Ergonomic risk analysis applications at the industry

Methods - Time Measurement

1948, Maynard, Schwab, Stegemerten
MTM
a worldwide Standard of Work Performance

- MTM is an analytical tool for directly analyzing manual work processes.
- MTM offers a worldwide uniform standard for businesses to use in describing and quantifying manual work processes.
- MTM is a tool for developing standardized building blocks from the MTM basic system (MTM-1). These building blocks are used to economically describe, quantify and design a wide range of work processes.
- MTM enjoys the greatest worldwide distribution as an instrument of industrial engineering and time management.
- In addition, building block systems were developed based on MTM-1 for application in different process types (mass production, batch production and one-of-a-kind and small variable batch production).
- MTM has gradually been transformed from a predetermined time system to a productivity management system.

EAWS – Project issues

- Companies need an ergonomic first level analysis tool (screening) to evaluate the biomechanical load over the whole body.
- This tool must be accepted and recognized by any involved part (companies, workers, unions, authorities, etc.)
- User deviation must be minimized by having an objective identification and measurement of actions, wrong postures and applied forces.
- This tool must be usable during the stages of product/process design.
EAWS is a 1st level system for screening ergonomic risk due to biomechanical overload.

Up to a certain extent EAWS can also be used as 2nd level analysis tool, since it is quite analytical and detailed. EAWS gives the necessary information to redesign the work task, making the second level systems seldom necessary.

**Note**

1st LEVEL systems: risk evaluation systems which require a quick screening checklist.

2nd LEVEL systems: risk evaluation systems which require a detailed analysis with index calculations. They are applied where a possible risk has been already detected by a 1st level system.
Documenting and evaluating work conditions, regarding the operator's workload

Ensuring favorable ergonomic conditions

Compliance with labor legislation (national and international), e.g.

Developing an extension of the Automotive Assembly WorkSheet (AAWS) in accordance with all parts of EN 1005 standard and the corresponding ISO standard (11226 and 11228)

Making this tool usable in any kind of company, from mass production to one of a kind production

Providing a useful communication tool for product/process design

Developing a free tool without any kind of copyright

Linking EAWS to MTM
  - MTM-2: mass production systems
  - UAS: batch production systems
  - MEK: one of a kind production systems
### EAWS main users

<table>
<thead>
<tr>
<th>Company</th>
<th>Tool name</th>
<th>Status</th>
<th>ERGO-MTM</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEL/GME</td>
<td>NPW</td>
<td>Implemented in 1997</td>
<td>N</td>
</tr>
<tr>
<td>Porsche</td>
<td>Design/Check</td>
<td>Implemented in 1998</td>
<td>N</td>
</tr>
<tr>
<td>Daimler</td>
<td>EAB</td>
<td>Implemented in 2000</td>
<td>N</td>
</tr>
<tr>
<td>Bosch</td>
<td>BiB, EAWS</td>
<td>Implemented in 2005</td>
<td>N</td>
</tr>
<tr>
<td>Bosch Rexroth</td>
<td>EAWS</td>
<td>Implementation in progress (ITA)</td>
<td>N</td>
</tr>
<tr>
<td>Audi</td>
<td>APSA</td>
<td>Implemented in 2006</td>
<td>N</td>
</tr>
<tr>
<td>Karman</td>
<td>AAWS</td>
<td>Implemented in 2007</td>
<td>N</td>
</tr>
<tr>
<td>Smart</td>
<td>EAWS</td>
<td>Implemented in 2008</td>
<td>N</td>
</tr>
<tr>
<td>MAN</td>
<td>AAWS Cargo</td>
<td>Development in progress</td>
<td>N</td>
</tr>
<tr>
<td>FGA</td>
<td>EAWS</td>
<td>Implemented in 2008</td>
<td>N</td>
</tr>
<tr>
<td>IVECO</td>
<td>EAWS</td>
<td>Spain implemented in 2010-11</td>
<td>Y</td>
</tr>
<tr>
<td>FFPT</td>
<td>EAWS</td>
<td>In progress</td>
<td>Y</td>
</tr>
<tr>
<td>VW</td>
<td>EAWS</td>
<td>Implementation in progress</td>
<td>N</td>
</tr>
<tr>
<td>Denso T-S</td>
<td>EAWS</td>
<td>Implemented in 2008</td>
<td>N</td>
</tr>
<tr>
<td>Lamborghini</td>
<td>EAWS</td>
<td>Implemented in 2010</td>
<td>N</td>
</tr>
<tr>
<td>Beretta Armi</td>
<td>EAWS</td>
<td>Implemented in 2010</td>
<td>Y</td>
</tr>
<tr>
<td>Chrysler</td>
<td>EAWS</td>
<td>Implementation in progress</td>
<td>Y</td>
</tr>
<tr>
<td>VM Motori</td>
<td>EAWS</td>
<td>Implementation in progress</td>
<td>Y</td>
</tr>
<tr>
<td>SEAT</td>
<td>EAWS</td>
<td>Implementation in progress</td>
<td>N</td>
</tr>
</tbody>
</table>

**Source:** Introduction to EAWS (Ergonomic Assessment Worksheet) Workshop

**Dipl.-Ing. Torsten Wagner – IAD, 2012**

### Ergonomic assessment process

- **Observer**
  - working posture
  - action forces
  - manual material handling
  - repetitive tasks
  - extra points
  - duration
  - frequency

- **Process**
  - recognize
  - categorize
  - calculate

**Source:** Introduction to EAWS (Ergonomic Assessment Worksheet) Workshop

**MTM Hungária, Dunajcsik Zoltán**

**30th May, 2013**
Application notes

- Works best for short cycled tasks (cycle time ≤ 5 min)
  - For cycle time above 30 minutes the amount of tasks often exceeds the capabilities of the observer and makes a "pen and paper"-analysis of a certain section impractical
  - No peek loads for long periods
- Calibrated to assembly tasks (automotive industry)
Section 2

Action Forces

EN 1005-3
ISO 11228-3

CORRELATED 2° LEVEL SYSTEMS
RULA; SCHULTETUS

Section 3

Manual materials handling

EN 1005-2
ISO 11228-1/2

CORRELATED 2° LEVEL SYSTEMS
MOOR; ENDOR & CIRELLO

Section 4

Upper limb load in repetitive tasks

EN 1005-5
ISO 11228-3

CORRELATED 2° LEVEL SYSTEMS
OCRA
-SI (Strain Index)
HALTV (*)

European Conference on Applied Ergonomics
Factors rising occupational risks:

Physical factors:
- Moving heavy loads
- Unfavourable postures
- Repetitive tasks
- Heavy loads
- Etc.

Factors rising occupational risks:

Physical factors:
- Moving heavy loads
- Unfavourable postures
- Repetitive tasks
- Heavy loads
- Etc.

Right lamp (EAWS) – Upper limbs

Frequency

High risk

Low risk

Force

precision

Tendinitis
Load of the upper limbs - Examples

- Sorting of goods
  - High frequency
- Insertion of finger strength
- Using clips
  - High precision

Design with MTMergonomics®

- Based on MTM-analyses, an ergonomic risk can be identified already during the planning phase
- Pro-active evaluation of processes and design
- Consideration of a total strain situation
- Overall evaluation of physical strains
- One person is responsible for the planning and ergonomic evaluation of processes
- Result: traffic light evaluation of the ergonomic risk for the worker
Deutsche MTM-Gesellschaft mbH, Softwarehaus

The MTM analysis is complemented by additional information on the load situation.
MTM Hungária, Dunajcsik Zoltán

30th May, 2013

Deutsche MTM-Gesellschaft mbH, Softwarehaus

Evaluation generator

- Display of result
  - whole Body
  - upper limbs

- detailed evaluation
  - Points of posture
  - Points for forces
  - Points of load
  - Extra points
  - RSI points

Design example

Turn drum

manual testing process

high loads upper limbs

poor body posture (twisting)

Only men can be used at WP!

Reactive power rotate work piece carrier

manual testing process

Invest: approx. 80 € (Renovation screwer)

Elimination of physical load

Now feasible for women!

20% reduction in execution time
Holistic approach

- MTM planning concept
  - Construction
  - Planning
  - Production

- Holistic approach
  - MTM methods
    - ProKon
    - Standard target time analysis
    - MTM planning analysis
    - MTM production analysis
    - Know-how transfer

- Consideration ergonomic requirements
  - Integration ergonomic relevant elements

- Integrated and harmonized design of process chain
- A methodological consistent optimization concept

Benefits and prospects

Ergonomics pays off.

For the company:
- Multiple use of data reduces analysis effort
- Efficient and ergonomic work processes
- Lower absenteeism/costs
- Increase the efficiency and quality
- Prevention and reduction of costs for changes

For the employee:
- Reducing of physical load
- Increased working comfort
- Motivation and satisfaction
- An optimal working system resp. working environment release free potential