

Displacement Ventilation for an Industrial Production Hall: Saving of Energy, Improvement of Air Quality

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- **Overview**
- **Problem/ Initial situation**
- **Alternative concepts**
- **Cost-benefit analyses**
- **Summary**

Building data

- assembly hangar (165m x 90m x 8,6m)
- gearing manufacturer
- designed in 1979
- 280 workers

Ventilation system

- supply and exhaust air
- seven supply units
- five extract units
- several local exhaust systems

Problems

- **Too hot in the summertime**

- employees complain about very high room temperatures

- in the warm season more than 30°C

- **Bad air quality**

- smoke

- aerosol

- smell

Ventilation data

- air volume rate: 625 000 m³/h
- air change rate: 5 1/h
- running time: 4680 h/a

Supply air

- 50 swirl outlets arranged under the ceiling
- 12 m distance between 2 outlets
- heating units and filters
- no cooling
- 100% external air (also in winter)

Exhaust air

- ducts with inlets under the ceiling

Heat sources

Heat emission generated by

- people 34 kW
- machinery 268 kW
- lighting 208 kW

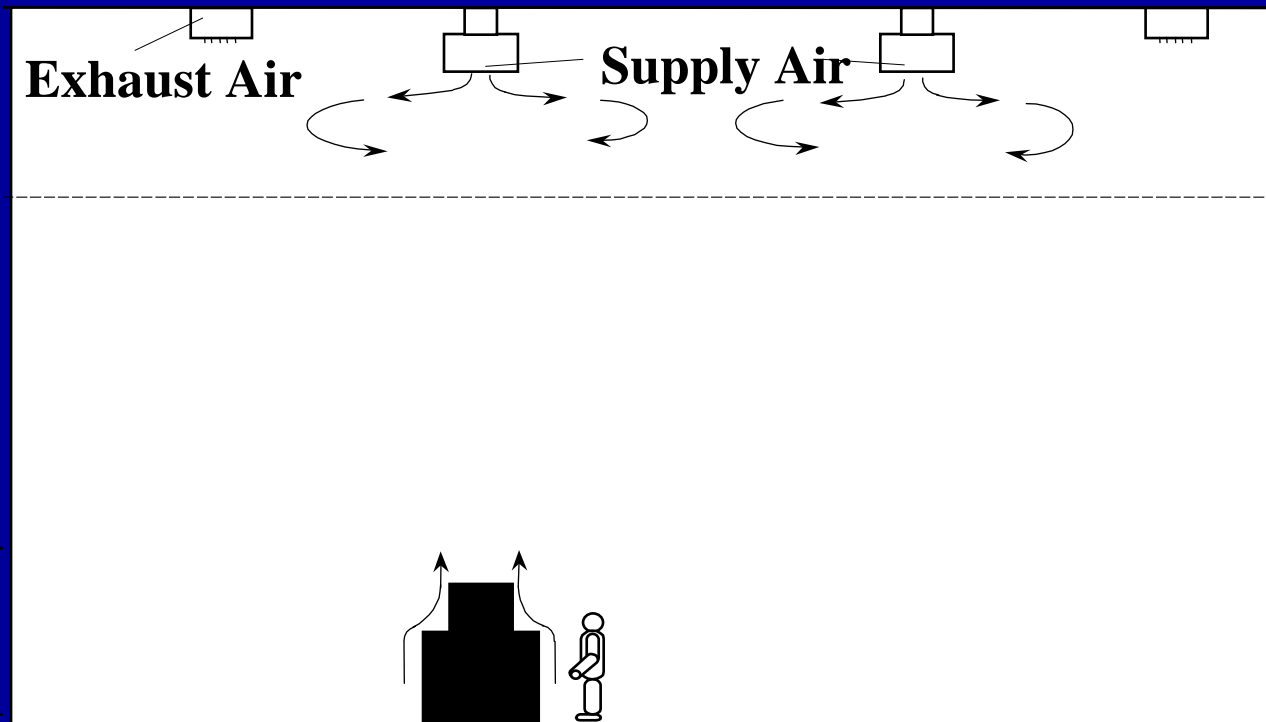
Internal cooling load

510 kW → 34 W/m²

Controlling of the air flow pattern/ fog



Controlling of the airflow pattern



- horizontal emission of supply air
- temperature of supply air = hangar air temperature
- short circuit

→ More or less fresh air in the working area

Requirements

Improvement of the

- thermal situation
- air quality

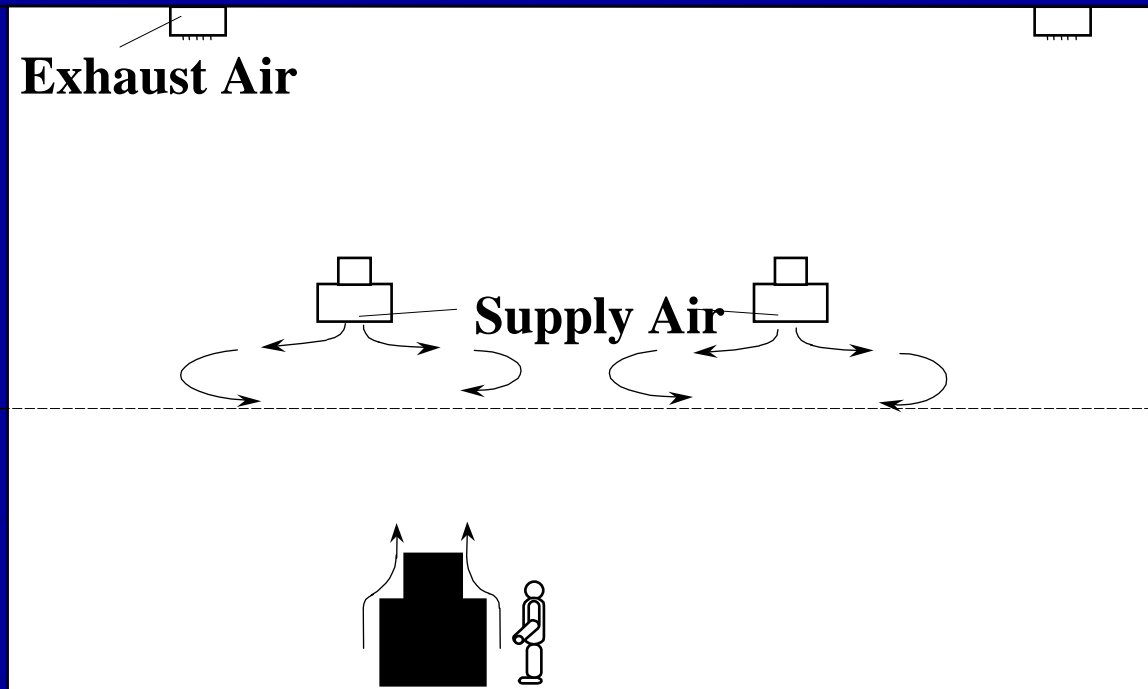
in the working area

No restriction of the process flow by the ventilation system

→ little space required for air ducts, inlets and outlets

→ no limitation of the indoor crane

Solution 1: move Supply air outlets



Evaluation:

- fresh air in the working area
 - good ventilation
-
- draft
 - no cooling effect
 - backflow of air pollutants

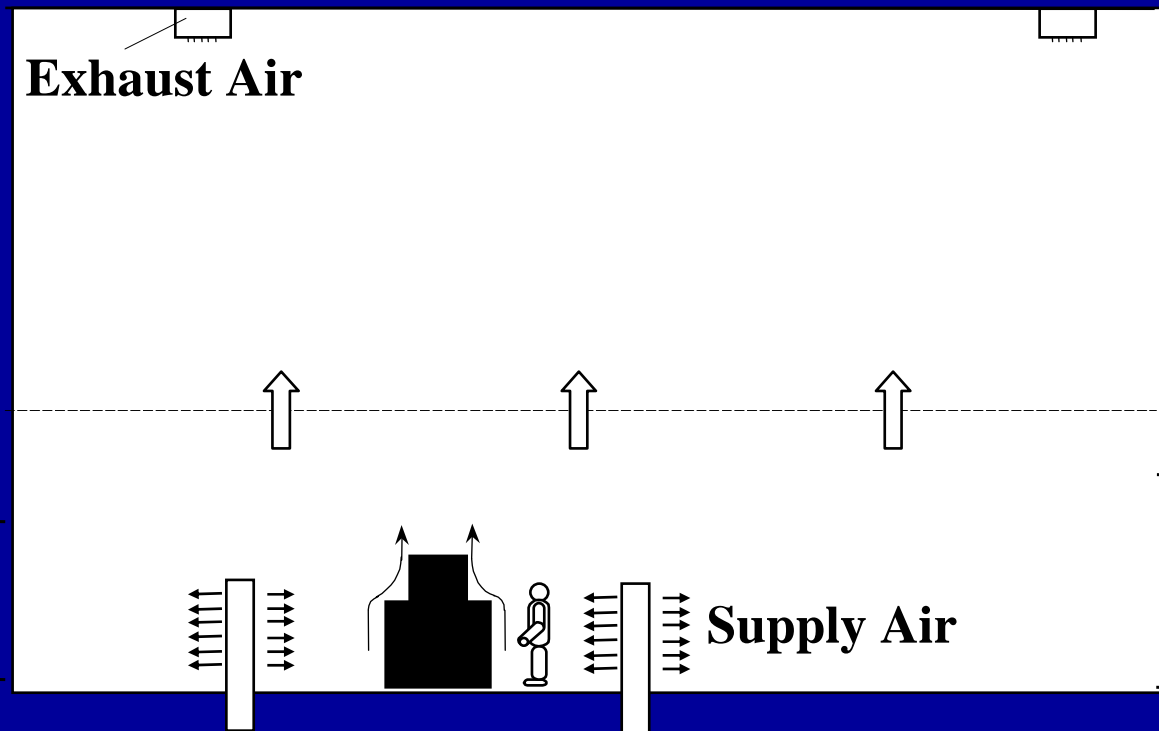
Solution 2: Installation of cooling elements



Evaluation:

- decrease of air temperature
 - no draft
-
- large spaces are necessary (600 elements)
 - no ventilation effect
 - backflow of air pollutants

Solution 3: Supply air outlets at the ground



Evaluation:

- displacement ventilation
 - cooling unit is necessary->cooling effect
 - no draft
 - no backflow of air pollutants
-
- 22 outlets at the ground
 - required space

Comparison and costs

Concept	Reduce Air rate	Thermal Situation	Air Quality	Total Costs TEUR	Saving TEUR/a
1 Move supply inlets	-66%	0	+	422	76
2 Cooling ceiling	0%	++	0	797	0
3 Displacement Ventilation	-80%	++	+++	745	122

Summary

Using Displacement Ventilation means

- better thermal quality
- better air quality
- large reduction of the air volume rates
- Short pay back time

Implemented in the meantime. Satisfaction is very high!

Thank you!