human engineering

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The application of ergonomic standards in the design of a processing machine: difficulties and challenges

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introduction

- Why **should** Ergonomics be **implemented**?

Injuries

Error rates

Accidents

Fatigue

Illness

Absenteeism

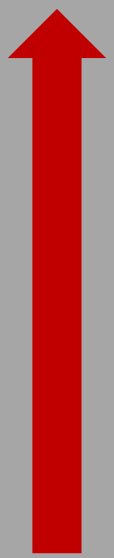
Employee turnover

Training time

Skill requirements

Maintenance time

Insurance work



Productivity

Performance

Materials and equipment savings

Employee commitment

Better attitudes

Quality of life

Corporate image

…

introduction

- Why **should NOT** Ergonomics be **implemented**?

Extra cost

Waste of time

Uncertain benefits

…

Fuzzy' discipline, providing vague recommendations

(Burns & Vicente, 2000)

Ergonomic standards are "too wordy", "too general", "too hard to understand"

(Campbell, 1996)

objectives

- Demonstrate some of the **difficulties** regarding the application of ergonomic standards into a machine design;

- From them, discuss some **challenges** aiming to facilitate the implementation of Ergonomics in an engineering design process.

Implementing Ergonomics is not ONLY a matter of there being standards!

methodology

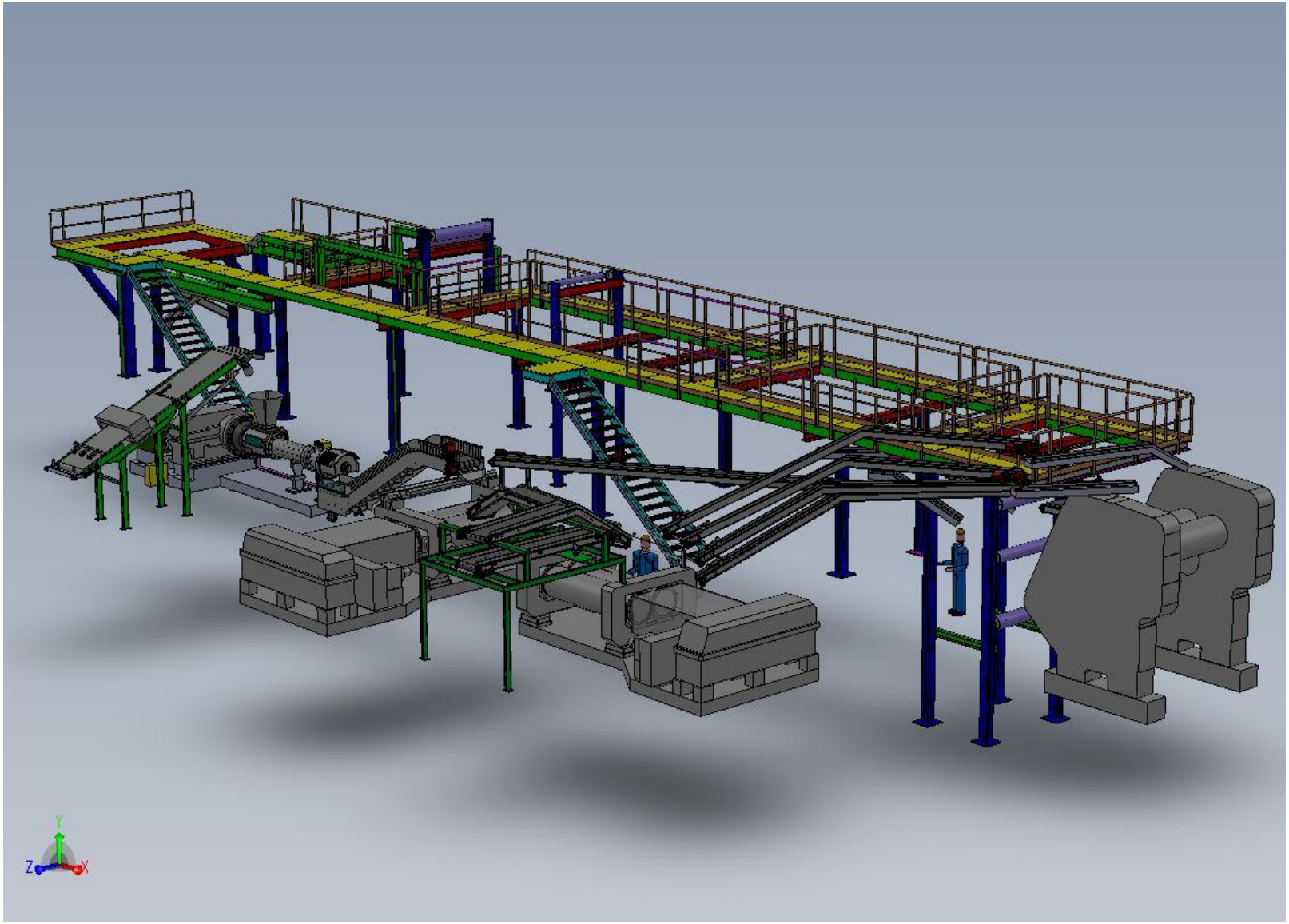
Ergonomic intervention

- manufacturing company, automotive chain;
- contribute to the design of a processing machine;
- planned phases:
  1) analysis of the work system
  2) Integration with the engineering design team

negotiation: the machine's **certification** (the product conforms with the requirements of the applicable EC directives)

results

- The importance of the machine's **certification**:
  - It was **not a central issue** to the ergonomic intervention,
  - But, it was a **concern** to the project manager,
  - Used as a **"bargain"** for the intervention,
  - It would impose the accordance with **Ergonomics**, **Health and Safety** requirements and other standards.



results

- **Available ergonomic standards:**
  NP EN 614-1:1996 Safety of machinery. Ergonomic design principles. Part 1: Terminology and general principles;
  NP EN 614-2:2004 Safety of machinery. Ergonomic design principles. Part 2: Interactions between the design of machinery and work tasks.

- **No standards** available within the company regarding ladders and stairways.

However, no updated:

EN 614-1:2006 + A1:2009 Safety of machinery. Ergonomic design principles. Part 1: Terminology and general principles;
EN 614-2:2000 + A1:2008 Safety of machinery. Ergonomic design principles. Part 2: Interactions between the design of machinery and work tasks.

results

- **Standards not available in the company:**

Originally published by ISO in 2001. Enacted as an european standard and translated as a national standard in 2011.

NP EN ISO 14122-1:2011 (Ed.1) Safety of machinery. Permanent means of access to machinery. Part 1: Choice of fixed means of access between two levels;
NP EN ISO 14122-2:2011 (Ed.1) Safety of machinery. Permanent means of access to machinery. Part 2: Working platforms and walkways;
NP EN ISO 14122-3:2011 (Ed.1) Safety of machinery. Permanent means of access to machinery. Part 3: Stairs, stepladders and guard-rails.

Originally published by ISO, enacted as an european standard in 2004, but not adopted as a national standard:

EN ISO 14122-4:2004/A1:2010 (Ed.1) Safety of machinery – Permanent means of access to machinery. Part 4: Fixed ladders.

Originally published by CEN in 2007, enacted as European Standard, adopted as a national standard:

EN 131-1:2007 (Ed.2) Ladders. Part 1: Terms, types, functional sizes;
EN 131-2:2010 (Ed.2) Ladders. Part 2: Requirements, testing, marking;
EN 131-3:2007 (Ed. 1) Ladders. Part 3: User Instructions;
EN 131-4:2007 (Ed. 1) Ladders. Part 4: Single or multiple hinge-joint ladders.

Occupational Safety and Health Administration that aim the design and use of ladders: **OSHA 29 CFR 1926.1050-1060**

Guide to appliance of OSHA Rules for Stairways and Ladders: **OSHA 3124-12R 2003**.

results

- **Concerning the European directives, the only one available at the company was:**

  98/79/EC - 98/37/EC Machine Directive: States that machinery design must take into account ergonomic principles, so that the discomfort, fatigue and psychological stress of the operator is minimized.

- **Other not available directives:**

  89/391/EEC: A general framework directive. Obliges employers to take necessary measures to safeguard worker´s safety and health in every aspect of their work;
  89/654/ECC: Concerns minimum safety and health requirements both for workplaces currently in use and the ones used for the first time. Special topics concerning freedom of movement at workstations;
  2006/42/EC: States essential health and safety requirements related to the design and construction of machinery.

results

- **Difficulties:**

- The **knowledge** of the design team about safety and ergonomic standards and recommendations was very **scarce**;
- Most of the standards were under the **responsibility** of the Safety Department, which had no representatives in the machine design team;
- Many standards were not **available** at the company, which meant that they would need to be purchased;
- The need to **“adapt”, “translate”** the recommendations.

conclusions

Ergonomic standards are good sources of data, and they **should be used** in order to help the incorporation of Ergonomics in the engineering design….

- **Challenges:**

- There is a need for the **training** of engineers and designers on ergonomic standards;
- **Multidisciplinary** design teams, including occupational safety representatives, can **minimize the gaps** in the design concerning ergonomic aspects;
- **Encourage** the application of ergonomics in the workplace design, not only as an obligation.

conclusions

- The implementation of ergonomics does not only depend on the **standards, recommendations and guidelines**: it is also a matter of **changing the way** engineering design is done.

Thank you

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