a good view in all needed directions
controls/pedals	• some companies have their own joysticks, this makes integration in the whole cab and combination with the functions easier • natural feel is important, the joystick should feel like an extension of the human body
vibration/noise	• the coming regulations oblige manufacturers to take these items into account
vision/climate	• a better vision is closely linked to climate as more glass automatically means higher temperature
general	• an integral approach is essential as the cab dimensions, vision, seat, pedals and controls together influence the posture and thus the comfort and vision are again connected to climate (see previous point). It is difficult to find the optimum. The Ergomix (see figure 13.4) could be a helpful instrument

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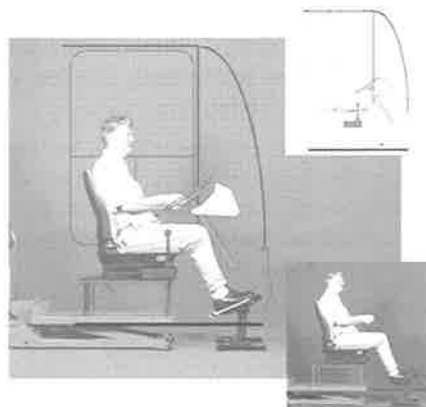


Figure 13.4 The Ergomix of TNO: a system in which real drivers and (computer) drawings are mixed. Designers, users and ergonomists can see immediately the consequences of redesign proposals and discuss them

Table 13.2 New comfort aspects found in the automotive industry

Air-conditioning almost standard
Lumbar support
More adjustability
Seat heating and humidity systems
More roominess in less space
Same seat for different cars
Seat stimulates drivers mobility
Joystick controls/computer screens
Every car is made custom specific

The second workshop was attended by representatives from Kobelco, Daewoo, Komatsu, STA and Bosal. Some comments on the results of the interviews were:

aspect	comment
seat	• in some countries drivers spend more than 12 hours in the seat • the seat is the connection between vision, controls and pedals and therefore also the most important element in the future • it is important to take over ideas from the automotive industry, like heat and humidity control in drivers' seat (see table 13.2) • in fact, in the future seats should be smaller with increased comfort experience to give more room in the cab for other elements or to reduce the cab
controls/pedals	• it is important to have feeling for joystick or other control use; some people seem to lack this feeling • the above could also be seen as a challenge to design controls that enable operators with less 'feeling' to be able to work well with a machine. In times when it is hard to find operators this may prove valuable • one company agreed that the joystick is indeed a future issue, while another company mentioned that there is not so much to be done by them anymore

aspect	comment
noise	• a difference should be made between sound and noise. Drivers should like the sound of the machine whereas at the same time noise should be reduced. Noisy environments may cause fatigue and also lead to stress reactions in the body
vision/dimensions	• on company improved comfort and interior space by making the console (with instruments) height adjustable. This is related to cab dimensions and vision, because the driver can decide on the optimal vision/space combination. The steering wheel adjustability is already found in many machines
general	• every machine should be customized to a specific driver. However, this is not possible because different drivers use the machines, but also because it is very expensive to manufacture. Perhaps ideas from automotive industry can be borrowed • all aspects are important. Common sense is no longer enough to improve the cabin comfort. Therefore several companies use questionnaires among drivers. They are useful in getting ideas for improvement. However, users should also be involved in the next steps of the design process. In that case special research techniques are needed to get the right information from the users/drivers • the styling is an important issue to the manufacturer, as was shown by O&K at the Bauma (see figure 13.5)



Figure 13.5 Styling is an important aspect. O&K showed its latest model at the Bauma

13.6 Conclusion

In a study in 1997 (see table 13.3) the seat was one of the most important comfort aspect in the cabin.

The present study shows that 4 years later the seat is still the most important comfort aspect in construction vehicle interiors. In both workshops the integral design was stressed. The seat should therefore be seen in relationship with other aspects. In fact the seat is the link between vision, controls, pedals and cab dimensions.

Table 13.3 The priority given by users to the different parts of a cabin with respect to comfort (1 = high priority, 7 = low) (Nakada, 1997)

	Kansei desirability ranking: Kansei ranking importance			
	types of construction machinery			
	bulldozers	dump trucks	wheel loader	passenger vehicles
cab interior				
operator seat	1	2	2	1
instrument panel, monitors, meters	3	1	1	2
levers, switches, pedals	2	5	3	7
temperature control, audio equipment	4	7	6	4
interior finish, trimming (ceiling, sides and pillars)	5	4	5	3
steering wheel	–	3	4	6
windows (shape, glass, colour)	6	6	7	9
console box and glove compartment	7	9	9	8
floor mat	8	8	8	5

In the future operators will remain working inside the vehicle over prolonged periods of time, which supports the need for a comfortable seat.

Noise and vibration are regarded second most important, because of guidelines that are now developed and because it is essential to reduce fatigue (long periods result in more fatigue).

The third most important aspect is vision. Good view on the work will remain very important for quality and it is not always easy to make that possible.

Engineers and designers also see the controls as important, because operating should be simple, easy, precise and comfortable. The controls should be a logical extension of your body.