

# Computer-aided visualization of work flow to support lean construction

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Many of the “traditional” lean tools from the stationary industry are based on visualization.

Unfortunately we cannot adopt the tools from the stationary industry into construction 1 by 1 in every case. Maybe new computer-aided tools can fulfill the needs that simpler tools – such as Kanban cards – fulfill in manufacturing.

But the research activities in computer-aided visualization have focused on design and construction planning - neglecting the needs of the construction management on site.

The presentation shows two software prototypes of computer-aided visualization not only for the construction product, but also for the construction process.

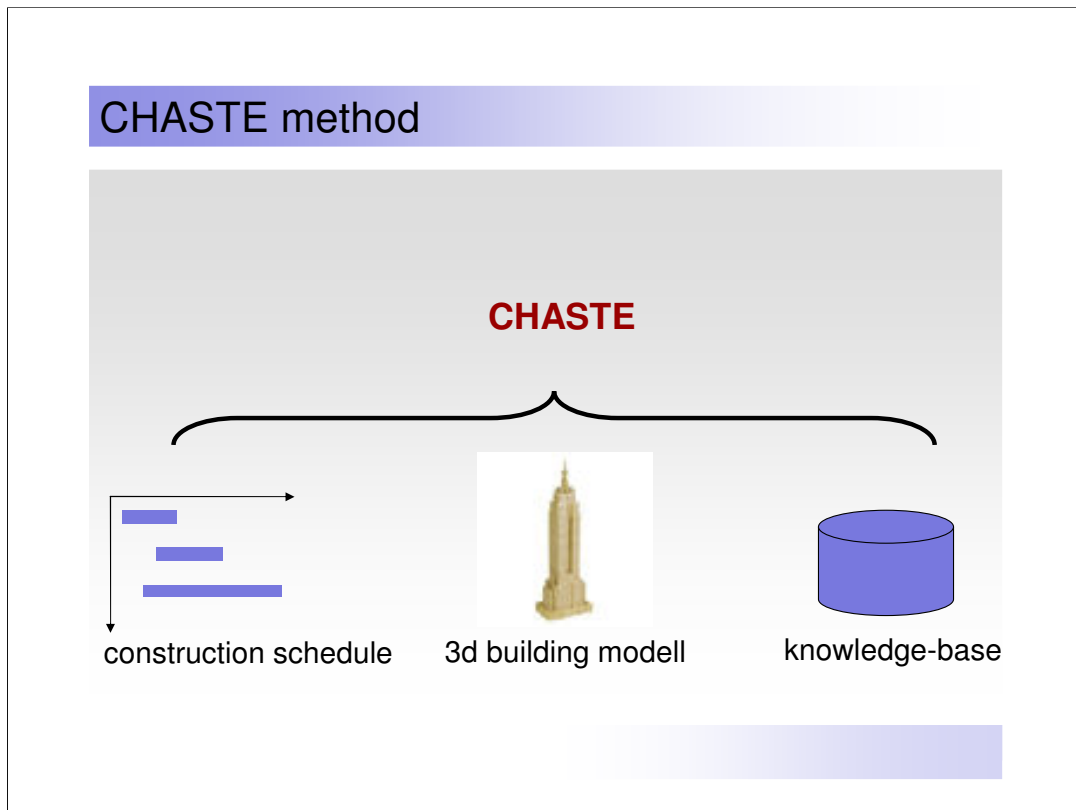
## CHASTE method

**C**onstruction  
**H**azard  
**A**ssessment with  
**S**patial and  
**T**emporal  
**E**xposure

Construction is one of the most hazardous industries all over the world. And one reason for this is the difficulty of identifying exposures to hazards.

A new tool for the risk-assessment is the CHASTE-method, which means

**C**onstruction  
**H**azard  
**A**ssessment  
with **S**patial  
**E**xposure.

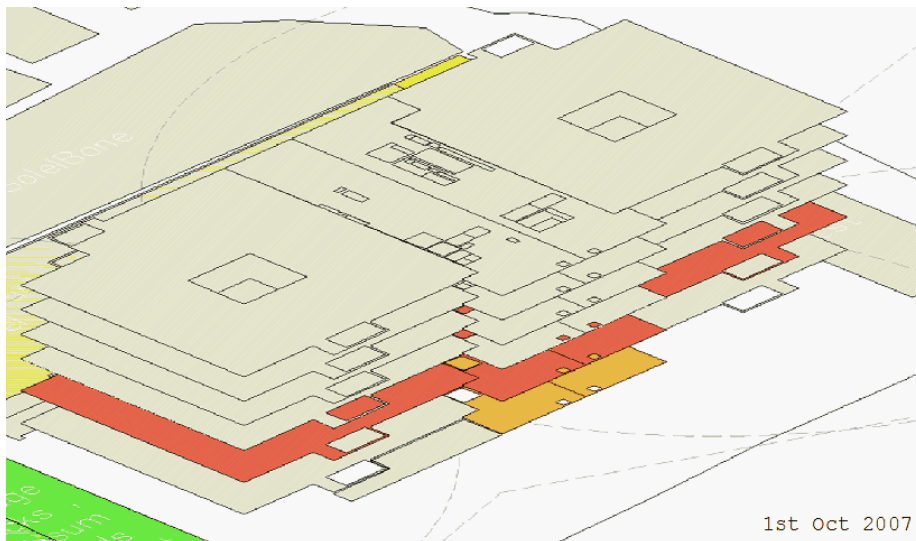


The CHASTE method consists of

- a three dimensional model of the building
- a construction schedule
- and a knowledge-base.

The knowledge-base stores a variety of construction methods and their associated levels of risk.

## CHASTE method



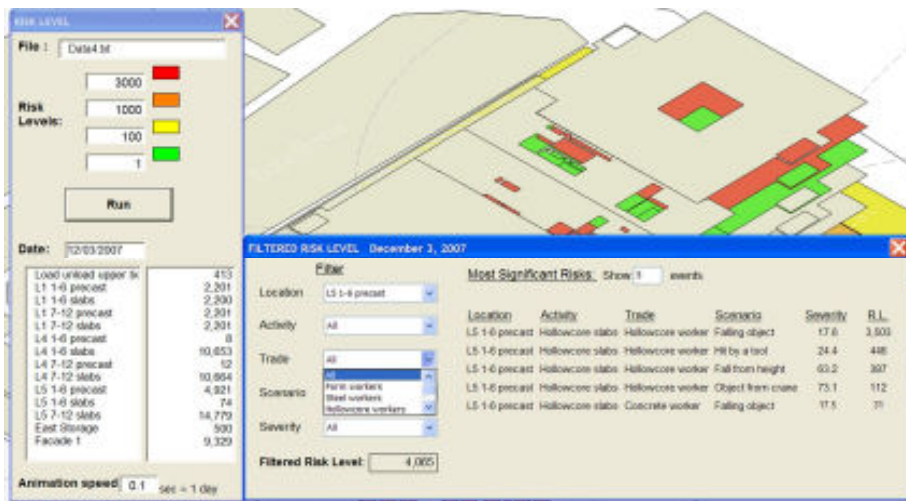
**Risk: minimal - normal - high - highest**

The risk-level is achieved by colouring the locations in four grades along a scale ranging from green to red.

The level can be calculated for each day by paying attention to the expected work and the hazards associated with.

The hazards may be self-imposed, but they may also be created by other workers at remote locations.

## CHASTE method



Detailed information about a risk can be obtained by selecting a particular region. It shows a dialogue with the most threatened teams in this area.

Running a CHASTE analysis of a proposed project can show peaks of risk levels. By rescheduling activities, a plan with low risk level may be developed.

## 4d-CAD & Lean Construction?

- make process transparent to all
- space-time-conflict analysis
- plan for stable work
- reduce design effort
  - reduce design time
  - reduce costs

The CHASTE method is based on the 4d-CAD-Technology, in which 3D building models are “animated” by linking them to construction schedules that provide the fourth dimension.

Beside the shown risk assessment we can use such a 4D-CAD-Software to make the construction process transparent for all participants.

Or we can use this system to detect a space-time-conflict more easily.

## Pull Flow Control Chart & Status Board



In construction it is common to divide the whole task/the building into smaller sections.

This could be - for example –the apartments in an apartment building or the shops in a shopping-mall etc..

## Status Board

		Sections →						
		M 134	M135	M 136	M 137	M 138	M 139	M 140
Processes ↓	Fundament							
	Mastbau							
	Seilzug							
	Qualität							

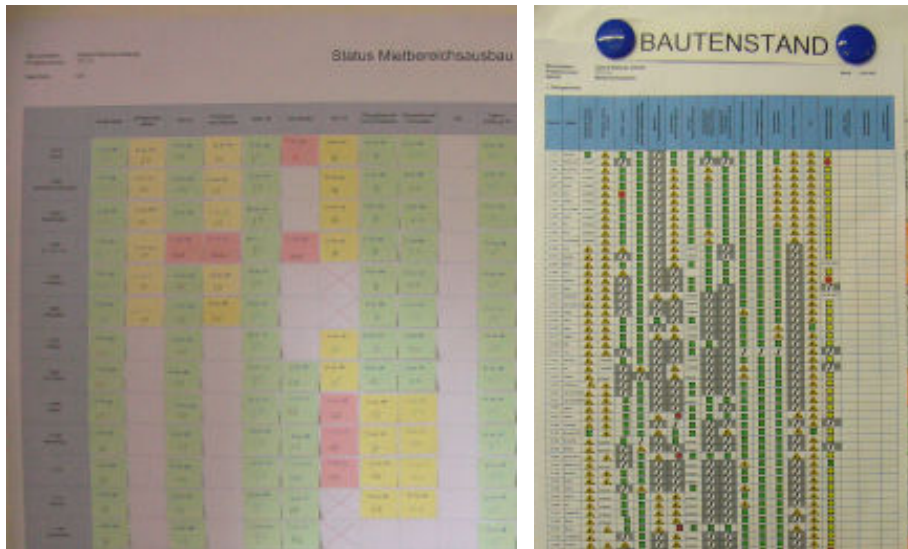
Status	Symbol
No access	
Prepare	
Start work	
Under construction	
Work complete	
Work stopped	

The sections are on the top of the matrix.

The processes are on the left side of the matrix.

At the intersection of a process with a section we can visualize the work progress by using different symbols.

## Status Board

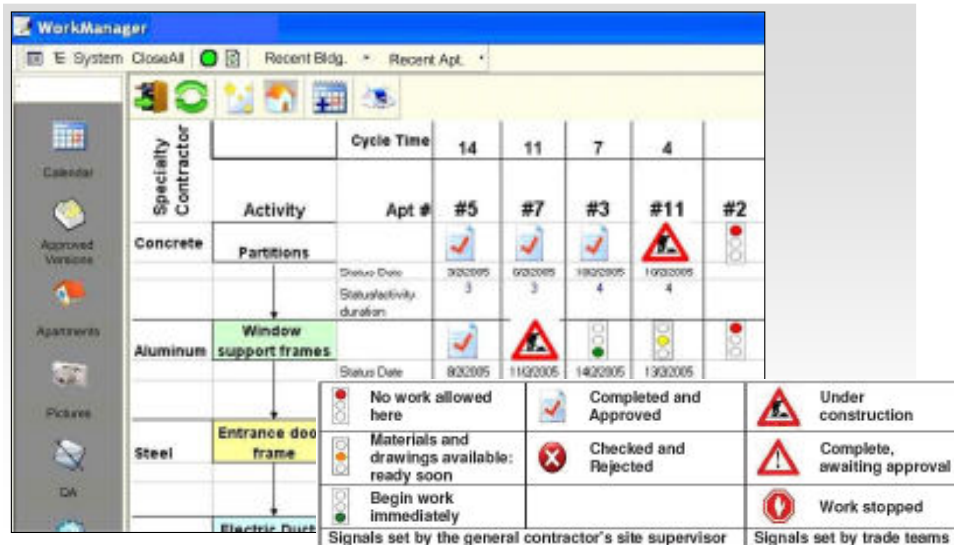


On this slide you can see two Status boards which were used for the interior work in a new shopping mall in Poland.

The left one is made with sticky notes and the right one with MS Excel.

These paper-based boards were used from the construction management as an information tool and to monitor the multitude of trade teams.

## Pull Flow Control Chart (PFC)

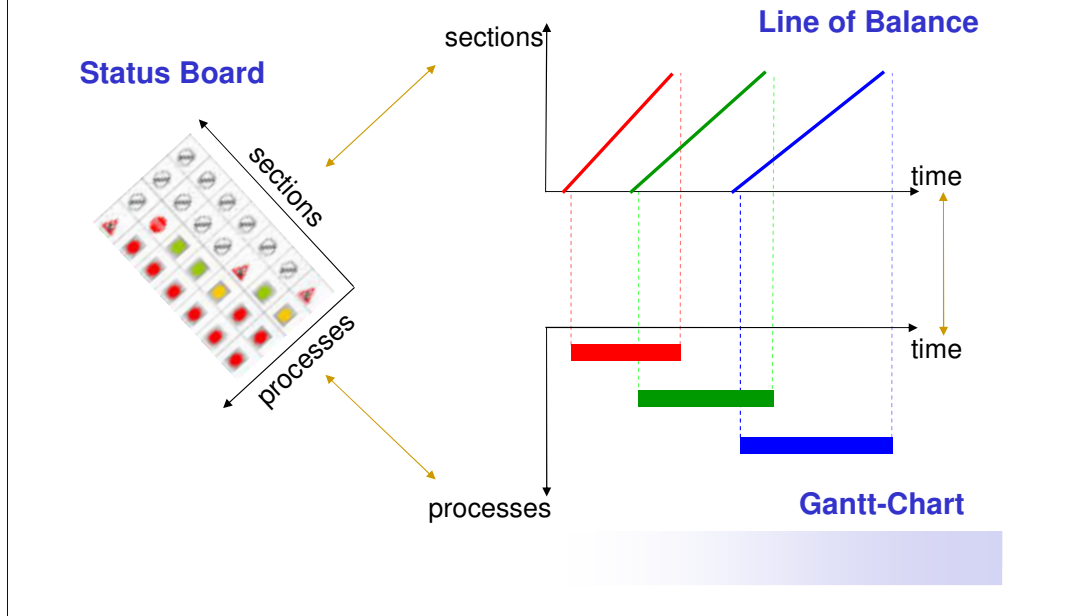


The Pull Flow Control-Chart is implemented in the Workmanager, an information framework of a large construction company.

It looks similar to the status board, and it was also used for a better flow of information within the construction management team. But in addition to the status board it enabled a pull-system for workers in an apartment-building project.

But the big advantage in my opinion is that this Interface is based on a database in the net. Thus, the information is not available on the construction site only. Beside this, the information on this Chart is given to the subcontractors and the trade crew supervisor on handheld pocket-computers.

## Project Management Tools

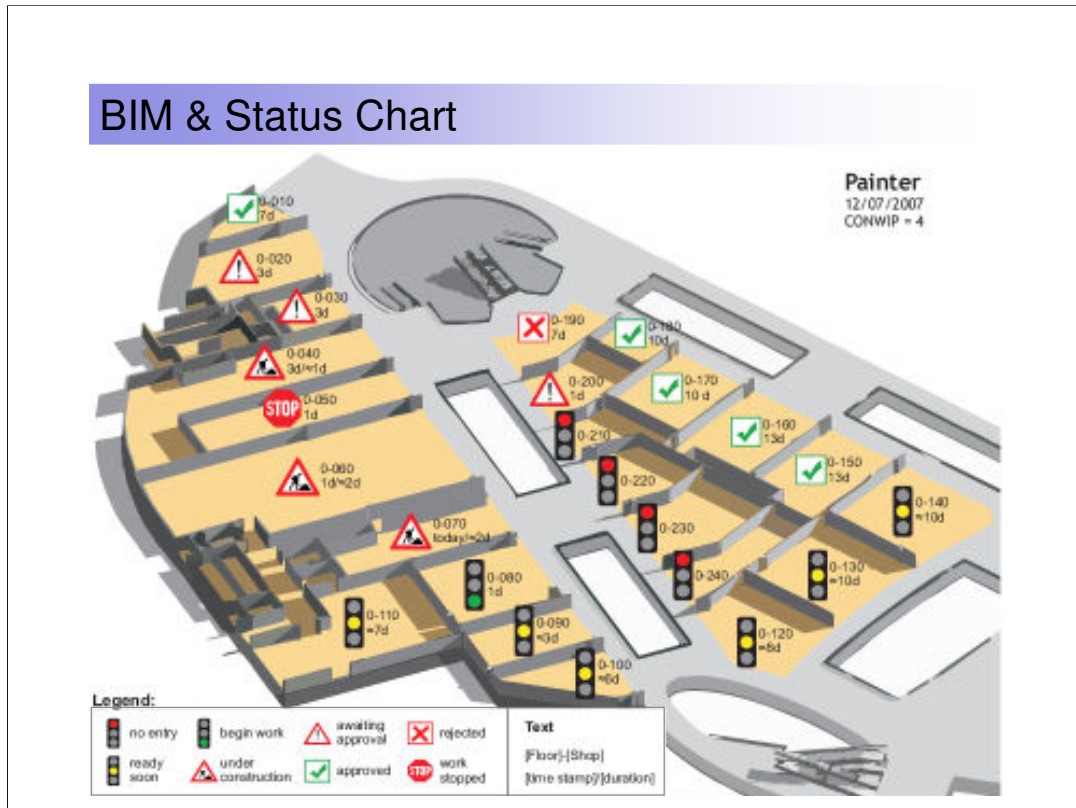


To maximize the benefits of the Status Board, we can use it in combination with other project management tools.

The Status Board connects the Gantt-Chart and the Line of Balance at the points sections/processes with each other. So it offers additional information.

Consider that the axes of the Status Board in the figure above are mixed-up (like in the Status Board on page 14).

## BIM & Status Chart



Sometimes the work-crews don't need to know the whole status board at a glance.

So it is a good idea to give them only the information required.

This slide shows a graphic Building Information Modeling interface on which work status icons are shown for each location in a three-dimensional model view.

## Work-Flow Visualization

*Main Benefits*

### Improves

- transparency
- identification of workstations and pathways
- communication
- planning and control
- employer motivation

### Reduces

- required management capacities
- propensity for errors

The main benefit of workflow visualization can be seen in increased transparency and employer motivation.

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Questions?

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