

3 Efficiency of on-site labour

3.0 Introduction

Labour efficiency is a key issue with regard to both progressing the project and also in determining the earning potential of the trade contractors who undertake the work. The management of the Logistics process together with the Skills of individuals are the prime factors determining efficiency of on-site labour.

In this section we explore how logistics affects efficiency. This looks at factors determining the degree to which skilled trades people are able to apply themselves uninterrupted to their work. It includes the degree to which skilled trades are involved in handling materials, the use of specialist handling equipment, the degree to which planned work is available for trade contractors and the reliability of trade contractors. This section then also looks at the degree to which provision is made for handling and distribution and the degree of re-working.

3.1 Degree to which skilled trade people are able to apply themselves uninterrupted to their work

It is recognised that there is an acute shortage of skilled trades people in the industry. To the extent that they are able to apply themselves uninterrupted to their work is clearly an important factor in determining the efficiency of both their own performance and the overall performance of the activity in which they are engaged.

The factors affecting their ability to apply themselves uninterrupted are the same factors that determine the ability of a task to be performed. These are the availability of:

- Materials
- Access to the area
- Plant and equipment
- Design information
- Completed previous task
- An agreed method and permissions in which to operate

and

- Acceptable weather conditions

The availability of materials is one factor amongst many that impact on the efficiency of on-site labour. On a project level there was an example of a delay through a lack of materials. This was brought about through a delay in the specification of the front doors which were on a 12 week lead time.

However, there was no evidence on either project of a delay to an activity that had already commenced. Therefore, efficiency was not compromised by this factor. One area that was explored was the extent to which skilled people are interrupted by the need for fetching and handling materials.

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3.1.1 Degree to which skilled trades people are involved in handling materials

Responsibilities for unloading and distributing materials is an area that is agreed between the main contractor and the trade contractors on a case by case basis. The typical arrangement for bulk items such as bricks and blocks is for the main contractor to be responsible for unloading deliveries and for distribution to the appropriate storey level within the building. These tasks are normally carried out with the aid of a crane, forklift truck or goods hoist which invariably are under the control of the main contractor. Distribution within the storey level is then usually down to the trade contractor.

There tends to be a pragmatic approach to the degree to which skilled trades people are involved with handling materials. Trades with a high material wastage factor tend to employ labourers for the purpose of handling materials and cleaning up. Trades using relatively high value components tend not to have labourers and skilled trades people take responsibility for handling their own materials.



Plasterboard stacked ready for fixing

Trades employing their own labourers to manage material handling include:

- Brick and block layers
- Plasterers
- Roof tilers

Trades handling their own materials include:

- Electricians
- Plumbers*
- Carpenters*
- Wall tillers
- Decorators



Sanitary ware and a boiler positioned ready for skilled trades to commence fitting

** the main contractor will normally be responsible for handling heavy items such as doors, kitchens and boilers. Alternatively these trades may employ a labourer.*



Electricians and plumbers generally distribute small high value materials themselves. These tend to be stored centrally in a secure storage area. Materials are taken as and when needed usually at the start of work or on the way back from a break. This reduces the incidence of work being disrupted by the need to obtain materials.

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These trades also tend not to produce high levels of wastage. Clearing up tends to be relatively small and is often undertaken by the main contractor.

Other trades have materials placed in position for them, either by the main-contractor or by their own specialists. These trades therefore do not need to have labourers nor do skilled trades people need to distribute the materials themselves.

These trades include:

- Window fixers
- Sheet roofing fixers
- Floor plank layers



Timber storage – skirting and architraves. One delivery is equivalent to one month's supply



Trade contractor lock-up boxes giving easy access to tools or and small components

3.1.2 Use of Specialist handling equipment

The two sites involved in the research project deployed a range of specialist handling equipment. These included:

- *Tower crane and Luffer crane*

These cranes were generally employed in positioning bulk items such as bricks, blocks, plasterboard and scaffolding. The Luffer crane was selected for the Talwin Street because of the need to avoid over-sailing the Blackwall Tunnel approach road on one side and a railway line on another. The usefulness of these cranes decreased rapidly once the buildings were watertight. This is due to the fact that with the roof on they can no longer position materials within the building.

- *Mobile crane*

These were primarily employed for positioning floor planks. The use of a mobile crane avoided tying up the tower crane on the Ordell Road site which could therefore still be used for other lifting activities. Due to limitations on access the Talwin Street site was not able to use a mobile crane. All lifting of floor planks had to be carried out by the main luffing crane.

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- *Forklift with telescopic reach*

The forklift is seen as a highly versatile piece of equipment. Not only is it used for unloading lorries and carrying materials around site, its telescopic forks allows it to lift materials upto all floor levels. This versatility allows it to take pressure off the crane.



The forklift is able to position materials directly onto loading bays at high level

When the crane on Talwin Street was decommissioned the 9m reach forklift featured in the picture was replaced with a 17m reach forklift.

- *Concrete pumps*

These were used on the Talwin Street scheme to pump concrete into the formwork making up the structural five storey frame. The alternative is using a crane to lift a specialist concrete skip. The disadvantage of this latter method is that it ties up the crane during the entire process.



Forklift removing a rollover-tipping bin from 3rd storey loading bay

- *Hiab attached to delivery lorries*

This is a piece of lifting equipment that is attached to the delivery vehicle and is used for unloading within a few metres of the lorry. They are particularly useful with deliveries to sites with a street frontage where materials need to be placed on a gantry at first floor level.

- *Forklift accompanying delivery lorries*

A number of delivery lorries now incorporate a detachable forklift truck. This means that the delivery vehicle can unload without waiting for the availability of the site-based lifting equipment.

- *Pallet trucks*

Pallet trucks were found to be a highly effective in distributing materials within the building. The forklift truck positioned the palletted materials on the loading bays from where they could be moved by the pallet trucks.

- *Wheeley bins for debris*

Wheeley bins provided a simple method of collecting waste material within a floor and transporting it to a roll-over tipping bin for collection by the forklift.



Wheeley bin for rubbish collection

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3.1.3 Degree to which planned work is available for trade contractors as programmed

Factors affecting programme can be split between project management issues and logistical issues. The project management issues tend to be high level issues such as obtaining consents and completion of detailed design work from trade contractors. These types of issues can be taken into account when scheduling work so they rarely lead to disruption of individual tasks.

Disruption at the project management level

Gaining consents was the greatest factor in disrupting planned work in the early stages of the project, particularly at Ordell Road. This included work to be carried out on a sewer access chamber and an unstable boundary wall. In both instances work had to proceed around these disruptions. There was 3 month delay caused by Japanese knotweed.

Disruption at the logistics level – labour availability

At the logistics level the principle disruptive factor was the availability of labour. This was most pronounced during the mid to latter stages of the project where there is more parallel working and greater dependency between trades for completing and starting tasks.

This labour issue was most graphically illustrated by a review of the site induction records. Over the course of a 2 year project in excess of 1,000 operatives had been inducted onto site on a project that had a requirement in the order of 300 operatives. No exit information was available but anecdotal evidence suggested many operatives left within a few days of starting due to their trade supervisors judging them not to be able to perform to the necessary standard.

This high attrition rate was most common in trades such as plastering, scaffolding, bricklaying and carpentry. In many instances, trades still performed well against programme despite this labour issue. In the more regulated trades such as plumbing and electrical installation labour shortages were equally great but there was less hiring and firing.

This labour issue tends to result in a lot of small adjustments to when individual tasks are performed and completed. However, the site management process of weekly planning updates ensured that in general, succeeding trades were able to start work when planned. A feature of construction appears to be the ability of site management and trade contractors to accommodate these short-term disruptive influences.

Disruption at the logistics level – material as the constraining factor

The feature of both projects was that early trades, such as groundworks, bricklaying, and in the case of Talwin Street, concrete frame, performed ahead of programme. Due to the fact that they had relatively long clear runs or work, the supply of material tended to be the most critical factor. This was both in terms of ensuring supply to the site and ensuring that materials got to the work-face.

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The most challenging logistical issue when work is progressing ahead of programme is ensuring that the follow-on trades are ready to commence their work when needed. This is a particularly challenging issue when the follow-on trade's activity relies on materials which are subject to long lead times. A good example of such a trade activity is precast concrete floor planks.

Floor planks over 7m in length have to be made to order. (Under 7 metres are supplied as a stock item). These made to order items can have a lead-time of 12 weeks or more. Most floor plank manufacturers work to an agreed delivery schedule with very little flexibility built in.

On a previous project undertaken by the Ordell Road team, a three week gain in the programme was entirely lost due to the floor plank manufacturer being unable to bring forward their delivery schedule. On the Talwin Street project, not only did the floor plank manufacturer bring forward their deliver, they monitored progress themselves and initiated early manufacture. This proactive response from a material supplier, particularly in this sector of the industry, appears to be relatively uncommon.

A key variable in managing materials on site that cannot be controlled is the weather. Wind, wet and cold are all factors that can disrupt the programme. In terms of a tower crane availability it is generally recognised that 20-30 days of operation in a year can be lost due to wind.

3.1.4 Reliability of trade contractors in committing the necessary resources to undertake the agreed work

Labour tended to be the main resource where trade contractors experienced difficulty in delivering the agreed levels. The degree of reliability tended to be related to the degree of skills shortage affecting the trade in question. Reported problems tended to be most acutely felt in relation to electricians and plumbers. These are two of the trades suffering from highest labour shortages.

There were no critical shortages in other trades, although the high turnover rate did suggest that most trades experienced difficulties in attracting and retaining skilled and competent labour. In addition to an underlying labour shortage there were also two other factors affecting the supply of labour.

The first was in relation to the volatility of workflow experienced by companies across all their projects. This meant that on some occasions they might flood the site with labour to keep their employees or their self-employed workers in work. On other occasions they may be over-committed and unable to deliver the necessary labour. Their cash flow position also affected their ability to perform in this respect.

The second factor is with regard to seasonal surges in demand for labour. In the private residential market, the publicly listed house builders will often look to accelerate works ahead of the close of a financial quarter to improve trading results. This can often cause disruption as demand jumps for certain trades, particularly plasters and some of the finishing trades.

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3.2 Provision for managing material handling and distribution

The approach to material handling and distribution was traditional in the sense that there was no dedicated logistics team and that both main contractor and trade contractors took responsibility for various aspects of material handling and distribution. The general arrangement was that lifting to storey heights was the responsibility of the trade contractor. This is due to the lift equipment such as crane and forklift trust being provided by the trade contractor. Distribution from a loading bay at a particular floor level to the work face was the responsibility of the trade contractor, unless agreed otherwise.

3.2.1 Site set-up arrangements

A considerable amount of thought had gone into the setting up of both the sites in terms of the location of the offices, welfare facilities, stores, cranes, access routes and unloading areas. On both sites the site management team had 6 weeks prior to commencing works in order to fully familiarise themselves with the project and develop a logistics plan. See the site logistics plan for Talwin Street.

A significant feature of both these sites was the fact that as soon as the foundations and ground floor slabs were in place a layer of tarmac was laid across the entire site. This meant that all site operations could take place in a clean environment free of mud. The tarmac allowed for site to be clearly demarcated in terms of setting out vehicle routes, pedestrian access, storage areas and skip locations etc.

This 'clean site' approach was also followed within the buildings themselves. The requirement for trade contractors to clean up after themselves was rigorously enforced. All debris had to be taken to a central location on each floor from where it was removed by the main contractor. Once the floor was screeded, floor protection in the form of a non-slip hardwearing plastic sheet was laid down and remained in place until the fitting of the floor finishes. The floor protection was



Floor protection used to mark-out positions of kitchen units, radiator positions and pipe runs

used for marking-out positions of partitions, kitchen and bathroom units, pipe runs, electrical sockets and radiators. This provides a highly visual method of preventing clashes of services and fixtures.

The 'clean site approach' also contributed significantly to providing a very safe working environment. The discipline of ensuring that materials were properly stored and the mud-free work surface resulted in a very low level of trips being reported. Safety statistics were also very impressive with no reportable accidents occurring on either site.

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There was also evidence that individuals working on the sites appreciated the measures that had been taken. A number of workers commented that these were the best sites that they had worked on. This positive view was supported by an assessment of the sites as part of the Considerate Contractors scheme which scored the sites at 36 and 37 out of 40.

In terms of material handling there was no central coordination of activities. Individual trade contractors were responsible for handling their own materials with logistics support being provided by the main contractor. As has been noted in section 3.1.1, trades involving bulk materials and a high degree of wastage employ their own labour for material handling. Where the materials tend to be smaller and higher value, such as electrical and mechanical, the material handling tends to be carried out by the trades people themselves.

In terms of logistics support, the main contractor on these projects provided the following services:

- Site labourer - assisting with unloading, cleaning the site and maintaining the welfare facilities
- A gatekeeper - signing for deliveries and maintaining the signing in book of workers and visitors
- Banksman (Tower Crane) – directing the crane operator, attending to the securing of loads and changing slings. On the Talwin Street project upto three banksman were involved in directing operations with regard to concrete pouring.
- Banksman (Forklift truck) – attending to the forklift truck, loading materials and signalling
- Crane operator
- Forklift truck operator
- Canteen cook – provided by independent operator

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3.3 Degree of re-working

Reworking describes the situation where work that has already been performed needs to be carried out again. This situation arises when the work was not performed correctly, there has been a change in specification, the right materials were not used or the original work has been damaged. Reworking has implications in terms of waste of resources and also in relation to disrupting and slowing up the delivery of the project. Although logistics plays some part in explaining the cause of reworking the major factor appears to be in relation to the skills and attitude of the trade operatives.

- 3.3.1 Traditionally sites have been very dependant on inspection as the means of ensuring compliance with standards of workmanship. This is largely the role of the site manager and where appropriate, the site foreman. Some trades will also have their own system of quality inspection through the use of a trade foreman or visiting contracts mangers.
- 3.3.2 The degree to which re-working results from poor logistics management is quite low. A failure in delivering the correct materials, labour or information usually results in the task not being undertaken or being disrupted. In some instances this can lead to works being carried out that are not in accordance with the specification and need to be re-worked.
- 3.3.3 Major elements of reworking on site are relatively common. This often occurs due to problems with previously installed items. This is particularly an issue with wet radiator systems and electrical circuits. The problem sometimes arises through poor workmanship. In the case of wet radiator systems this is manifested in leaking joints. In other instances the problem arises due to damage to the installation. Screws and nails hitting the pipes or electrical systems being the most common cause. Often these problems are not identified until the system is made live towards the end of the project. This can often result in sections of walls or ceilings having to be removed to locate the source and then to be repaired.
- 3.3.4 The most common cause of reworking tends to be in relation to the attitude of operatives. The main issue is that the majority of construction work is undertaken on a price basis. This means that operatives are paid according to how much work they carryout. There is therefore an incentive to complete works which have a high rate attached and to ignore the elements of work which will generate a lower income. This therefore leads to an element of reworking where the operative has to return to the work area and complete or put right work that has been left.
- 3.3.5 Damage to previously completed work appears to be recurring problem. The view commonly expressed by site managers is that trade operatives typically show a disregard for other trades' work. This issue comes into particular focus during the final stages of a project when remaining identified defects known as 'snagging items' need to be put right. It is common for one trade to carryout a snagging item and in the process damage some other completed work. This might lead to a two or three trades needing to be involved in putting right some damage which in turn increases the chance of other damage occurring.