Sustainable Assembly Systems: 
Ergonomic Optimization of Volkswagen Commercial Vehicles Production, Hanover

@ 30th Ergonomic Summer University

Baráth Edit, imk automotive GmbH
Contents

1. Challenges at Volkswagen Commercial Vehicles
2. General Procedure and Employee Participation
3. Implementation of Improvements
4. Ergonomic Design Process
5. Summary
Challenges at VW Commercial Vehicles
Length and Height in Comparison to Passenger Cars

Crafter (max. 2.7 m)
T6 (max. 2.4 m)
Amarok
Golf 1.4 m

Crafter max. 6.9 m
T6 max. 5.3 m
Amarok
Golf 4.2 m
Challenges at VW Commercial Vehicles

(1) Product Dimensions

- **Product Dimensions:**
  - Greater length and height of vehicles
  - More difficult accessibility
  - Increased proportion of overhead work
  - Parts are bigger in size and weight
  - More assembly tasks in car interior

- **Product Lifecycle**

- **Plant Structures**
Challenges at VW Commercial Vehicles

Part Dimensions

Wooden ground floor (ca. 20 kg)

Paint auxiliary fittings
Challenges at VW Commercial Vehicles

(2) Product Life Cycle

- **Product Dimensions:**
  - Greater length and height of vehicles
  - More difficult accessibility
  - Increased proportion of overhead work
  - Parts are bigger in size and weight
  - More assembly tasks in car interior

- **Product Lifecycle**

- **Plant Structures**
Challenges at VW Commercial Vehicles
Product Lifecycle in Comparison to Passenger Cars

T5  T5 GP  T6
2003  2015

Golf V  Golf VI  Golf VII
2003  2015
Challenges at VW Commercial Vehicles

(3) Plant Structure

• **Product Dimensions**:  
  - Greater length and height of vehicles  
  - More difficult accessibility  
  - Increased proportion of overhead work  
  - Parts are bigger in size and weight  
  - More assembly tasks in car interior

• **Product Lifecycle**

• **Plant Structure**
Challenges at VW Commercial Vehicles

Structure of Hannover Plant: NZM (New Sustainable Assembly)
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General Procedure at Hannover Plant
Ergonomics as Part of the Plant Strategy

Volkswagen Production System

Volkswagen „Fit for Future“ Programme

Vision „Fit für die Zukunft“

Kommunikationsstrategie

Das nutzt.
Werk Hannover

Seite 11 08.07.2016 Team Ergonomie, NP-HE/22
General Procedure at Hannover Plant
Employee Participation in „Review Teams“

• Review Teams consists of representatives from different departments (Production, Planning, I.E., HR, Unions, etc.)

• Common generation and assessment of ideas for ergonomic improvements

• Systematic status tracking and continuous reporting to plant management
General Procedure at Hannover Plant

Reporting and Escalation Levels

Improve ergonomics workplace design in 21 review teams across the entire commercial vehicle production process

### Step 1
Activity: Cost center committee  
Level: Section Manager  
Turnus: Every 3 weeks

### Step 2
Activity: Ergonomics steering committee (all shops, all activities)  
Level: Plant Manager  
Turnus: Every 2 month

### Step 3
Activity: Live presentation of topics from Body, Paint and Assembly shop  
Level: Board Member  
Turnus: Every 6 weeks (1 example)
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Implementation of Improvements

Categories of Improvements

1. Work organization:
   1.1 Workplace design (working height, platforms, racks, trolleys, etc.)
   1.2 Process design (change of sequence, line balancing, optimization)

2. Technical improvements:
   2.1 Lightweight stool
   2.2 Raku seat
   2.3 Tools & Fixtures
   2.4 Manipulator & Balancer
   2.5 Automatic Tools / Screwdrivers
   2.6 Full Automation

3. Product design:
   3.1 Parts & Design changes
Implementation of Improvements
Definition of „Ergonomic improvement path“

Initial Situation
1.HY 2014
2. HY 2014
1.HY 2015
2.HY 2015
2016
20xx

Product changes T7

(x dates and improvements are fictitious)
**Status quo**

**T6**

**Amarok**

Work organisation & technical measures

NZM 2016

NZM 2017

NZM 2018

T7
Example: Body shop
(1) Hood assembly und adjustment

**Before**

- Hood fixture has to be lifted manually (7.5 kg)
- Red workplace for 8 workers

**After**

- Fixture with gas spring. Lifting force < 30 N
- Strong reduction of asymmetric shoulder strain
Example: Assembly shop
(2) EC-screwdriver for seat belts

Before

- Screw seat belts with power screwdriver (pistol grip) and manually tightening with wrench
- Screws have to documented on data card

After

- Screws are tightened with the EC-screwdriver, no manual tightening and documentation
- Increased productivity, double handling avoided

- 25 Pts.
Example: Assembly shop
(3) Door preassembly

Before
- Doors were fixed at the vehicle
- Ergonomic problems due to restricted accessibility in many assembly stations

After
- Doors are now separated in a pre-assembly line, and reassembled to the car later in the process
Example: Assembly shop
(4) Lightweight stool for interior tasks

Before

- Stool placed in the vehicle, multiple pick & place actions with asymmetric load handling (> 5 kg)
- Red workplace for 5 workers

After

- Lightweight stool 2.5 Kg
- Reduction of manual load handling > 50%
- High acceptance by workers

-7 Pts.
Example: Paint shop
(5) Optimization glueing of interior structur parts

**Before**

- Rework for glueing
- Deep bending, standing posture or crouching
- Red workplace for 2 workers

**After**

- Sitting on lightweight stool
- Reduction of rework through optimization of the glueing station and workplace
Project „Leightweight stool for interior tasks“

Prototypes and Try out

Before

- Weight: 2.2 kg
- Modular construction
- Rotatable, adjustable in height
- Loadable up to max. 120 kg

Procedure:
- Try out in production
- Feedback from employees
- Volume production tool

Design

Construction

1. Prototyp

Weight: 5 kg
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Ergonomic Design Process

General (Future) Procedure

- **Product Engineering**: Ergonomic Product Design
- **Production Planning**: Ergonomic Work Design
- **Series Production**: Ergonomic Assessment and Continuous Improvement

Critical ergonomic work tasks from reference car

- Optimizing ergonomically critical work from **PRODUCT point of view**
- Optimizing ergonomically critical work from **PROCESS point of view**

**Prospective Ergonomics**

**Corrective Ergonomics**
Summary

• Ergonomic challenges in commercial vehicles production due to greater dimensions of body and parts and prolonged lifecycle

• Systematic approach is based on plant strategy and includes comprehensive risk assessment and status tracking

• Participation of employees (Review Teams) and reporting to plant management (Escalation Levels) is key for success

• In future more efforts should be concentrated on prospective ergonomic design at product and production process level