

BETTERLIFT – INTRODUCING A SEMI-AUTOMATIC EXHAUST MANIPULATOR TO REDUCE A HIGH ABSENTEEISM RATE

1. Organisations involved

Ford Motor Company

2. Description of the case

2.1. Introduction

Absenteeism was high among exhaust assembly workers at Ford's Genk plant in Belgium. Workers reported heavy strain on their back, shoulders, neck and wrists from repetitive lifting, holding and fixing exhausts. To alleviate the problem the ergonomic team designed, built and implemented a semi-automatic exhaust manipulator, which decreases the physical workload of the operators. The introduction of the manipulator resulted in a fall in repetitive strain injury (RSI) complaints and absenteeism, a decrease in the number of operators needed to perform the job and consequently a decrease in costs related to this job.

From 1994–2000 the senior medical officer at Ford Genk carried out a study on absenteeism related to RSI. He compared production-related and non-production related departments for both the incidence and severity rate. The study revealed a clear difference between the two departments. Production jobs in particular had a high absenteeism rate, caused by the repetitive actions performed in this work, and the assembly department showed the highest rate of all.

Workers in the assembly department (especially the chassis line) reported more complaints of pain in the shoulder, back, neck and wrists than other workers. These complaints are related to the weight of the exhaust. As technology has improved and more double exhausts are now used, exhausts have gained in weight, placing a greater strain on workers.

2.2. Aims

With the introduction of the semi-automatic exhaust manipulator, Ford Genk aimed to:

- decrease absenteeism due to RSI;
- make it possible for the task to be carried out by a much larger percentage of possible workers (50 % of women and 95 % of men; Lifting Index = 1.5);
- optimise safety when performing this job;
- increase motivation and morale;
- eliminate compulsory job rotation (which was only intended as a temporary measure);
- reduce the number of workers needed for this process (two to three workers were involved) to reduce the costs of this workstation and achieve break-even in this project as soon as possible — the second worker from the workstation was transferred to another workstation under the leadership of the same supervisor.

2.3. What was done, and how?

The project was done in two phases: production of the first manipulator for the Mondeo Sedan and production of the second manipulator for the Mondeo Wagon, the S-max and Galaxy. The first project was entitled LEC project 3E289 and the second LEC project 3E304.

General ergonomic approach and strategy

The starting point of the ergonomic approach within Ford Genk is 'adapting work to people'.

Each of the four areas of Ford Genk has a Local Ergonomic Committee (LEC), which is a multidisciplinary team (safety advisor, financial services, HR, unions, ergonomic services,

CASE STUDIES

medical services, production, maintenance, etc.) that identifies ergonomic problems and helps resolve them. This team aims to put the Ford ergonomic philosophy into practice. The members of the LEC are trained in using a six-step methodology, the 'job improvement cycle', to identify, evaluate and solve ergonomic problems.

The job improvement cycle.

1. Identify priority jobs

The LEC investigates which jobs have ergonomic problems, based on several information sources. The 'Problem Logbook' gives an overview of all running/ pending ergonomic issues, with their priority rate, based on the gravity of possible lesions or on the number of employees involved.

2. Evaluate straining jobs (with potential ergonomic hazards)

The LEC analyses the problem in order to point out the exact causes. The evaluation requires an investigation of the process, the work method and the environment.

3. Development of solutions

The LEC comes up with one or more solutions to the identified problems, and discusses ways in which the workstation or process can be altered.

4. Implement solutions

The reorganisation or redesign of the job is put into practice. Workers have to receive instructions on how to deal with the new situation.

5. Document the project

The LEC has an 'Evidence Book' containing all information on current and finished projects. Anyone is entitled to consult the book and prevention experts check it regularly.

6. Follow-up

After the implementation, the LEC has to visit the operations and evaluate the effects of the improvements on a regular basis. Further adjustments might be possible.

A. The job-improvement-circle applied on the LEC project 3E289

1. Identify priority jobs

The adjustment of the workstation was identified as priority No 1 based on the following facts:

- complaints from operators, reported through supervisor or union delegates;
- high grade of FTOV (first-time occupational visit): 21 records;
- high absenteeism: 1 018 days lost — Sedan: 627 & Wagon: 391;
- high grade of sickness periods: 43 — Sedan: 26 & Wagon: 17;
- operation only suited for a limited number of workers.

2. Evaluate straining jobs (with potential ergonomic hazards)

Based on the ergonomic assessment, the following description of the former task can be given:

Two workers from the chassis line pick up exhausts — ranging in weight from about 20 to 28 kg — from the conveyor system, bring them towards the vehicle and deck them under the car. Two or three operators manually lift the exhaust over head height and support it with one arm whilst they connect the exhaust to the exhaust isolator on the body (Figures 1 and 2).

This process puts excessive strain on the upper limbs and particularly on the shoulders, the worst part being the one-handed support of the exhaust at head height.

CASE STUDIES

Figures 1 and 2. Operators picking up the exhaust from the rack and decking it under the vehicle

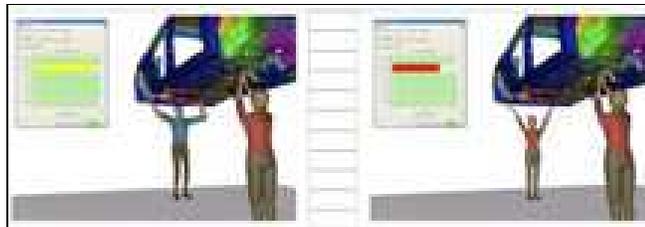


The NIOSH lifting equation was used to calculate the recommended weight limit and the Lifting Index. Ford used the Ford Design Action Limit, which is based on the 50th percentile of women and 95th percentile of men and is $LI = 1.5$ ($LI =$ Lifting Index).

When this action limit was applied to the former situation (manual manipulation), it became clear that the situation was unacceptable. In several instances the LI was higher than 1.5.

Based on the actual situation (and the results from NIOSH) it was possible to do a digital simulation of the job with the 'Jack' software, which showed that many women couldn't perform the job because of anthropometrical and strength-related reasons. Even 10 % of the male population couldn't perform the task, without repetition, because of strength-related reasons (see Figures 3 and 4).

Figures 3 and 4. Screenshot from 'Jack' software — simulation of men and women decking the exhaust



3. Development of solutions

Ford Genk examined how other Ford plants and other automobile organisations handle such problems. For example, Rover had already developed an exhaust manipulator. The LEC developed the idea of making an exhaust manipulator that would relieve workers from having to lift, hold and fix heavy exhausts repeatedly.

12.2.2002 to 3.4.2002

The engineering team, in conjunction with three workers, built a first wheeled prototype that had to be pushed or pulled towards the car.

3.4.2002 to 20.5.2003

This prototype turned out to be impractical. Pulling and pushing the manipulator took too long because the wheels regularly slipped on the soap that is used at this workstation. (The rubbers that are attached to the exhaust in order to put it beneath the car are soaped. The soap leaks onto the floor where the manipulator passes.)

20.5.2003 to 13.1.2004

LEC suggested creating an automatically driven manipulator on rails in the floor. This system allows the operators to work faster. A test version gave the workers the opportunity to try it out and give feedback. In the stage of testing and retesting, the operational buttons were also

CASE STUDIES

ergonomically tested to determine whether they were well placed, easy to push, the right colour, etc.

4. Implement solutions 9.2.2004

The exhaust manipulator was put into use in the Sedan (Mondeo) workstation.

The task can now be described as follows:

The exhaust manipulator picks up the exhaust from the conveyor system and brings it towards the vehicle. The worker operates the manipulator so that the machine positions the exhaust just beneath the vehicle. Then the operator fixes the exhaust on the car. The operator pushes a button, which makes the manipulator return to start where it will pick up a new exhaust. The process is repeated every 42 seconds (current cycle time).

Figure 5. The manipulator carries the exhaust towards the car – Figure 6. The operator makes the manipulator lift the exhaust – Figure 7. The operator fixes the exhaust to the car – Figure 8. The manipulator goes towards the rack in order to pick up a new exhaust



5. Document the projects

LEC project number 3E289 was documented and put into the 'Evidence Book'. This document also describes all the actions that were taken at different times.

6. Follow-up

Some characteristics of the manipulator had to be adjusted to improve efficiency. These adjustments will serve as 'lessons learned' in the follow-up LEC project 3E304.

B. The job-improvement-circle applied on LEC project 3E304

After the successful implementation of the exhaust manipulator in the Sedan workstation, a new manipulator was built for the Wagon workstation. Based on the deficiencies of the first type, adjustments were made.

The second manipulator was electric rather than pneumatic. This provides more control possibilities, the manipulator goes faster and maintenance is easier.

At the bottom of the manipulator an additional safety measure was installed. A bar detects when workers stand in the path of the machine. When a signal is sent to the operating cell, the machine shuts down.

At present, due to process modifications, only this second and most efficient version of the manipulator is still in use, not only for the Wagon series but for all variants of Mondeo, S-max and Galaxy.

What kind of risks were dealt with?

The manipulation of heavy weights (the exhaust pipes) above the head placed heavy strain on the back, neck, arms and wrists. This led to health complaints and a high absenteeism rate.

Finances available for the action

For the LEC project 3E289 no budget was estimated in advance but the Area Manager gave his permission to use finances from Area 3, which is the Assembly Department. A cost breakdown shows the actual budget used for the engineering, fabrication and implementation of the first manipulator (Table 1).

Table 1. Estimated budget for exhaust project

Work done or parts used	Amount/EUR
Pneumatic parts/linear guideway	45 505
Civil works	16 700
Mechanical parts	11 942
Construction	12 518
Legal requirements	1 782
CAD design	4 456
Total	92 903

For the second project, a budget was provided based on the amount spent for the implementation of the first one.

Other resources

Apart from the financial resources, human resources were also provided. For both projects a multidisciplinary team was put together that consisted of:

- the Senior Medical Officer,
- the Supervisor, Tool & Equipment Shop FG-3E1,
- the Checker, Equipment & Automation,
- the Work Coordinator, Toolmakers,
- the Proactive Ergonomist Genk plant.

2.4. What was achieved?

The number of lost days before and after installation of the exhaust manipulator

Before the installation of the manipulator, the loss of time due to absenteeism was very high in both workstations. After the implementation of the exhaust manipulator in Workstation 1, absenteeism fell to zero lost days between January 2004 and February 2006. In Workstation 2 where no manipulator was implemented until 2006, 36 days were lost during the same period. Despite the fact that in Workstation 2 no exhaust manipulator was implemented during that period, the number of days lost fell considerably. This was because of the introduction of an efficient compulsory rotation system. After 30 minutes of fixing exhausts workers had to switch to a task that did not involve handling heavy weights. The decrease can also partially be explained by a reorganisation at the end of 2003 that resulted in a change in the composition of staff at the station (Table 2).

Table 2. Number of days of absence before and after the project

	1.2000 until 6.2003	1.2004 until 2.200
Workstation 1	(without manipulator) 627 inactivity days, 26 sickness periods, 14 operators	(manipulator in use) 0 inactivity days, 8 operators
Workstation 2 (without manipulator)	391 inactivity days, 17 sickness periods, 9 operators	36 inactivity days, 3 sickness periods, 3 operators

Working conditions before and after the exhaust manipulator

The job has become accessible to more workers and puts far less strain on the workers. Workers no longer complain about the job; instead the job has become quite 'popular' because the strain is quite low.



Problems faced

Problems were mainly related to the technical part of the project, such as constructing the manipulator. When the first solution was tested, the manipulator on wheels, there were problems with the stability and the manoeuvrability. Soap that leaked on the floor made it difficult to handle the manipulator. Another solution was suggested, namely to create a rail on which the manipulator could move from one place to another. A second problem was periodic technical failure of the machine. To increase the technical efficiency, the second type of semi-automatic manipulator, ran on electric rather than pneumatic power. This also allowed the machine to go faster, which was a request from the manufacturing department.

2.5. Success factors

Concerning the initiators involved in the project

The LEC or local ergonomic committee initiated and coordinated the whole project. The multidisciplinary nature of this committee ensured that the project would take every aspect of the problem into account when coming up with a solution.

Concerning partners involved in the project

According to the procedures for taking expensive facility measures, top management has to approve a project at the OPC (Operations Policy Committee, top management meeting). Management gave its approval for the implementation of the exhaust manipulator, which ensured (financial) support from the beginning. Once the top management supported the project, all other partners followed. Another important group of people whose support is necessary are the union delegates. These delegates were involved from the start because some workers reported complaints about the job via their union. As this project would result in the improvement of working conditions, they supported it from the beginning.

Concerning the target group

The workers themselves were also involved throughout the whole process. They reported complaints about the job, they were represented in the LEC and they had the chance to test the manipulator in advance.

Concerning the methodology used

Ford uses a structured approach in the implementation of ergonomic projects and documents all projects very well. This makes the progress and follow-up of a project much easier. When similar projects are carried out in future, they can easily check what was done the first time and what has to be done differently.

Concerning what was produced or what was done

The manipulator was fully designed and built in-house by workers who are familiar with the process and the problems related to it. They have a comprehensive view on the situation. Apart from that, workers are often less resistant to solutions from colleagues than from outsiders. In the future it will also be easier and cheaper to repair the manipulator if necessary. A separate area was provided in order to set up a trial version. This allowed the engineers to detect flaws in the system and to ask the opinion of the workers. The operators were better prepared for what was coming.

2.6. Further information

Contact information:
Ford Genk (part of Ford Motor Company)
Bart Haesen
Pro Active ergonomics, BG-FGM-4
Henry Fordlaan 8
3600 Genk, BELGIUM
Tel. +32 89616886
E-mail: Bhaesen@Ford.com

2.7. Transferability

The implementation of the exhaust manipulator is transferable to all manufacturers from the car industry that fix exhausts beneath cars. The project has already been added to Ford's 'best practice replication system', which means that all Ford plants over the world can consult the methodology. Ford's ergonomics process approach can serve as a good practice example for all kinds of companies from different sectors.

3. References, resources:

- <http://osha.europa.eu/en/publications/reports/TEWE09001ENC>