
Comfortable earth moving machinery

Knowledge and experiences from the Eurocabin project

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14 What would operators like to see

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14.1 Introduction

What would operators like to see in their future cabins? What are their wishes and their needs? To get answers to these questions we questioned 273 wheel loader and excavator operators during the Bauma 2001.

In this chapter we describe the operator's demands and wishes for future wheel loaders and excavators. We also pay attention to the feasibility of these wishes and needs.

14.2 Future demands according to operators

The operators were asked to answer two questions about their future machine. The first question was about the changes needed to improve comfort. The second question was about other aspects, not necessarily connected to comfort, that should be improved in the future. Both questions were open-ended and the operators gave a lot of different answers.

As was done before we classified the answers into 15 categories (see table 10.1). We then calculated the percentage answers for each category. Based on these percentages the future demands are listed. We only mention the categories which contain more than 10% of the given answers.

Wheel loaders

Wheel loader operators find, that their overall comfort during working in the machine can be increased by improving seat comfort (e.g., seat pan, lumbar support, arm rests, curvature of back support), climate control (e.g. temperature, dust filters, ventilation, position blowers), design/dimensions/in- and egress (design and dimensions of cabin and machine, position of steps, grab rails), and accessories (e.g. fridge, cup holder, storage space, and radio).

The largest category is 'seat comfort', as 17.3% of the answers are classified into this category (figure 14.1). Climate control is second largest with 16% of the answers, followed by design/dimensions/in- and egress (13.6%), and accessories (12.3%).

When asked what other aspects should be improved, the operators are quite unanimous: 64.1% of all answers fell inside the category 'Machine performance'.

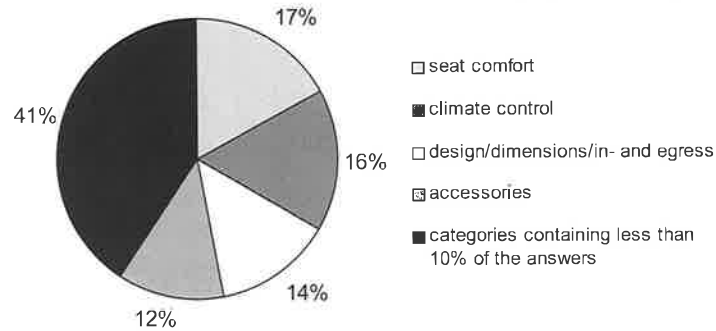


Figure 14.1 Future demands of wheel loader operators: changes that are needed to improve the comfort

Excavators

In the excavator group the top 4 of desired changes to improve comfort consists of climate control (18.9%), seat comfort (17.9%), design/dimensions/in- and egress (16.3%), and accessories (13.6%) (figure 14.2). These are the same categories as the wheel loader operators mentioned, though in a slightly different order.

Regarding other aspects to be improved it was the category 'machine performance', that was again the largest category with 56.7% of the answers. View was also mentioned in more than 10% of the answers (10.2%).

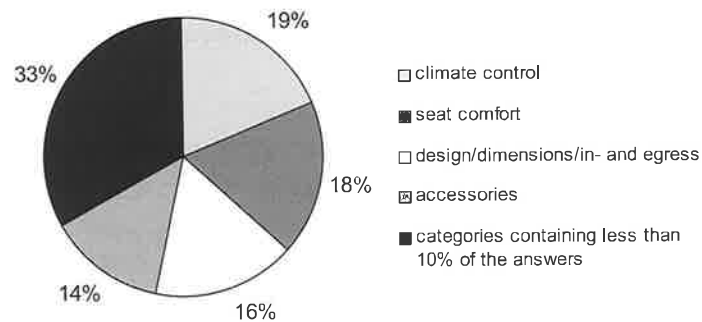


Figure 14.2 Future demands of excavator operators: changes that are needed to improve the comfort

14.3 Feasibility of future demands

Climate control

Continuous attention is paid to improving the operator's viewing area when designing new machines. The O&K study that was shown at the Bauma is an example (see chapter 13). There is a general tendency towards an increased glass area, not only in earth moving equipment but also in the automobile industry (see chapter 15) and even in architecture. Obviously the increased glass surface places higher demands on the climate control inside the cab. To keep temperature within comfort ranges air-conditioning would be necessary.

Preventing heat build-up from radiation requires different techniques such as coloured glass, specific coatings or electro-chromatic glass that can be obscured electrically. Some of these techniques are already in use. Air-conditioning, if not already standard, is mostly optional in a cab. Electro-chromatic glass is applied in automobile prototypes and may therefore not yet be ready for use in heavy industry. The fact that these features will probably increase the price of a cab, will not add to a speedy introduction.

Seat comfort

Improving seat comfort should be seen as wide as possible. Beside the comfort of the seat itself and the damping of vibrations, it includes making sure that the operator is correctly positioned with respect to hand and foot controls and viewing area, while maintaining a healthy posture. Improving seat comfort therefore requires more than improving the seat and its suspension. Improving the comfort of seat and backrest may even prove to be useless if other factors are not optimized.

Nevertheless, should one wish to further improve the seat's comfort, scientific knowledge on comfort is required as described in chapter 2. The comfort experience is highly individual and varies accordingly. The challenge lies in satisfying as many operators as possible, without creating widespread opinions about the seat.

With respect to vibration damping, there is still work to do. In present seats damping characteristics change with the chosen seat height. This should not be the case. Also, the pitching of the cabin has not been taken into account. Operators often complain of getting 'hit' by the back rest when the machine moves violently.

In addition solutions should be sought in all other interfaces between the earth and the cab or the carried load and the cab, such as boom hinges and cylinders

and cab suspension. Because of the possibility of resonance, solutions should be phased. This might be the largest challenge because seats are ready-to-buy products and are therefore generally not adapted to a certain specific machine.

Cab design/dimensions

Operators would like to have a larger cab. Especially in excavators this is quite logical considering the limited available space for the cab. Apparently space or the (sense of) roominess of a cab is closely connected to the comfort feeling. Also it is often the storage space that is being missed. Adding storage space in the back of the excavator cab should be possible by extending the cabin's footprint to the back. This, however, will generate a conflict with the general desire to reduce machine size while maintaining or increasing machine power.

In wheel loaders there is also a conflict with the direct viewing area. Increasing the size of the cab to the back and sides will impair the operator's downward view. As view is scored second (after machine performance) on aspects needed to work well with the machine, creating more space or the sense of space is a challenge to the designers.

Machine performance

Machine performance is high on the operator's list of wishes. We mentioned above that it is not yet clear what aspects of machine performance are most important to the operator. This should first be investigated. With the outcome designers will have better information on how to make sure the machine lives up to the expectations of the operator, which is very important considering the influence operators have on the buying of equipment.

The trend towards more power in the same machine is already present. Here also the trend comes into conflict with other machine demands such as compacting the machine and reduction of exterior noise production. Making the machine compact to increase viewing area and application areas mostly requires a minimization of the engine compartment. On the other hand noise reduction requires space for insulation materials. In addition an increase in power requires more cooling, which not only needs space but can also be noisier. With increasing environmental regulations with respect to exterior noise it will not be easy for manufacturers to keep increasing machine performance without a deterioration of other important factors.

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14.4 Conclusion

It is clear that with so many operator demands covering aspects that are in the same time strongly interrelated, machine design should be taken as a whole. There should be a close co-operation between all involved disciplines, not only technical but also with respect to human factors. A complicating factor is the fact that manufacturers are increasingly becoming system integrators as is the case in automobile industry. Many components that form the interface between the operator and the machine are purchased, making it more difficult to create a cab including all controls and functions that is built around the operator. A large manufacturer may be able to influence his supplier, for a small company this is near to impossible.