



Last Planner™

collaborative conversations for
reliable design and construction delivery

*The **Last Planner System (LPS)** manages the relationships, conversations and commitments that together enable programme & production planning decisions to be made collaboratively at the lowest possible level in a whole range of one-off production settings — software development, ship building, yacht fit-out, one-off manufacture and construction. By promoting conversations between trade foremen and site management at appropriate levels of detail before issues become critical, LPS is creating significant improvements in programme predictability, productivity, profit, safety and feelings of wellbeing among project staff.*

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A Director of the Lean Construction Institute UK www.lci-uk.org, **Alan Mossman** trained as an architect and then worked for many years as a management and organisation development consultant. He only returned to construction in around 2000 building on his knowledge and understanding of collaboration, systems thinking, quality and lean. An accredited Last Planner trainer, he coached a number of teams implementing Lean and Last Planner for clients such as Kier Western, Moss, Robertson, Grinaker-LTA, Pearce & CLIP. He keeps up to date with the continuing development of lean thinking applied to design & construction through his connections with colleagues in the Lean Construction Institute in the US, UK and elsewhere in Europe. He is exploring the use of Last Planner as a Logistics Planning System. From 2005-07 Alan was founding Director of Constructing Excellence South West. He is co-editor of the Lean Construction Journal www.leanconstructionjournal.org and writes an occasional blog at www.thechangebusiness.co.uk



A major source of uncertainty, frustration and waste in projects is waiting — waiting for access, design information, materials, plant, waiting for the previous trade or design team to complete work. When one team is late delivering, follow-on teams are prevented from starting when they planned to and work ceases to *flow*.

"The Last Planner System [enables] our site supervisors to **plan their workload on a weekly basis** and assess their team's performance on a daily basis [and] to make an accurate prediction of the labour required on a weekly/daily basis. **This plan is based on facts, not a site manager's wish list...** Once supervisors understand ... Last Planner, and are confident in using the documentation, it can reduce the frequency of senior management visits to site. The foremen are capable of handling situations as they arise as their decisions are based on facts that are documented weekly."

Nick Wain, MD, Image Decorations Ltd

Creating value in construction

Value is what the customer/client/end-user wants. It is defined by the client and often involves the end-user in some way – in the case of a hospital or school for example this could be through research which shows what building attributes are associated with faster patient recovery or improved student behaviour and results.

Creation of **value** in construction, as in manufacturing, requires the **transformation** of materials. Unlike manufacturing, there are seven flows—people, information, equipment, materials, prior work, safe space & safe working environment—required to come together at the workface to enable construction transformations to **flow**. If any one of the seven is interrupted or out of sequence value cannot be created¹.



Figure 1: the seven construction flows

This still applies on projects where sub-assemblies are manufactured off-site. Value creation only occurs as the sub-assemblies are added to the structure on-site.

Within projects there are conflicting objectives. For each trade contractor (and often each design team member too) there is a clear desire to optimise the use of personnel across a number of projects. The same is true for the lead constructor and, in addition, the lead constructor's project team are seeking to optimise their project's delivery process.

Managing this level of complexity requires a high level of collaboration, communication and commitment. *CPM* based project management tools on their own are inadequate to the task as they only focus on one of the flows – prior work².

Location based planning methods such as *Line of balance* see *safe space* as the major constraint – and base planning on that.

1 The flow, transformation, value theory and the identification is of the seven flows is due to Prof Lauri Koskela of the University of Salford, UK.

2 Lauri Koskela and Greg Howell wrote the critique of CPM based project management methods referred to here.
<http://galbarello.googlepages.com/ObsoleteTheory.pdf>

Ignoring trade contractors' legitimate objectives doesn't help as that makes it difficult to have conversations about the issues that inevitably arise.

Last Planner helps manage flows

The Last Planner System (LPS) manages all seven flows by building relationships, creating conversations and by securing commitments to action at the right level at the right time throughout the process. LPS is a simple tool suited to smaller projects that is also used on larger projects such as £4.2bn Heathrow T5 and £400m N Staffs Hospital PFI. All that is required for smaller projects is post-it notes, paper, pencil, eraser and photocopier. As projects grow, generic software such as MS Excel and then bespoke software such as *SPS Production Manager (ProjectFlow)* can be helpful. The system only works effectively in the context of whole system thinking and a learning culture. *Command and Control* thinking or a blame culture will quickly destroy any benefits.

LPS was developed by **Glenn Ballard** and **Greg Howell** of the Lean Construction Institute (LCI). Last Planner is a registered Trade Mark of LCI. LCI, Ballard and Howell are happy for constructors to use LPS to support delivery of their projects and would appreciate it if constructors joined LCI. For more information see "Learning Last Planner" page on the LCI website www.leanconstruction.org. They particularly request that those trainers and consultants outside constructors who want to teach Last Planner read the section on *copyright and trademarks* on that page. NOTE: this document is not a full description of LPS.

5 crucial conversations

Recognising that personal relationships and peer pressure are key to managing the network of production relationships and commitments required to deliver quality projects on-time, LPS creates conversations at the right level and at the right time to build trust between key project performers — the *last planners* [i.e. trade foremen on site, design team leaders] and overall project managers so as to increase the chances that work flows.

Any company with schedule slip as a standard part of their business is a candidate for the Last Planner System.
**Owen H Howell, Vice President Operations,
Burger Boat Company.**

It is these *last planners* who collaboratively plan production week by week and ensure that tasks are ready to be done when planned. They use continual improvement to improve both planning and production. Last planners and project management collaboratively plan the sequence of the work for each phase of the project so they understand the overall process before work begins.

There are five key conversations that together make up the Last Planner System. Each brings its own benefits. When all are working together they reinforce each other and the overall benefits are greater. The *conversations* are:

- **Collaborative Programming** (or scheduling) — creating and agreeing the production sequence (and compressing it if required)
- **MakeReady** — Making tasks in the LookAhead period ready so that they can be done when we want to do them.
- **Collaborative pull-based Production Planning** — collaboratively agreeing production tasks for the next day or week
- **Production Management** — monitoring production to help keep all activities on track
- **Measurement, learning and continual improvement** — learning about and improving the project, planning and production processes.

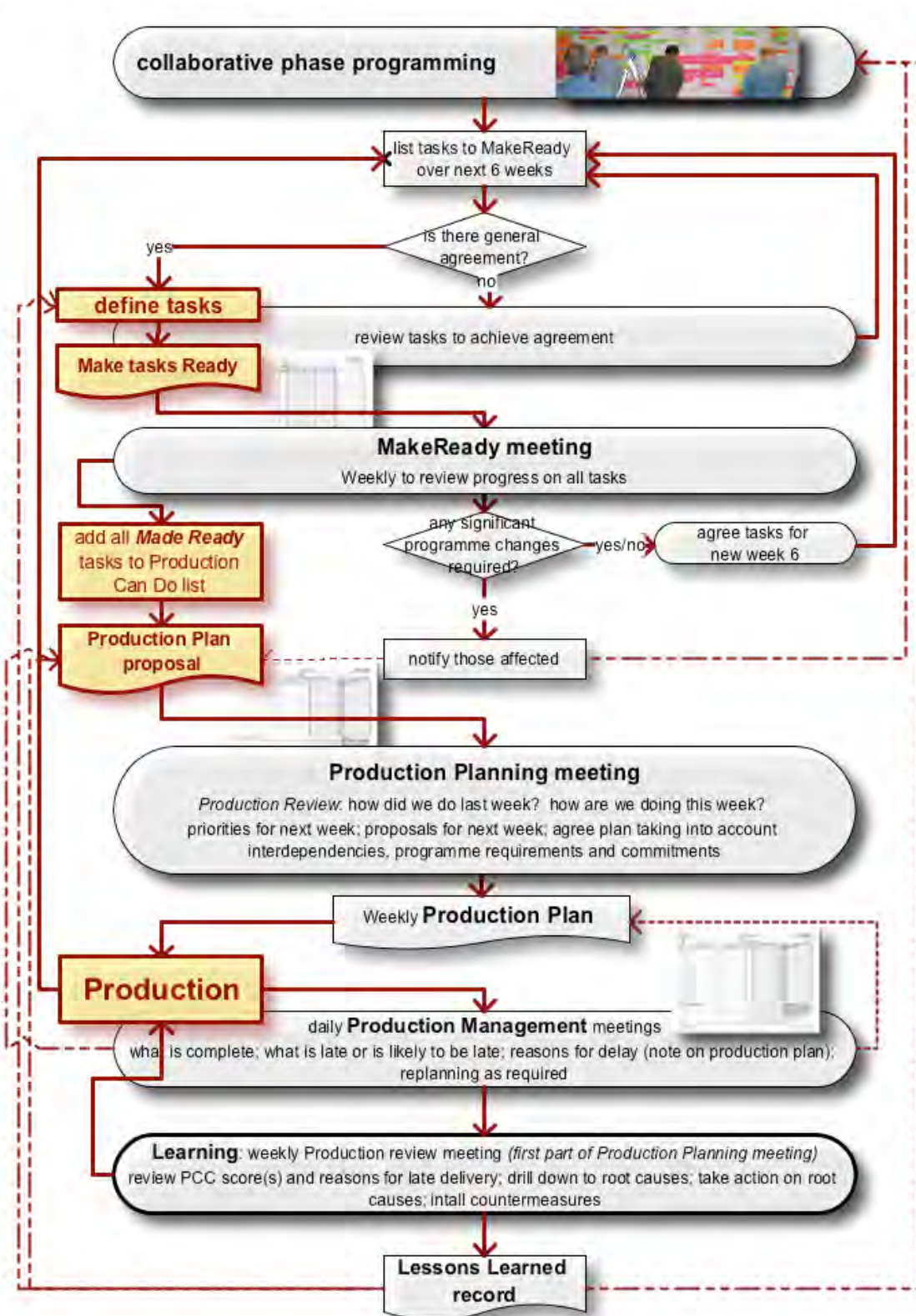


Figure 2: the collaborative process for Production Planning

LPS can work as well with the design process as it does in construction. Some elements have been used to plan the delivery of tenders and to plan the work to be done in phases of PFI/PPP projects leading up to financial close.

One of the few tools to be mentioned explicitly in the UK *Rethinking Construction* (Egan) report in 1998, LPS became required practice for all BAA projects from 1999 and

subsequently by other clients such as Waitrose and Carphone Warehouse in UK and Sutter Health in the US.

Many contractors in a number of countries now use some or all of LPS as part of their standard operating procedures for project delivery, recognising the benefits of more reliable programmes and greater involvement of the whole team; of issues identified and resolved before getting to site rather than emerging part way through the build; increasing the chances that work will flow and projects will be completed on time.

**Bad news makes good information.
Bad news early is even better.**

Last Planner is now used elsewhere too — new product development, one-off manufacturing (including shipbuilding) and software development.

A mature implementation of Last Planner will probably begin with a phase programming workshop for the first phase, but if this is your first implementation it could well start part way through a project. Just the implementation of daily or weekly work planning can help to stabilise a project so that other elements can be progressively introduced. This is particularly useful where an existing project is running behind schedule.

We do it already

Many project managers do some or all of these things already—to a degree. Last Planner is a formal and rigorous discipline. It consists of a system of inter-related elements and it is only when *the full set* is systematically implemented over time by the whole project team that the major benefits will be appreciated. Greatest benefit is likely when an integrated team use Last Planner consistently over a number of projects.

Signals that you are not yet *doing it* include:

- work done out of sequence
- sub-contractors with no sense of ownership of the programme
- operatives with no idea of what work there is for them the day after tomorrow.
- project dominated by fire-fighting
- work pushed into production by the programme

Production planning

Throughout the project there is a regular production planning meeting (PPM) involving all *last planners*. It generally lasts less than an hour. In very tight projects shorter daily work planning may be necessary, but generally the PPM is weekly. The purpose of the PPM is to plan the work that will be done in the next period bearing in mind the work that is being done now and in the knowledge of work that **can** be done.

**With every pair of hands
comes a free brain.**

Each last planner/team leader proposes a production programme for her or his team. In the PPM, team leaders explore any inter-dependencies between proposals — conflicts of space, resources, access or equipment for example. As team leaders get used to the discipline of Last Planner they will do a lot of negotiating immediately prior to the meeting. Even then, nothing is finally agreed until everything is agreeable within the context of the PPM. One cause of late delivery at this stage is team leaders who over-commit. It is in every team member's interest to prevent this happening.

Last Planner – collaborative short-term production planning

Proposed production plan		Date entered: Monday 25 August 2008									PPC analysis	
Task description		Final MakeReady needs		when will the work be done?							PPC analysis	
		Work that must and can be performed prior to the release of the task		who will do the work?							Reasons for late delivery*	
				M	T	W	T	F	S	S		
Plan A												
ref												

Figure 3: part of a Production Plan form used by trade foremen & design team leaders for PPM (pt).



Figure 4: a Production Planning Meeting

There are two rules for collaborative production planning:

- If you promise to do it, get it done
- If it cannot be done, don't promise to do it

In the next section we will look at how you might know that a task cannot be done. First let us look at some of the benefits³ of systematic and collaborative production planning:

Benefits of PPM in the context of Last Planner:

- *maintains commitment to the intention of the project and current client concerns*
- *suppliers prepare better because they know what's expected of them*
- *builds relationships with & between supplier team leaders*
- *focuses attention on what can really be done.*

The PPM alone will not realise these benefits week-in week-out. Trade foremen can only reasonably commit their teams to deliver a particular piece of work if the work **can** be done. Just because a task is on the project programme doesn't mean it can be done — there may be inadequate design information, pre-requisite tasks incomplete, resources or materials not available or any of the other seven flows broken. LPS has a systematic *MakeReady* process to ensure that when work is programmed for production it CAN be done.

MakeReady

Earlier I referred to seven flows – all of which are essential to creating value in construction. There is no point in putting a task into production if any one of the flows is broken. The MakeReady process systematically checks that everything is in place for each of the tasks in the LookAhead⁴ window. At least a weekly activity, it continues throughout the project.

Benefits of the MakeReady process:

- *tasks are ready for production when required*

3 The benefits in blue are from a variety of LPS users in the UK and US, both managers and operatives.

4 The size of the LookAhead period varies – usually between four and eight weeks. Any flow with a longer leadtime than the chosen LookAhead period becomes an item in the programme so that it is not forgotten.

- safer working — planning involves hazard analysis and method statements
- greater certainty of time, materials and equipment — less waste

The MakeReady process is based on the Activity Definition Model:

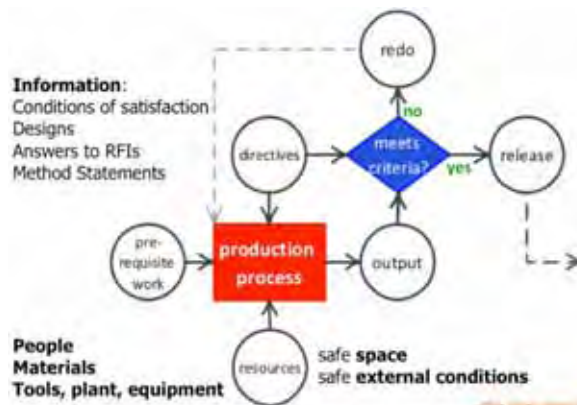


Figure 5: Activity Definition Model

Directives enable tradespeople to recognise whether they are doing a quality job safely – or not – self- inspection. Pre-requisite work is prior work done by other trades and resources covers the remaining flows that are required to complete the task. MakeReady progress is recorded on a simple tick sheet like the one in Figure 5.

Together PPM and MakeReady go a long way to improve the way the work works in a project. They are even more effective within the framework of an agreed, collaboratively produced project programme (or schedule).

Figure 6: MakeReady form for guiding and documenting the process of making tasks ready (part) note: only the four flows most relevant to design are included in this version of the form

Traditionally programmes are prepared by professional planners and project managers — *first planners*. To do this they make many assumptions — and build slack into the programme to compensate for these uncertainties. First planners may consult members of the delivery team if the packages have been let, but delivery team members will not easily give up buffer when they are uncertain about whom they will be working with and what the project involves. The first planner programme is generally imposed on the project. Projects are then managed in terms of what the programme says *should* happen. It often requires work to be done that cannot be completed at the time set in the programme because one or more of the flows is broken.

Collaborative programming

LPS is a programme coordination and production control system designed to ensure the achievement of *agreed* goals. Those goals are set in a *collaborative programming process* so that all the main suppliers and specialist contractors are engaged right from the start in developing and signing up to the master programme and to the programme for each phase.



Figure 7: programming the production of detail design drawings for a factory

A number of UK constructors *only* use collaborative programming. They get significant benefits from doing so but miss out on many others by failing to support the collaborative programming with collaborative production planning, management and systematic learning from experience quite apart from systematic MakeReady.

Systematic risk analysis is integral to collaborative programming. Float is included to protect programme integrity and predictability.

When all major players meet early in the process it's possible to discuss critical interdependencies, test assumptions and agree on good practice.

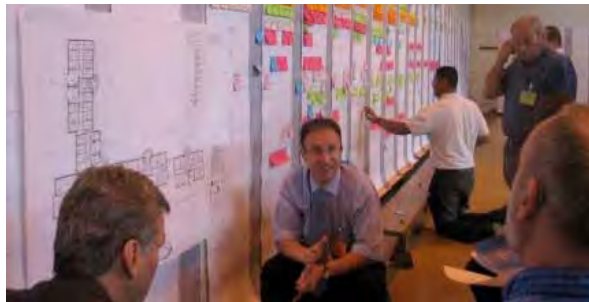


Figure 8: Review of construction sequence (front) while others continue to create the programme for a student housing scheme.

Sven Bertelsen, a Danish Engineer and consultant, described the range of uses of a collaboratively produced programme:

- a **workplan** of what *should* be done
- an **organisation chart** - who does what?
- an **agreement between trades** (or design teams) about when to start and when to finish
- a **logistics plan** defining when we need materials, trade teams, drawings etc
- a tool for **workflow control** - when we want to do which tasks
- a basis for monitoring progress

Benefits of collaborative programming:

- *prepares team members for action together*
- *team members discuss details much sooner*
- *sorts out sequencing & other issues that would be difficult to change later; issues sorted on paper rather than at the workface*
- *enables team to test options to improve work flow, buildability and programme reduction*
- *identifies unclear design details*
- *builds commitment to programme and reduces overall programme period.*

Construction logistics

LPS is a Logistics Planning System. Logistics involves more than just materials*. MakeReady ensures that all seven flows — information, plant, equipment, materials, people etc — are flowing to the workface so that tasks can be done when required.

Collaborative programming is an opportunity to confirm a detailed logistics plan and secure agreements to key logistics decisions.

Production Planning is a signal to the logistics team about when it will happen and PPC (see below) is as much a measure of *logistics* team effectiveness as it is of the project as a whole.

* For more on this see "More than materials: managing what's needed to create value in construction" — downloadable from <http://www.thechangebusiness.co.uk>

Programme compression

With an agreed programme it is possible to explore ways to compress the programme if this is desired or required. With a supply team that have worked together on a number of similar projects previously, one UK constructor took 6 weeks out of a 20-week programme using this approach. This clearly has enormous benefits for their client — their building is

earning significantly earlier. It also has benefits for the main contractor and their suppliers — they are more competitive — reducing the programme itself reduces cost — and they all stand to make a larger margin.

Some claim that it is generally possible to **reduce programmes by about 20%** using collaborative programming and I have certainly seen that done on supermarket fit out programmes (twice) in addition to the examples cited here.

"Results show a **30% improvement in the rebuilding times for runways** since Last Planner was introduced and predictability is greatly improved." **Gerry Chick, Supply Chain Development Manager, BAA**

"LPS is an effective set of tools for leveraging the shared knowledge of all members of the project team. Without LPS a project manager is guessing at what can be accomplished versus knowing how the job will get done." **Tom Richert, Programme Mgr, Linbeck Construction**

One constructor showed an airport upgrade project could be delivered in 16 weeks instead of the 21 or 22 weeks that *first planners* thought it would take. In a subsequent workshop they managed to get that down to 12 weeks.



Figure 9: intense concentration & discussion during a programme compression workshop

For another constructor collaborative programming and compression rescued a 70-week programme that was running about six weeks late after 30 weeks. From the time of that

workshop, involving all the major suppliers on the project, Last Planner was used to help keep the project on the agreed new track so that it came in on time.

Securing reliable promises

A contract is a formal promise to the client to deliver the project by a certain date in a specified condition. Within the project it is helpful to think about the production plan as a record of promises made to the wider project team.

The agreed programme defines when tasks should be done and acts as a request to the supplier to do that task. The *last planners* only promise once they have clarified the *conditions of satisfaction* including the due date and are clear that the task *can* be done — i.e. they have the capability, materials labour, information, etc. to do the work.



Figure 10: the promise conversation cycle

Once the task is complete the *last planner* responsible *declares delivery* so that site management or the team responsible for the next task can assure themselves that it is complete to an appropriate standard.

The discipline of managing promises improves the way operatives engage in the project. They become members of a *team* intent on fulfilling the overall promise to the client. They cite the effect of peer pressure following their public commitment to deliver and demonstrate initiative in keeping promises and adjusting to the changing performance of others so that the overall project is a success.

Collaborative programming, MakeReady and negotiation in and around the PPM all help trade foremen promise reliably. Continual Improvement — the fifth key conversation in LPS — can further increase promise reliability and the predictability of production plans.

Production Management

Construction is a social process. Peer pressure works so long as there is a shared sense of responsibility for project delivery. The Collaborative Planning and WWP conversations particularly help to develop that. A daily stand-up meeting on site or a brief morning telephone conference of design team leaders lets everyone know what was completed yesterday, allows early warning of any late delivery and last minute adjustments.

Measurement, learning & continual improvement

Our task is not to fix the blame for the past, but to fix the course for the future. John F Kennedy

All these elements together contribute to more predictable and reliable work-flow. It is only by adding continual improvement processes that we systematically learn how to work more effectively together, to make the work programme ever more predictable. They also contribute to the quality of the finished product as the process significantly reduces hurry and wait and smooths work flows.

Last Planner – collaborative short-term production planning

Within Last Planner there is a measure of predictability of work delivery — **PPC** — the **P**ercentage of **P**romises **C**ompleted on time. At the PPM each team leader promises to complete one or more activities by a given day of the next week. Used to improve production reliability, PPC measures the proportion of promises made that are delivered *on time*. LCI research shows that where Last Planner isn't used, PPC is typically 30% overall — only 1 in 3 of the tasks promised for next Tuesday will be delivered by the end of that day!

Studies in both the US and the UK show that there are step changes in productivity and margins with a PPC around 75% and 90%.

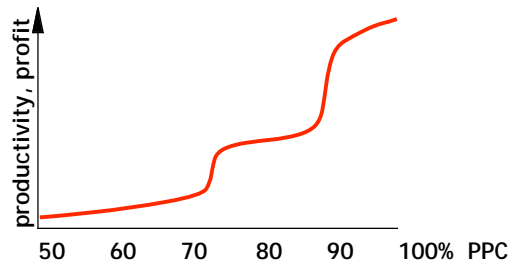


Figure 11: productivity, profits increase with PPC

Tasks Made Ready (TMR) is a great predictor of the PPC and a good measure of the quality of the MakeReady process. Measurements are only indicators of improvement.

Reason occurrence	
Unclear information	X X X X X X X X X X X X X X
Too few operatives	X X X X X X X X X X X X X X
No promise to deliver	X X X X X X X X
Client/design change	X X X X X
Overrated capacity	X X X X X
Late request	X X X X X
Unclear requirement/CoS	X X X
Pre-requisite work	X X X
Failure to request	X X
CoS not made clear	X X
Rework	X X
Other	X
Absent operatives	X
Unplanned work	

Figure 12: example of a reasons Pareto chart

Part of the **continual improvement** of TMR & PPC scores and programme predictability is a study of the reasons why tasks promised in the production plan are delivered late and why tasks are not made ready on time. Recording reasons in a Pareto chart (Figure 12) shows where attention is most likely to yield the most results.

Using tools like *5 Why* and *cause-effect diagrams* helps a team understand what needs to be done to improve.

Push vs pull

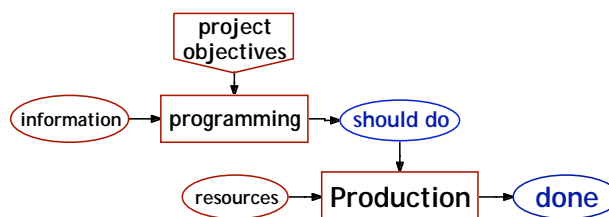


Figure 13: historic push approach to production

The historic planning system is a push system — it pushes work into production based on pre-determined start and completion dates, without regard to whether the work is ready

to be done or not — or the readiness of the producers. If this system worked, there would be a high coincidence between **should do** and **done**.

This traditional *push* approach leads to *nonsenses* such as ceiling contractors installing ceilings before the M&E contractor has finished working above them. In software engineering it can lead one programmer to make assumptions about what another is or will do, resulting in rework; in design, one designer will make an educated guess about what will be required and proceed on that basis — sometimes they'll be spot on, but more often, they'll have to do a load of rework too. When building luxury yachts installing fitted furniture in the wrong sequence can lead to problems for the plumbing, electrical or mechanical teams.

LPS changes the way the programme is arrived at and adds a critical step designed to ensure that only work that **can** be done is scheduled for production.

Its not for us ... our projects are too small/big/simple/complex/low margin

I hear many reasons for not using LPS:

- **we only do small projects** – LPS was deigned to be relevant to projects with more than three suppliers and more than 8 weeks long. (I know of one complex *15 minute* project where it was used!)
- **our projects are too big/complex** – LPS was used on the Largest project in Europe – Heathrow Terminal 5
- **the subbies will never agree** – yet they do *and* they prefer this way once they know it
- **its going to cost more** – while you are learning perhaps and that is often the case when learning something new. Many pilot projects have resulted in significant savings.
- **We get rewarded for firefighting and LPS reduces the number of fires to be fought** – I've no answer to that one save a question: *do you really want to continue working in an adversarial way?*

LPS is a rigorous planning process – much more rigorous than is generally used in construction. Planning reduces problems on site and in the design office so that more of your energy goes into creating value for your customers.

Integrated Lean Project Delivery

Last Planner is a key element in the **Lean Project Delivery System** and in **Integrated Project Delivery (IPD)** approaches to collaboratively aligning people, systems, business

"MT Højgaard - the largest construction company in Denmark - has applied the Last Planner System on more than 25 building projects during the last two years. No matter what the size or type of project, **the Last Planner System improves the building process and hence the overall result — reduction in costs, projects that are on or ahead of schedule, and a shorter [defects] list.** The most significant improvement is the **lower accident frequency & severity.**" *Mikkel Thomassen, Project Manager, MT Højgaard 2002*

processes & practices to harness the talents & insights of all participants so that they can optimise value for the client (while creating an appropriate return for all stakeholders), reduce waste & maximise effectiveness through all phases of design, fabrication & construction. Integrated projects are led by a highly effective collaboration between client, lead designer & lead constructor from early in design through to project

handover and use lean thinking throughout the process⁵. IPD is different from both Design & Build and from historic Design-Bid-Build.

Safety and personnel

Last Planner benefits don't stop at programme predictability, profit and productivity.

On like for like project comparisons 45% fewer accidents and 60-70% less sickness absence on Last Planner managed construction sites according to Danish research.

Image Decorations Ltd, a Sheffield UK based decorating company, found that using LPS improved the managerial skills of their foremen on site and led to a freeing up of senior management time. MD Nick Wain told a *Construction Productivity Network* meeting⁶:

Yes – Last Planner has worked for our company. The team works towards common goals, and team members have joint ownership in planning and delivering the project. There has to be mutual trust, open communication and a desire to have all members of the team win.

*Here are some of the **benefits** to his company and its staff that Nick mentioned:*

- *It is a management tool that enables our site supervisors to plan their workload on a weekly basis and assess team performance on a daily basis.*
- *It enables us to make an accurate prediction of the labour required on a weekly/daily basis. This is based on facts, not a site agent's wish list.*
- *Site supervisors improve their management skills in running the site works, dealing with customers and managing site labour.*
- *It gives our site supervisors a better understanding of the planning that goes into a job in the office and has created a closer working relationship between directors, managers and on-site foremen.*
- *Progress through Last Planner is monitored daily against the requirements of the planned work. If targets are not being met it is easy to assess where the problem lies and address it.*
- *Subcontractors tend to work more closely with each other, recognising that they are responsible to succeeding trades for ensuring that they can carry out their works in line with the programme. A professional pride develops in not letting the team down. It can be embarrassing at the next meeting to admit failure to deliver on time.*
- *By putting more emphasis on management and planning of work Last Planner can dramatically reduce site labour costs.*
- *Although it is not the reason to use Last Planner, it can provide evidence that you have acted within the terms of the contract in the event of a dispute.*

Nick Wain also acknowledged a number of issues – as with any system there are some points that should be followed up to increase the success rate:

- The only companies that have to be concerned about using Last Planner are those that work with no regard to the programme.
- If Last Planner is not carried out in a systematic manner, it will fail. The documents have to be completed in full and discussed weekly.
- Project managers must police the Last Planner System effectively. There is still a need for sanctions against badly performing companies.

⁵ For more information see <http://www.thechangebusiness.co.uk> and click on Integrated Project Delivery.

⁶ 17 September 2003 in London. For a copy of the meeting report see: <http://tinyurl.com/3eh9an> for other CPN Last Planner reports see: <http://tinyurl.com/4kc9s3>

- Last Planner will highlight teams that don't perform well. If project managers don't use the data to manage performance, Last Planner will be discredited and the benefits lost.
- Last Planner can show up poor project managers. This can trigger appropriate training and/or reassignment.

Fire prevention

At the same meeting Gerry Chick, then Supply Chain Manager at BAA, talked of the value of getting everyone round a table. He emphasised the importance of it being supplier driven and the recognition it gave to bad news. *Bad news*, he said, *provides good information. Bad news early is even better.* Last Planner enables bad news to surface quickly before it becomes a major issue. It can also provide signals of imminent bad news that may enable the team to head it off.

Much of construction management is described as *fire-fighting* — dealing with things that have gone wrong in effort to get back on track. Continuing that metaphor, the Last Planner System is an *integrated fire prevention system*. Collaborative programming anticipates problems and help the team develop countermeasures; MakeReady weeds problems out before they impact on production; collaborative production planning reduces potential problems still further and continual improvement helps the team learn how to avoid the problems that do emerge.

LPS is not for construction managers who thrive on fire-fighting, but, as DTI research showed⁷, most in construction would welcome more influence on their work. Last Planner is a good way to start creating that, *with* them, in the context of the overall project goals.

Learning Last Planner

There are a number of learning pathways for those who want to implement Last Planner including:

- A generic introductory workshop
- An Action Learning development programme based on a live project.

Individuals have successfully implemented Last Planner after attending an introductory workshop. It is a very challenging task.

Integrated action learning on a project supported with just-in-time instruction and coaching gets Last Planner up and running in the project team without interrupting the workflow. If you choose this method ask around or consult the LCI website www.leanconstruction.org before you select your coach.

Greg Howell cautions those involved in their first implementation. LPS will provide you with data about your project management systems that makes uncomfortable reading. DON'T PANIC. Pilot LPS in your organisation carefully with project teams that welcome a more collaborative approach. Gather data systematically and make improvements then invite others to inspect what the pilot project or projects have done and learn from them.

Most companies that successfully implement LPS have done so incrementally as a strategic learning and improvement intervention.

⁷ A survey of 500 UK construction workers carried out for the Department of Trade and Industry (DTI) (reported on the Contract Journal website 30 September 2004) showed almost 3 out of 5 want to be more productive. A similar proportion feel they would be more productive if they had greater control and choice in their working patterns. Over 4 out of 5 say they would be more committed to their employer if they were helped to realise their full potential at work.

Waiting or flow

A major source of uncertainty, frustration and waste in projects is waiting — waiting for access, design information, materials, plant, waiting for the previous trade or design team to complete work. When one team is late delivering, follow-on teams are prevented from starting when they planned to and work ceases to flow.

Last Planner enables a project team to focus on keeping all seven critical flows moving so that they come together at the workplace where materials are transformed and value is created.

It creates a structured series of conversations that enable projects to progress and provides the basis for relationships within the team so that when *shit happens* it is easier for the team to pull together and find ways to move beyond the crisis.

By making it possible for team members to share bad news early some crises can be avoided and others mitigated.

Each element of the *Last Planner System* brings its own benefits. Together they help deliver quality projects on time and within budget.

