

RECOMMENDATIONS

ON

IMPROVING THE SAFE USE

OF

SUSPENDED (SWING STAGE) SCAFFOLDS

PREPARED FOR

WORKPLACE HEALTH & SAFETY QUEENSLAND

PREPARED BY

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1. INTRODUCTION

This report has been commissioned by Workplace Health and Safety Queensland to examine and make recommendations on the design, installation, maintenance, inspection, training and other operational aspects of suspended or swing stage scaffolding.

The need for such an examination became evident following a series of serious incidents involving suspended scaffolding. The most recent of these incidents involved the death of two workers on 21 June 2008 when the suspended scaffold failed on a high rise construction site on the Gold Coast.

The investigation has involved a review of the relevant Australian Standards, Codes of Practice from a number of State Authorities and overseas Standards. The investigation has involved input from a reference group selected by Workplace Health and Safety Queensland. The members of the reference group were:

- Mr Tim Campbell, Workplace Health and Safety Queensland
- Mr Stuart Davis, Workplace Health and Safety Queensland
- Mr Royce Kupsch, BLF
- Mr Andrew Ramsay, CFMEU
- Mr Sean King, QMBA
- Mr Kevin Bell, Scaffolders Association

In addition, invaluable expert assistance was received from Mr Peter Ferguson and Mr David Elder.

The aim of this report is to present a set of practical recommendations which will increase or enhance the safe use of suspended scaffolding. It is envisaged that the recommendations will be used in conjunction with the requirements of the current Australian Standards

2. CURRENT AUSTRALIAN REGULATIONS

The requirements for the materials and design of suspended scaffolding are specified in AS 1576.4 Suspended Scaffolding. The particular requirements are contained in the following section of the standard:

- Section 3 details the requirements for the materials and components, including the suspension ropes and suspension rig counterweights.
- Section 4 details the requirements for structure, including the strength and stability of the suspension rig as well as the cradle. A number of general requirements, including the working load limit, the strength of the supporting structure, load limiting devices, etc are specified also.
- Section 5 details the requirements for the electrical equipment and controls.

It is my opinion that the requirements of AS 1576.4 are comprehensive and provide clear guidelines for the safe design of a suspended scaffolding system. The requirements for the training and certification of scaffolders, the supply, erection, maintenance, inspection and use of suspended scaffolding are specified in AS 4576.

An important aspect of AS 4576 is the training and competency of scaffolders. Guidance is provided on the level of knowledge that is expected of scaffolders. The training requirements for scaffolders are specified also. Finally, AS 4576 states that an Advanced Scaffolding Certificate of Competency is required for the installation of suspended scaffolding.

Section 11 of AS 4576 provides additional requirements that are specific to suspended scaffolding. In particular, Section 11 addresses issues such as:

- Testing of hoists and cradles
- Sign-off statements
- Alterations to the cradle or suspension rig
- Access to and from the cradle
- Assessment of the adequacy of the supporting structure
- Stability design of the suspension rig
- Securing of counterweights
- Assessment of rope tension
- Electrical equipment and controls
- Protective devices
- Load-limiting devices
- Cradles
- Training
- Safety equipment
- Operation
- Work practices
- Unattended cradle

Again, it is my opinion that the requirements of AS 4576 are comprehensive and, if fully implemented, would result in a suspended scaffolding system that was safe.

In addition to the Australian Standards discussed above, a number of State Authorities have published their own scaffolding guidelines. In general, these guidelines duplicate the requirements contained within the Australian Standards. However, WorkSafe Victoria in their publication entitled *What You Need to Know ... Suspended Scaffolds* have presented a series of Safety Checklists. The Checklists involve the following scopes of work:

- Scaffold Suppliers – Pre-delivery of equipment
- Scaffold Designers – Initial planning and design
- Scaffold Erectors – Erection and installation, Electrical Installation, and Handover of scaffolds
- Scaffold Operators – Operation, Unattended scaffolds, and Inspection, servicing and maintenance

Again, while the contents of the Checklists are essentially a summary of the requirements specified in the Australian Standards, they do provide a

convenient reminder to all parties of the obligations that are necessary to ensure the safety of a suspended scaffolding system.

3. RECOMMENDATIONS

My review of the relevant Australian Standards and State Authority publications in relation to suspended scaffolding has revealed that the requirements for the design, installation, maintenance, inspection, training and other operational aspects are well defined. Moreover, I believe that if the specified requirements were implemented in their entirety, suspended scaffolding systems could be expected to be safe.

However, the recent incidents have shown that despite the comprehensive requirements, not all parties appear to be fully conversant with their obligations.

Therefore, I believe that in order to enhance the safety of the use of suspended scaffolding systems it is necessary to ensure that all parties understand and follow the regulations which already exist in the industry.

Despite my views on the adequacy of the existing regulations, I believe that it is necessary to introduce several additional measures that would enable the safety of suspended scaffolding systems to be further enhanced. In particular, I believe that some additional testing and design obligations are required.

My recommendations are summarised below:

1. INFORMATION

- Designers, installers and users need to understand the regulations. Therefore, a more comprehensive Scaffolding Code of Practice (or a stand alone Guide for Suspended Scaffolding Systems) needs to be developed in order set out the particular requirements. It is recommended that a series of specific Checklists, similar to those developed by WorkSafe Victoria, be included in this Code of Practice.
- To assist with the education process, it is recommended that a series of industry seminars be developed and presented to all parties involved in the design, supply, installation, maintenance and use of suspended scaffolds.

2. COMPETENCY

- Provide update or bridging training for existing scaffolders/riggers. It is recommended that this course would extend over a period of two days. The content of the course would need to be possibly formulated, but certainly approved by the Scaffolders Association.
- The course content of the current Advanced Scaffolding Certificate of Competency should be expanded to include the recommended two day specialist course discussed above.

- Provide formal training for operators of suspended scaffolding. This would most probably involve a one day course in which the participants would obtain a specific ticket or card. It would be mandatory for at least one operator to have this ticket or card.

3. EQUIPMENT

- The suspension rig needs far greater understanding and controls over its use. The requirements of the Australian Standards are clear but it would appear that they are not being followed consistently. This issue would be solved with the implementation of Recommendations 1, 2 and 5.
- There appears to be abuse and misunderstanding of the safe use and set up of suspended scaffolding. Similar to above, this needs clarifying and, most importantly, policing.

4. TESTING

- In addition to the on-going inspection, servicing and testing of items of equipment, as specified in the Australian Standards, it is recommended that an on-site load test of an installed suspension rig on initial setup on site be carried out. The load test would involve loading the suspension rig to the same load that it would experience if the load-limiting device on the hoist was activated. The calculation of the necessary load and the supervision of the testing would be carried out by a suitably qualified engineer. Such a load test would provide a high level of confidence that the suspended scaffold was “safe”.

5. DESIGN AND INSPECTION

- I have concerns regarding the competency of advanced scaffolders to carry out the design of all aspects of the suspension rig. The suspension rig is a complex structure and it is my recommendation that all of the components of the suspension rig are designed and documented by a suitably qualified engineer. Although the current Australian Standards permit the sizing of the counterweights to be carried out by an advanced scaffolder, I recommend that even this aspect of the work be designed (or at least verified) by a suitably qualified engineer.
- All areas of design for a suspended scaffolding system need to be inspected by and receive a formal sign off from a suitably qualified engineer.

6. DOCUMENTATION

- In association with the Design and Inspection recommendations, it is recommended that there is a package established and kept on site that may be best termed a “compliance pack”.

- The compliance pack would consist of a series of required documents to ensure that all aspects of safety have been properly addressed, dealt with and verified by appropriate person(s).
- This may be likened to similar information required for other important items such as cranes.
- The recommended contents of this pack are outlined in Attachment 2.

7. SAFETY OF USERS

- As noted in the Competency recommendation above, a formal course needs to be developed for suspended scaffold users.
- This specific training would be in addition to the site induction (which is site specific).
- Users clearly need more skills to be able to safely use the suspended scaffolding and particularly, to understand both the need and the method, of carrying out daily safety inspections of the equipment.

8. FALL PROTECTION

- It is my recommendation that independent lifelines not be adopted.
- It is recommended that users rely on fall protection from within the cradle.
- It is my recommendation that the fall protection aspect should be seen as what it is, PPE and only relevant in extreme situations. A more detailed discussion on this issue is presented in Attachment 3.

9. EMERGENCY PROCEDURES

- As noted above, it is recommended that the users rely on fall protection from within the cradle as it is likely that the fall will be less serious and that the person can be returned to the cradle. In this case, the need for a prompt rescue may be diminished.

Further discussion on all of the above recommendations is contained in Attachment 1 of this report.

4. CONCLUSION

A review of the current Australian Standards relating to the design, supply, installation, maintenance and use of suspended scaffolds reveals that there are comprehensive guidelines that should ensure that these items of equipment can be used in a safe manner. Despite these guidelines, incidents have occurred.

It is my opinion that the incidents are the direct result of a lack of knowledge of the parties involved. Therefore, I have recommended that a number of new initiatives be introduced in order to address this issue. These initiatives involve the upgrading of information available to the industry and the general raising of the levels of competency through the introduction of additional specialised training courses.

In addition, I have recommended that a number of new initiatives be adopted. These include:

- Load testing of the suspended scaffold is undertaken to ensure that it is safe for use.
- All aspects of the design of the suspended scaffold system are carried out by a suitably qualified engineer.
- A compliance pack containing the documentation for the design, testing, inspection, etc. associated with the suspended scaffold.

It is my firm view that if each of these initiatives is adopted and fully implemented by the industry, then suspended scaffolds can be considered to be entirely safe.

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ATTACHMENT 1

RECOMMENDATIONS – FURTHER DISCUSSION

The following table attempts to provide more detail on the above recommendations. It is likely that many of the items may require further discussion and investigation.

| | ITEM | RECOMMENDATIONS & DISCUSSION |
|------------|-----------------------------------|--|
| 1.0 | REQUIREMENTS | |
| 1.1 | Standards, Codes of Practice etc. | 1. With exception of some specifics set out below, do not introduce new “rules”, but rather, ensure industry complies fully with those already in existence. |
| 2.0 | COMPETENCY | |
| 2.1 | Installers | <ol style="list-style-type: none"> 1. Provide an additional amount of training (recommend that a 2 day course in <u>addition</u> to advanced scaffolding/rigging) to ensure that installers are aware of the current requirements and how they should be instituted on site. 2. Require suspension rig to be designed by a suitably qualified and experienced engineer and not be designed on-site by scaffolders/riggers. |
| 2.2 | Users | <ol style="list-style-type: none"> 1. Require suspended scaffolds to be used with a minimum crew size of 2 (other than special designs made for one person only). 2. Ensure that at least one of suspended scaffold occupants undertakes formal suspended scaffolding use <u>training</u> (suggested minimum of 1 day course) and that <u>all</u> occupants then undertake site specific <u>induction</u> into site equipment, as installed. |
| 3.0 | EQUIPMENT | |
| 3.1 | Suspension rig | <ol style="list-style-type: none"> 1. Require all suspension rig systems be designed by a suitably qualified and experienced engineer and be installed strictly in accordance with the design. 2. Ensure the equipment is inspected and signed off by the engineer on initial installation on each project. 3. Ensure that subsequent moves (on that project) are inspected and signed off by a competent |

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| | | <p>person.</p> <ol style="list-style-type: none"> 4. On standardised equipment, ensure that elements of suspension rig comply with original design information, and are in safe and useable condition. 5. Ensure that components of the suspension rig equipment are regularly inspected including, where required, non destructive testing. 6. Any structural repairs must be noted on service records and signed off by a competent person. 7. No mixing of components from differing systems (ie. Scaffold systems) may be used unless verified by the engineer. |
| 3.2 | Hoists and associated equipment | <ol style="list-style-type: none"> 1. Ensure that hoists and safety devices including overload devices meet requirements of Plant Regulations and any associated required registrations. 2. Ensure all hoisting and safety equipment arrive at site having been serviced, tested and carry marking clearly indicating this work has been carried out. 3. On long term projects, ensure that all hoisting and safety equipment is serviced in accordance with manufacturer's recommendations. 4. Ensure that components of the hoists and safety devices are regularly inspected and tested including, where required, non destructive testing. 5. Any structural repairs must be noted on service records and signed off by a competent person. 6. Require use of 2 wire ropes at each hoist – one for the hoist and the second, for the safety system. |
| 3.3 | Cradle | <ol style="list-style-type: none"> 1. Ensure that the cradle is manufactured to a specific design and that all components used are part of that design. 2. Ensure that the setup of the cradle is strictly in accordance with the design. 3. Ensure that components of the cradle are regularly inspected/tested including, where required, non destructive testing. |

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| | | <ol style="list-style-type: none"> 4. Any structural repairs must be noted on service records and signed off by a competent person. 5. Ensure that each assembled cradle is clearly marked with working load limit for that installation. |
| 4.0 | LOAD TESTING | <ol style="list-style-type: none"> 1. Require an on-site load test on each site at time of initial installation to a “typical” drop, i.e. single test to cover all typical installations on that site. |
| 5.0 | DESIGN OF SUSPENSION RIG | |
| 5.1 | Equipment design | <ol style="list-style-type: none"> 1. All items of the suspension rig shall be designed by a suitably qualified and experienced engineer. 2. This requirement includes any structural items in the load path such as needles, structural supports, scaffolding components, screw jacks etc. |
| 5.2 | Site specific design | <ol style="list-style-type: none"> 1. If using “pre-designed” equipment, there needs to be an engineered design or verification for the site specific application. 2. If the equipment is part of a system with documented parameters, this site specific design may be taken from documentation providing it is between known and documented parameters. |
| 5.3 | Design review of supporting building structure | <ol style="list-style-type: none"> 1. Irrespective of site specific or system use of suspension rig equipment, there needs to be an engineering review of the load capacity of the building on which suspension rig is mounted. |
| 5.4 | Specific requirements applicable to suspension rigs | <ol style="list-style-type: none"> 1. Where suspension rig equipment is set up to be mobile via castors, once parked at the correct location, screw jacks should be used to ensure loads are not carried only by castors. |
| 5.5 | Counterweight fixing | <ol style="list-style-type: none"> 1. Irrespective of the roof rig design, if relying on counterweights, they must be fixed and positioned in such a way: <ul style="list-style-type: none"> • That the failure of any single friction components (i.e. scaffold clip) will not allow catastrophic failure • That the counterweights cannot be removed or dislodged without the use of a tool (i.e. spanner, lock and key). |

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| 6.0 | DOCUMENTATION | |
| 6.1 | Documentation on site | <p>1. Provide a “compliance pack” on site containing the following information (this file should be available for viewing by any interested party including users):</p> <ul style="list-style-type: none"> • Compliance certification relating to hoists, safety devices and overload devices • Design certification for top rigging design, suspension rig site installation and suspension rig loading to structure • Servicing and testing information for suspension rig, swing staging, hoisting, safety and overload items. • Risk assessments for all equipment including site specific installation • Construction safety plan if relevant • Work method statement • Public protection requirements • User training records • Inspection and commissioning documentation • Relevant site drawings/plans related to specific swing stage drops • Fall protection and rescue information • Testing records – site load test • 24 hour contact numbers for action in the case of incident or breakdown |
| 6.2 | Sign off process | <p>1. Require sign offs by Engineer for the following on a new installation:</p> <ul style="list-style-type: none"> • Design of suspension rig • Assembly and installation of roof rig • Capacity of the building structure to support the suspension rig <p>2. Require sign offs by a competent person after</p> |

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| | | an equipment move, providing assembly of gear is to a design specified by Engineer |
| 7.0 | SAFETY OF USERS | |
| 7.1 | Use of suspended scaffolding | 1. Ensure that training, and documentation provided for users during training and/or inductions, address issues such as actions to take in case of breakdown, effects of weather, problems with other site activities or catching on building elements. |
| 7.2 | Access/egress to cradle | 1. Ensure safe and complying access and egress is provided for suspended scaffold users at all points where it is intended for them to enter or leave the cradle – in many cases this may require additional scaffolding, guardrails or anchor points. |
| 8.0 | FALL PROTECTION | |
| 8.1 | Current Scaffolding COP | 1. It is recommended that a lesser emphasis is placed on separate fall arrest drop lines and a higher emphasis is placed on general compliance with the requirements of the code. |
| 9.2 | Fall protection in cradle | <p>1. There has been significant work in Qld into provision of fall protection in cradles. This has also led to wide ranging opinions into rescue from possible incidents.</p> <p>2. It is suggested that the preference for independent drop lines not be adopted and that there be a general “backing off” on emphasis on these. Instead, it is suggested that it is better to encourage users to always be connected at the hoist frame whilst hoisting/lowering.</p> <p>3. It is suggested that connection to the cradle while in a static situation is very a difficult requirement as it makes many works impractical and the safety of the users still cannot be guaranteed due to the difficulty of providing a practical solution. (Refer to Attachment 3)</p> |
| 9.0 | EMERGENCY PROCEDURES | |
| 9.1 | Rescue from a fall | <p>1. If the installation relies on external (from the suspension scaffolding) fall protection such as drop lines from top of building, rescue systems need to be available for action within a few minutes of the fall</p> <p>2. This means that the rescue equipment and trained and competent persons need to be available on site in most cases, however it also may mean the use of, for example, a crane box</p> |

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| | | <p>on a construction site.</p> <p>3. If the users rely on fall protection from within the swing stage, it is likely that the fall will be less serious and that the person can be returned to the swing – in this case, the need for a prompt rescue may be diminished. (Refer to Attachment 3)</p> |
| 9.2 | Rescue from disabled swing | <p>1. A site plan should be in place in case of a breakdown of the swing requiring removal of the users from the cradle and access to the cradle by service personnel – this plan should be available in the compliance file kept on site.</p> |
| 9.3 | General | <p>1. There should be clear information in the cradle and in the site compliance file on what action to take in the case of emergency or breakdown.</p> <p>2. There should be adequate communication capacity available to the users in the swing to enable a call for assistance to be made at all times – if total reliance on mobile phones is used, there should be 2 phones and they should be site tested at all heights on the drop to ensure reliability.</p> |

ATTACHMENT 2

PROPOSED COMPLIANCE PACK

It is recommended that the following documentation is contained within the Compliance Pack:

PRE-INSTALLATION

- Hoists and safety devices (if present) are registered under plant regulations (if required)
- Hoist and safety devices (if present) are “in service” (including testing of overload and safety devices)
- All electrics are test and tagged
- All electrics safe and mounted correctly
- Certification of the cradle design for the nominated working load limit.

EQUIPMENT SITE CHECKS

- Installation checks
 - Harness attachment points are present and defined
 - Harnesses are present and fitted with correct length and configuration lanyards
 - Load sign
 - Suspension rig system, including counterweights (whether scaffold or purpose built) properly assembled and checked
 - Counterweights secure
 - Building structure, including roof and parapet are acceptable and checked
 - Ropes connected properly and moused
 - Power supply hung correctly, secure, no damage and plugged to correct supply point (with earth leakage)
 - Final inspection and sign off
 - Access to swing, if available, to be safe
 - Tampering prevented
 - Users trained in harness use
 - Users trained in swing use
 - Users trained in daily inspection
 - Users trained in emergency procedures
 - Ground level
 - Public protection
 - Wire ropes secure
 - Power cable secure and set up so can't be landed on
 - Safe access to swing
 - Tampering prevented
- On-going checks
 - Daily check (semi formal)
 - Weekly check (semi formal)
 - Monthly check (formal)

- Sign offs / Verifications
 - Design of suspension rig specific to site, including needles, counterweights, etc.
 - Design of suspension rig if custom built
 - Suitability of building structure for loads to be applied by suspension rig
 - Design of cradle
 - Hoists & safety devices– plant regulations
 - Hoists & safety devices – service and testing
 - Installation
 - Load testing
 - Commissioning
 - On-going inspections
 - User training

- Queensland specific construction site requirements:
 - Work method statement (WMS) *Required all construction sites*
 - Construction safety plan (CSP) *Required on construction sites over \$80k*

ATTACHMENT 3

FALL PROTECTION IN SUSPENDED SCAFFOLDS

There are three broad options to provide a harness based solution to fall protection in suspended scaffolds:

1. Separate drop lines from an independent anchorage at roof level (this is the system promoted in the Qld Scaffolding Advisory Standard 2004)
2. Provide anchor points adjacent to each hoist
3. Provide a horizontal life line or rail running the length of the cradle

Each of these options has advantages and disadvantages which are set out below. However, the issue of reliance on harness based solutions requires some discussion.

The use of a harness to protect against a fall is low on the hierarchy of controls and is generally seen as a “last resort” solution, taken only in the event of an unusual event.

In the context of swing stages, the user is in what should be a safe place protected against falling by the floor, the guardrails and the proper installation of the equipment.

The harness is there mainly to protect against an event such as the sudden unexpected action of weather, to guard against “misadventure” (such as operator climbing on the guardrails to reach a point on the building) or in the extreme, something going wrong with the hoist/safety device during hoisting or lowering.

All of the above is said assuming that the suspended scaffolding is used with two ropes each end – one for the hoist and a second, running through a safety device which will activate during a broken hoist rope or over speed event. This is an important point – there are still some suspended scaffolds used with single ropes at each end.

In some countries (parts of USA, NZ) it is reasonably common to use single wire ropes to the cradle ends and to then have the users protected by drop lines from the building top.

This is not a good arrangement! A far better arrangement is to have a properly constructed and fixed/counterweighted suspension rig, suspending the swing stage with two wire ropes to each end and to then ensure the safety of the operators within the swing. In this way, there is significantly less chance of the suspended scaffolding coming detached from the building and thus leaving personnel hanging and probably injured on the side of the building with the resultant need of an urgent rescue.

It is strongly recommended that every effort should be made to ensure the cradle and the suspension rig is erected and maintained in a safe condition. The users can then be connected to the cradle at times of greater hazard level, whilst being free to move about during normal works.

Wide industry experience around Australia and the world indicates that this is the most practical and safe approach, providing industry is made to follow simple compliance.

| FALL PROTECTION METHOD | FOR | AGAINST |
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| Separate drop lines from an independent anchorage at roof level | <ul style="list-style-type: none"> • Totally independent fall protection to totally separate anchor point • Enables some freedom of movement for operators in swing • Allows personnel to enter/leave swing with harness backup | <ul style="list-style-type: none"> • Double the amount of top rigging to be placed (manual handling) and to be set up correctly (compliance) • Ropes over parapet edges need careful protection • Movement in cradle is a big issue on a long cradle near top where operator may “pendulum” during a fall event and makes movement in stage at this level very restricted • Operator likely to be injured by swing if he is “pulled out” during a fall or even during normal operations – needs to keep adjustment correct • Ropes can move significantly during action of wind which can lead to greater fall heights • Any rescue becomes extremely urgent as a) a person hanging on side of building and b) likely injury from cradle or suspension rig that may have come over side. |
| Anchor points adjacent to each hoist | <ul style="list-style-type: none"> • Straight load path back to top rigging without requiring any of the (often aluminium) parts of the swing to be loaded • Forces the operator(s) to stand adjacent to hoist when raising/lowering • Allows personnel to enter/leave swing with harness backup | <ul style="list-style-type: none"> • Not practical to use if long cradle and operator wants to remain connected while moving about (pendulum falls) • Precludes the use of central control of cradle (some would say this is a good thing) |
| Horizontal life line or rail running the length of the | <ul style="list-style-type: none"> • Allows operators to be connected at all times even while moving about in swing | <ul style="list-style-type: none"> • Makes it very difficult to allow one operator to pass another inside swing |

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| swing stage | | <ul style="list-style-type: none"> • Difficult to set up for fall arrest loads, particularly on long cradles • Requires the use of specialised equipment such as lanyard which likely needs to be very short • Due to position (low in swing) is not practical in most cases to assist safety when entering/leaving cradle. |
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In addition to the above, it should be noted that the industry in Qld already seems to be reasonably widely using horizontal lifelines in cradles. This is both a good and bad thing as there is inadequate training or supervision of this use and many operators who use the equipment do so while wearing the wrong equipment.

(Engineering information on the system, which is made in Queensland, has not been able to be obtained – the concern is that it will not meet the requirements of the AS/NZS 1891 (harness based fall protection) series.)

CONCLUSION

There is a concern that concentrating thinking on the fall protection aspect will divert attention away from the more needed engineering aspects of ensuring equipment, particularly the suspension rig, is properly designed, maintained, installed and used.

If the suspension rig is competently designed and installed, it provides a factor of safety of three on any likely load. In this case, the likely use of the harness should not be for an instance of a swing coming off the building (which simply cannot be allowed to occur), but to account for some form of misadventure.

It is concluded that the most practical form of fall protection is as follows:

- Require operators to wear harnesses at all times while in the cradle
- Require operators to clip on short lanyards to anchor point adjacent to hoist whenever cradle is raised or lowered
- During normal works, allow the operators to decide themselves whether to clip on or not, but if they do, to be at defined locations (i.e. at the hoist, at places on the swing that the manufacturer has defined as suitable, or to a HLL which also needs the manufacturer's verification).

The above conclusion is made recognising that the clip on points while working MAY not be able to fully meet the anchorage requirements of the AS/NZS 1891 series.

RESCUE

Following the above conclusion, there are three likely situations where a person(s) may need to be rescued:

1. Following misadventure (i.e. climbing on guardrail and falling out)
2. Following actions of weather where, for example, ropes may be tangled or power disabled, leading to the cradle being disabled
3. Following a hoist or suspension wire failure or damage

In Item 1, it is very likely that the fallen operator and the second person in the swing will be able to get the fallen person back into the cradle. A rescue may be required due to one person being unable to drive the cradle on his own or because of injuries to the fallen operator.

In Items 2 and 3, it is likely that the cradle is unable to be moved either because of breakdown or tangled gear. In such a case, the operators can clip onto anchor points in the cradle and remain in a (likely) place of safety inside the swing. Whilst a prompt rescue may be desirable, there will likely be time to wait for professional rescue services such as the fire brigade rather than have to mount an urgent site rescue due to the possibility of a person suspended in a harness developing suspension intolerance (suspension trauma).

Note – part of the site risk assessment and WMS process should be to examine likely rescue methods and response times.