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Tebodin Netherlands B.V.

Modular Building in the Chemical Industry

Solution for a safe and efficient project approach

Taco Boerstra

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Introduction

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Tebodin is a multidisciplinary consultancy and engineering firm.

We offer our clients worldwide the knowledge and experience of approximately 4,900 experts in industry.

As strategic partner our range of independent services covers consultancy, project management, design and engineering, procurement and construction management.



Taco Boerstra
Director Chemicals
Tebodin

Introduction to the Huntsman Capstone project



HUNTSMAN

Enriching lives through innovation

Client: Huntsman

EPCm: Tebodin



Huntsman

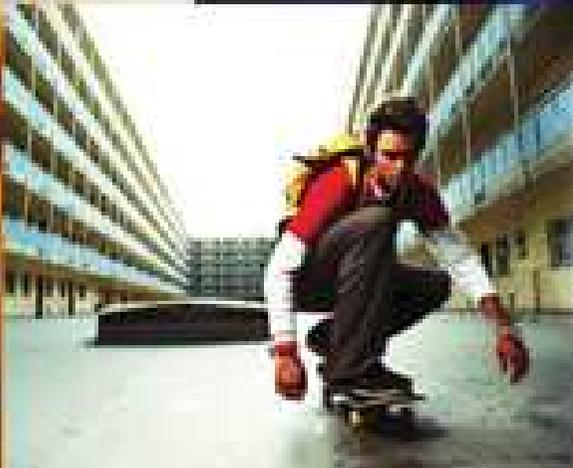


HUNTSMAN

Enriching lives through innovation

Markets include:

- Adhesives, Coatings and Elastomers
- Appliances
- Automotive
- Insulation
- Composite Wood Products
- Footwear
- Furniture & Bedding
- TPU



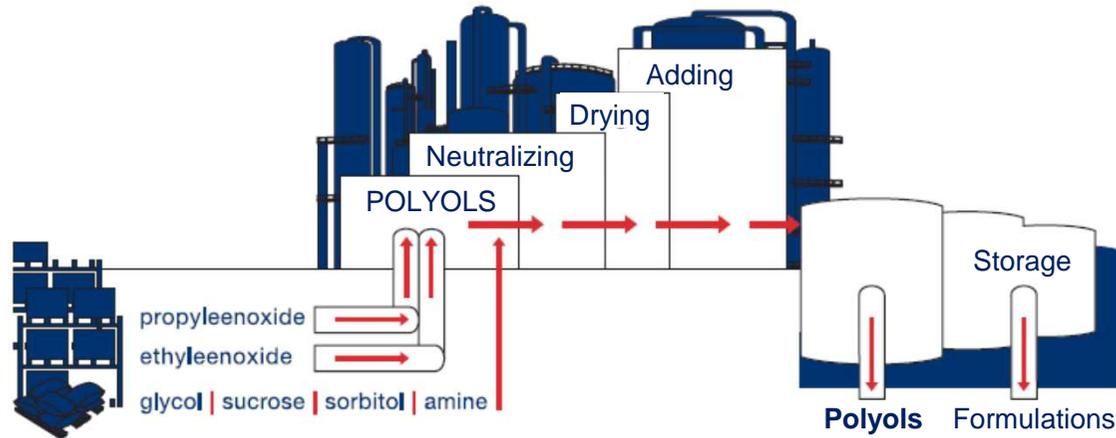
Introduction to the project

Project Capstone ⇒ New Rotterdam Flex Polyols Unit

Purpose:

- Increase flex polyols capacity for the flexible foam industry
- Free up capacity in existing plant for other polyols grades

POLYOLS PROCESS



HUNTSMAN

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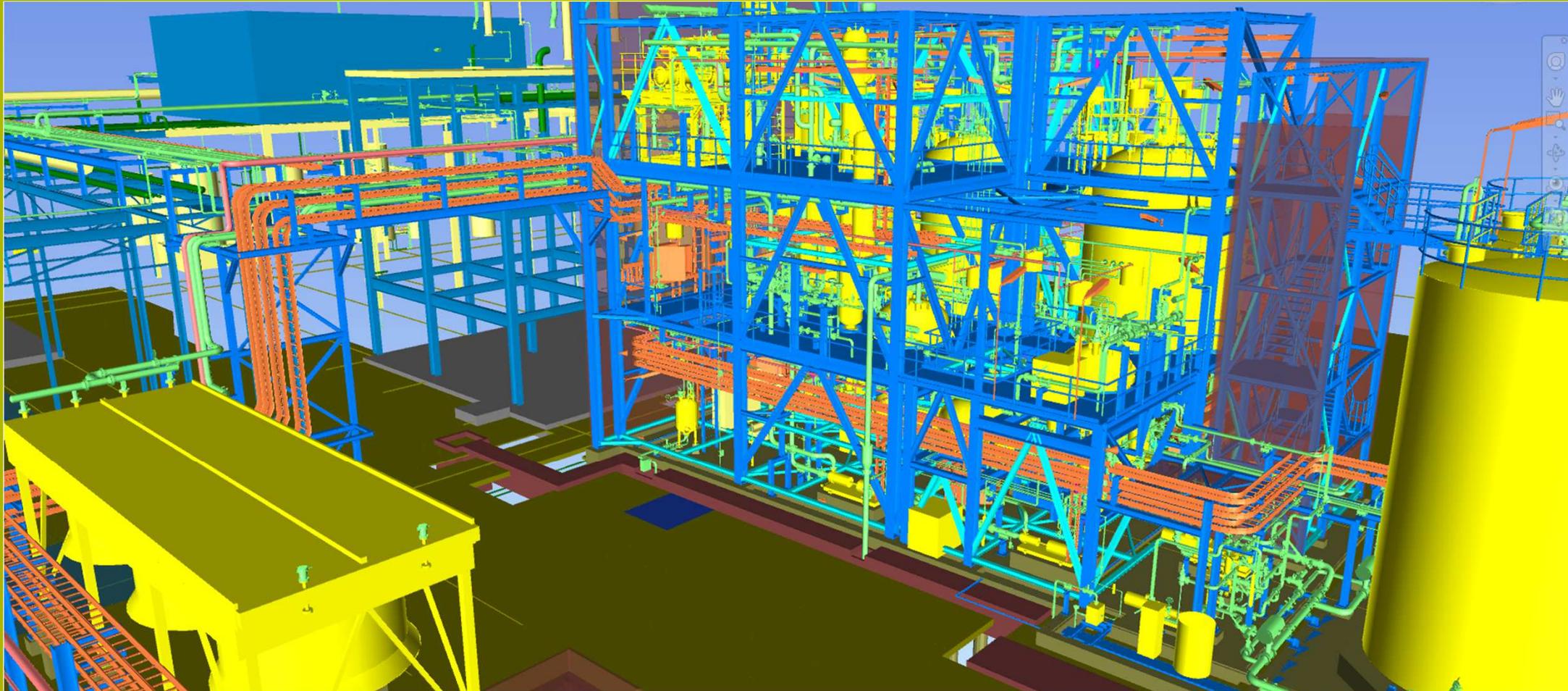


Introduction to the project

- **Realization of a new Flex Polyols Unit**
 - L x B x H = 21m x 12m x 15,5m
 - Open steel structure, two elevated floor levels
 - Reactor, vessels, heat exchangers, filters, pumps
- **Location on Huntsman site Rotterdam (Netherlands), next to existing units**
- **Used chemicals are PO and EO (hazardous area)**
- **Besides main unit:**
 - Tie-ins in the existing plant
 - Tank storage, air cooler, E&I substation



Introduction to the project



Main challenges



- New plant to be located next to existing plant in hazardous area
- Permit application estimated to take at least 1 year

Solution: Modular building approach

Unique in size and approach in chemical market



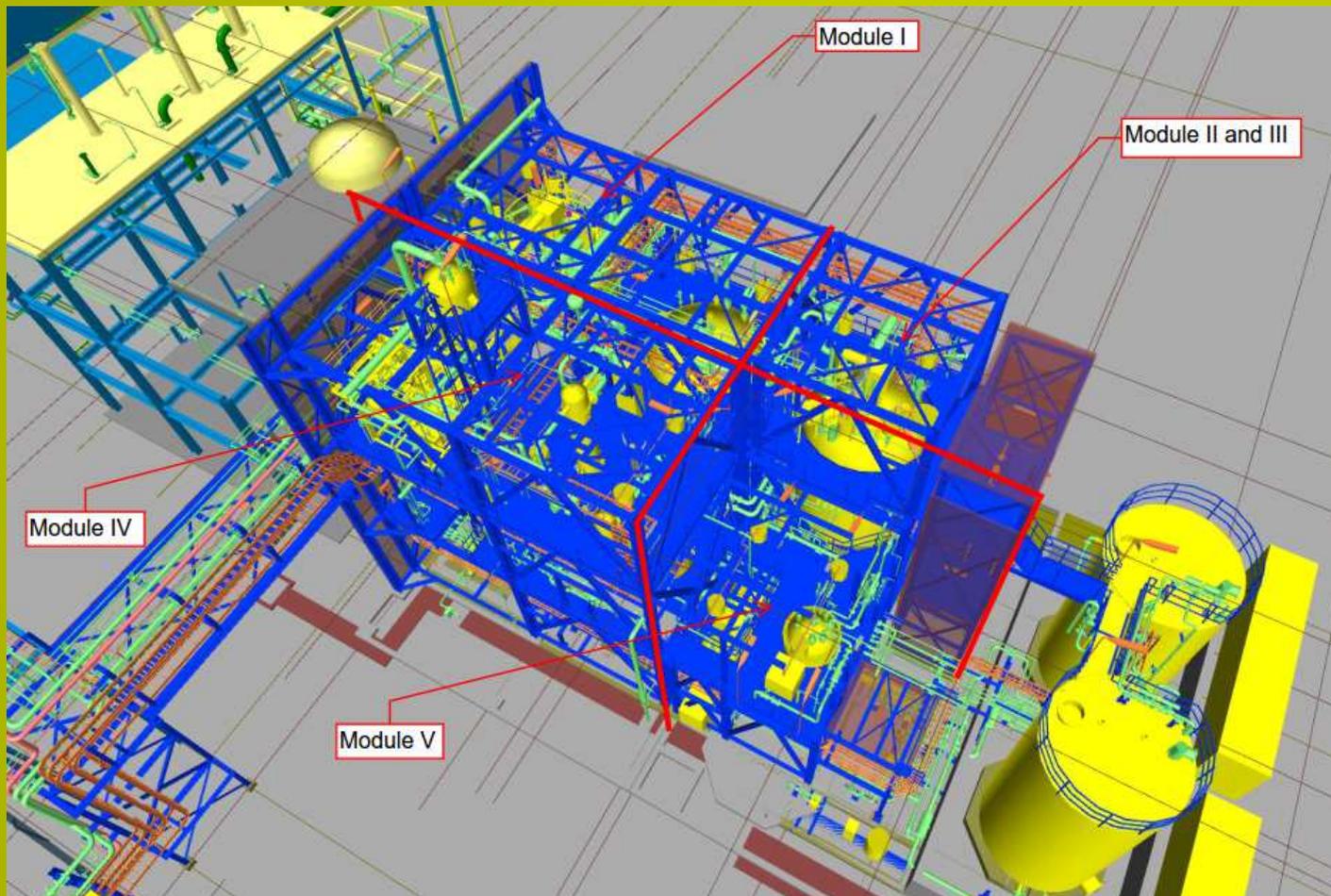
Conventional construction method

1. New plant built next to existing Polyols plant
 - Safety risk (hazardous area)
 - Hindrance of Operations
 - Hot work not allowed
 - Work permits
2. Planning
 - Permit application ⇒
 - Foundation works ⇒
 - Start construction of unit

Modular building method

- Unit built at manufacturer's premises
- Safe environment
 - Only manufacturer's activities
 - All construction equipment and utilities at hand
- Parallel execution
- Construction of unit can start independent of permit

Module building approach



- Module design based on Limitations to transport
- Early involvement of transport company in the engineering phase

Project specifics

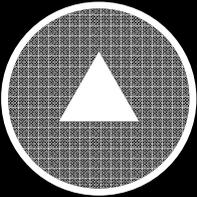
- At start of engineering:
Module Manufacturers invited to discuss approach, attention points, engineering deliverables
- Choosing modules
 - Investigate limitations (hoisting and transport)
 - Minimized number of modules
 - Vertical split
 - Part of the project built the conventional way
- Steel floor eliminated
 - Strong preference of Huntsman, easier cleaning, less vibrations
 - This increased the amount of temporary steel
 - Increases the amount of work on site



Transport and hoisting



- **Use 3D model to calculate**
 - Weight
 - Center of gravity
- **Thorough preparation of the works is essential**
 - Transport & hoisting plan
 - RI&E
 - Insurance





Conclusions



Modular building: Solution for a safe and efficient project approach

- **Safety**

- Less construction activities at site

- **Planning**

- Parallel construction of OSBL site works and module(s)

- **Cost effective**

- Temporary steel required -
- Transport & hoisting cost -
- Preparation and design +/-
- More efficient construction ++

Tebodin is a multidisciplinary consultancy and engineering firm.

We offer our clients worldwide the knowledge and experience of approximately 4,900 experts in industry, health & nutrition, oil & gas, chemicals, infrastructure, property and energy & environment.

The company has a network of around fifty offices in West, Central and Eastern Europe, the Middle East, Asia and Africa.

As strategic partner our range of independent services covers consultancy, project management, design and engineering, procurement and construction management.

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