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Presentation on "Scaffolding the way upwards (and Forwards)"

By Brian Dunckley and Eddie Keenan, Balfour Beatty Specialist Holdings Division.

Brian introduced the presentation by announcing that he would be talking about the history of scaffolding and a review of experience to date, whereas Eddie would be looking at the basis for Best Practice.

Brian started by referring to the definition of **scaffolding** in the **Oxford English Dictionary** – always a wise move if you want to make sure that you are covering your subject effectively! In it he found that scaffolds were **"A temporary structure which provides access, or from which persons work, or which is used to support materials or equipment."** Additionally, he found that it said scaffolding was **"A temporary raised platform for the execution of criminals"** This latter structure also comes complete with a trapdoor – but it seems a rather excessive punishment for contravention of Section 2 of the HASAWA, even if talk of **Corporate Manslaughter** is a popular topic!

Brian then entertained us with photographs of scaffolding through the ages, starting off with the complex Chinese designs of 4000 years ago, through to the relatively modern Egyptian ladders and trestles 3700 years ago, Greek towers and Roman bosuns chairs! The early history in the UK saw the use, on Norwich Cathedral in 1213 AD, of suspended scaffolds and flying scaffolds in 1260 AD. Brian also quoted examples at Salisbury, Winchester Chapter House and the Tower of London, all using timber components incorporating a variety of raking, flying and dead shores. He added that large putlog holes can still be sen in some of the older buildings!

This **"scaffolding evolution"** culminated, in the early years of the 20th Century, with the development of **"tube and fitting"** scaffolds. In the 1920s they evolved into the equipment currently in use. The great merit of this system is its flexibility of application and that it is relatively inexpensive. Brian demonstrated this by showing photographs of it in use around a restoration site, motorway protection underneath a 400,000 volt electric line crossing, around the supports of the Forth Railway Bridge, rather unconventionally, as a lifting frame for a wrecked railway carriage AND as a temporary support for beer kegs!.

In a departure with this historical tradition, the so-caled **"System Scaffold"** came into use in the 1850s, the first design being attributed to Isombard Kingdom Brunel at the time of the Crystal Palace construction. The poineering **"Kwikstage"** system was designed by Peter Gosling in 1948, after he apparently saw a similar system in France. Because of patent problems, Kwikstage in Europe had "C" pressings, instead of the "V" pressings used in UK. The system scaffold became very popular in the middle to late 1960s and other companies, such as SGB and Mills, tried to break into the market with

competing designs in the 1960/70s. Names such as **Readylock, U.P., Acrow Scarf, Sprite Brand and Fixscaff** have long been forgotten!

From about 1980, European System Scaffolds began to apear in the UK, with scaffold companies such as Palmers (Allround) and SGB (Cuplok) importing them. Other names, such as **Plettag, Haki and Frame Scaffolds** became known. System scaffolds are generally more expensive than tube and fitting types, butcan be quicker to erect, if set out correctly. It is not unusual for tube and fittings designs to be mixed with systems scaffolds for specific applications. In an attempt to catch up with systems, **'H' Frames** were developed for use with standard tubes. Transoms with welded fittings were also introduced and are still in use.

The use of scafolding is required in a number of pieces of legislation, namely: -

- **Construction (Health, Safety and Welfare) Regulations 1996**
- **Provision and Use of Work Equipment Regulations 1998**
- **Construction(Design and Management) Regulations 1994**

Anyone seeking a higher authority is urged to read what is written about guardrails in **Deuteronomy 22, "When you shall build a new house, then you shall make a parapet for your roof, that you may not bring guilt of bloodshed on your household if anyone falls from it!"**

As far as design standards are concerned, the only guidance from 1967 to 1981 was **British Standard, CP97, Metal Scaffolding, Part 1, Common Scaffolds in Steel.** When it was realised that this was inadequate, the **National Association of Scaffolding Contractors (NASC)** arranged for one of its technical committees to write **BS5973, Scaffolding**, which is now the key document. In general terms, it does not apply to systems scaffolds which are governed by their own manufacturer's handbooks. It is complemented by: -

- **BS5974, Cradles, and**
- **BS5975, Falsework Systems Handbooks.**

Another collection of essential guidance is the Construction Industry Training Board (CITB) **CE509, A guide to Practical Scaffolding: The Construction and Use of Basic Access Scaffolds,** published in 1997. The only in-depth text book written on scaffolding is by Ronald E.Brand, in 1975, entitled **Falsework and Access Scaffolds in tubular Steel.** Although it has its faults it is still worth buying if you are fortunate enough to fall over it in a secon-hand bookshop – it is sadly out of print!

Looking to the future, we are anticipating the **Working at Heights Directive, Standard EN12811 – 1, Part I, Temporary works Equipment Scaffolding (System Scaffolds).** This is to be in place by 2004, following an extension granted to the scaffolding industry. As he name implies, it does not recognise the existence of tube and fiting scaffolds, because system types are more common in Europe. Brian then screened

some examples in the UK, inclding the recently completed project to refurbish the Sentinel blocks at Holloway circus in Birmingham City centre.

Brian went on to describe the changes to be produced by the design process change from **"Permissible Stress" to "Limit State" Designs.** The current 'Permissible Stress' practice in the UK allows for the publication of design parameters, as in BS5973. The 'Limit State Design' does not provide the flexibility of using a Code of Practice including **broad parameters** as it requires **specific designs.** This will lead to a need to provide a drawing for each scaffold erected in the UK and some will even need design details. Currently BS5973 is being re-drafted to include **'model designs'** but, because the UK Industry has not nurtured scaffold designers in recent years, there is a shortage of competent persons available..

A draft document is available of the **"Work at Height Regulations",** which includes discussions on : -

- **The use of scaffolds to be identified by Risk Assessments.**
- **The assessment will identify the "use of ladders" and provision of safe handholds.**
- **The scaffold requirement is to be planned**
- **Competent supervision**
- **Suitability of the scaffold**
- **Where appropriate, consider emergency evacuation procedures.**
- **Designers will have to consider the effect of weather, specifically wind, freezing and the hot weather distroting boards**
- **All platforms will be fixed and this will include scaffold boards. (Generally, European systems have fixed platforms)**
- **The need for calculations will have to be identified**
- **Assembly and Dismantling plans will be required.**
- **Discusses the provision of anti-slip devices "check fittings"**
- **Identifies the need for the use of harnesses, if necessary. (The NASC, SG4.00, is specific to scaffolders, althoughit does not apply to systems, at the moment. Scaffolders DO NOT like it, it is difficult to monitor and only applies above 4 metres.)**
- **Design loads for guard rails could be a problem, especially for edge protection on roofs if the load parameters are required to be the same as for permanent structures.**
- **Fixing of ladders to prevent slipping and the provision of secure handholds, whilst carrying a load. This iindicates a possible move to the use of staircases.**

The major conclusions form reading this document are: -

1. **The directive is pushing for the use of system scaffolds. Brian showed a photograph of the Statue of Liberty, encased in a system scaffold and concluded that, as we seemed to foll US trends, Why not lie back and Enjoy it?**

2. **Companies will have to draw up procedures to indicate how they will comply with how they will comply with the working at Heights Regulations.**

Brian then handed over to **Eddie Keenan**, to deal with the questions of Best Practice, as laid down in the BALVAC Whitley Moran Scaffolding Procedure. This was originally written in the Mid 1990s by Brian Dunckley and a BALVAC Engineer, Gerry Lister and it was revised two years ago to move towards cmntinuous improvements in scaffold controls. Every scaffold ordered from a sub-contractor (Or Contractor, if you are a client) should be covered by a written specification stating the requirements, as shown in this model: -

- Type of scaffold
- Loadings.
- Lifts – Height/Number
- Sheeting
- Hoist
- Staircase
- Pedestrian protection
- Bonding for Lightning protection
- ANO need, as required

It is also vital to sheck the competency of the scaffolding erectors who must hold a **Construction Industry Scaffolder's Certificate Registration Scheme (CISCRS)** card, with a **System Competency Certificate** for the specific system, where necessary. The CITB is only now addressing the basis for training on Systems. Scaffolders and their employers must also provide evidence that the scaffolders have been trained on the NASC SG4.00, Use of Safety Harnesses and the Site Managers should also have been briefed on the same Code.

Regarding the Design standards, these fall into three main categories: -

- Basic Scaffold : -
  - Unsheeted
  - Sheeted up to 25m **Drawing**
  - 3 Boarded Lifts **Required**
  - 50m high (Max.)
- Design Scaffold: -
  - Any Scaffold with more than 3 boarded lifts **Drawing and.**
  - Sheeted over 25m high **Design Spec.**
  - Off existing structure **Required**
  - Free standing
- Temporary Works Controls required, where there is a concern about the scaffold being safety critical. This control is often endorsed by Senior Management who will specify controls if they are concerned about the scaffold. The list is not exhaustive: -
  - High Rise – Heavy loadings
  - Temporary Ramps

- Pedestrian Bridges
- Cradle Rigs.

Occasionally, drawings are marked with residual risks, where tying is critical

Having taken rigorous steps to ensure safe designs and safe erection, there is a great need to ensure that everything stays safe during use and effective Scaffold Inspection arrangements are essential. They should be carried out by a competent inspector and it is not good practice to employ the scaffold erector to do this. During **Handover,** the **Inspector must accompany the scaffold supervisor** and the handover certificate issued by the **scaffold company.**

Thereafter, Inspectons must be carried out Weekly. Inspections also need to be done during periods of temporary site closure, such as at Christmas, or planned cessation of work for operational reasons. Each type of inspection requires a distinct format and it is important to use an effective method of marking scaffolds, like the SCAFFTAG system, to indicate whether they are safe to use.

To be competent, Inspectors must have attended a CITB course and should be assessed annually by a competent **Assessor to D32/33 level.**

As explained, previously, staircase systems are becoming more in favour and wherever a system scaffold is used, a separate system tower should be used for access. Edie showed an exmple of this to gain access to the roof of a building at the NEC in Birmingham. Where external ladder access is provided to tube and fitting scaffolds, they should land on an extended transom, protected by a self-closing gate. Long ladders should be supported at mid-span and a separate tower should be provided for high rise scaffolds.

If a ladder access is projecting through a trap-door in the platform, three sides must be protected by guard rails and the fourth by a self-closing gate. If the ladder is projecting through, this will protect one edge.

Where adverse weather conditions occur, the procedure must address conditions such as icing and wind, particularly when walking from the lee- into the windward-side of a lift. Severe icing can additionally affect the windage on a scaffold, as well as causing injury form impact or falling debris.

On the question of street scaffolds, a pavement licence is required and it is essential to protect third parties and prevent vehicle strikes by adhering to Road Transport Act, Chapter 8 requirements.

Members' Questions

Peter Hebblethwaite of Olver and Rawden asked about the specification for Grade A Scaffold Boards. Brian replied that the BS asked for supports at 1.25m centres and the NASC Technical Bulletin mentioned 1.2m centres, with a specified number of knots per metre. Brian added that modern boards showed a tendency to warp because they came into use soon after being unloaded from freight ships.

Malcom Copson of GEOPOST asked if an independent inspector should be used and Eddie confirmed that inspections should not be done by the scaffold erection company. He went on to say that **you** have the duty for scaffold safety and must realise that there are godd and bad erectors in the business.

John Kessell remarked on the problems of 'floating' standards when erectors failed to compact the ground underneath. Eddie stated that erectors do not level the ground in preparation and this must be done by the client who should aldso ensure that it is comapacted.

Warwick Adams of Interserve Project Services asked if there wasany advice on Temperature and Wind speeds. Brian said that there was a problem with freezing, particularly on wet jobs, as illustrated by the photograph in the presentation. He added that one critical problem with high wind speeds was the danger experienced when moving round a scaffold from the lee-side of a building into a high wind on the other side.

David Callaby enquired about the competency levels of scaffolders. Brian confirmed that a CISCRS Basic Scaffolder could erect where there was no design requirement. CISCRS Advanced Scaffolders were mandatory on designed scaffolds. Where a system scaffold was involved, additional certification of competence is required.

Anthony Ferris of Independent Asbestos Surveys and Services asked for gidance on tying-in to buildings. Brain answered by saying that the type of tying-in was limited by the building materials and the 'pull-out tests needed. Reveal ties could be used in only 50% of the total number.

Mark Hoare of Birmingham University asked about the hoisting of scaffold tubes with just a half-hitch on a sash rope. Eddie commented that a 21 foot tube wighed 35Kg and scaffolders were trained and highly adept at handling such loads on a very frequent basis.

As there were no other questions, Warwick Adams closed the meeting with the remark that the presentation showed just how careful we had to be when designing,erecting, or using scaffolding. He asked the members to thank Brian and Eddie for a most informative presentation, in the traditional manner.