DREES & SOMMER

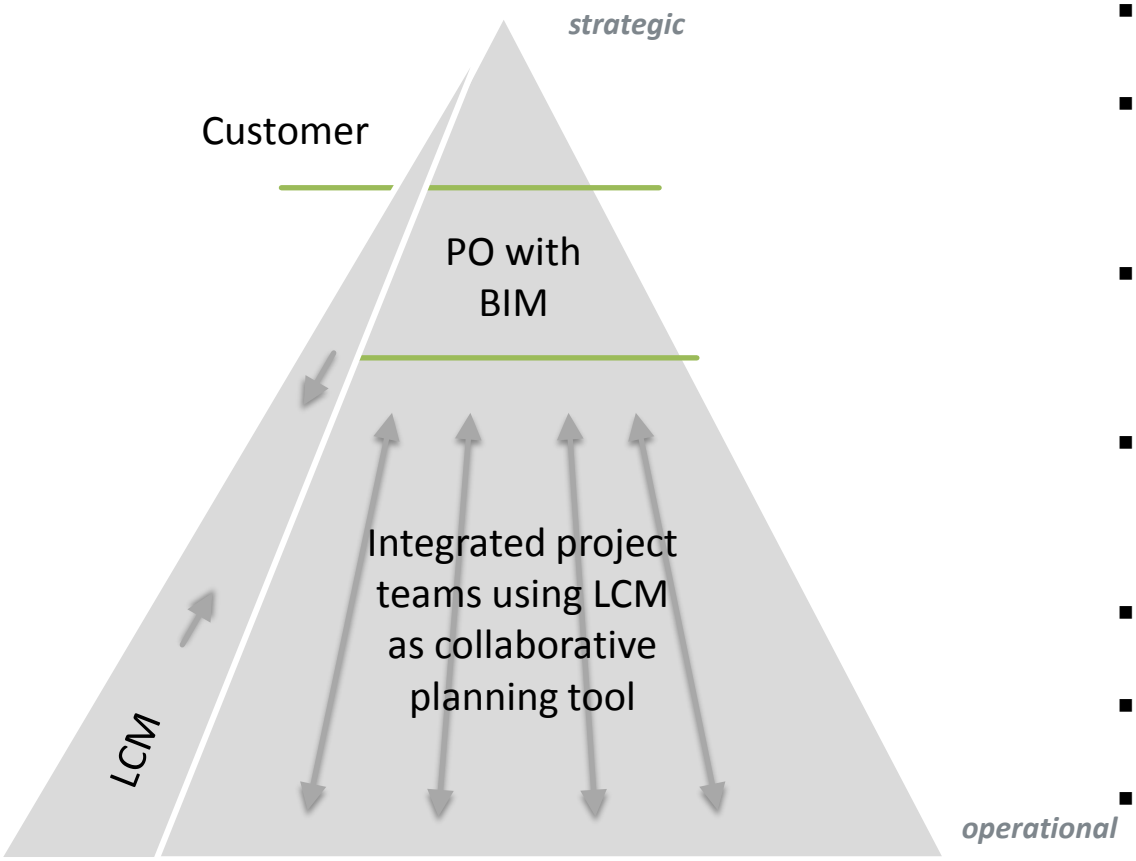
Lean Construction Management & BIM

Implementation of LCM to bridge the gap between BIM and the construction site

Patrick Theis, 29.10.2013

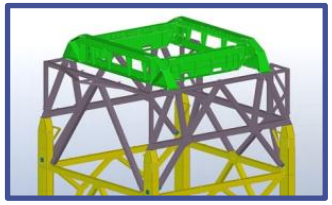
Projectorganisation and BIM with Lean Construction Management

Briding the strategic and operational level

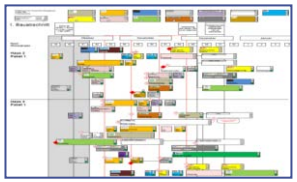


- Top down *and* bottom up
- Production system to speed up the planning and execution
- Highly flexible and dynamic regarding changes
- Control by common commitments and involvement
- Complete system integration
- Continuous and real time
- Real + virtual world

Integration of BIM and a LCM production system

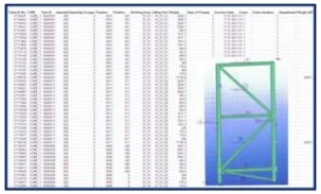


BIM / 5D

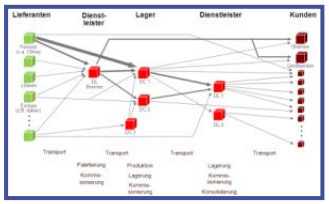


Process Planning

Process Analysis

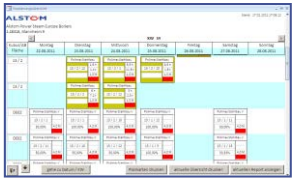


Work packages & material list

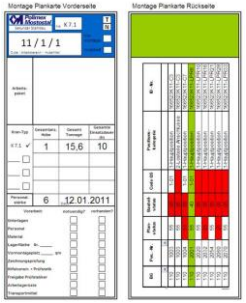


Supply Chain & material Tracking

Logistic hub



Production Planning



Production Control

LCM and BIM interaction

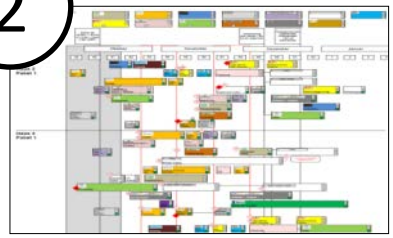
Working sequence feed for 5D Model out of LCM

1

Process Analysis

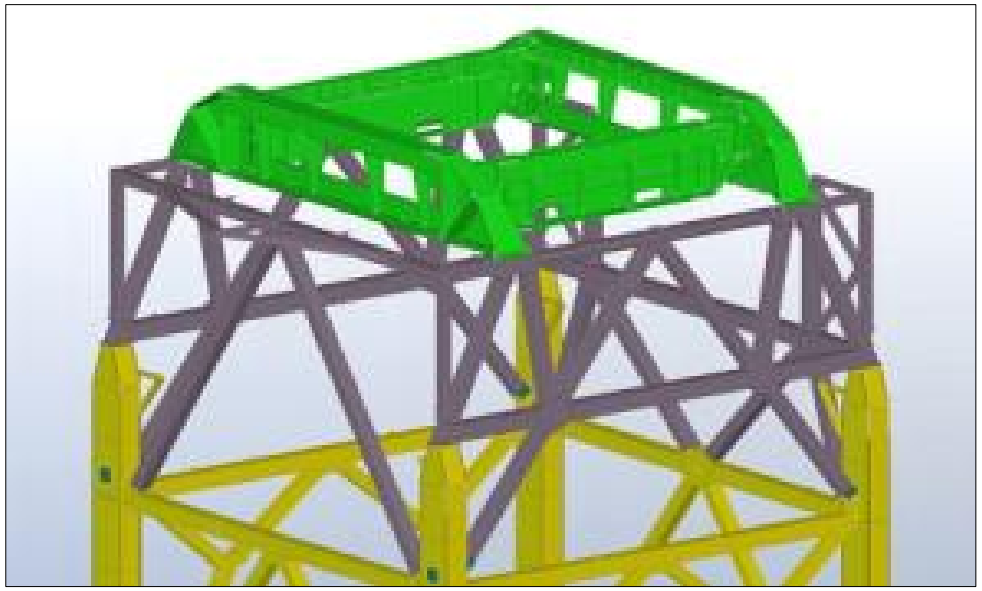
general steps

2



Process Planning

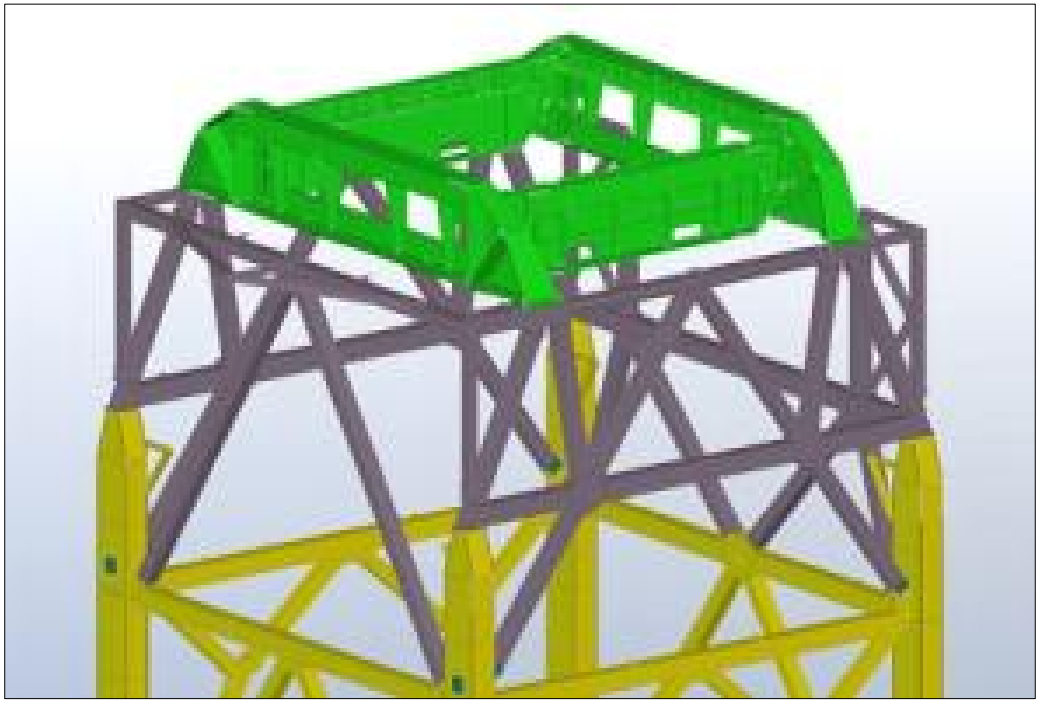
detailed process



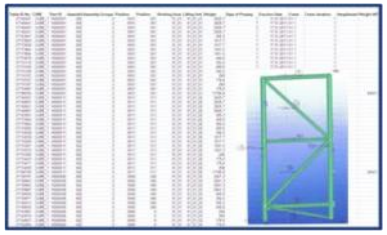
BIM / 5D

LCM and BIM interaction

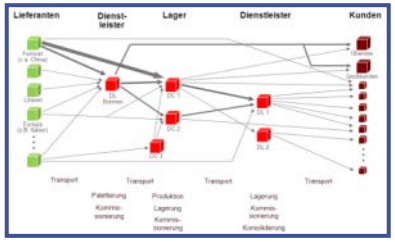
Information out of 5D Model



BIM / 5D



Work packages & material list



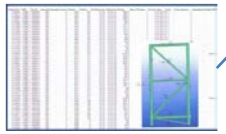
Supply Chain & material Tracking

LCM and BIM interaction

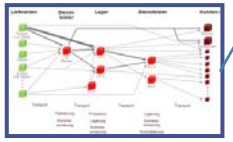
Information out of BIM and LCM tools for planning the execution / production

Process Analysis

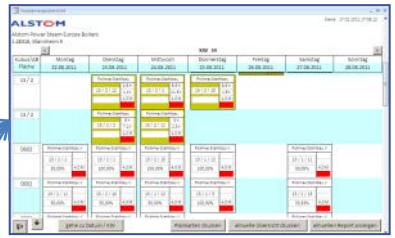
Process Planning



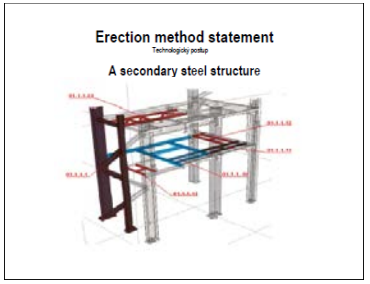
Work packages & material list



Supply Chain & material Tracking



Production Planning



Method statement

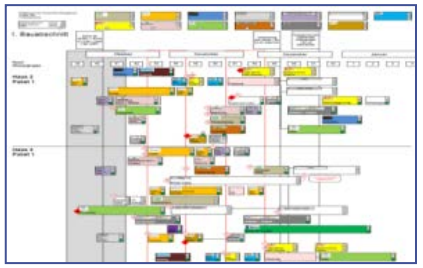
Production Control

LCM and BIM interaction

Control of construction site with LCM and BIM tool

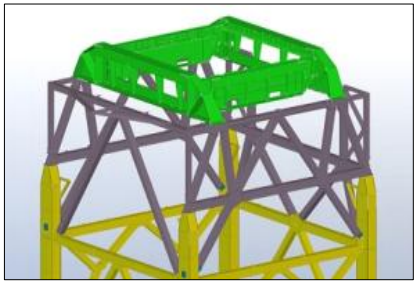
Planning Board

Planning Board



Process Planning

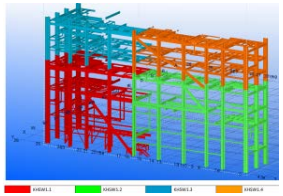
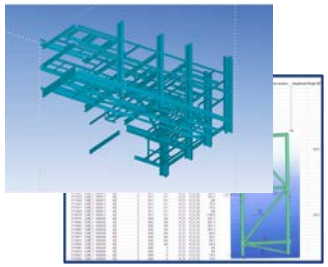
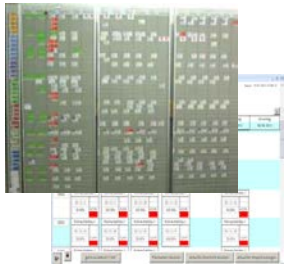
Construction site



Tecla Model

LCM and BIM interaction

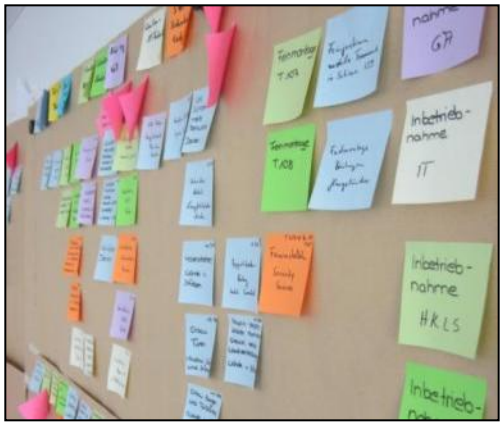
Overview of LCM & BIM shares at the different phases

OPA & PP	5D Model	Visualisation	Execution planning	Execution
				
LCM: Using LCM for planning the possible working sequences	**LCM:**	**LCM:** breaking down the Model into working packeges (Areas, lifting units, …)	**LCM:** Planning of the execution with planning boards,planning cards, action lists	**LCM & BIM:** Execution on cionstruction site with help of LCM and BIM tools
BIM:	**BIM:** using the Information of LCM and 3D Model to prepare the 5D Model, checking the practicability	**BIM:** visualisation of the working areas, lifting and construction units, material lists, simmulation and status tracking	**BIM:** supply chain management, material tracking	

Production management on site

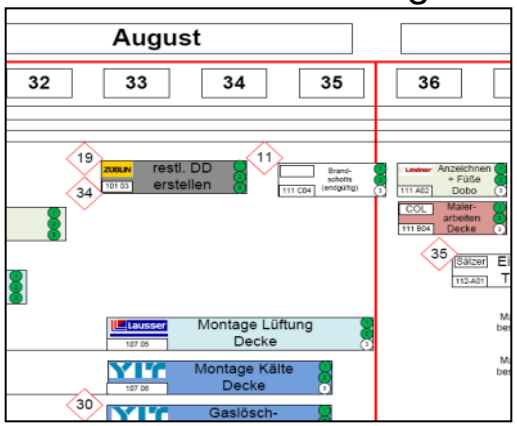
Reliable processes to speed up projects

Process Analysis



- Develop construction process
- Detection of open issues

Process Planning



- 4 Month lookahead for engineering, procurement and construction
- Stable, reliable and leveled construction processes

Detailed Planning

- Detailed 4 weeks lookahead on a daily basis
- Production plan on site including logistics
- Remove obstacles

➡ higher flexibility, faster process, less claims

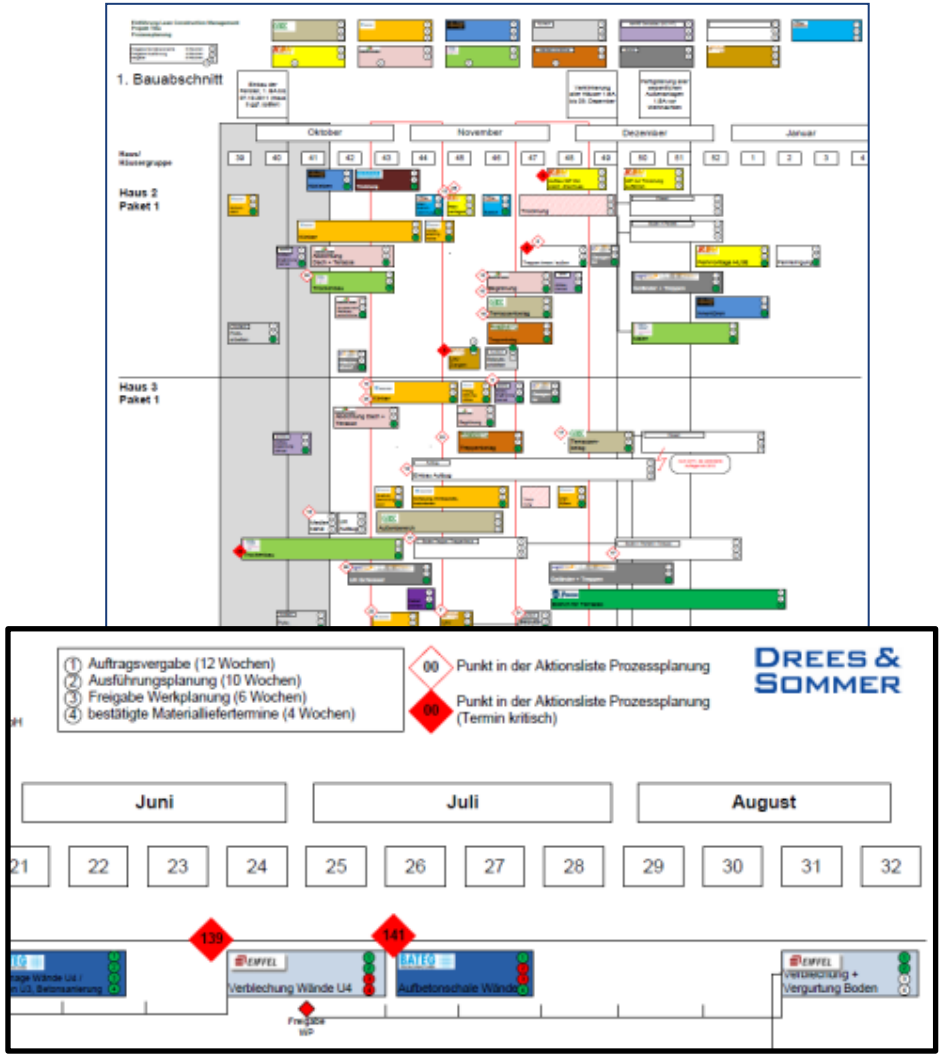
Overall process analysis for the whole project

- With a **transparent process view** development and simulation of the whole process sequences
- **Reverse planning**: start of process development from the end to the beginning of the whole project
- **Early identification** and solving of conflicts already in planning phase
- **Optimization of processes** for a part of the processes and for the whole construction
- **Takt timing** and **Sequencing** on basis of the process analysis
- **Interconnection of process and logistic** (JIT) for optimal usage and bottleneck

4-8 Month look ahead process planning

Obstacle free fom engineering to the construction site

- **Linking** of design and construction
- On basis of the master time schedule a process planning is created **with all relevant participants** on site
- The focus is on obstacles and **bottleneck resources**
- Defined „**Quality** Gates“ and Milestones are used to identify the stability of the flow between planning and the construction site
- The goal is to **solve all constrains** – before the construction process could be influenced
- Link of detail design, erection concepts and construction



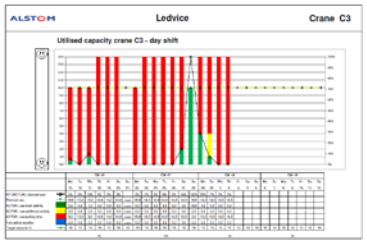
Detailed planning / Planning board

Visual work preparation for construction on a daily basis

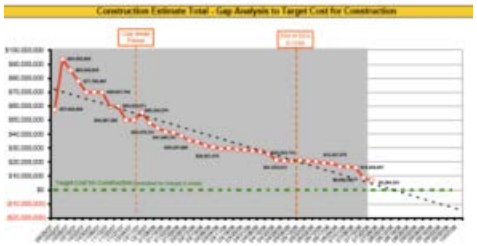
- **Visual tool** for a daily scheduling of the construction and pre-assembly works
- **Takt time** on a daily basis
- **Process optimization**
- **Capacity utilization** of bottleneck resources
- “The **pulling** construction site”
- **Information flow**
- **Stabilization**
- **Stable KPI forecast**

Alstom Construction System

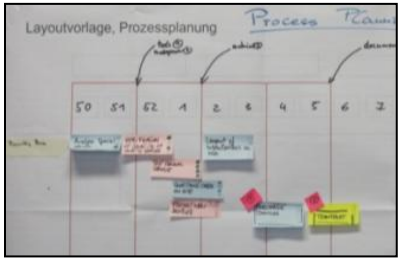
Example - Lean Design in plant construction



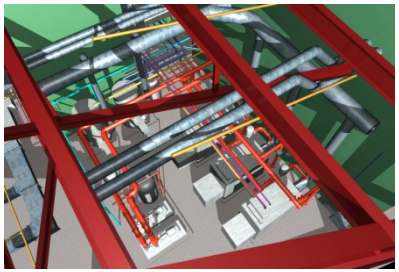
Process KPI



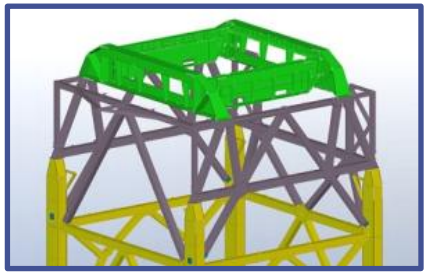
Target Costing



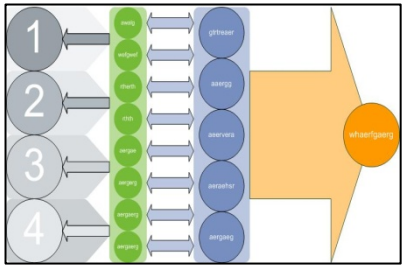
Integratet EPC Planning



5D processes and tools

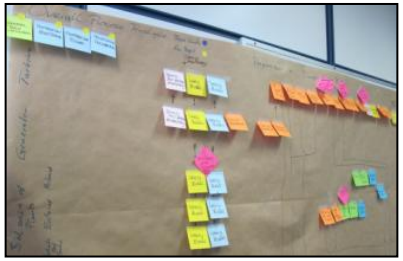


Interface management



Virtual organisation

Planning in teams

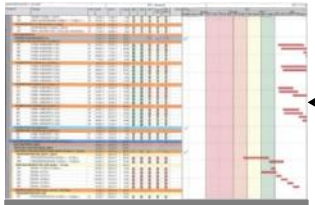


Process Design

Example

Alstom Construction System

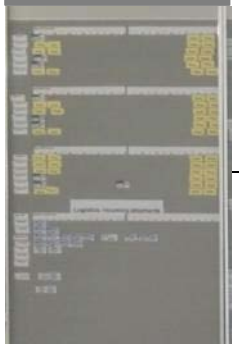
The elements of the planning process



process planning

4 weeks lookahead planning

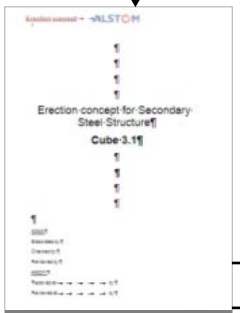
crane planning



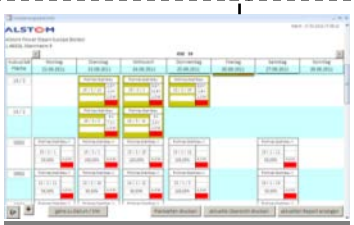
area planning

visualization

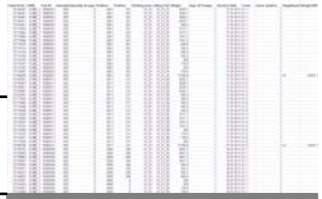
Example



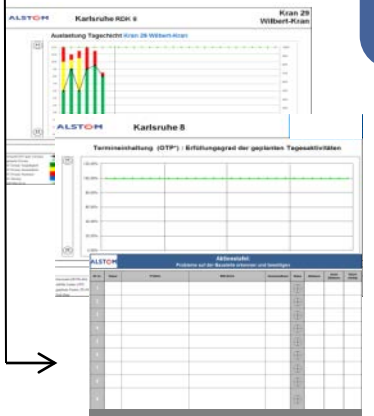
erection concept



ACS - database



logistic (HuT-list)



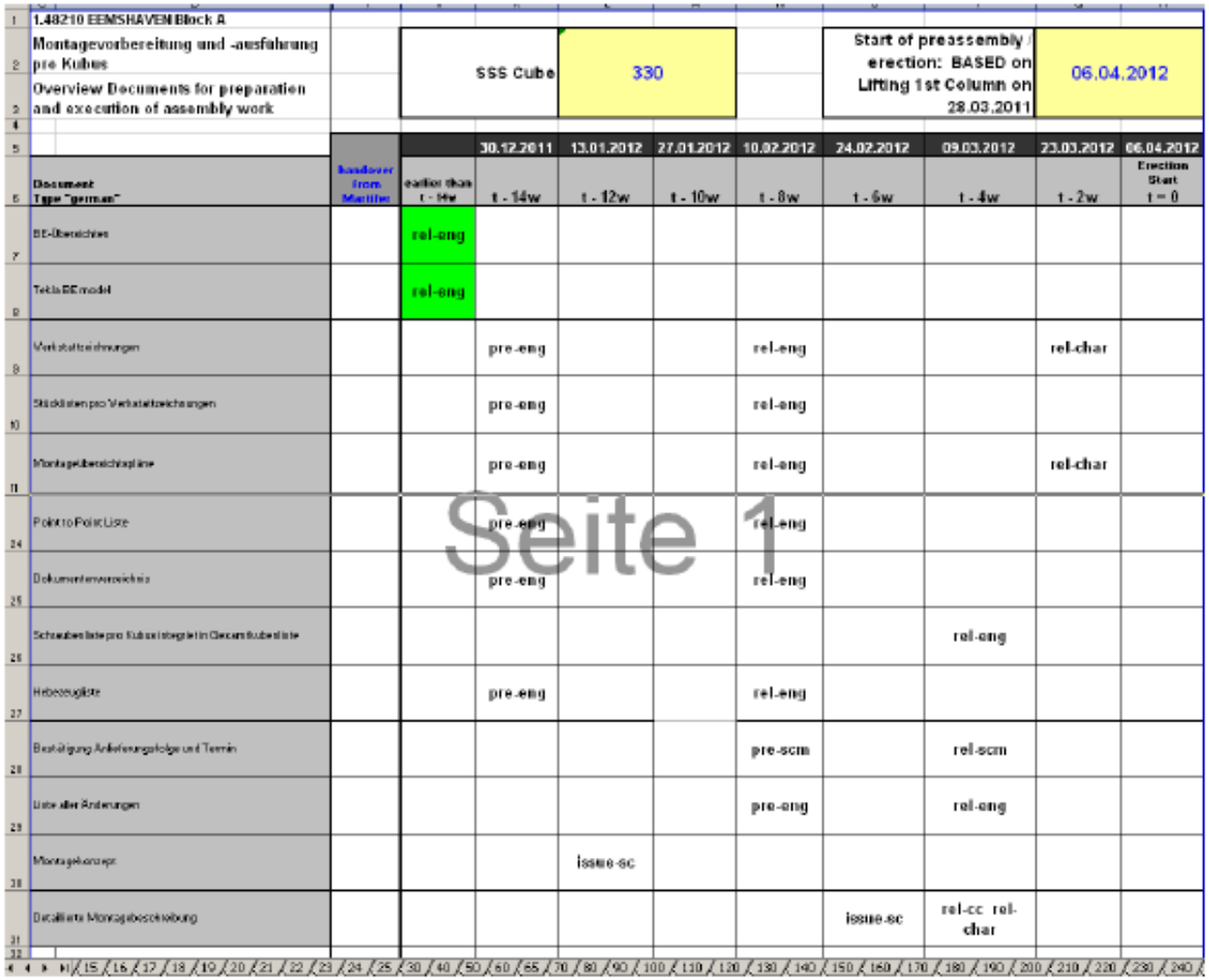
Key figures

Result of the Overall Process Analysis

Alstom, Sostanj

Example

List of documents ACS



1	1.48210 EEMSHAVEN Block A									
2	Montagevorbereitung und -ausfahrung pro Kubus		SSS Cube	330		Start of preassembly / erection: BASED on Lifting 1st Column on 28.03.2011		06.04.2012		
3	Overview Documents for preparation and execution of assembly work									
4										
5				30.12.2011	13.01.2012	27.01.2012	10.02.2012	24.02.2012	09.03.2012	23.03.2012	06.04.2012
6	Document Type "german"	handover from Mattlite	earlier than t - 14w	t - 14w	t - 12w	t - 10w	t - 8w	t - 6w	t - 4w	t - 2w	Erection Start t = 0
7	BE-Übersichten		rel-eng								
9	Tekla BE model		rel-eng								
8	Werkstattzeichnungen			pre-eng			rel-eng			rel-char	
10	Stücklisten pro Werkstattzeichnungen			pre-eng			rel-eng				
11	Montageübersichtspläne			pre-eng			rel-eng			rel-char	
24	Point to Point Liste			pre-eng			rel-eng				
25	Dokumentenverzeichnis			pre-eng			rel-eng				
26	Schraubenliste pro Kubus integriert in Gesamtkubusliste								rel-eng		
27	Hebezeugliste			pre-eng			rel-eng				
28	Bestätigung Anlieferungsfolge und Termin						pre-scm		rel-scm		
29	Liste alle Änderungen						pre-eng		rel-eng		
30	Montagekonzept				issue-sc						
31	Detaillierte Montagebeschreibung							issue-sc	rel-cc rel-char		

Example

Ducts tracking ACS

1.48210 EEMSHAVEN PROJECT

Montagevorbereitung und -ausführung pro Kubus

Overview Documents for preparation and execution of assembly work

		Duct System	RGK bis LUVO		Start of preassembly / erection:	01.09.2011			
			28.06.2011	09.08.2011	23.08.2011	07.07.2011	21.07.2011	04.08.2011	18.08.2011	01.09.2011
Document Type "German"	handover from Mattes	earlier than t - 14w	t - 14w	t - 12w	t - 10w	t - 8w	t - 6w	t - 4w	t - 2w	Erection Start t = 0
BE-Übersichten		rel-eng								
Werkstattzeichnungen			pre-eng			rel-eng				
Stücklisten pro Werkstattzeichnungen			pre-eng			rel-eng				
Übersichts- / Zusammenbauzeichnungen			pre-eng			rel-eng				
Verwendungslisten			pre-eng			rel-eng				
Dokumentenverzeichnis			pre-eng			rel-eng				
Armaturenliste			pre-eng			rel-eng				
Hängerliste			pre-eng			rel-eng				
Messstellenliste			pre-eng			rel-eng				
Elektrotechnikliste			pre-eng			rel-eng				
Legenspezifikation			pre-eng			rel-eng				
Schnittstellenliste			pre-eng			rel-eng				
Bestätigung Anlieferungsfolge und Termin						pre-com		rel-com		
Liste aller Änderungen						pre-eng		rel-eng		
Montageanweisungen (soweit von dem Fachbereich / Lieferanten zu erstellen)		rel-eng								
Montagekonzept				issue-co						
Detaillierte Montagebeschreibung							issue-co	rel-co		

Example

PP tracking ACS

1.48210 EEMSHAVEN A+B PROJECT

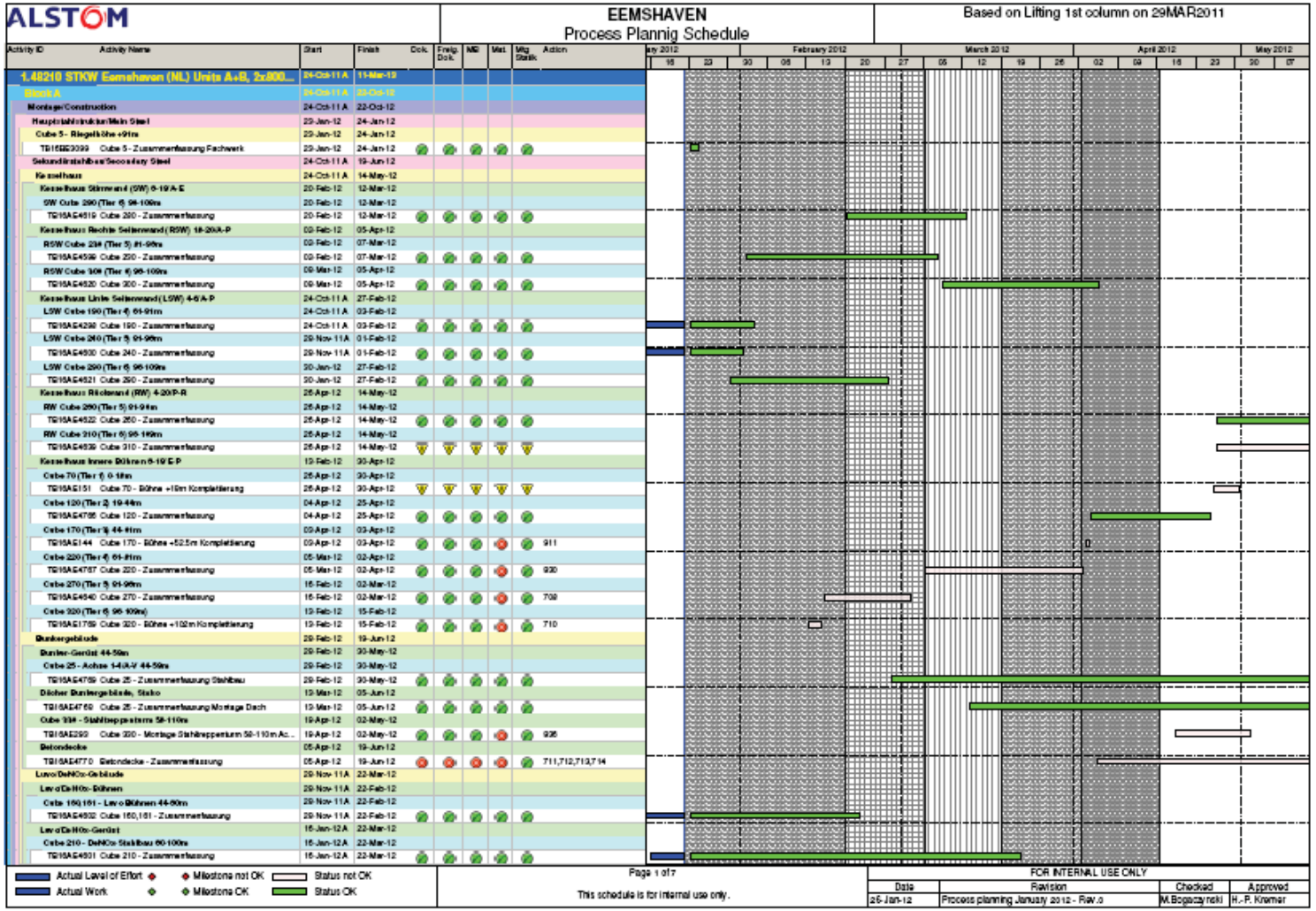
Montagevorbereitung und -ausführung pro Kubus
Overview Documents for preparation and execution of assembly work

vertical walls | vertical walls incl. Buckstays haeder external hanging tubes | Start of preassembly / erection: 28.06.2011

Document Type "german"	handover from Mattifer	earlier than t - 14w	22.03.2011 t - 14w	05.04.2011 t - 12w	19.04.2011 t - 10w	03.06.2011 t - 8w	17.06.2011 t - 6w	31.06.2011 t - 4w	14.08.2011 t - 2w	28.08.2011 Erection Start t = 0
Übersichtszeichnungen		pre-eng								
Montagezeichnungen			pre-eng			rel-eng				
Versandstücklisten			pre-eng			rel-eng				
Dokumentenverzeichnis			pre-eng			rel-eng				
erections records			pre-eng			rel-eng				
Lagerspezifikation			pre-eng			rel-eng				
Bestätigung Anlieferungsfolge und Termin						pre-scm		rel-scm		
Montageanweisungen (soweit von dem Fachbereich / Lieferanten zu erstellen)		rel-eng								
Montagekonzept				issue-sc						
Montageschweißpläne in BIMAS						rel-eng				
WPS -							issue-sc	rel-SiteQM		
Detaillierte Montagebeschreibung							issue-sc	rel-cc		
Liste aller Änderungen						pre-eng		rel-eng		

Example

Process planning – today (ACS)



Example

Actionlist of PP ACS

ALSTOM — **Interne Aktionsliste (Prozessplanung)**
Probleme auf der Baustelle erkennen und beseitigen
Stand: 26.01.12

lfd. Nr.	Datum	Problem	Maßnahme	Verantwortlicher Baustelle	Verantwortlicher	Status	Zieldatum	neues Zieldatum	Datum erledigt
976	24.01.12	Block B - Vormontage PL Ansaugung: Material nicht vollständig auf der Baustelle	Material auf Vollständigkeit überprüfen, Liefertermine abklären und Wareneingang bestätigen	Böske		◑	30.01.12	06.02.12	
977	24.01.12	Block B - Einheben PL Ansaugung: Montagebeschreibung noch nicht übergeben	Montagebeschreibung / Lifting plan an Alstom übergeben	Böske		◑	30.01.12	06.02.12	
978	24.01.12	Block B - Einheben PL Ansaugung: Material nicht vollständig auf der Baustelle	Material auf Vollständigkeit überprüfen, Liefertermine abklären und Wareneingang bestätigen	Böske		◑	30.01.12	06.02.12	
979	24.01.12	Block B - PL Ansaugung: Montagestatik ggf. nicht vorhanden	Prüfen, ob Statik erforderlich	Böske		◑	30.01.12	06.02.12	
984	26.01.12	Auftragsvergabe für das Ölsystem ist noch nicht erfolgt	Anfrage erfolgt nach Übergabe der techn. Dokumentation durch die Fachabteilung	Lugschi	Summermatter	◑	15.02.12		
985	26.01.12	Dokumente für Heiöllagertank noch nicht freigegeben	Die Dokumente für den Heizöllagertank müssen noch freigegeben werden	Steinbach	Summermatter	◑	01.02.12		
986	26.01.12	Montage Kondensatleitungen: Dokumente gem. Liste "Review documents for assembly preparation and execution per cube" ggf. nicht vollständig	Dokumente auf Vollständigkeit überprüfen	Steinbach		◑	31.01.12		
987	26.01.12	Aufbau K12: Dokumente gem. Liste "Review documents for assembly preparation and execution per cube" ggf. nicht vollständig	Dokumente auf Vollständigkeit überprüfen	Windisch		◑	31.01.12		
988	26.01.12	Aufbau K12: Freigaben von Prüfstatiker ggf. nicht vorhanden	Prüfen, ob Freigaben vollständig vorhanden sind	Windisch		◑	31.01.12		
989	26.01.12	Aufbau K12: Montagestatik ggf. nicht vorhanden	Prüfen, ob Statik erforderlich	Windisch		◑	14.02.12		

120126_Aktionstafel EEM_intern.xls

◔ = definiert; ◑ = in Arbeit; ◕ = umgesetzt; ● = erledigt

Seite 15 von 15

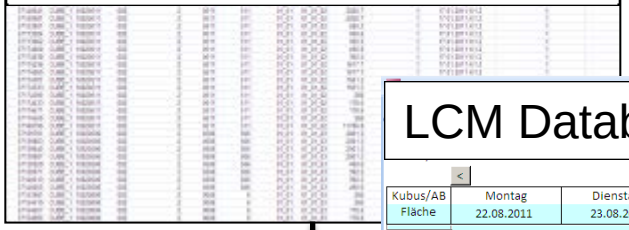
Example

Detailed production planning

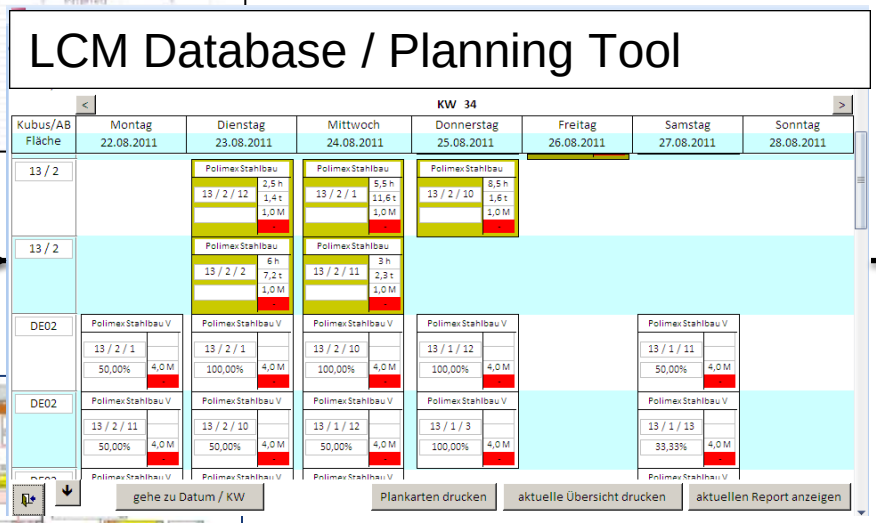
Resources, logistics and equipment capacities

Material Database

Material Part List / Material Handling (e.g. RFID)

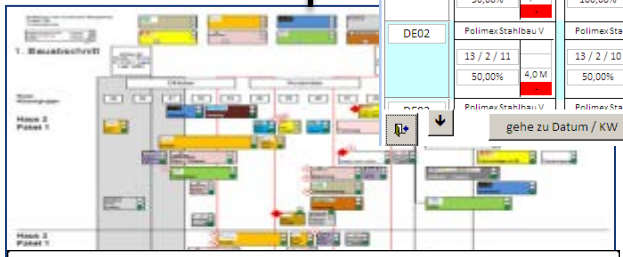


LCM Database / Planning Tool



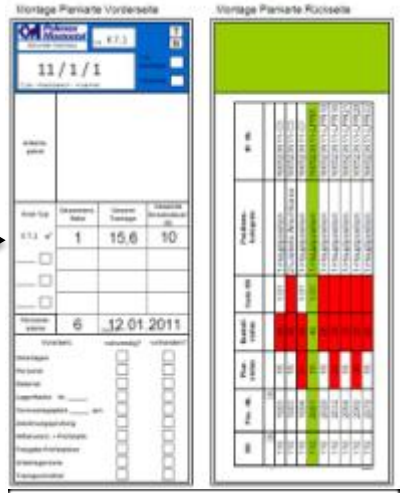
Process planning

4 month lookahead linked to the overall shedule (MTS)



"Working Cards"

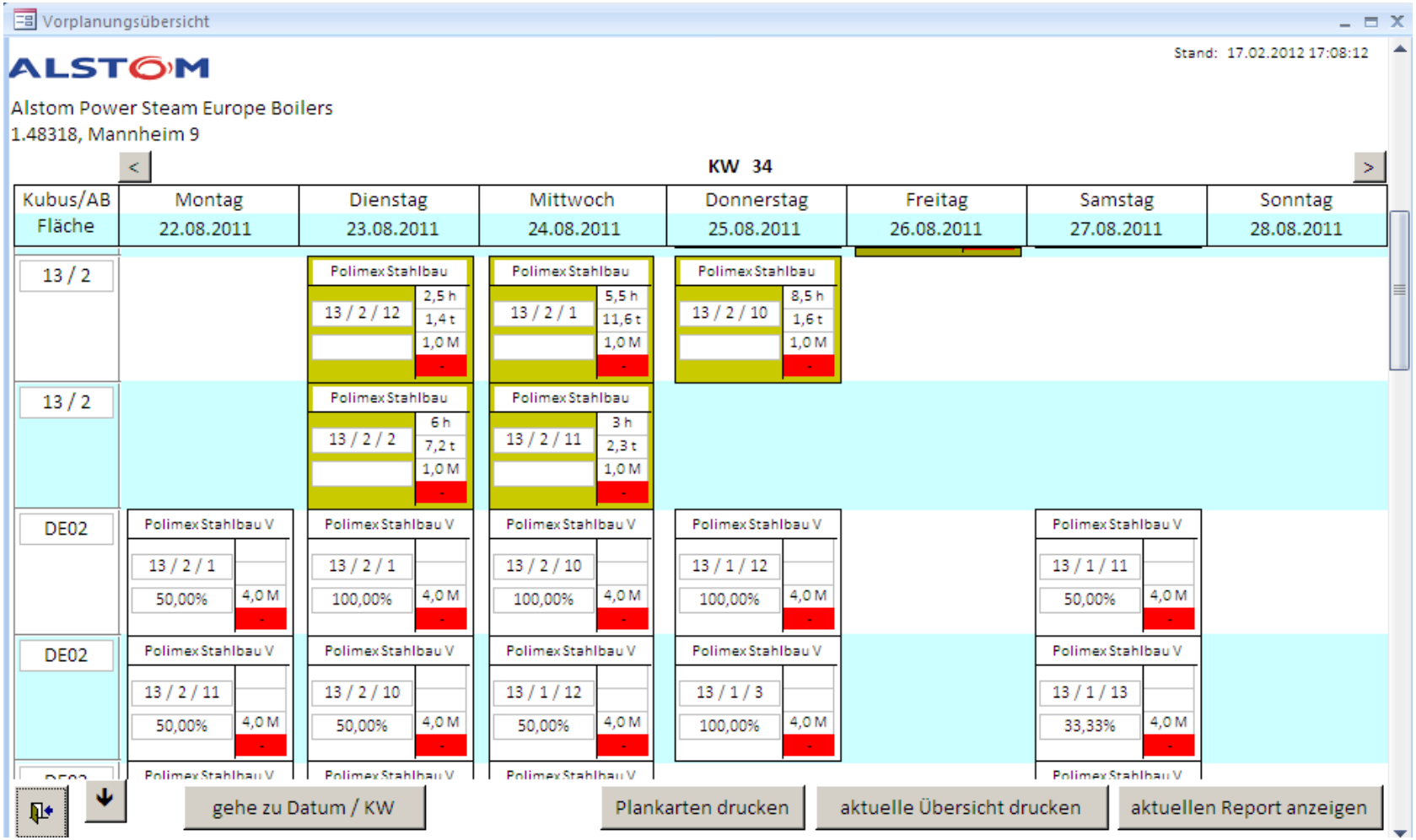
incl. logistic information



Example

ACS-Database

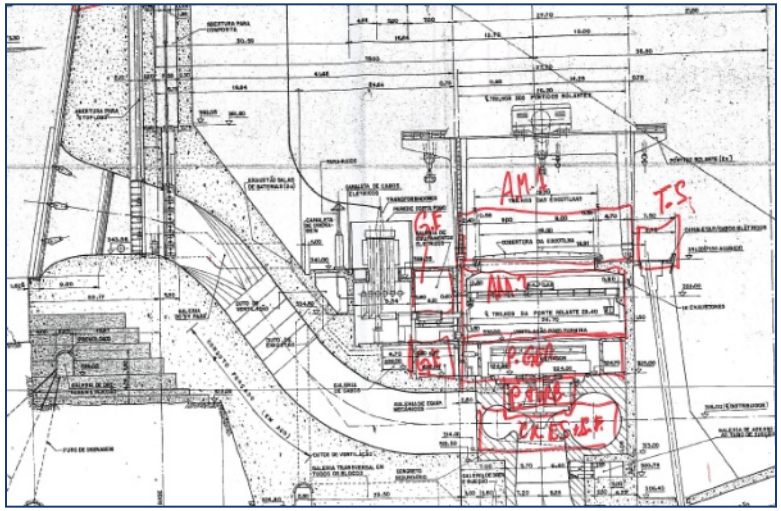
Overview of Pre-planning

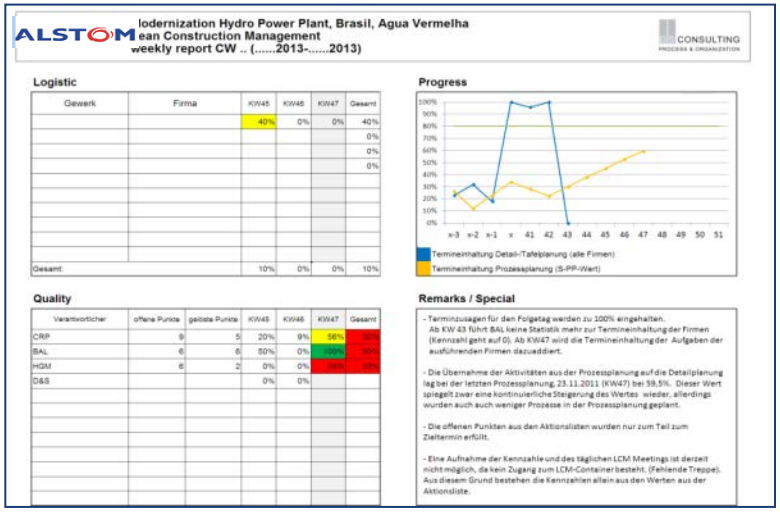


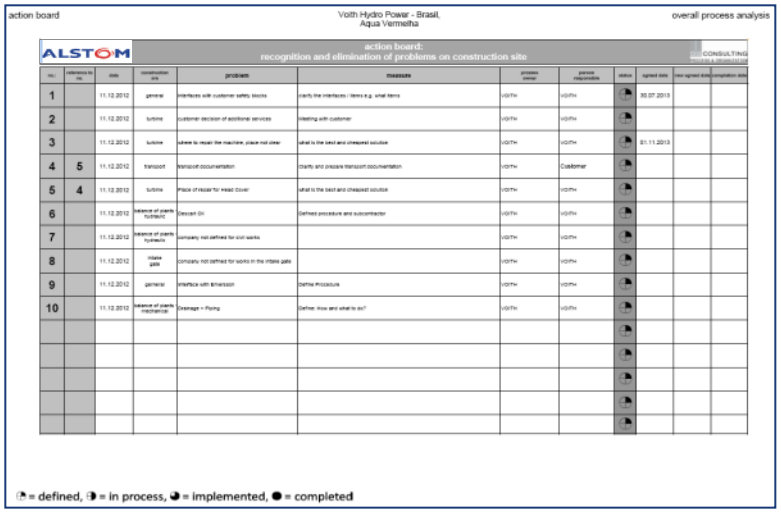
Example

Adaptation of LCM elements to Alstom

Planning cards, OTP's, meeting structure







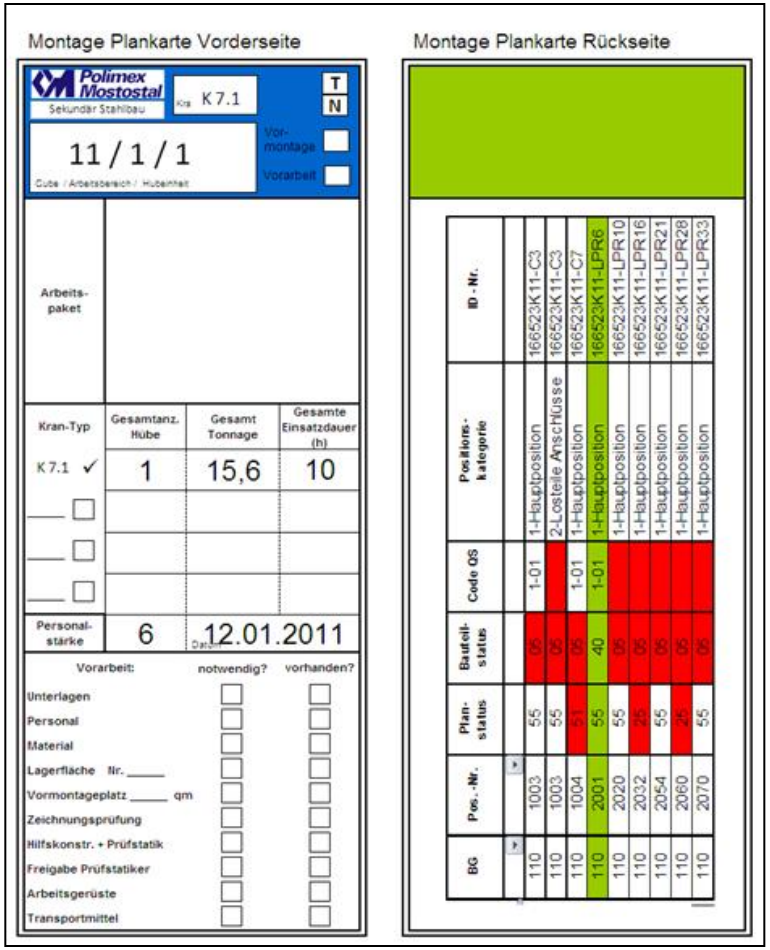
Example

Detail Planning Board

Planning on a daily basis

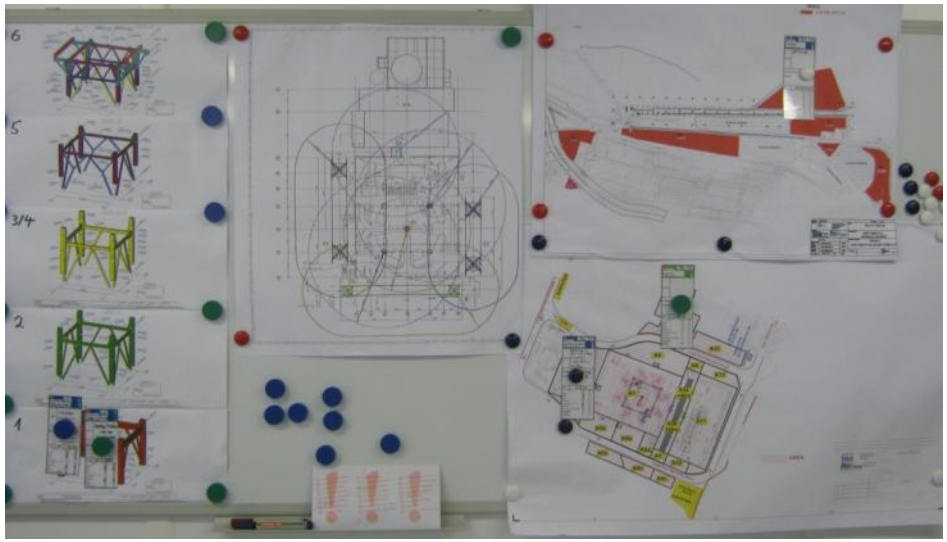
Visualization of activities on planning cards

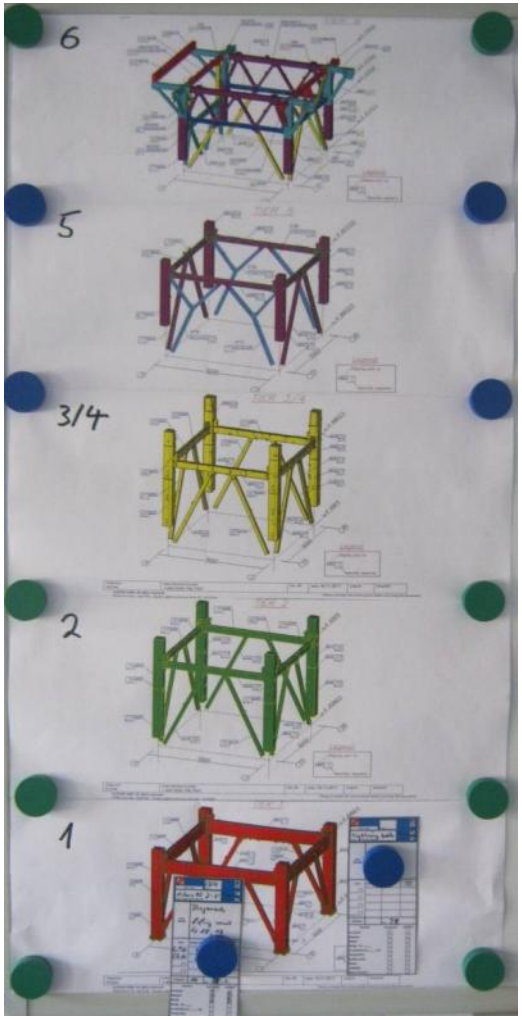
Transparency of workload per day



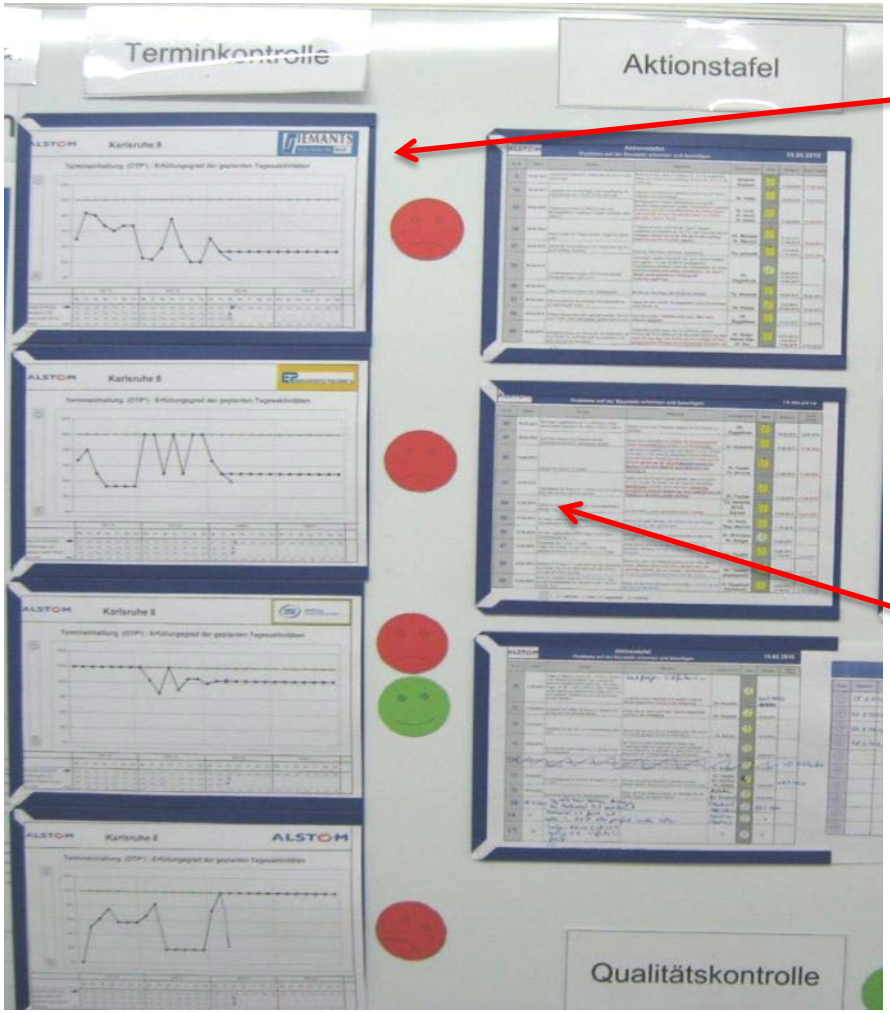
Assignment of planning card

Working areas





KPI's and Action board ACS



Reasons for bad OTP are placed behind the KPI-sheets an available for everyone

Basis Claim Management

Example

ACS Implement at Alstom sites

Implementation throughout Europe

Sostanj Boiler (Slowenja)

Eemshaven (Netherlands)

Belchatow (Poland)

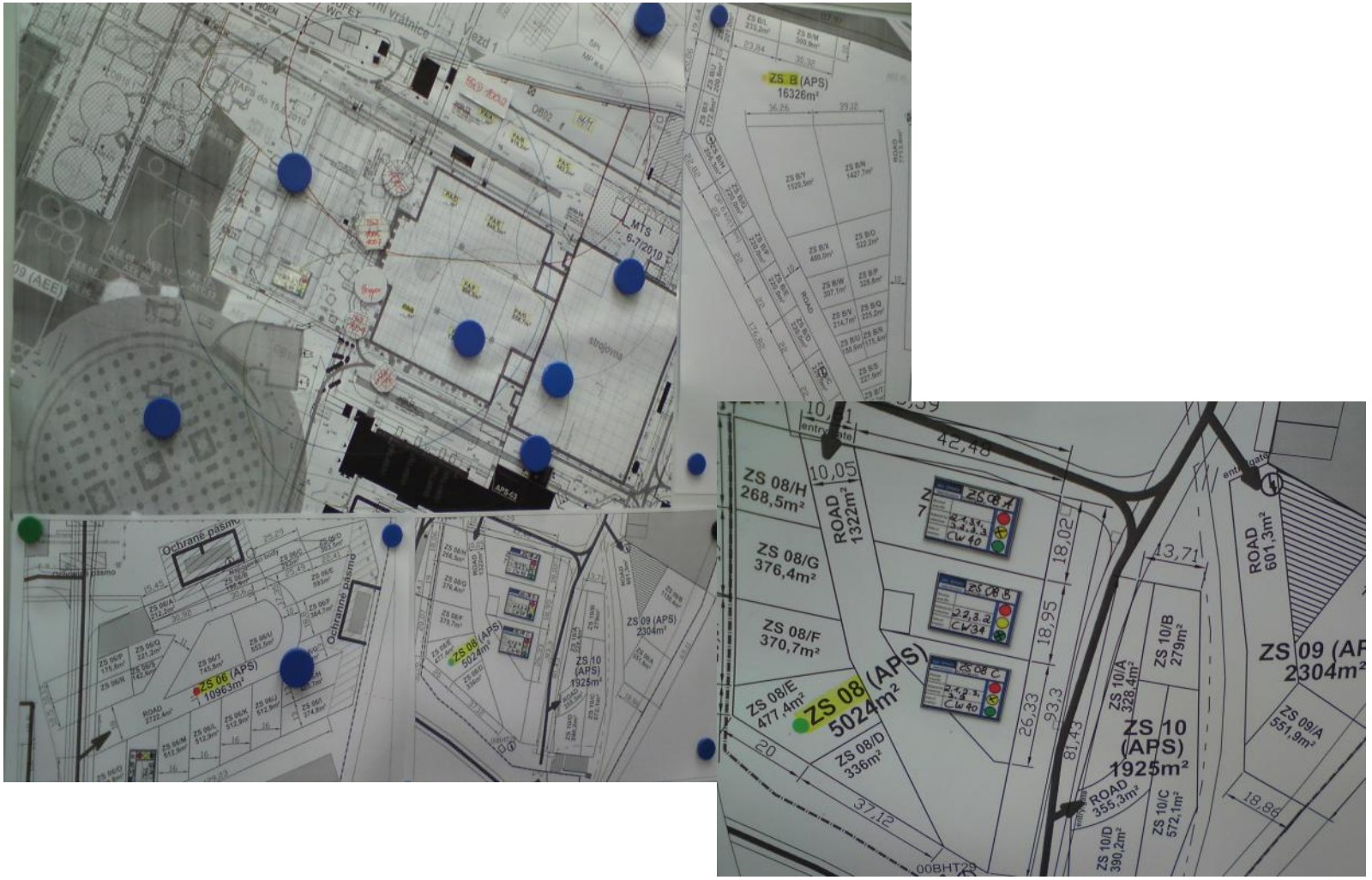
Sostanj Plants (Slowenja)

Karlsruhe (Germany)

Ledvice (Czech Republic)

Example

Area-space management ACS



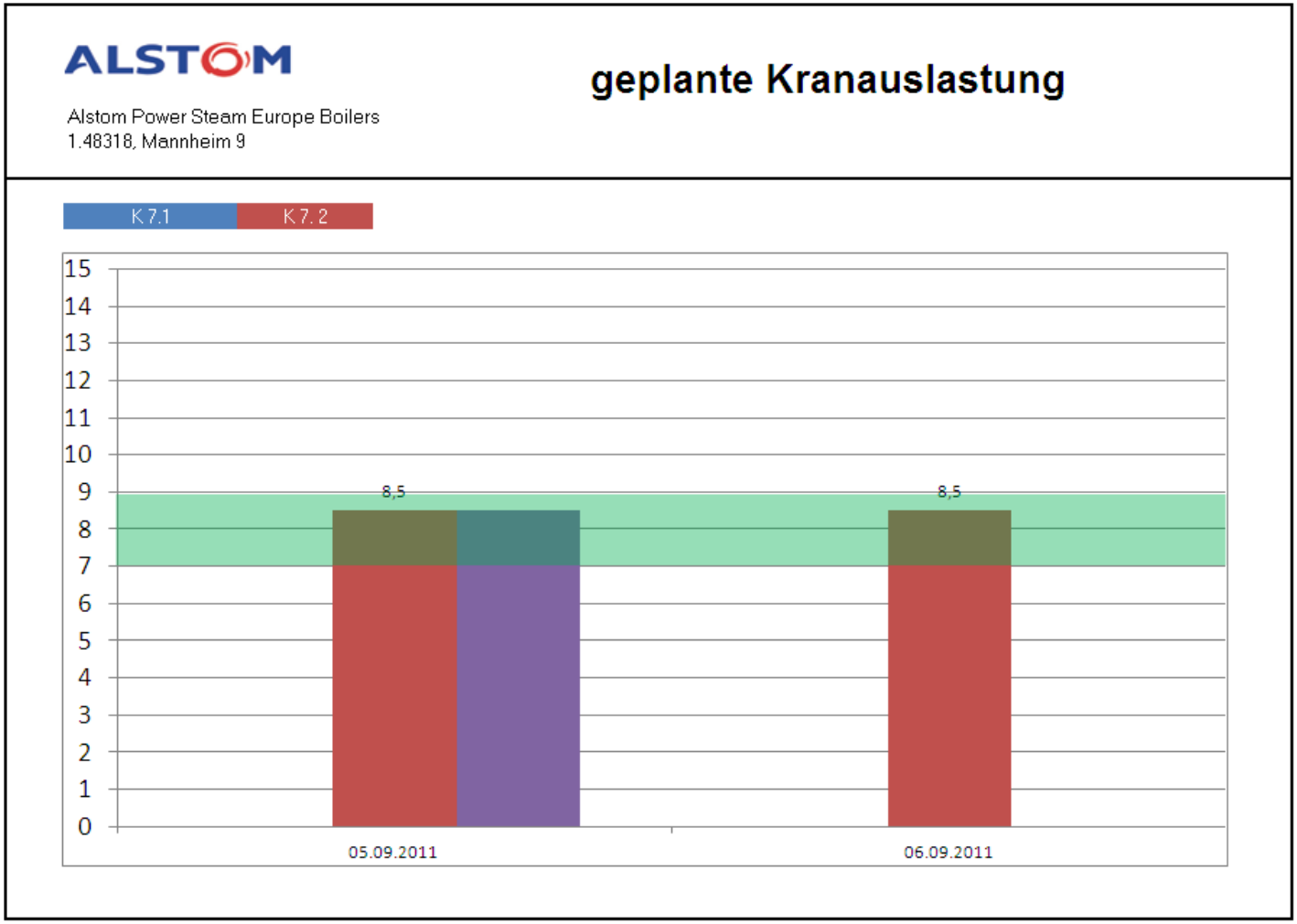
Example

Detail Crane-planning and controlling of crane workload

Example

ACS Database

planned use of resources (crane)



Example

Info out of 4 weeks lookahead

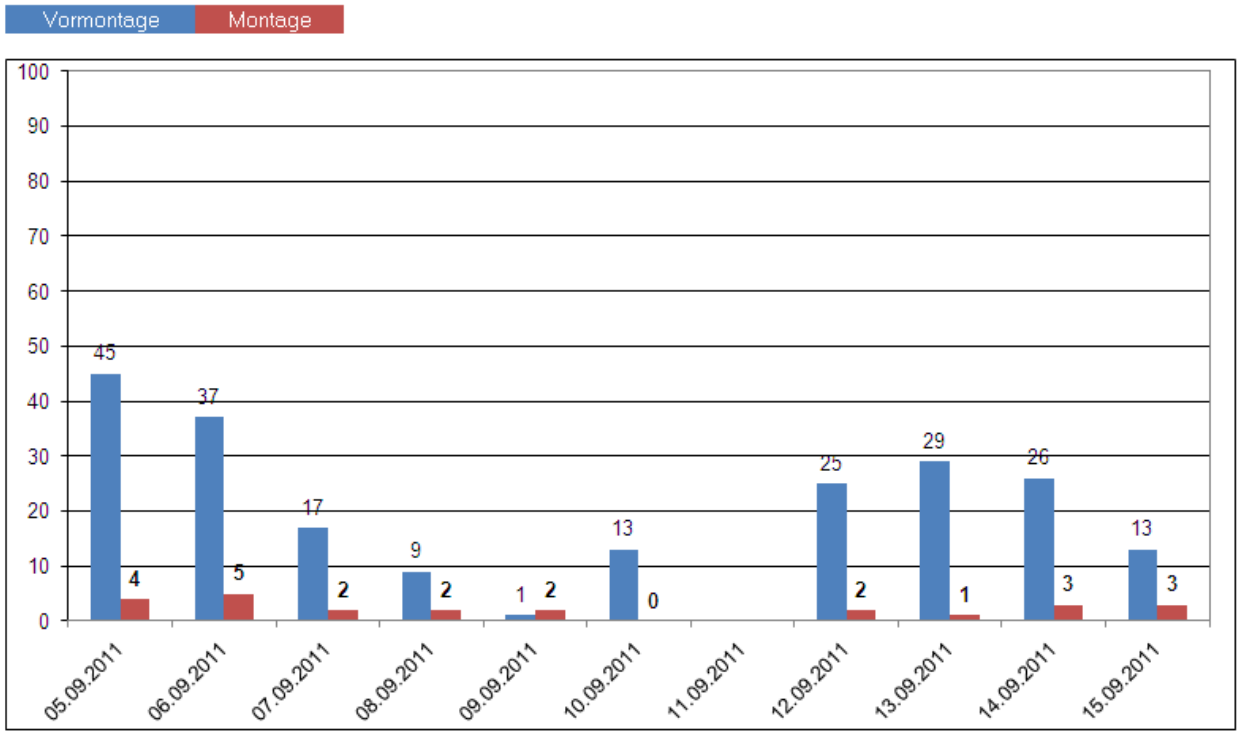
ACS Database

Planned use of resources (workload of staff)

ALSTOM

Alstom Power Steam Europe Boilers
1.48318, Mannheim 9

geplante Personalauslastung

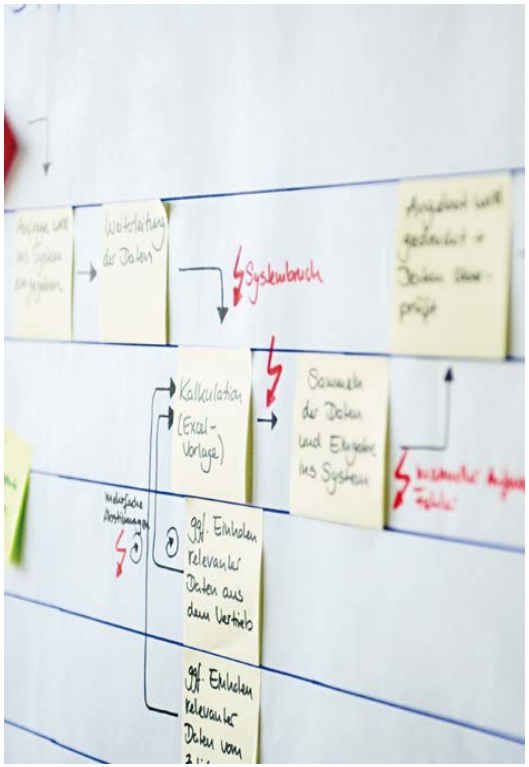


Example

Info out of 4 weeks lookahead

Effects by Lean Construction Management

Reliability of processes



- **Combination of advantages** of both tools (BIM + LCM)
- **Reduction of costs** due to more efficient processes and prevention of interferences
- **Testing the practicability** of the planned execution
- **High stability** for personnel planning, logistics and other capacity utilization, bottlenecks
- **Transparent and planned processes** for all trades with the aim to eliminate problems as early as possible
- **High flexibility** for changes
- **Realistic view of total costs**
- **On budget and on time completion** of projects

Win-Win situation for all involved parties

Your contact

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