Fast-tracking by High Performance Design Teams

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FAST-TRACKING BY HIGH PERFORMANCE DESIGN TEAMS

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ABSTRACT

Among professional clients, there is a growing need for faster delivery of buildings. Until recently fast-tracking processes concentrated mainly on the construction process and concurrent engineering. Nowadays, more and more the awareness is growing that fast-tracking also has evidential consequences for the earlier design phases. Particularly in the case of a complex building project, where many design professionals and advisors are involved, a lot of professional, managerial communication and team skills of all project participants is required, as well as specialised methods, techniques and instruments.

Based on several recent Dutch fast-tracking cases, the paper explores the design, execution and management of fast-tracking design processes. The cases are discussed based on a small model developed in this paper, to analyse and design fast-track design processes. Special attention is 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, project website and construction case studies.

INTRODUCTION

Depending on the market situation, buildings to be delivered to professional clients mostly 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 might face a certain loss. However due to the complexity of modern buildings, throughput 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 should have 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 cases of complex building projects in which 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.

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 management, they also can be subject to fast tracking.

If the design process is considered within a context of fast-tracking, two triangle sets of aspects must be considered in their mutual dependency.

While every building project is realised within a physical, social, political and cultural environment, first this project environment has to be taken into consideration. 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. (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 terms of public law procedures, often can be critical, manipulations in terms of fast tracking can usually be defined concerning this aspect. In the starting assumptions 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 to specific risk management to protect the project. This aspect is not further discussed in this paper.

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

PEOPLE ASPECTS CONCERNING FAST TRACK DESIGN

Having a motivated design team always is a necessary pre-condition for acquiring a high quality architectural design – and even more so in case of fast track design. Fast tracking a design process not only puts a high claim on motivation, but also on professional skills and teamwork abilities. Maybe 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 delivery of the same type of designs as in the particular project. This not only concerns the individual designers but also the organisations from which they are working. Contractors often get a penalty fee every day a project is delivered later than 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 is a design organisation 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 out. 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, in cases of fast track projects, when selecting design firms, their IT-infrastructure is an important 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 maybe 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 have 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 than a threat.

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 temporary facility on the building spot itself, more or less isolated from their respective organisations.

While managing a fast track design team, a design manager 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, learning from failures and looking forward to how to speed up the process, might be far more effective than all the traditional techniques a design manager might try to implement.

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 projects mostly three fast track methods are distinguished:

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

**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 working hours spent beyond the normal daily schedule (figure 2).

![Figure 2: Reducing time by faster delivery.](image)

Executing design activities within parallel phases implies people working with insufficient design inputs working beside each other more or less ineffectively with an increase of interfaces to be managed between – artificially - separated design tasks. So on the one hand executing activities in 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 one hand can consist of extra co-ordination between the activities (interfaces), but on the other hand activities sometimes will be executed less efficiently, 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.

**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 into several sub-projects, which each can be specified from global to detailed. Every defined sub-project is managed separately. By doing this the project complexity is reduced to a certain extent, although the interfaces between the sub-projects are becoming more complex compared to the interfaces between the phases in a traditional project. In fact,
instead 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 manager becomes 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 in parallel (figure 4).

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

**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 in 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 substantially 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 the 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 its time reduction, might lead to more integration between structural and spatial concept and HVAC systems, so delivering better design quality.

**Other process aspects of fast track design**

In the 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.

Fast track design might imply specialised process forms for the building process organisation. Maybe the best way, in terms of quality to be obtained for fast-track design, is having a full network team (Prins, 1998). A full network team as an 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 parallelism in content, which does not necessarily have to be accompanied by formal parallelism 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](image)

Instrumentation can be another entrance for fast tracking. There is some evidence that the use of so-called Project websites for instance can increase the design process speed up to 30% because of the improvement of information handling. Computer-mediated communication is promising for a high performance team because time slacks, 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 interaction 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, 2001). 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 ordering of activities, work packages and phases becomes complex, the management of the interfaces between these constituent process elements as well as between the design team participants is becoming of essential importance.
Connected to that, good planning techniques have to be implemented. Output has to be specified clearly and detailed. Contract management has to be based on the outputs to be delivered in time as well as on the interfaces (more especially for instance the starting point of depending activities) between different outputs.

OBJECT ASPECTS OF FAST TRACK DESIGN

In this paragraph the output of the design process, as a set of object specifications is discussed within the context of fast-track design.

In the case of fast-track design, the use of a modular approach to the design object might be useful in defining design activities for the different design specialists - especially when the development of the conceptual design is a result of collaborative effort in which all designers act more pro-active trying to find the right solutions to the client’s brief. Combining these two approaches might yield a collective design process with collaboration of all partners starting from scratch in the conceptual design phase, and growing to individual design activities based on specific modular design parts, defined by all partners after the concept is agreed on 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, supply chain, construction process, and the site layout have to be considered as mutual dependent 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 those cases where the design is open enough to incorporate realised unchangeable parts. In this case design constraints, 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.

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.

Inland Revenue Automation Centre, Apeldoorn

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 through 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. What happened after this client’s decision is described shortly below. The case is described more extensively in Wilbrink (1999).

2. People
It was calculated by the client agency that a late delivery of the building complex 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 client’s demand, would imply being excluded from the project. The design fee was only slightly raised for the remaining part of the design.
The architect’s firm 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.

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 any more. 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 were engineered and specified, and sometimes even before the engineering was fully completed. So in fact in this case was chosen a form of concurrent engineering and construction. It appeared at several times that the information need of contractors was higher than 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 coordination 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 that if designers had informal bi-lateral consultation together, decision made had to be formally put on paper and reported to the project team meetings. Special attention was given to the central project archive. Besides a normal paperwork archive, a digital one, which could be easy accessed by the project team participants, was also developed and maintained.

When decisions within the design team meetings 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 were raised within this case.

4. Object
After the fast track assignment it was agreed that some of the technical advisors took a subsidiary 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 beside the architect and main designers. In fact this means that the initially integral design approach of the team transformed into a more linear sequential approach. It might be assumed this resulted in a certain loss of design quality.

Before the detailed design was completed the building design was divided into 23 parts, each of which could be designed and constructed concurrently as well as separately. As was mentioned before, dividing of the building design in parts was done to realise a process of concurrent engineering and construction. 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 moved to the other parts under construction, running more successfully at that certain moment.
Region office of the Social Insurance Bank (SVB) in Breda

1. The project
This project was one out of nine almost similar projects for new regional offices of SVB, a governmental organisation in the Netherlands. The total SVB-office organisation was re-shaped and organised and new workplaces were realised for all 2000 employees. The total operation had to be realised finally in the year 2000 because SVB wished to present its 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. There were three project managers involved, each acting as delegated client, who each managed three projects. Four projects were set up as turn key projects, the other five projects as Design & Built projects. The Breda office of SVB is the best representative example of a fast-track design & built project. The Design & Built partners were selected through a European tendering process. Both the designer, the Dutch architect Bonnema as well as the building contractor BMF, finally contracted in a Design & Built contract, were 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 - for instance, the prefabricated concrete outside walls. There was a high penalty per day for delivering the building late.

2. People
In terms of people there was a big difference between the design team and the team working on the site. Although the design team delivered a good result at the end, the architectural partner was hard to manage and problems with the schedule were not discovered in time. The project manager had to find out afterwards, that the management of the design office wasn’t capable to replace a design manager when the former one left the design office before finishing his job. Also different and overlapping holiday times of the participating designers wasn’t put in the schedule. The team at the building site was acting very much pro-actively, looking forward to anticipate to possible failures as well as learning from their own mistakes during the process and improving procedures for working together with different sub-contractors.

3. Process
Although it was 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 built within even a shorter time then the 12 months agreed with the client.

The second major problem the project manager faced regarding time 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, during 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 shortening 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.

4. Object
Although the design took too much time, as described, the design product delivered was of good quality without much 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 turn key projects.

**HBG halftime project: World Port Centre, Rotterdam**

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 were assessed 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 at project manager 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 was to gain 50% time saving. The team succeeded in reaching this goal. The costs of the extra procedure for control and co-ordination were a lot lower then the profit made in terms of time, translated to money.

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

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, ease 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 ease of use. The quality of the change process rose because a better version control was achieved.

Negative experiences in terms of time, costs and quality were: The pressure on 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 grows, rights and duties are very important. Computer crashes can easily lead to accidental stops in production of drawings and documents. Network speed can also be very annoying and irritating.

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

**CONCLUSIONS**

The small model developed concerning fast-track design processes can be well used for analysing fast-track building projects.

The Inland Revenue Automation Centre, Apeldoorn, case showed a fast track building project which can be characterised by it’s attempt to change the process procedures (in terms of the decision structure and phasing), and by its attempt for concurrent design and construction. To make the concurrent design and construction process possible, the design was interpreted as an object consisting of over twenty, relative independent parts, which each could be constructed separately.
The Social Insurance Bank (SVB) in Breda showed the importance of the building organisation form. Despite that the design partners failed to stick to their time targets, the main contractor gained so much insight that he was able to reschedule the construction process several times to keep the full project within its original planning limits. The penalty for not delivering in time was high enough to put in the necessary effort.

The World Port Centre in Rotterdam showed the importance of the implementation of an adequate ICT project infrastructure.

1. People
The case of the Inland Revenue Centre in Apeldoorn showed the importance of the experience level of the design team members. Fast tracking was possible while the architectural designers were familiar with the project. In this project the contractor was chosen on, in addition to other criteria, his explicit willingness and ability to execute a fast track construction process. A penalty system was introduced to guarantee in time delivery.

In case of the SVB bank only the positive attitude of the main contractor and his project manager rescued the building team to meet their original time targets. Although all participants were contracted for a fast track process, only the contractor appeared to be able to handle such a process.

The advanced ICT tools used in the case of the World Port Centre only worked while all team members were experienced, trained and motivated to use these kind of systems.

2. Process
In case of the Inland Revenue Automation Centre, Apeldoorn, the traditional formal phasing was left out to ease decision making. Although this might seems dangerous, in this project it worked reasonably well. Parallelism of the design and construction was also chosen, and this too proved to be successful. To handle the complexity of concurrent design and construction ICT support was used in form of a kind of basic Project websites.

The Design & Build organisational form showed its potential in the case of the Social Insurance Bank (SVB) in Breda. Although the designers failed to stick to their schedule, due to the penalty and the insight in the project, the main contractor was able to put the project back on time. Also, this case showed that the Design and Build organisational form delivered better project quality in case of fast tracking compared to a turn key building organisation.

The World Port Centre Project again showed the possibilities of modern ICT tools to improve project speed. By use of a so called Project website during construction, a 30% improvement in time occurred.

3. Object
Only the Inland Revenue Automation Centre in Apeldoorn case evidently showed the importance of fast track specific object specifications during the design stage.

4. Final Remarks
Each of the projects analysed in this paper showed a substantial improvement in delivery time, although in none of these cases all three aspects (people, process, object) according to our model were systematically used to support the fast track process. It might be assumed that a more systematic approach according to the framework described, will lead to even better throughput times than in the explored cases.
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