

AN EXPERIENCE OF INTRODUCING LAST PLANNER INTO A UK CONSTRUCTION PROJECT

Eric Johansen¹ and Geoff Porter²

ABSTRACT

The Last Planner methodology developed by the Lean Construction Institute is a production control tool which has possible benefits for improving planning in the UK construction industry. Its application has been considered in countries outside the UK but there is scope for considering whether it is a practical tool for use in UK construction projects.

The application of the methodology to a UK construction project was studied with a view to establishing the value of the tool and the possible barriers to its implementation. After training by the writers the method was developed for use on a project by the project team and applied to the main activities. The writers observed the process and interviewed the participants.

The methodology had some success in terms of improving structure and discipline in planning but there were structural and cultural barriers identified which need to be addressed before it can be fully successful.

KEY WORDS

Last Planner, lookahead, subcontractors.

¹ School of the Built Environment, Northumbria University, Ellison Place Newcastle upon Tyne, NE1, 8ST, UK. 0191-227-4720, eric.johansen@northumbria.ac.uk

² Sustainable Cities Research Institute, Northumbria University, 6 North Street East, Newcastle upon Tyne, NE1, 8ST, UK, geoff.porter@northumbria.ac.uk

INTRODUCTION

The Last Planner theory (Ballard 1994) is essentially a practical approach to planning in construction rooted in a production control philosophy. There is evidence of research into its practical application within national construction industries outside the UK (Pappas, 1999, Mendes Jr & Heineck, 1999, Conte, 2002, Fiallo and Revello, 2002, Alarcon, Diethelm & Roco, 2002). There is evidence of the theory coming to industry attention in the UK through its mention in demonstration projects in the Government's Rethinking Construction movement. This group has also begun to offer Last Planner seminars as a means to disseminate it to the broader industry but as yet there is little published research on its practical application in the UK industry to mainstream building construction projects. This paper seeks to describe the progress of a research project to improve planning within a large construction company through the application of Last Planner (Ballard 1994, 2000^{1&2}). on a pilot project. It identifies organizational and cultural issues which need to be addressed if the company is to make progress with this.

BACKGROUND

Northumbria University's School of the Built Environment have been involved with a regional division of one of the UK's largest construction companies, in considering improvements to their planning functions. The company, in benchmarking its performance since 1998, had identified production planning as an area which they wished to improve. A process of ensuring the transfer of existing best practice and attaining threshold performance levels was undertaken during 2000 to 2001. This used a model based on traditional planning theories and methods as the context for training courses for all managers and commercial personnel within the region. Northumbria University worked in partnership with the company in facilitating the development of the model and the training.

During the discussions in the process of developing the model the University introduced concepts from Lean Construction and particularly Last Planner. The criticisms made in work by the Lean Construction Institute of traditional planning regarding the failure to deal with the uncertainty in the process, the effects of dependency and variation and the lack of commitment to making plans happen were recognized by the company team.(Ballard 1994, Howell 1999, Lean Construction Institute 2001). However, at the time they were perceived as being interesting but untested and were not to form part of the model.

The company retained interest in the concepts but preferred a slow and steady approach to any changes. They believed that ensuring existing systems were working should be the first step in any improvement process. During the training process it became clear that managers at various levels within the company were also concerned about the areas criticized by the Lean Construction Institute and this feedback led the company to begin considering Last Planner as a theory which might be investigated further.

A useful indication of interest in the concepts came from within the company itself. The discussions of the issues during the model development resulted in one senior manager attempting to pilot his own "pull" planning system to try and improve planning on a project to produce apartments from refurbishing an existing "listed" building. The results of this indicated that there were many positives in terms of goodwill and commitment from the

participants and the use of first run studies but it was found to be still fundamentally linked to the schedule-pushed traditional approach to planning. Culture change problems also presented a key issue. An investigation of this took place as the first part of this research project (Johansen 2002).

The company was willing to part fund a research project to test the application of Last Planner on two of its large projects. Northumbria University was able to match the funding through its Sustainable Cities Research Institute and the research commenced in April 2002. The two projects involved were a new office building for a software development client and a new hotel. The office project was completed in March 2003 and forms the basis for this paper.

LAST PLANNER

Ballard (1994) proposed that construction was rooted in a “control” focus which made historic comparisons aimed at preventing “bad change”. However, Ballard believed that Juran’s idea of causing “good change” was more fitted to the problems of construction. Ballard has refined a theory since 1994 that seeks to improve planning by essentially turning around the traditional way of planning and making it a “*pull process*”. He called this the “*Last Planner*” (2000¹).

The Last Planner system of production control addresses the perceived planning problems in construction (Ballard 1994, Lean Construction Institute 2001). These endemic problems are considered to be those that produce the current failures of planning. Specifically construction does not manage the “*combined effects of dependency and variation*” (Howell 1999).

Johansen and Greenwood (1999) produced a model of construction planning that was based upon existing theory as seen from the perspective of the training and education available in the UK. It is a hierarchical model where planning is owned by managers and carried out by teams, including subcontractors. In it plans develop in detail from whole project to weekly and information gathering and accurate calculation of time and resources are also carried out. Control is by means of regular checking using accurate measurement of achievement. However, they proposed that this model was not matched by the reality of planning. The problems, associated with uncertainty and lack of quality resources, that they saw as existing in UK construction, produced a lack of ownership of plans, little time for information gathering and inaccurate activity durations based on guesstimation and with little input from subcontractors. Managers attempted to put float into all activity durations and used excessive overlaps. Control was poor with achievement of planned progress limited. They saw a self fulfilling failure in the lack of belief in the efficacy of planning because uncertainty meant that plans were produced inaccurately which resulted in more failure. They suggested that this failure of the process could be attributed to it being rooted in a hierarchical approach with a long term planning horizon. Ballard’s theory addresses the failure of planning to “cause” a desired future and breaks planning down into three main components some of which allow a reduced planning horizon. These are *Front End Planning*, *Lookahead Planning* and *Commitment Planning*”.

The corresponding outputs from these are the *Master Schedule*, “*Lookahead Schedule and Weekly Work Plan*”. The theory suggests that traditional control based planning produces

a forecast of what SHOULD be done then does it and compares it to what was done [DID]. It proposes that SHOULD needs adjusting to current reality and then, using lookahead and weekly planning, must be further adjusted to what CAN be done and what WILL be done. The lookahead schedule is a 6 week plan which seeks to identify and eliminate the restraints on the activities in the plan. This allows the “*Last Planner*” i.e. the person who makes the final commitment to what is done in the weekly plan, to choose from achievable assignments. The final component of the theory is the use of Planned Percentage Completion [PPC] as a measure of the performance of the planning system and as a tool for learning from plan failures. (Ballard 1994).

THE PROJECT - INITIALISATION

The project is a £25 million, four storey, office development in a major city in the UK. The project was procured through a design and construct contract with a repeat client. The objectives of the research were to test Last Planner, to engage the whole team including client and designers and to engage the "front end" managers in planning [including the subcontractors managers]. This was to be achieved by:

- Training participants in using the “Last Planner” system
- Involving Clients, Designers and Subcontractors in initial planning
- The use of “Lookahead Schedules” to ensure work is made ready to allow project objectives to be met
- Establishing the foremen as “Last Planner” and choosing weekly targets from the lookahead schedule that can be achieved. [Planning what “will” be done as opposed to what “should”]
- Driving improvement by having the team use analysis of percentage plan completion [PPC] on the weekly targets as the main metric.

The main contractor's Project Manager had some knowledge of Last Planner and was keen to test its use on the project. In addition one of the Planners from the Head Office had similar knowledge and was also keen to support the research.

The issue of involving designers proved a problem as the research team only became involved in the project after it had commenced on site. Initial training was therefore carried out with the main contractors team and the major structural subcontractor. The introductory training used production control games to highlight the issues and identify perceived advantages of Last Planner. This was followed by a series of meetings at which the application of the system was discussed in detail and examples from the Lean Construction Institute considered. The Project Manager took responsibility for developing the system to be applied to the project. The basis of this was:

- That the site team should be responsible for training the subcontractors to try and engender more ownership of the planning
- That the documentation needs to be user-friendly, demystified and with reduced jargon. A standard excel based A3 spreadsheet was used which included a bar

chart of the weeks work, a list of make ready needs and a make ready checklist and a Planned Percentage Completion [PPC] column with a reasons for non completion section. Additionally the sheet illustrated a miniature floor plan for each levels, which would be used for coloured shading as a visual plan. The Last Planners were encouraged to “own” the documents.

- The client had a representative who was expected to be involved in co-ordination and in the Last Planner system.
- The lookahead planning would be carried out by the main contractors Construction Manager and Site Agent who would act as "Lead planners" and would conduct the planning meetings
- As the main structure work was already under way Last Planner would concentrate on the finishing works. The Project Manager took the view in any event that the co-ordination of the finishing work was the stage of construction likely to benefit most from Last Planner techniques.
- A single weekly meeting was held on Thursday/Friday separately with each subcontractor. It was considered that a single meeting involving all of the subcontractors together was not a realistic option, bearing in mind the ‘culture shock’ that this might present to the subcontractors.
- The weekly meetings would commence with a review of PPC and discussion and then move to consider the next weeks target by considering blockages, constraints and alternative work faces. The focus of the meetings would be to minimize blockages
- An integral part of the process was the extraction from the Master plan of a floor by floor lookahead schedule by which the Last Planner sheets would be co-ordinated.

The Planner also produced a very clear and effective Power Point presentation that the site team used as a basis for training the subcontractors foremen.

THE PROJECT - LAST PLANNER IN USE

The University researchers carried out their work by observing the planning meetings regularly and by discussions of the process with the participants.

The client had been involved in early discussions of the programme with the main contractor although perhaps more in terms of negotiating the date than in trying to determine a realistic programme. While the clients representatives took great interest in the outcomes of the planning and discussed issues directly with the Project Manager they were not actually involved in the weekly Last Planner meetings but had a separate meeting with the Project Manager. Designers did not attend the meetings and were only involved peripherally in the planning as the subject of requests for information based on lookahead constraint discussions. It was accepted by the Project Manager that the involvement of clients and designers in

setting up the initial programme and continuing to be involved should have benefit on most project but it had not been fully possible here.

The weekly meetings always took place and produced a large time commitment for the Lead Planners. Approximately half of the subcontractors filled in the LP form in advance of the meetings but the other half relied on the Lead Planner to do the job with them in the meeting. Both approaches had some advantages. If the quality of the work produced by the subcontractors in advance was good then the planning system had better balance and there was an ownership of the plan. If the quality of advance planning was poor and the plan was only produced because the subcontractor perceived they had to produce something, such as in the concept of "show pipe" (Koskela and Howell 2000), then the other approach had advantages. Although it increased the workload for the lead planners it did introduce elements of detail discussion and consideration of the plan with the resultant reduction in uncertainty. It also acknowledged the reality that some subcontractors will not either sign up for or be capable of planning within the terms of the Last Planner system. Other research into practical applications of Last Planner have described the use of common meetings where co-ordination discussions between subcontractors can take place (Pappas, 1999). In this model the Lead Planner took this responsibility.

A key issue which arose was the managerial level of the Last Planner. The meeting needs commitment from a representative of the subcontractor who has both the power and authority to commit and the knowledge of the project and its weekly needs and restraints to ensure that the planning is practical and relevant. In some cases the subcontractors Last Planner was a visiting supervisor who was not on the project all the time. Another aspect of this was that some of the operatives were on a piece work payment system which encouraged them to concentrate on "bulk" work for which they received a higher rate of pay. This resulted in their supervisors having less control over the workforce and a reduced ability to make commitments.

The system did promote effective discussion of availability of workfaces and alternatives as well as an improved anticipation of blockages caused by other trades. It allowed the opportunity to reshuffle work when unexpected problems occurred. The visual planning using coloured floor plans worked particularly well in this respect although they did throw up a side issue in the unavailability of coloured copying facilities.

A general – although certainly not exclusive – trend to emerge was that higher levels of detail provided on a Last Planner form tended to produce higher percentages of completion. This appeared to support the idea that the more time spent on planning the more chance there was of achieving the plan. However there was clearly a trade-off to be sought between the time spent by the Site Agent on planning activities, and time needed for him to co-ordinate activities on the site.

THE PROJECT - LAST PLANNER REVIEWED

The Last Planner process as used for this project was subject to a final review discussion as the project came to a close. Taking this review and the researchers' observations into account certain positive and negative comments can be made.

The team believed that the Last Planner system adds value through structuring the planning and giving discipline to the participants. However, it needs to draw in the more

undisciplined subcontractors and they need to improve their skill base to make it work. One of the Lead Planners said *"For me it is a great tool, it helps me to coordinate and to see the whole job"*. He thought that it particularly focussed the main contractors managers on thinking about the detail of next weeks work and that the structure and discipline imposed was invaluable. There was a dichotomy in his argument in that he also said that he was not fully convinced of its benefits relative to the time he had to take with it. The concern was that the better subcontractors already perform well and he has to spend less time with them [approximately 60% of his time was spent on Last Planner]. He believes that improving the quality of all subcontractors to that of the best will ensure that high quality planning and coordination will occur. The feedback also suggested that there was a clear need for additional resources to verify achievement of the plans and to gather information. This was translated as a request for more planners to be involved. However, this does raise the issue of what managers are supposed to do when they are not planning. The apparent cultural need to be *"out on the park"* solving problems rather than planning them out of the project seems to be alive and well even in projects with a positive attitude to improving the process.

The Project Manager illustrated one of the positive issues arising from the process by pointing out that he had not intended that the external works be carried out using Last Planner but that the manager on this section had made a specific request to use it because of his perception of its success on other sections. In particular this manager was impressed with the way the planning message was communicated. The simple visual nature of the Last Planner form appeared to help the subcontractors to understand what was going on. The Lead Planners however, saw that the level of detail needed to go beyond the simple communication to deal with look-ahead issues imposed a high workload.

The system was considered very useful for prompting discussion of make ready issues but there were problems with ownership of the look-ahead. To enable a proper look-ahead needs information gathering from a range of sources including the subcontractors themselves. In reality the Lead Planners expected the Last Planners to provide some of this information and they themselves felt that it was not a job they had time to do completely. For a lot of the subcontractors the Lead Planners had to take on this task, because the subcontractors did not have the skills or capability. Often this meant that the lookaheads would be based on what was needed for next week rather than the medium term [6 week] consideration recommended in the theory. This again raised the issue of support for the Lead Planners from a planning resource who could verify achievement and gather information. One comment was *"The Lead Planner needs to be the co-ordinator and ensure that lookaheads are produced [and probably needs to be full time]."*

The use of Planned Percentage Completion as a tool for improvement had a limited impact on the performance of the project. The main question here was how to interpret the 'no blame' culture of Last Planner. For example, some of the more battle-hardened subcontractors would only agree to unchallenging weekly targets, in order to give themselves an easy time. Sometimes the failure to meet a target would result in protracted discussions about the extent of failure, without any clear conclusion, so as to avoid apportionment of blame for what was essentially a general failure of many subcontractors to provide adequate levels of labour on site to meet the agreed weekly targets.

The major problem with making the system work was the performance and abilities of the subcontractors and the system under which they were appointed. For the weaker subcontractors the main contractor ended up planning for them, which engendered no ownership of the plan. What the main contractor was seeking to achieve was the subcontractors to do their own planning and for the Last Planner meetings to be about discussing refinements and interfaces. The lack of ownership of some of the plans also produced problems because of the inadequate level of the supervisor attending the meeting or the method of payment and control of their workforces.

There was little evidence of the use of high quality performance data by the subcontractors. The Lead Planners in many cases had to either assume that the performance proposed was normal or use their own judgement. No "first run studies" were carried out.

One of the major problems on the project was the under-availability of subcontractor's labour on the site. Most of the subcontractors appear to have over-reached their capabilities in their commitment to labour supply especially as the current demand for skilled labour is particularly high in the surrounding area. The project was consequently always struggling to keep pace with the master schedule and the key Last Planner requirement of "sound assignments" was challenged. Sound assignments were theoretically possible with the available workforce but often the available workforce was insufficient to meet the project needs.

The trend towards the end was that this resource pressure became the major problem. The subcontractors seemed to work on an inter job resourcing process based upon "*the loudest shouter gets the resource today*" and little pressure could be produced even on preferred subcontractors to improve this.

The option of weekend working was used but this is costly and tends to be less productive than weekday working, so although weekend working took place, this was of limited value. There was a cultural problem with some of the workers ("*We finish at 3.30*") which is not conducive to meeting tight targets. There was also a limited incentive for subcontractors to perform, as they know that the main contractor will pay the overtime to try to catch up on delays. This is a repeat client with whom the main contractor has a long term relationship and the subcontractors are aware of this. In fact, some of the subcontractors are preferred contractors who also are part of a long term supply chain arrangement with the main contractor but this does not seem to influence their performance.

Labour Resource forecasts from subcontractors do not exist in anything but a general way so the main contractors managers rely on their own assessment or the general promises of subcontractors in pre-start meetings for what should be on site.

Towards the end the main production driver became completing the project. The "snagging" [punch list] process meant that many small activities took on a significance in terms of progress which had not been considered in detail before. Uncertainty was high and the sheer time involved in managing the number of subcontractors and the interface issues meant that real planning ceased and the detailed Last Planner meetings were discontinued.

CONCLUSION

The culmination of the problems was that the target handover date was missed by several weeks. Although the client was given phased access and was generally not unhappy [approximately 9% extra work was carried out during the project] the Project Manager was extremely disappointed that this might be seen to indicate the failure of Last Planner. In fact, although it is difficult to quantify, the Project Manager and the team believe that the use of Last Planner certainly helped to avoid a more substantial over run.

Last Planner training was effective up to a point in that it introduced the subject of weekly performance planning to the subcontractors. However, there is evidence that some of them did not accept the premise that there is anything wrong with construction planning despite the message of the training. There seems to be a cultural issue in getting the subcontractors to adopt the methodology in a comprehensive way. This needs time, but even then the commitment was patchy, with some subcontractors adapting well and others effectively paying lip service to it.

This limited study has considered how the Last Planner methodology can be applied to UK building construction and suggests that there are cultural barriers that need to be overcome before it can be fully effective. Having observed the application of a Last Planner model on this project the researchers believe that the system still has validity as a tool but that there are lessons for the company to learn. The researchers consider the company to be representative of UK contracting as a whole, and also believe that these lessons have validity throughout the whole UK building industry.

The specific aims were to test Last Planner (which has been achieved), to engage the whole team including client and designers (which has not been fully achieved), and to engage the "front end" managers in planning including the subcontractor's managers (which has also been achieved). However, the study has raised a number of important structural and cultural problems for the success of Last Planner in the UK.

In UK building construction, work tends to be carried out by subcontractors. Time pressure on lead-ins means that commercial pressure to "do the deal" takes precedence over production issues. Centralised Estimation may often spend little time on vetting the production capability of subcontractors. There is a limited consideration of the relationship between price and performance. The basis for close relationships with subcontractors needs consideration. These relationships should ensure that commitment and the quality of provision is high. It is clear from this project that some subcontractors with preferred status feel that they could get away with a limited commitment to next week's targets, perhaps due in part to their over-confidence in their relationship with the main contractor, and in part to the relative scarcity of the resource they are providing. Some subcontractors are simply not committed. There is a lack of understanding of the project needs by the subcontractors. The culture is that the Main Contractor carries the responsibility and some subcontractors actively avoid taking on certain aspects of responsibility themselves. For Last Planner [or any other planning system] to work subcontractors have to have a wider job knowledge which goes beyond just their own work. There is a clear need for better training of subcontractors in planning and understanding the processes with which they interface. In particular subcontractors must provide high quality performance data and resource forecasts. Consequently the Last Planner methodology may need contractual commitment, and links to

stiffer penalties for under-performance. Here lies a paradox, however, in that such a contractually bound approach would have potentially negative side effects on the 'no blame' culture required under the philosophy of the Last Planner system.

A final point to stress about the approach of the construction industry in the UK is that Master Schedules tend to be put together much too quickly both during and following award of contract, and consideration needs to be given as to how this can be refined before more detailed construction planning is attempted. Although this was not tested on this project it is felt that the involvement of designers and subcontractors, as well as clients, in the initial and subsequent planning of projects is essential. Perhaps Last Planner should not be considered in complete isolation and needs to be applied as part of the whole of the Lean Construction Institute's Lean Project Delivery System. (Ballard 2000²)

Whatever the background to the inception of the project, the Project Manager must use whatever tools will help deliver the project to specification and Last Planner appears to offer an important opportunity in this respect. However, in the method used here it is necessary to clarify the role of Lead Planner and the responsibilities for the Lookahead Plan.

REFERENCES

- Alarcon, LF, Diethelmand, S, and Rojo, O (2002) Collaborative implementation of Lean Planning systems in Chilean construction companies. Paper presented at the *11th Annual Conference of the International Group for Lean Construction*, Gramado, Brazil, 6-8 August 2002.
- Ballard, G (1994) The Last Planner. *Northern California Construction Institute* 22-24 April 1994, available at <http://www.leanconstruction.org>
- Ballard, G (2000)¹ The Last Planner™ System of Production Control, *Unpublished PhD Thesis*, School of Civil Engineering, The University of Birmingham.
- Ballard, G (2000)² Lean Project Delivery System – Revision 1, *LCI White Paper 8*, Lean Construction Institute, available at <http://www.leanconstruction.org>
- Conte, SIC, (2002) Lean Construction: From theory to practice. Paper presented at the *11th Annual Conference of the International Group for Lean Construction*, Gramado, Brazil, 6-8 August 2002.
- Fiallo, M and Revelo, VH (2002) Applying the Last Planner control system to a construction project: A case study in Quito, Ecuador. Paper presented at the *11th Annual Conference of the International Group for Lean Construction*, Gramado, Brazil, 6-8 August 2002.
- Howell, G A, (1999) What is Lean Construction -1999? Paper presented at the *7th Annual Conference of the International Group for Lean Construction*, University of California, Berkeley, 26-28 July 1999.
- Johansen, Eric and Greenwood, David (1999) Hard, Soft or Lean? Planning in medium sized construction projects. *In: Hughes W, (Ed.), 15th Annual ARCOM Conference*, 15-17 September 1999, Liverpool John Moores University. Association of Researchers in Construction Management, Vol. 2, 385-394.
- Johansen, Eric (2002) The application of a pilot pull planning system to construction projects. *In: Greenwood D J, (Ed.), 18th Annual ARCOM Conference*, 2-4 September 2002, Northumbria University. Association of Researchers in Construction Management, Vol. 2, 761-770.

- Lean Construction Institute (2001) Last Planner Application Guide. *Lean Construction Institute* April 2001, available at <http://www.leanconstruction.org>
- Mendes, R and Heineck, LFM (199?) Towards production control on multi-story building construction sites. Paper presented at the *7th Annual Conference of the International Group for Lean Construction*, University of California, Berkeley, 26-28 July 1999.
- Pappas (1999). Extract from: Evaluating Innovative Construction Management Methods through the assessment of intermediate impacts. Thesis for a “Master of Science in Engineering”, University of Texas at Austin. available at <http://www.leanconstruction.org>