FAST-TRACKING BY HIGH PERFORMANCE DESIGN TEAMS

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ABSTRACT

There is a growing need for faster delivery of buildings, especially by professional clients. Until recently fast-tracking processes concentrated mainly on the construction process and concurrent engineering. More and more nowadays the awareness is growing that fast-tracking also has evidential consequences for the earlier phases. Especially complex building projects, where a lot of design professionals and advisors are involved, require a lot of professional, managerial communication and team skills of all project participants, as well as specialised methods, techniques and instruments.

Based on several recent Dutch fast-tracking cases, the paper explores how fast-tracking design processes were designed, executed, and managed. The cases are discussed based on a small model developed in this paper, to analyse and design fast-track design processes. Special attention will be given to the implications of this kind of high performance design teams for the design management and co-ordination function.

KEYWORDS:
Fast-track building design, design management, concurrent design, fast-track design and construction case studies.

1. INTRODUCTION

Especially in cases of professional clients buildings to be delivered are seen as part of a commercial production process, or of a real estate portfolio. This implies that every day the building isn't yet available the client or owner has to face a certain loss. However due to the complexity of modern buildings, production time often is increasing as well in terms of the duration of the design as well as the construction process.

Until recently fast-tracking processes concentrated mainly on the construction process and concurrent engineering. More and more nowadays the awareness is growing that fast-tracking also has evidential consequences for the earlier phases.

On the one hand this concerns the throughput time of these phases, on the other hand this concerns the demand for a fast-tracking customised form of specification of the building design. Especially in the case of complex building projects where a lot of design professionals and advisors are involved this requires a lot of professional, managerial communication and team skills of all project participants, as well as specialised methods, techniques and instruments. Besides that in fast-track projects legal authorities and formal public law procedures often are becoming critical. While in traditional fast-track literature most attention is given to reducing throughput time by parallel processing, in this paper a more sophisticated model is presented which can be used for analysing fast-track cases, as well as for designing fast-track design processes.

2. A MODEL TO DESIGN AND ANALYSE FAST-TRACK DESIGN PROCESSES

The aim of fast-track design is to shorten the throughput time of the design process. Often it is assumed that the process cost will increase in these cases, although this isn't a necessary fact. Other general constraints are the avoiding of loss of quality and money in case of fast tracking. As has been stated traditionally fast-tracking is limited to the engineering and construction phase. It's the assumption of this paper that also the design process itself can be subject to fast-tracking. The complication concerning fast-track design is that normally the design process isn't planned as much into detail as the engineering and construction process. Also architects often are reluctant to participate in fast-track design due to the opinion that creative processes can't be subject to acceleration if architectural quality has to prevail. However recent developments within the area of architectural design management more and more gave evidence that also creative architectural design processes can – and ought to- be planned and managed. The central statement in this paper is that given the fact that design processes can be subject to planning and managing they also can be subject to fast tracking.

If the design process is considered within a context of fast-tracking two systems of aspects must be considered in their mutual dependency. The first triangle has the following constituent elements: process, object and people. Within the borders of an architectural design project all three can be subject to specific measures with the aim of shortening the throughput time of a building design project. Efforts in terms of fast-tracking concerning these elements have to be evaluated in terms of their effects on money, time and quality. While every building project is realised within a physical, social, political and cultural environment, also this project environment has to be taken into consideration (figure 1).

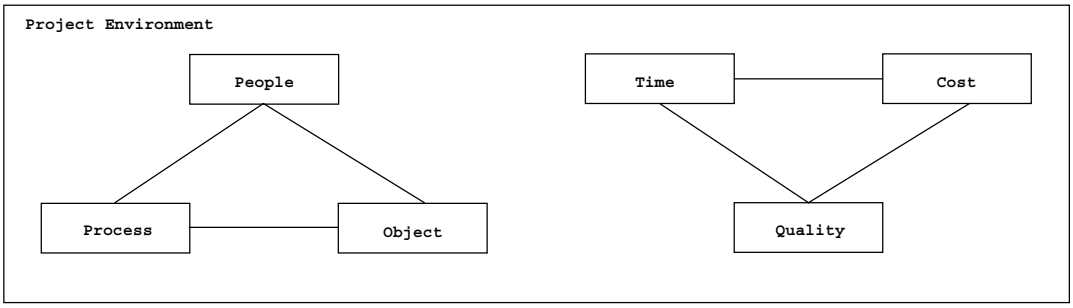

Figure 1: *Two mutual dependent triad's of aspects to be considered in case of fast track design.*

Although the environment, for instance in term's public law procedures, often can be critical, manipulations in terms of fast tracking nearly can be defined concerning this aspect. In the starting conditions of a fast track design project, the project environment on the one hand determines a part of the throughput time, on the other hand it must be subject in terms of risk management for project injure. This aspect is not further discussed in this paper.

In the next three paragraphs the aspects on people, process and object will be considered on terms of their possible effects on time cost and quality in case of fast track design.

3. PEOPLE ASPECTS CONCERNING FAST TRACK DESIGN

In this paragraph the aspects on people and practices involved in fast track design processes will be taken into consideration.

Having a motivated design team always is a necessary pre-condition for acquiring a high quality architectural design, Even more this can be stated in case of fast track design. While fast tracking a design process, not only puts a high claim on motivation but also on professional skills and teamwork abilities is given. May be the best personal characteristic of a high performance fast track design team

member, is a high potential professional, working in a large experienced firm with a good back up system of senior professionals and a rewarding system based on individual employee performance.

In a fast track design team design team members have to be carefully selected on their proven experience with the deliverance on the same type of designs as is in the concerning project. This not only concerns the individual designers but also the organisations from within they are working. Contractors often get a penalty fee every day a project is delivered later as the date of agreement. This procedure also might be applied to a fast track design process. This would imply that only design firms could be selected who have enough volume to take such a risk. However having a highly motivated team this might not be an appropriate view. When design partners evidently are not capable to deliver design products within the time limits appointed, they ought not to be selected, and if they are the best solution might be to exit the process. In case of high performance teams, a rewarding system for delivering design products before the time limits appointed, might be a better approach then a penalty system.

Concerning the organisations to be selected special attention has to be given to the capacity in terms of drafting and calculation. Only if the division of designers, engineers and drafters is well balanced, a design organisation is capable to handle real fast track design processes. In most cases this also implies that only the larger design firms can be considered to be selected. Only the larger design firms can permit employees to be full time involved in only one project, or can deliver replaceable as well as extra design capacity for instance in cases of illness or when time is running up. Delivering sufficient capacity is another important success factor for fast track design.
As will be worked out when the process aspects of fast track design are concerned, having available a sufficient IT-infrastructure can substantially increase the speed of design processes. This implies that in terms of selecting design firms based on their IT-infrastructure is an essential criterion.

Before assembling a fast track design team one has to realise that it is of essential importance to invest in productivity and motivation. This has to be done in terms of a well prepared project start up, a reward or/and penalty system, and may be even a fast track training and tuning program. While selecting a fast track design team a design manager has to realise that creating an effective and efficient collaborating team will cost several months. Selecting parties who has already collaborated before, will reduce a lot of time slack. People working within a fast track design project must realise that speed is more an opportunity in stead of a thread.
Essential for making things faster is the awareness that nobody is perfect. The ambition to deliver and present only perfect solutions to vague formulated design problems is the end of every fast track ambition. Having more than one team working on a certain special design problem in a kind of design contest can increase speed substantially. Another aspect to be taken into consideration is having the full team working together in a temporally facility on the building spot itself, more or less isolated from their respective organisations.

While managing a fast track design team a design leader is highly depending on the motivation of the team. Special attention has to be given to opportunities for bottom up process design and planning. Procedures and planning invented by the design team members themselves will be far more effective than top down management (Heintz, 1999). Regular evaluation sessions with the full design team, evaluating the process, learn from failures and looking forward to how to speed up the process might be far more effective than all traditional techniques a design manager might try to implement.

4. PROCESS ASPECTS CONCERNING FAST TRACK DESIGN

In this paragraph the aspects on design processes in case of fast track design will be taken into consideration. Almost all fast track literature is mainly concentrating on this aspect. Considering large complex design projects mostly three fast track methods are distinguished:

- Shortening project-phases;
- The division of a project in several sub-projects;
- Combining project-phases.

4.1 Shortening project-phases

Shortening project phases is the most usual attempt to fast track design processes. Shortening project phases can be done by:

- Increasing working speed, with or without special methods, systems and instruments;
- Executing traditional sequential activities parallel.

Increasing working speed has the risk of losing quality by having design participants working under high pressure, and increasing process costs in terms of a reward on workings hours spend beyond the normal daily schedule (figure 2).

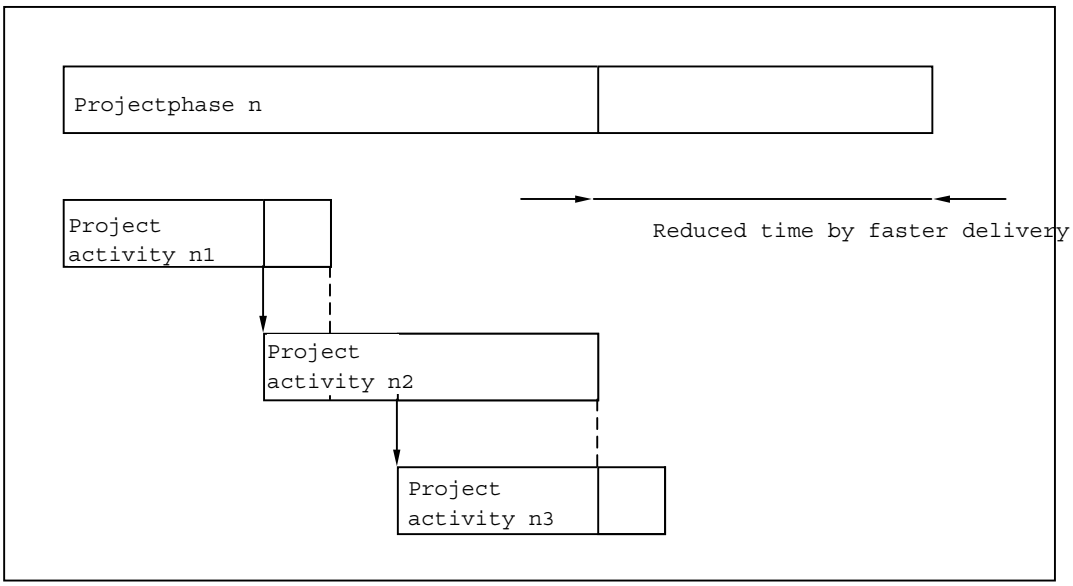

Figure 2: *Reducing time by faster delivery.*

Executing design activities within phases parallel implies people working with insufficient design inputs working besides each other more or less ineffectively with an increase of interfaces to be managed between –artificial- separated design tasks. So on the one hand executing activities parallel might increase speed, on the other hand a certain loss in labour capacity (productivity) and connected to that, time slack, might be introduced, reducing overall effectiveness (figure 3). This time slack on the hand can consist of extra co-ordination between the activities (interfaces), but on the other hand activities sometimes will be executed less efficient, due to the incomplete information input at the starting point. When activities are defined in such a way that there are no input output relations (independence) this time slack will not occur. The problem concerning productivity loss is to define the optimal point of overlap between each phase to be distinguished.

4.2 The division of a project in several sub-projects

In this case a project is not only divided in phases according to specification levels (from global sketch design to detailed design information concerning the integral object), but also in aggregation levels (Prins, 1992), by decomposing the project in several sub-projects, which each can be specified from global to detailed. Every sub-project defined is managed separately. By doing this the project complexity is reduced to a certain extend although the interfaces between the sub projects are becoming far more complex compared to the interfaces between the phases in a traditional project. In fact in stead of working with one project organisation, now several project organisations, each separately to be managed, are distinguished. Communication between the project leaders of the sub-projects and the over-all project leader become of essential importance.

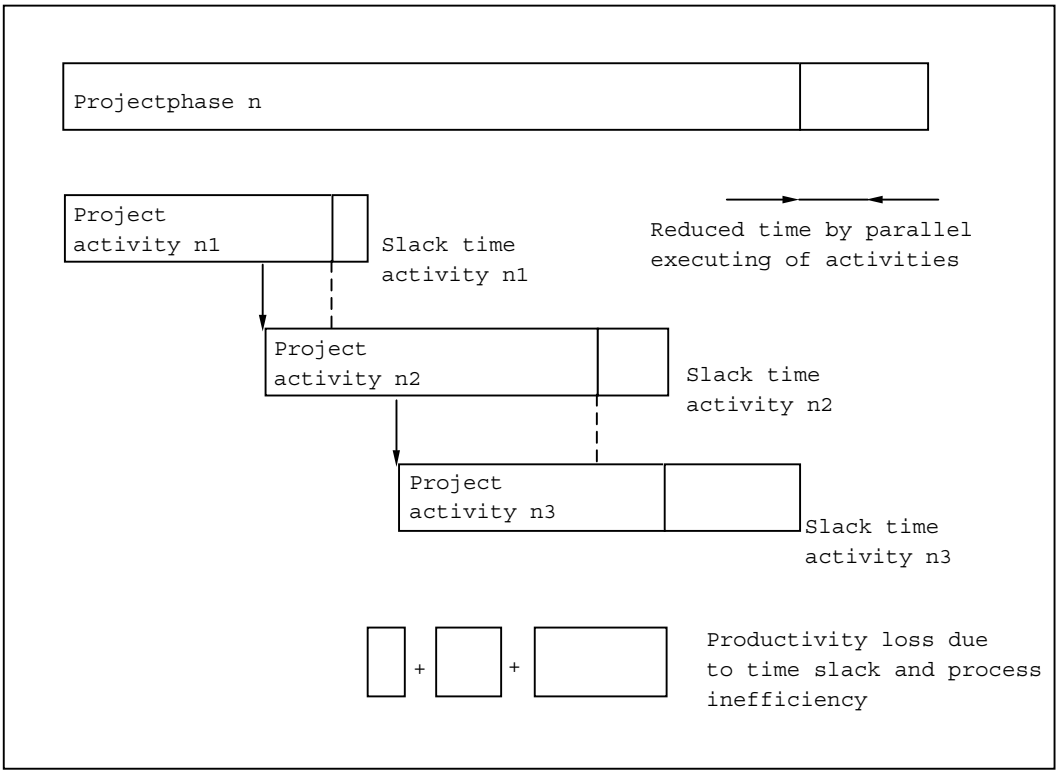

Figure 3: *Reducing time by parallel executing of activities.*
While at least one other managerial level is introduced, managerial complexity is increased substantially. Reducing throughput time can be acquired by executing sub-projects parallel (figure 4).

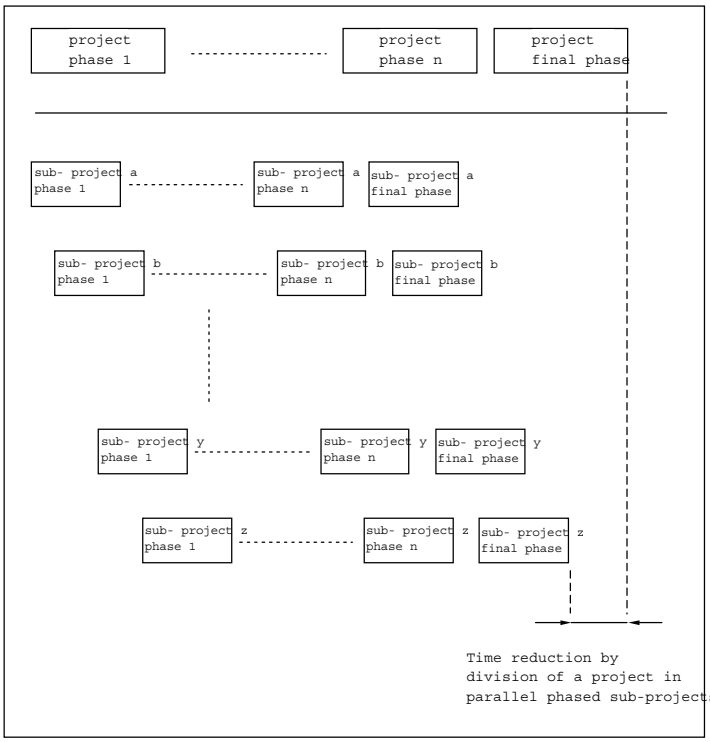

Figure 4: *Reducing time by the division of a project in several sub-projects*

4.3 Combining project-phases

This traditional fast track principle is in essence the same as the parallel execution of design activities within a phase, but now the main phases are executed parallel. The problem of time slack in terms of productivity loss due to incomplete information inputs and extra co-ordination of the interfaces between the phases is of substantial higher relevance in this case. Another aspect which becomes of relevance is that the content of the phases might be different compared to sequential phasing. For instance, if normally an HVAC engineer, works on the basis of a more or less defined structural and spatial concept, in case of parallel phasing this concept might be not available, which implies that on a far more fundamental level he has to develop rough concepts for the HVAC systems. This working method, besides it's time reduction might led to more integration between structural and spatial concept and HVAC systems, so delivering better design quality.

4.4 Other process aspects of fast track design

In case of fast track design the designing and management of the design process itself becomes of essential importance. Defining clear project goals agreed on by all participants (the client included) unanimously is of great importance. This for instance can be reached by means of a well-prepared and organised Project Start Up (PSU). In fact this PSU, when the outcomes are written down and formalised in a legal contract between the participants, can function as the feedback document during the process. The brief in this case, compared to a more traditional process, is extended with all items agreed on during the PSU. The development of the clients brief has to be unambiguous and definitely finished as early as possible and not later as the conceptual design phase.
Implementing specialised process forms for fast track design, can interfere with the building process organisation. May be the best way, in terms of quality to be obtained, for fast-track design, is having a full network team. A full network team as organisational structure offers possibilities for feed forward loops, for instance by integrating specialist trade contractors knowledge in the early stages of the design process. This is a way of working parallel in content, which not necessarily has to be accompanied by formal working parallel of process activities, work packages or phases. Having a full network team in a fast track project implies that the time and level of involvement of the building parties will be substantially different compared to a traditionally organised project. This is illustrated in figure 5.

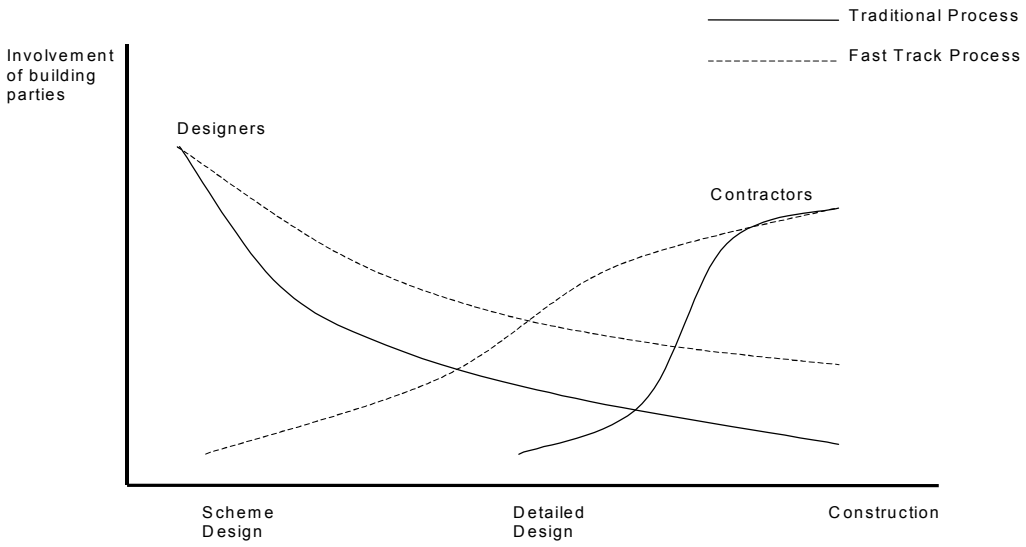

Figure 5: *Level of involvement of building parties over time*

Instrumentation can be another entrance for fast tracking. There is some evidence that the use of so called Data Web Houses for instance increase process speed up to 30%. Computer mediated communication is promising for a high performance team because time lacks, as well as distances can be lowered to almost zero. So working with a team at different locations, at different times might not influence the design process in a negative way but might increase the inter-action in the team and challenge the team to a higher performance level. To reach this level of improvement design team partners must be well trained motivated, and experienced in the use of this kind of ICT-tools (Den Otter & Prins, 2000). Also the use of advanced design decision support systems, and modern visualisation tools can speed up the process.

When within a fast track process the specification and ordening of activities, work packages and phases becomes complex, interfaces between these constituent process elements as well as between the design team participants are becoming of essential importance. Connected to that good-planning techniques, has to be implemented. Output has to be specified clearly and detailed. Contract management has to be based on output to be delivered in time as well as interfaces (more especially for instance the starting point of depending activities) between different output.

5. OBJECT ASPECTS OF FAST TRACK DESIGN

In this paragraph the output of the design of the design is discussed within the context of fast-track design.

In case of fast-track design the use of a modular approach to the design object might on one hand help defining design activities for the different design specialists. On the other hand the development of the conceptual design might be a result of collaborative effort in which all designers act more pro-active trying to find the right solutions for the client's brief.
Combining these two approaches the result might be a starting collective design process with collaboration of all partners in the conceptual design phase and growing to individual design activities based on specific modular design parts defined by all partners when the concept is agreed by the client.

A pro-active approach within the design phase to optimise the supply chain can save a lot of time during construction. Design, construction process, supply chain and the site layout have to be considered as mutual depending design variables in the early phases. Optimisation of the design by these variables can decrease construction time substantially. Modern virtual reality simulation tools can be of great help to achieve this.

An early start of construction of specific parts of the design is possible in case the design is open enough to incorporate realised unchangeable parts. In this case design constrains, in terms of what still can be changed and what is fixed after construction of the design part, have to be specified. Implementation of parallel design and construction implies the use of subsets of building specifications.

6. THREE DUTCH CASE STUDIES

In this paragraph the framework for fast track design discussed in this paper is illustrated with the description of three recent Dutch fast track building projects.

6.1 Inland Revenue Automation Centre Apeldoorn

6.1.1 The project

In 1998 the Dutch Governmental Building Agency (RGD) made the first contacts with JHK Architects, a medium sized high service architectural firm, for the design of a new Inland Revenue Automation Centre (BAC) in Apeldoorn. The project consisted in the re-destination of two existing buildings (formerly owned by Apple Computer), the demolition of one building, and the design of one

new building. Originally the complex had to be delivered to the client in October 2001. The total project costs are approximately 22,5 million Euro. When the architectural design process was halfway the conceptual design phase at the end of the summer of 1999, the client body decided to force a fast track delivery by November 2000. The case is described more extensively in Wilbrink (1999).

6.1.2 People
By the client body it was calculated that a late delivery of the building complex to be delivered would cost several million Euro on a yearly basis compared to a fast track delivery. This was clearly communicated to the design team. The design team was offered a take it or leave it proposal. To be more exact, not agreeing with these new clients which means being excluded out of the project. The design fee was only slightly raised for the remaining part of the design.

The architect in this case originally was selected because this firm also designed the original Apple Computing buildings. Their familiarity with the design of course was an advantage when the process was speeded up. While the design parties weren't especially selected with the aim to execute a fast track project, this was the case for the contractors.

6.1.3 Process
The first thing which was decided by the design team after the fast track task was accepted, was to raise the frequency of team meetings, to one meeting every week. The formal phasing of the project in concept design, detailed design etc. (as is more or less fixed in the Dutch Standard Agreements) was totally replaced by a new system of project control. Every design solution, which was not explicitly rejected by the client body in a design team meeting, was considered to be accepted. In the beginning the design team still accepted design change proposals by the client. Within half a year after the new assignment, parties agreed on a model in which no changes to earlier made decisions were allowed anymore. Actually this meant that every new insight in the housing demand of the client, from this point on, resulted in demolish, redesign and rebuild activities after project completion.
When parts of the design came in the detailed design phase the contractor was selected. Construction work started as soon as building parts where engineered and specified, and sometimes even before the engineering was fully completed. So in fact in this case is chosen for a form of concurrent engineering and construction. It appeared on several moments that the information need of contractors in this case was higher as the production capacity of the designers and advisors. The contractors selected must confirm themselves to working in shifts or in a six day's a week scheme, as soon as the completion date would come into danger.

While having a project with concurrent engineering and design the building was divided in separate parts each with their own planning.
As a consequence, information co-ordination and over-all planning (each design part got a separate planning for design as well as construction work) became far more complex. It was agreed on that if designers had informal bi-lateral consult together, decision made had to be formerly put on paper and reported to the project team meetings. Special attention was given to the central project archive. Besides a normal paperwork archive also a digital one, which could be easy accessed by the project teams participants, was developed and maintained.
When within the design team meetings decisions had to be made for which this team hadn't a mandate, but when project completion became under pressure, they were allowed to proceed awaiting a final decision of the steering committee. Although this seems to be a risky procedure no serious problems did arise with it in this case.

6.1.4. Object
After the fast track assignment it was agreed on that some of the technical advisors got a bit weaker position within the project team. Initially all advisors worked as a kind of co-designers on an equal hierarchical level. Later on they resigned a bit in influence, and took a position besides the architect and main designers. In fact this means that the integral design approach of which with the team started, was replaced by a more linear sequential approach. It might be assumed this has leaded to a certain loss of design quality.

Before the detailed design was completed the building design was divided in several (23) parts, which each could be designed and constructed concurrently as well as separately. As was mentioned before dividing of the building design in parts was done to make a process of concurrent engineering and construction possible. Another planned advantage of dividing the building design and construction work in parts was that when problems occurred in the construction of one part, labour capacity was shoved to the other parts under construction, running more successfully at that certain moment.

6.2 Region office of the Social Insurance Bank (SVB) in Breda

6.2.1 The project
This project was one of nine almost similar projects for new region offices of SVB, a govern-mental organisation, in the Netherlands. SVB organisation re-shaped and re-organised their organisation and realised new workplaces for all 2000 employees. The total operation had to be realised finally in the year 2000 because SVB likes to present her renewed organisation to the public in the millennium year. Because of this, most projects had to become fast-track projects. Delivering in time as well as high quality was more important then an economic budget. Four office-projects were set up as turn key projects. The five others were set up as Design & Built projects. The Breda office of SVB is the best representative example of a design & built project. The partners were selected through a European tendering process. The designer, the Dutch architect Bonnema, as well as the building contractor BMF, finally contracted in a Design & Built contract, are well known firms. Instead of realising the building in 18 months, the client asked and paid extra to built the office within 12 months. To realise this 30% shortening in time, contracts were made with some suppliers, during the preliminary design phase, to deliver in time specific building parts as for instance the prefabricated concrete outside walls. There was a high penalty per day for delivering the building too late.

6.2.2 People
There was a big difference between the design team and team working on the site. Although the design team delivered a good result at the end, the design process was hard to manage and problems with planning were not discovered in time. The project manager had to find himself that the management of the design office wasn't capable to continue the design after the design leader left the office. The team at the building site was acting very much pro-active. Looking forward to anticipate on possible failures as well as learning from their own mistakes during the project and improving procedures for working together with different sub-contractors.

6.2.3 Process
Although being a fast-track project, the design wasn't ready in time, due to a change in the management of the architectural office. Due to that, there was a delay of four months, so the building contractor had to build within even a shorter time then the 12 months agreed by the client. The second major problem regarding time, the project manager faced, was a possible delay in delivering in time the prefabricated walls. Although the contracts with main suppliers were signed a year before start of the construction, in the preliminary design phase, the supplier couldn't deliver in time. Time was to short to find another supplier, so; a solution had to be found in making a second mould for the walls and parallel execution of the outside walls.
The main building contractor had to reschedule again to finish the work in less then ten months. The shorting in time was realised by rescheduling the realisation plan working with concurrent activities as much as possible. By starting with the installations during the construction phase of the prefabricated walls, (only two floors lower), the contractor finally was able to succeed the target and finished the building in time and not facing the penalty for delay.

6.2.4 Object
Although the design took too much time, as described, the design product delivered was of good quality without many changes afterwards. The framework designed didn't change at all after the preliminary design phase. The building has advanced installations for heating and cooling as well as a second glass façade outside. There was a high level of integrating the design work of the installations design and the architectural design. The changes in design were not controlled very well to the opinion

of the project manager. Different versions of drawings, specifications of changes, could easily lead to higher costs, might go up to over 30%, if the building contractor would have focussed to that kind of things.

The costs of the project, due to the fast track procedures finally raised about 14% compared to the normal total building costs when the project was realised within 18 months. To the opinion of the project managers of SVB the Design & Built projects were better to control and a better quality was delivered for the same price, then in the turnkey projects.

6.3 HBG halftime project: World Port Centre Rotterdam

6.3.1 The project
This project concerned an office building in Rotterdam; the World Port Centre a design of Sir Norman Foster. In a sub-project as a pilot, the capabilities of using a Project Website to improve communications and to get a better control on the process of design changes as well as to shorten the change process and the co-ordination of the infra-structure in the building. All the technical drawings and reports and contracts were put on the Website. All the partners in the project team had access to the Website by electronic keys and passwords.
To realise this, the process was organised around a central controller on project manager's level. After each control and change loop with one of the designers as well as advisers in the design team the status was taken by the project manager and recorded before starting the next loop with another partner. The target on the aspect of time was to gain 50%. The team succeeded to reach this goal.

6.3.2 People
The team involved in the project Website was a highly motivated team all experienced in the use and working with computers and exchanging information by the use of Internet and email.

6.3.3 The Process
The results of the sub-project were: throughput time reduction, better accessibility and availability of information needed, better version control and archive structure, easiness and pleasure of archiving.
Positive experiences in terms of time, costs and quality were: Faster access to drawings, increasing information handling, time profit because of reduction of post time and easiness of Use. The quality of the change process raised because a better version control was achieved.
Negative experiences in terms of time, costs and quality were: The pressure to partners who don't work hard because the process becomes transparent to everybody involved. Everybody can see and watch who is working when on a drawing and how much time is necessary. The system dependency is growing. Validity as well as consistency of data is essential. Computer crashes can easily lead to accidentally stops in production of drawings and documents. Network speed can also be very annoying and irritating.

6.3.4 Object
Because all the partners had a better and transparent view on the information the object quality raised.

7. CONCLUSIONS

The paper shows by the review of the three case studies using the model developed and described in this paper, this model can be well used for analysing fast-track cases and gives a better view on the reduction of time concerning the aspects: People, process and object as well as new directions to improve substantially the aspect Time in fast-track projects.

Due to the process orientation of the case studies, there is not a high score to people aspects. Working with well-experienced partners in a team who doesn't need much explanation how to work together in good collaboration will certainly lead to reduction of throughput time.

It seems that the changes in the process made in the JHK project also can be adapted in the Breda-SVB project and will lead to shortening in throughput time. In fact, the Breda-case shows that despite the delay caused by the designers, the manufacturing process still could be improved to finish the project in time. It is made clear that the management of the design team needs better tools to control the design process and to discover deviations in the process in time. The HBG case shows that Electronic Document Management (EDM) can be an important tool to reach substantial goals in reduction of throughput time, up to 50% of the normal time with a lower risk to failures.

In terms of object, all three cases concern office buildings. It might be that for other types of projects, for instance schools and hotels the same constrains could be recognised, because there is a certain repetition effect in the design and construction of those types of buildings.

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