A cloud-controlled climator for the van Gendthallen
TO TURN THEM INTO A CULTURAL CONVENTION CENTER
MACHINE | DATA CENTER

PEOPLE | CONVENTION CENTER
MACHINE

INTRODUCTION

DATA CENTER

VAN GENDTHALLEN

HEAT

COLD

SPACE

Introduction mesa<connections<>heat plaza<>cold >spatial requirements introduction<

C3

Cultural Convention Center

Presentation | 26 January 2016 | Stef Hoeijmakers | 4016025 | aE Studio 14 | Job Schroën - Maarten Meijs - Siebe Broersma
C3 cloud-controlled climator

SITUATION
Introduction

VAN GENDTHALLEN

SITUATION
SITUATION
DESIGN GOAL

Sustainably transform the van Gendthallen into a new cultural center,

while keeping intact its characteristic industrial appearance
MACHINE

INTRODUCTION

DATA CENTER

VAN GENDTHALLEN

HEAT

COLD

SPACE
THE DATA CENTER
THE DATA CENTER
DATA CENTERS AMSTERDAM
MACHINE

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VAN GENDTHALLEN

HEAT

COLD

SPACE
HEAT PRODUCTION

HIGH WASTE HEAT PRODUCTION
LOW QUALITY HEAT (40 °C)
HIGH WASTE HEAT PRODUCTION

LOW QUALITY HEAT (37 °C)

PLACE INSIDE THE BUILDING TO REDUCE ENERGY LOSSES
37°C
27°C
1.5kW/m²

REQUIRED SPACE ESTIMATION

DATA CENTER
- Introduction
- Model
- Cold
- Spatial requirements
- Connection
- Mesa
- Plaza
- Introduction
- V. GENDTHALLEN

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FACADE MATERIALS OVERVIEW

- BRICKWORK
- ROOF TILES / PLATES
- GLASS
- POLYCARBONATE SHEETS
- PERFORATIONS

22510 m²
FACADE MATERIALS OVERVIEW

<table>
<thead>
<tr>
<th>BRICKWORK</th>
<th>ROOF TILES &amp; PLATES</th>
<th>GLASS</th>
<th>POLYCARBONATE SHEETS</th>
<th>PERFORATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLOSED</td>
<td></td>
<td>TRANSPARENT</td>
<td></td>
<td>OPEN</td>
</tr>
<tr>
<td>48%</td>
<td></td>
<td>50%</td>
<td>2%</td>
<td></td>
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FACADE MATERIALS OVERVIEW

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DATA CENTER

> Introduction
> Heat
> Cold
> Spatial requirements

Connections

Heat Plaza

Cold

Introduction

V. GENDT-HALLÉN

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data center v. gendthallen

> introduction mesa<connections<>heat plaza<>cold >spatial requirements introduction<

FACEADE MATERIALS OVERVIEW

<table>
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<th>GLASS</th>
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<tbody>
<tr>
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<td>25% OPEN</td>
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</tbody>
</table>
FACADE MATERIALS OVERVIEW

BRICKWORK

ROOF TILES / PLATES

50% TRANSPARENT

POLYCARBONATE SHEETS

PERFORATIONS

49% CLOSED

SE

SW

NW

NE
Introduction

C3 cloud-controlled climator

Cultural convention center

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Facade materials overview

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brickwork</td>
<td>49%</td>
</tr>
<tr>
<td>Roof tiles/plates</td>
<td>50%</td>
</tr>
<tr>
<td>Glass</td>
<td>5%</td>
</tr>
<tr>
<td>Polycarbonate sheets</td>
<td>2%</td>
</tr>
<tr>
<td>Perforations</td>
<td>2%</td>
</tr>
</tbody>
</table>

SE

NW

NE

SW
HEAT LOSSES OVERVIEW

CURRENT SITUATION

NO INSULATION

**-5 °C**

**20 °C**

CURRENT SITUATION

**HEAT LOSSES OVERVIEW**

**CURRENT SITUATION**

**NO INSULATION**

**-5 °C**

**20 °C**
HEAT LOSSES OVERVIEW

CURRENT SITUATION

57%   TRANSMISSION LOSSES   3.1 MW

-5 °C

CURRENT SITUATION

HEAT LOSSES OVERVIEW

57%   TRANSMISSION LOSSES   3.1 MW

-5 °C
HEAT LOSSES OVERVIEW

CURRENT SITUATION

<table>
<thead>
<tr>
<th>Loss Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission Loss</td>
<td>3.1 MW</td>
</tr>
<tr>
<td>Infiltration Loss</td>
<td>2.3 MW</td>
</tr>
</tbody>
</table>

-5 °C

TRANSMISSION LOSSES
INFILTRATION LOSSES

57%
43%

CURRENT SITUATION

HEAT LOSSES OVERVIEW

CURRENT SITUATION

TRANSMISSION LOSSES
INFILTRATION LOSSES

57%
43%

CURRENT SITUATION

TRANSMISSION LOSSES
INFILTRATION LOSSES

57%
43%

CURRENT SITUATION

TRANSMISSION LOSSES
INFILTRATION LOSSES

57%
43%

CURRENT SITUATION

TRANSMISSION LOSSES
INFILTRATION LOSSES

57%
43%
HEAT LOSSES OVERVIEW

CURRENT SITUATION

TRANSMISSION 3.1 MW
INFILTRATION 2.3 MW

TOTAL HEAT LOSS 5.40 MW

-5 °C

EQUIVALENT TO THE POWER OF 80 MIDDLE-CLASS CARS

...OR THE AVERAGE ELECTRICITY USAGE OF 13,500 HOUSEHOLDS
REQUIRED DATA CENTER POWER

5.5 - 6 MW

A DATA CENTER OF THIS SIZE WOULD OCCUPY TOO MUCH SPACE
HEAT LOSSES OVERVIEW

ROOF DAMAGE
COVERED AREAS HAVE NO INSULATION

MAKE MINIMAL ROOF ADJUSTMENTS:

- REPLACE BROKEN GLAZED AREAS WITH NEW GLASS
- INSULATE (5-10cm) CLOSED ROOF AREAS
Renovated Roof composition
- EPDM foil
- Roof insulation (50 mm)
- Damp-proof foil
- Existing concrete roof slag (80 mm)

Wooden Beam (50 x 10)
Lead Gutter (existing - partly lined with EPDM)

Existing roof structure
- composite steel bars (angle irons)
- steel plates
- steel beams (UNP 75/100 | INP 100)
- wooden rafter (50 x 400)

Sealing

Renovated roof composition
- EPDM foil
- Prefab PUR panel (20 - 50 mm)
- Damp-proof foil
- Existing concrete roof slab (80 mm)
- Roof insulation (50 mm)
HEAT LOSSES OVERVIEW

NEW SITUATION

<table>
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<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission</td>
<td>48%</td>
</tr>
<tr>
<td>Infiltration</td>
<td>52%</td>
</tr>
</tbody>
</table>

-5 °C

20 °C

SITUATION

1.2 MW

INFILTRATION

48%

TRANSMISSION

1.3 MW

52%
HEAT LOSSES OVERVIEW

NEW SITUATION

<table>
<thead>
<tr>
<th>Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission</td>
<td>1.2 MW</td>
</tr>
<tr>
<td>Infiltration</td>
<td>1.3 MW</td>
</tr>
</tbody>
</table>

TOTAL HEAT LOSS 2.49 MW

-5 °C

EQUIVALENT TO THE POWER OF 37 MIDDLE-CLASS CARS

...OR THE AVERAGE ELECTRICITY USAGE OF 6 250 HOUSEHOLDS
REQUIRED DATA CENTER POWER

2.5 - 3 MW

A DATA CENTER OF THIS SIZE WOULD ALLOW THE FACADES TO STAY FREE

NEW SITUATION

HEAT LOSSES OVERVIEW
USE HEAT DIRECTLY THERE WHERE IT'S EXPELLED

30°C

37°C

37°C
HOLEDECK APPLICATION TO VAN GENDTHALLEN

NEW COLUMNS AS AN OFFSET TO THE EXISTING GRID
AVOIDING CLOSE CONTACT WITH EXISTING STRUCTURE
MAX. SPAN: 12.8M (IN ACCORDANCE WITH HOLEDECK GUIDELINES)
MAX LOADED CANTILEVER: 2.4M

HOLEDECK APPLICATION TO VAN GENDTHALLEN
EXISTING COLUMN CONNECTIONS SOLVED WITH RECTANGULAR FITTING MOLDS

HOT AIR PLENUMS

HOLEDECK APPLICATION TO VAN GENDTHALLEN
MACHINE

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DATA CENTER V. GENDTHALLEN

COOLING INSTALLATIONS

ADIABATIC COOLERS

OUTDOOR AIR

WARM SUPPLY AIR FOR HEATING

HOT RETURN AIR FROM DATA HALL

COLD SUPPLY AIR TO SERVERS

WARM SUPPLY AIR FOR HEATING

OUTDOOR AIR

ADIASTATIC COOLERS
COOLING INSTALLATIONS

NEEDS FACADE SPACE FOR OUTDOOR AIR

OUTDOOR AIR

NEEDS FACADE SPACE FOR OUTDOOR AIR
3 BACK-UP UNITS > AVAILABLE FOR THE VAN GENDTHALLEN
MACHINE

VAN GENDTHALLEN

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SPACE
HIGH OPEN FACADE STRIPS BETTER SUITED FOR INSTALLATIONS
COOLING INSTALLATION LOCATION

WILL REQUIRE NEW FLOORS
COOLING LOAD

TRANSPARENT ROOFS AMOUNT TO HIGH SOLAR HEAT GAIN IN SUMMER
INSTALLATION FLOORS CAN HELP REDUCE THIS GAIN
ADDITIONAL COOLING INSTALLATIONS WILL BE NECESSARY

TECHNICAL FLOOR INCORPORATES INSTALLATIONS FOR VAN GENDTHALLEN AS WELL
MACHINE

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DATA CENTER AND COOLING INSTALLATIONS

ADDITIONAL SPACES

DATA HALL AND COOLING INSTALLATIONS

ADDITIONAL SPACES

DATA CENTER

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Spatial requirements

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V. GENDTHALLEN

ADDITIONAL SPACES
ADDITIONAL SPACES

POWER SUPPLY / ELECTRICAL ROOM
ADDITONAL SPACES

BACK-UP POWER / WATER STORAGE
ADDITIONAL SPACES

LOGISTICAL AREA

DATA CENTER

V. GENOTTHALEN

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ADDITIONAL SPACES

SECURED ENTRANCE(S)
SUMMARY

- Retain current facades and keep them open
- Holedeck system as direct heat medium machine ↔ people
- Raised shared climate machine
MACHINE DESIGN OVERVIEW
MACHINE DESIGN OVERVIEW

DATA CENTER
- Introduction
- Heat
- Cold
- Spatial requirements
- Connections
- Heat
- Plaza
- Cold
- Introduction

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MACHINE DESIGN OVERVIEW
UPE 200 floor edge profile
Comflor 95 steel-concrete flooring
Existing crane beam (IPE 500)
Newly welded plate for web bracing
Connecting plate (two-side welded)
Air duct (ø 400 mm)
Secondary girder (IPE 360 - ctc 1200 mm)
Primary steel girder (HEB 800 - ctc 6000 mm)
Suspended acoustic baffle
DATA CENTER AIR CIRCULATION

CLOSED AIR LOOP
VAN GENDTHALLEN WARM AIR SUPPLY

OUTDOOR AIR IS HEATED BY THE DATA CENTER’S HOT EXPELLED AIR AND THEN SPREAD TO ALL SURROUNDING AREA’S

ALONG FACADES THE HEAT FLOW IS HIGHEST TO MINIMIZE ‘COLD SPOTS’
HOLEDECK AS THERMALLY ACTIVATED CONCRETE SLAB

WATER CHANNELS IN THE HOLEDECK FLOOR SPREAD HEAT THROUGHOUT CONCRETE SLAB TO INCREASE ITS THERMAL CAPABILITIES

37 °C

40 °C

27 °C
In the summer, the data center will be less active. The remaining waste heat on hot days is neutralized by pumping cold water through the floor.
MACHINE | DATA CENTER

PEOPLE | CONVENTION CENTER
Introduction

Mesa

Connections

Heat Plaza

Cold Spacial Requirements

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MESA

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PEOPLE
MAIN DESIGN GOAL - ALLOW FOR FLEXIBILITY IN USE

CONCERTS

EXHIBITIONS AND EXPOS

CONVENTIONS

PUBLIC MEETING SPACE
CONCERTS

FLUCTUATING SPACE DEMANDS

EXHIBITIONS AND EXPOS

CONVENTIONS

PUBLIC MEETING SPACE

DATA CENTER v. Gendthallen

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C3 Cloud-controlled Climator

Cultural Convention Center

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CONCERTS 600 M²

EXHIBITIONS AND EXPOS 5000 M²

CONVENTIONS 1000 M²

PUBLIC MEETING SPACE 200 M²

FLUCTUATING SPACE DEMANDS

DATA CENTER
23:00 - 04:00

19:00 - 01:00

ALL WEEKEND

09:00 - 20:00

10:00 - 13:00

1 HOUR

10 MINUTES

EXHIBITIONS AND EXPOS

CONVENTIONS

FLUCTUATING TIME DEMANDS

CONCERTS

1 HOUR

ALL DAY

10:00 - 13:00

EXHIBITIONS AND EXPOS

CONVENTIONS

PUBLIC MEETING SPACE

ALL WEEKEND

09:00 - 20:00

PUBLIC MEETING SPACE
DIFFERENT ACOUSTIC DEMANDS

- CONCERTS
- BUZZ
- MODERATE SILENCE
- QUIET
- CROWDS
- EXHIBITIONS AND EXPOS
- CONVENTIONS
- URBAN NOISE
- CHATTER
- PUBLIC MEETING SPACE

DISTINCTIVE ACUSTIC DEMANDS

- CONCERTS
- BUZZ
- MODERATE SILENCE
- QUIET
- CROWDS
- EXHIBITIONS AND EXPOS
- CONVENTIONS
- URBAN NOISE
- CHATTER
- PUBLIC MEETING SPACE
This evokes a condition of division, separation and contrast, to allow for these activities to jointly take place.
As such, the design interacts with the existing elements of the van Gendthallen and the newly introduced elements of the data center to create soft and hard divisions on different scales.
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MAIN SEPARATOR

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Cloud-controlled climator

SEMI - PUBLIC TRANSITION SPACES AND INDOOR SQUARES

CONVENTION ROOMS AND MEETING SPOTS

SUPPORTING SPACES

PLAZA

MEGA

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Introduction

Data Center v. Gendthallen

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Note: KEEP PERIPHERY FREE
data center v. gendthallen

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EXTEND SQUARE INSIDE
RELATIONS INTERIOR <-> EXTERIOR

"SECONDARY MAIN ENTRANCE"

PUBLIC AREA EXTENDS INSIDE

LOGISTIC AREA

DATA CENTER

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Connections

Meals

Plaza

Introduction

V. Sendthallen

C3 cultural convention centre
RED MEANDERING WALL
RECESSED SPACES FOR CONVENTION ROOMS

CREATES QUIET ALCOVES WITH A NICE VIEW OF FACADE AND HARBOR
ENCLOSED ROOMS FOR SUPPORTING FUNCTIONS
DISPERSED OVER THE BUILDING TO ALLOW FOR ZONE DIVISIONS
WALL OPENINGS ARE FILLED WITH TRANSLUCENT RED GLASS BRICKS TO MAINTAIN PRIVACY BUT EVOKE A SENSE OF OPENNESS
CONVENTION ROOMS

ARE LINED WITH DOUBLE GLAZED CURTAIN WALLS

GLASS ROLLING DOORS WITH RED STEEL HINGES REFER TO

THE INDUSTRIAL SURROUNDINGS
Introduction to Mesa's connections heat plaza cold spatial requirements.

Data center vs. gendthallen.
**Impression of Plaza**

**Conference Rooms**

**Toilets / Passageway**

**Conference Rooms**
IMPRESSION OF INNER CORRIDOR
Introduction Mesa Connections Heat Plaza Cold Spatial Requirements

C3 Cloud-controlled Climator

Impression of Inner Corridor

Cloakroom Passage Stairs Toilets Restaurant
IMPRESSION OF INNER CORRIDOR
CONFERENCE AND CONCERT HALL

ARE ACOUSTICALLY DISCONNECTED AND ON HIGHER LEVEL THAN SURROUNDING FLOOR

MAIN ENTRANCE

DRESSING ROOM FOR PERFORMER / SPEAKER

FREIGHT ELEVATORS STOP AT STAGE HEIGHT

PASSENGER ELEVATOR HAS BACK EXIT AT HALL LEVEL

SECONDARY FUNCTION AS PROJECTION SCREEN
IMPRESSION OF MESA

data center v. gendthallen

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IMPRESSION OF MESA

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MAIN STAIRWAY

EVENT HALL 2 (W PROJECTION SCREEN)

DRESSING ROOM HALL 1

SECONDARY STAIRS

SECONDARY STAIRS

DATA CENTER

HOLD

Spatial requirements

connections

MEAT

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IMPRESSION PARAPET HALL 5
**Data Center v. Gendthallen**

**Introduction**

- **Mesas**
- **Connections**
- **Heat Plaza**
- **Cold Spaces**

**Spatial Requirements**

**February 3, 2016**

**Presentation**

**Stef Hoeijmakers**

**4016025**

**aE Studio 14**

**Job Schroën - Maarten Meijs - Siebe Broersma**

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**COLUMN CONNECTION DETAIL**

- Red aluminium angle profile
- Waterproof foil
- Floor side strip with insulation (10 mm)
- Edge of steel floor grating (50 x 3 mm)
- G clip grate fastener
- Anhydrite screed (65 mm)
- Cold-rolled steel U profile (80 x 80 mm)

**Custom steel floor grating**

- White (38 x 38 mm)
- Lost formwork (red concrete)
- Casting joint
- Custom steel floor grating (white, 38 x 38 mm)
THANK YOU | FOR YOUR ATTENTION

Cultural Convention Center | Van Gendthallen