

Assemble and install scaffolds according to the regulation announced by the director-general (according to the previous regulations on 1972, 1976 and 1982)

No.96

In case of using ladder, strong and safety ladder according to EIT standard has to be provided for workers.

No.97

For using trestle or step-ladder, structure of trestle or step-ladder has to be safe and strong enough and providing with enough area for standing.

Part 3: Protection for collapse and falling of equipments

No.98

For working place that may have collapse or falling of equipments, stone, sand or other materials, those materials have to be placed with enough side slope or provide with other collapse protections.

No.99

In case of working in duct, pipe, tunnel, or well that may collapse, the barrier, bracing, or other collapse protections have to be provided.

No.100

Protect spill or splash of materials by using net, canvas or other equipments to protect or convey materials up or down from place to place. Chutes may be provided with appropriate and safety convey method. In case of using conveyor belt, string or sling, structure for safety attachment of those cables has to be provided.

The adapted regulation in 1982 by the Ministry of Interior, Safety in Construction work with Scaffolds.

This regulation is not applicable for

1. Building constructed by wood and height less than 7.0 m
2. Repair or maintenance works by 2 workers or less
3. Utilities work by 2 workers or less

Section 1: Construction

No.6

Scaffold must be provided for any constructions at level higher than 2 m

Section 2: Drawing of Scaffolds

No.7

For single pole scaffold that higher than 7.0 m, or the scaffolds that higher than 21.0 m., the scaffolds must be detailed and designed by EIT licensed engineers

No.8

For single pole scaffold that not higher than 7.0 m, or the scaffolds that not higher than 21.0 m., the designed and detailed scaffolds by either EIT licensed engineers or the standard scaffolds according to No.12 can be both applied.

No.9

In case of using scaffolds designed by EIT licensed engineers, the scaffolds must follow the followings:

- (1) For wood scaffolds, woods with good condition without crack or other damages that can reduce wood strength must be used, and the Ultimate bending stress of wood must not be less than 500 ksc. with safety factor not less than 4 except of using bamboo, bamboo strength must be evaluated by government approved and trusted institute. The tested results must have enough strength according to No.11(6).
In case of metal, material with yield point not less than 2,400 ksc. with safety factor not less than 2.
- (2) The scaffolds must be able to carry not less than two times of service loads for metal scaffolds or 4 times for wood scaffolds.
- (3) Supports of scaffolds must be strong enough to carry not less than two times of service load.
- (4) Skeleton of scaffolds must be tied, braced or shored with ground or structures to prevent sway or collapse.
- (5) The guard rail must be provided at height between 90 cm to 1.10 m from scaffold board along the outside edge of the scaffolds except necessary locations for transportation of objects and the single pole scaffolds.
- (6) Floor Boards have to be continuously provided with width not less than 35 cm. and fixed with bearers except single pole scaffolds.
- (7) Wood or Metal Ladder has to be provided inside the scaffolds with inclination not more than 45 degree except single pole scaffold
- (8) The scaffolds must be designed to cover imposed loads of protection plastic sheets, metal sheet or other similar material according to No.10 and 11(7)

Section 3: Scaffolds assembling

No.10

Employer has to follow the drawing and details according to No.9 and the following regulations:

- (1) For wooden scaffolds, if nails are used, size and length of nails must be appropriate and strong enough for each joint connection. The nails should not be hammered in for resisting with direct pull out force. The nails should be hammered in with full nail length and when the scaffolds are dismantled, all nails must be removed or bended in.
- (2) For the scaffolds with transport lift, impact prevention must be provided during transporting materials.
- (3) The scaffolds must not be tied with lift
- (4) The protection plastic or metal sheets or wood boards or similar must be provided around outside of scaffolds for preventing accidents except those for the single pole scaffolds.
- (5) The plastic or metal sheets or wood boards or similar must be provided above the openings for walkway to prevent accidents.

Section 4: Scaffolds usage

No.11

Usage of scaffolds must follow the following regulations:

- (1) If any parts of scaffolds are damage or harmful, it should be fixed immediately and works on those parts are suspended until fixing complete.
- (2) Works on scaffolds are suspended during storm.
- (3) Works on scaffolds are suspended if floor of scaffolds is slip.
- (4) If workers must work near power line or electric appliance without insulation, works must be apart from the source of electricity, according to the voltages, by the following distance both for vertical and horizontal, except the protection or appropriate insulation is provided:

For voltage more than 50	volts to	12,000 volts:	2.4	m
distance				
For voltage more than	12,000 volts to	33,000 volts:	3.0	m
distance				

For voltage more than distance	33,000 volts to	69,000 volts:	3.3 m
For voltage more than distance	69,000 volts to	115,000 volts:	3.9 m
For voltage more than distance	115,000 volts to	230,000 volts:	5.3 m

- (5) If works are performed in many stories at the same time, protection for accidents must be provided for workers who work below.
- (6) If chemical substance that may have reactions with strings, ropes or hems used for binding scaffolds shall be used; for example using Sodium Hydroxide for cleaning outside the building, the scaffolds must not be bind with those strings, ropes or hems.
- (7) In case if the standard scaffolds are applied according to No.12, the average load on scaffolds is limited to 150 kg/sq.m. For the single pole scaffold, the average load on each storey of scaffold is limited to 50 kg/ 1 m. length.

Section 5: Standard scaffolds

No.12

For the scaffolds height less than 21.00 m. and those not designed by licensed engineers, the employer must provide the scaffolds follow the regulations No.9, 10 and the standard scaffolds stated as follows:

(1) The single pole scaffolds with height less than 7.00 m. for painting works

- (a) For bamboo scaffolds, average diameter measured at middle length of bamboo must larger than 6 cm. Connections must be lapped not less than 1.00 m. and wrenched not less than 2 rounds. Ropes or hems must be new and ductile with not less than 2 cm. diameter. The posts must not be more than 1.5 m. apart. The horizontal members must be bind with all posts. The diagonal members must incline not more than 45 degree from horizontal and zigzag bind with all posts. The scaffolds must bind to ground anchored post not more than 4.5 m distance. Each storey of the scaffolds must not be apart more than 2.0 m distance.
- (b) For other wooden scaffolds, cross section area of each wooden piece must not be less than 24 sq.m. and thickness of not less than 3 cm. Distance between vertical and horizontal members and floor distance must follow the bamboo scaffolds but using nailed connections. This type of scaffold is not applicable for applied loads more than workers weight and loads from light weight material.

(2) The scaffolds with height less than 7.00 m. for construction works

- (a) For bamboo scaffolds, average diameter measured at middle length of bamboo must larger than 6 cm. Connections must be lapped not less than 1.00 m. and wrenched not less than 2 rounds. Ropes or hems must be new and ductile with not less than 2 cm. diameter. Posts must be installed in 2 rows and not be more than 1.5 m. apart in each row. Distance between rows must be from 50-79 cm. The bamboo runners are used to bind with all posts on both sides. Other wood can be used for floor support bearers with cross section area not less than 24 sq.m. bind with bamboo runners those not more than 50 cm apart. Thickness of floor wood must not be less than 2 cm and firmly bind to the bearers. The bamboo diagonal members must be used and inclined not more than 45 degree from horizontal and zigzag bind with all posts on both sides. The scaffolds must bind to strong parts of building or ground anchored post not more than 4.5 m distance. Each storey of the scaffolds must not be apart more than 2.0 m distance.
- (b) Install the guard rail using bamboo horizontally bind with vertical posts at height above 90

cm from each floor of the scaffolds but not higher than 1.10 m. from the floor.

This type of scaffolds is not applicable for applied loads more than 150 kg/sq.m.

(3) The scaffolds with height not higher than 12.00 m. for construction works

- (a) Wooden posts must have cross section area not less than 33 sq.cm. and thickness of not less than 3 cm. Posts must be vertically installed in 2 rows with the distance of more than 50 cm between rows but not over than 75 cm. Each post must not be more than 2.00 m. apart. Connection of post uses Butt joint. At Butt joint position, lap wood must be attached on both sides with the length of not less than 60 cm and with the cross section area not less than that of the post.

The runner wooden members must have cross section area not less than 33 sq.cm., thickness of not less than 3 cm. and width of not less than 9 cm. Runners in each floor must have spacing of not more than 2.00 m. All Runners must connect to the post and supported with anchor (or pintle).

The bearer wooden members must have cross section area not less than 24 sq.cm., thickness of not less than 3 cm. and spacing of not more than 50 cm. All bearer members must connect to the runners and extend their ends beyond the runners of not less than 10 cm.

Shorings and Bracings must not be smaller than the bearers and zigzag braced from ground along the scaffolds with the inclination from 45 to 60 degree.

Wooden floor of the scaffolds must thicker than 2 cm. and install and fixed with bearer at all ends.

Use the appropriate size of nails or bolts to fix and connect all of the scaffolds.

For connection of scaffolds to the building, beams or columns around the building, 6 mm diameter dowel bars with length not less than 30 cm. must be embedded in concrete at spacing not more than 2.00 m. for fixed with the scaffolds. Bracings or Ties must be provided at every floor of building for preventing sway of the scaffolds against the building.

The ladder must be provided inside the scaffolds. Each ladder step uses the wooden piece of thickness not less than 3 cm and width not less than 7 cm. Distance between each step must not be more than 50 cm. in vertical, and horizontally lapped but not more than 10 m.

- (b) The guard rails of wooden piece of thickness not less than 3 cm and width not less than 7 cm must be installed all around the scaffolds at height above 90 cm. but not higher than 1.10 m.

This type of scaffolds is not applicable for applied live loads more than 10 kg/sq.m.

- (4) For the scaffolds with height not higher than 21.00 m. for construction works, regulation (3) can be applied except that thickness of the posts must not be less than 7 cm. and spacing of the posts must not be more than 1.50 m.

Section 6: Safety protections

No.13

Employer must equip all workers who work with/on/under/ or near scaffolds the safety equipments and protections those are appropriate with their works all the working time as follows:

- (1) For carpentry works: Safety helmet and Safety shoes
- (2) Smithery works: Safety helmet, Cloth or leather globes and Safety shoes
- (3) Cement works: Safety helmet, Rubber globes or similar and Safety boots.
- (4) Brick and Masonry works: Safety helmet, Rubber globes or similar and Safety shoes.
- (5) Structural works, Transport works and Installation works: Safety helmet, Cloth or leather globes and Safety shoes.

- (6) Painting works: Safety helmet and Safety shoes.
- (7) Plumbing: Safety helmet, Cloth or leather gloves and Safety shoes.
- (8) Glass and Mirror works: Safety helmet, Cloth or leather gloves and Safety shoes.

No.14

Employer must provide and equip the workers who work alone at height higher than 4.00 m. without safety equipment or other protections with safety belt and cable all the working time.

Section 7: Standards for Safety equipments

No.15

The personal safety equipments must follow the following standards:

- (1) Safety helmet: Single dome shape without seam and hole, made from non-metal material, weight not more than 420 g. When testing with impact and drilling according to the test standard, depth must not be more than 1 cm. Top of inner subpention must have space from inside shell of helmet not less than 3 cm.
- (2) Glove must be ductile and not easily to tear. Glove must cover unto wrist and be able to wear all separate fingers. After wearing, each finger must be able to move freely.
- (3) Safety shoes must be made of leather or cloth cover all parts of feet and heels, the shoes tread are rubber to prevent slip.
- (4) Safety belt must be made of leather or cotton or nylon or other materials with similar properties, knitted up as a band with the width not less than 5 cm, and have tensile strength of not less than 1,150 kg.
- (5) Safety rope and cable must have tensile strength of not less than 1,150 kg. In case of sling cable, flick reduction equipment must be provided and installed.
- (6) Safety boots must be made of rubber or other similar materials cover all parts of feet, heels up to at least half of shin and can protect water, acid and base.

Section 8: Miscellaneous

No.16

This safety regulation is the at least standards that must follow.

No.17

All expenses of activities according to this regulation are responsibility of employer.

Appendix B: Regulation of Malaysia

Laws of Malaysia, Factories and Machinery Act 1967 [ACT 139] (Safety) Regulations 1986 (Building Operations and Works of Engineering Construction)

Part 10 – Scaffolds

Regulation 72. Construction.

- (1) Every scaffold and every part thereof shall be of good construction, of suitable and sound material and of adequate strength for the purpose for which it is used.
- (2) Sufficient material shall be provided for and shall be used in the construction of scaffolds.
- (3) Timber used in the construction of scaffolds shall be of keruing wood or wood of equal or higher strength.
- (4) Timber used in the construction of scaffolds shall be rough sawn and shall be sound, straight-grained, free from dry-rot, or other defects impairing its strength or durability.
- (5) Timber used in the construction of scaffolds must have the bark completely stripped off, and not be painted or treated in any way so that defects cannot be easily seen.
- (6) Metal parts used for scaffolds shall be of suitable quality and be in good condition and free from corrosion or other patent defect likely to affect their strength materially.
- (7) All scaffolds and their supports shall be capable of supporting the load they are designed to carry with a safety factor of at least four.

Regulation 73. Maintenance.

- (1) Every scaffold shall be properly maintained and every part thereof shall be kept so fixed, secured or placed in position as to prevent, as far as is practicable, accidental displacement.
- (2) No scaffold or part thereof shall be partly dismantled and allowed to remain in such a condition that it is capable of being used unless either-
 - (a) the scaffold continues to comply with these Regulations; or
 - (b) a prominent warning notice in the national language indicating that the scaffold or part thereof is not to be used, is affixed near any point at which the scaffold or part, as the case may be, is liable to be approached for the purpose of use.

Regulation 74. Supervision of work and inspection of material.

- (1) No scaffold shall be erected or be substantially altered or be dismantled except under the direct supervision of a designated person.
- (2) All materials to be used for the construction of scaffolds shall be inspected by a designated person on each occasion before being used.

Regulation 75. Design and drawings of scaffolds to be approved.

- (1) every metal tube scaffold exceeding 40 metres in height and every other scaffold exceeding 15 metres in height shall be constructed in accordance with the design and drawings of a Professional Engineer. All other metal tube scaffolds shall have their designs and drawings approved by the Chief Inspector.
- (2) A copy of the design and drawings of the structure shall be submitted to the Chief Inspector for his record prior to the erection of the structure.
- (3) A copy of the design drawings certified by the Professional Engineer shall be made available at the worksite for inspection by an Inspector.

Regulation 76. Standards, uprights, ledgers and putlogs.

- (1) Standards or uprights of scaffolds shall be-
 - (a) where practicable vertical or slightly inclined towards the building; and
 - (b) fixed sufficiently close together to secure the stability of the scaffold having regard to all the circumstances.
- (2) The displacement of the foot of any standard or upright shall, unless prevented in some other sufficient way, be prevented either-
 - (a) by sinking the standard or upright to a sufficient depth into the ground; or

- (b) by placing the standard or upright on an adequate base plate in a manner to prevent slipping.
- (3) Ledgers shall be as nearly as possible horizontal and shall be securely fastened to the uprights or other means of support or suspension by bolts, dogs, ropes or other efficient means.
- (4) Where two ledgers are connected together the connection shall be secure and in the case of timber ledgers not connected together at an upright or point of suspension, both ledgers shall be connected to a separate splicing ledger of adequate strength spanning between and properly secured to the uprights or points or suspension on opposite sides of the connection of the ledgers.
- (5) Putlogs shall be straight or approximately straight and shall be securely fastened to the ledgers or uprights, except in the case of a timber putlogs so shaped and placed that fastening is not necessary to prevent its displacement. Putlogs which have one end supported by a wall shall have at that end a flat supporting surface of sufficient area. Nails shall not be used for fastening putlogs.
- (6) The distance between two consecutive putlogs or other supports on which a platform rests shall be fixed with due regard being given to the anticipated load and the nature of the platform flooring. As a general rule the distance with single planks shall not exceed one metre with planks 32 millimetres in thickness, 1.5 metres with planks 38 millimetres in thickness, or 2.6 metres with planks 50 millimetres in thickness.

Regulation 77. Support and stability of scaffolds.

- (1) Every scaffold shall be securely supported or suspended and where necessary sufficiently and properly strutted or braced to ensure stability.
Provided that if the scaffold is not properly designed and constructed as an independent scaffold, it shall be rigidly connected with the building.
- (2) All structures and appliances used as supports for scaffolds, working platforms, gangways or runs shall be of sound construction, have a firm footing or be firmly supported, and shall, where necessary, be sufficiently and properly strutted or braced to ensure stability.
- (3) Any mobile scaffold or scaffold which can be moved on wheels or skids shall, unless it is a suspended or slung scaffold, be-
 - (a) constructed with due regard to stability, and if necessary for stability, adequately weighed at the base.
 - (b) used only on a firm and even surface, not so sloping as to involve risk of instability of the scaffold or any load thereon;
 - (c) adequately secured to prevent movement when any person is working upon it; and
 - (d) moved only by the application of force at or near the base.

Regulation 78. Gears for suspension of scaffolds.

- (1) Chains, ropes and lifting gear used for the suspension of scaffolds shall be of sound material, adequate strength and suitable quality, and in good condition.
- (2) No rope other than a wire rope shall be used for the suspension of a scaffold, but this requirement shall not apply in the case of a suspended scaffold which is raised or lowered otherwise than by means of winches or in the case of those equipment being used for the purposes of a suspended scaffold in accordance with regulation 83.
- (3) Chains, ropes and metal tubes used for the suspension of a scaffold other than a suspended scaffold shall be properly and securely fastened to safe anchorage points and to the scaffold ledgers or other main supporting members. They shall be so positioned as to ensure stability of the scaffold, be approximately vertical and be kept taut.
- (4) Every scaffold suspended by means of ropes or chains shall be secured to prevent undue horizontal movement while it is used as a working platform.

Regulation 79. Cantilever, jib, figure and bracket scaffolds, etc.

- (1) No cantilever or jib scaffold shall be used unless it is adequately supported, fixed and anchored on the opposite side of the support, has outriggers of adequate length and cross-section and is, where necessary, sufficiently and properly strutted or braced to ensure rigidity and stability.
- (2) No working platform resting on bearers let into a wall at one end and without other support shall be used unless the bearers are of adequate strength, pass through the wall and are

securely fastened on the other side.

- (3) No figure or bracket scaffold supported or held by dogs, spikes, or similar fixings which are liable to pull out of the stonework or brickwork in which they are fixed shall be used.

Regulation 80. Scaffolds supported by buildings.

No part of a building shall be used as support for part of a scaffold unless it is sound material and sufficiently stable and of sufficient strength to afford safe support. Over-hanging eaves gutters shall not be used as such support unless they have been specially designed as walkways and are of adequate strength.

Regulation 81. Suspended scaffolds raised or lowered by means of winches.

Suspended scaffolds raised or lowered by means of winches shall not be used unless-

- (a) outriggers are-
- (i) of adequate length and strength and properly installed and supported;
 - (ii) installed horizontally;
 - (iii) properly spaced in relation to the putlogs or deck irons;
 - (iv) securely fixed to the building by anchor bolts or other equivalent means, or where such fixing is not reasonably practicable, adequately and securely anchored at the inner ends; and
 - (v) provided with adequate stops at their outer ends;
- (b) the points of suspension are at adequate horizontal distances from the building face;
- (c) the suspension ropes are-
- (i) of good construction, and sound material, adequate strength and free from patent defect.
 - (ii) securely attached to the outriggers or other supports and to the winch drum, and
 - (iii) of such length that at the lowest position of the platform there are at least two turns of rope on each winch drum; and
- (d) the platform is-
- (i) not less than 635 millimetres wide, and
 - (ii) so arranged or secured that, at each working position, the edge of the platform (whether of the normal platform or of an extension thereof towards the building face as the case may be) is as close as practicable to the building face, but so that where employees sit at the edge of the platform to work the edge may be not more than 460 millimetres from such face.

Regulation 82. Other suspended scaffolds.

Suspended scaffolds other than scaffolds raised or lowered by means of winches shall not be used unless-

- (a) outriggers are-
- (i) of adequate length and strength and properly installed and supported.
 - (ii) firmly anchored at the inner ends, and
 - (iii) securely fastened to any ballast or counterweight;
- (b) the points of suspension are at adequate horizontal distances from the building face;
- (c) the platform is-
- (i) not less than 430 millimetres wide;
 - (ii) suspended by ropes or chains which are spaced not more than 3.2 metres apart, are maintained in tension and are properly and securely fastened; and
 - (iii) suspended so as to prevent tipping or tilting of the platform;
- (d) the suspension ropes or chains are of good construction, sound material, adequate strength and free from patent defect; and
- (e) there are devices provided and used where necessary to keep the platform at a sufficient distance from the wall when persons have to work in a sitting position :
- Provided that sub-paragraph (ii) of paragraph (c) of this regulation shall not apply in the case of a scaffold which is securely suspended from fixed anchorages and has a platform more than 635 millimetres wide supported on metal bearers properly and securely connected to raising and lowering tackle (being wire rope or chain tackle which is capable to sustain the load).

Regulation 83. Skip, bucket, basket, boatswain's chair, etc. shall not be used as suspended

scaffold.

- (1) A skip, bucket, basket, boatwain's chair or similar equipment shall not be used for the purposes of a suspended scaffold except in special circumstances where the work is of such short duration as to make the use of a suspended scaffold unreasonable or where the use of a suspended scaffold is not reasonably practicable and shall only be so used under the supervision of a designated person.
- (2) Such equipment shall not be used for the purpose of a suspended scaffold unless-
 - (a) the equipment including the suspension ropes or chains and their means of support are of good construction, sound material, adequate strength and free from patent defect and the ropes or chains are securely attached; and
 - (b) suitable measures are taken to prevent spinning or tipping and to prevent any occupant from falling therefrom.
- (3) No skip, bucket or basket shall be used for the purposes of a suspended scaffold unless it is-
 - (a) at least 760 millimetres deep; and
 - (b) either constructed wholly of suitable metal or carried by two strong bands of suitable metal which are properly fastened and continued round the sides and bottom.

Regulation 84. Trestle scaffold.

- (1) No trestle scaffold shall be used-
 - (a) if constructed with more than three tiers; or
 - (b) if it has working platform more than 4.5 metres above the ground or floor or other surfaces upon which the scaffold erected.
- (2) The provisions of sub-regulation (1) shall not apply to trestle scaffolds constructed in accordance with the design and drawings of a Professional Engineer.
- (3) No trestle scaffold shall be erected on a scaffold platform unless-
 - (a) the width of the platform is such as to leave sufficient clear space for the transport of materials; and
 - (b) the trestle or uprights are firmly attached to the platform and adequately braced to prevent displacement.
- (4) No trestle scaffold shall be erected on a suspended scaffold.

Regulation 85. Inspection of scaffolds.

- (1) Subject to the provision of these Regulations, no scaffold shall be used unless-
 - (a) it has been inspected by a designated person within the precedings seven days; and
 - (b) it has been inspected by a designated person since its exposure to weather conditions is likely to have affected its strength or stability or to have displaced any part; and
 - (c) the results of such inspection are entered by the designated person into a register which is to be kept at the worksite for inspection by an Inspector.
- (2) The provisions of paragraph (a) of sub-regulation (1) of this regulation shall not apply to a scaffold where no part of which has been erected of more than seven days, and a trestle scaffold or a scaffold from no part of which a person is liable to fall more than 3 metres.

Regulation 86. Working platforms.

Every working platform from which a person is liable to fall more than 3 metres shall be -

- (a) either closely boarded, planked and plated, or a platform consisting of open metal work having interstices none of which exceeds 3,870 square millimetres in area;
- (b) at least 635 millimetres wide if the platform is used as a footing only and not for the deposit of any materials;
- (c) at least 860 millimetres wide if the platform is used for the deposit of material; and
- (d) at least 1.1 metres wide if the platform is used for the support of any higher platform.

Regulation 87. Boards and planks in working platforms.

- (1) Every board or plank forming part of a working platform or used as a toe-board shall be-
 - (a) of a thickness capable of affording adequate security having regard to the distance between the putlogs or standards; and

- (b) not less than 200 millimetres wide or in the case of boards or planks exceeding 50 millimetres in thickness, not less than 150 millimetres wide.
- (2) No board or plank which forms part of a working platform shall project beyond its end support to a distance exceeding four times the thickness of the board or plank unless it is effectively secured to prevent tipping, or to a distance which, having regard to the thickness and strength of the plank, renders the projecting part of the plank and unsafe support for any weight liable to be upon it.
- (3) Suitable measures such as the provision of adequate bevelled pieces shall be taken to reduce to a minimum the risk of tipping and to facilitate the movement of barrows where boards or planks which form part of a working platform overlap each other or are not of reasonably uniform thickness where they meet each other or owing to warping or for some other reason do not provide an even surface.
- (4) Every board or plank which forms part of a working platform shall-
 - (a) rest securely and evenly on its supports; and
 - (b) rest on at least three supports, unless, taking into account the distance between the supports and the thickness of the board or plank, the conditions are such as to prevent undue sagging more supports are required.
- (5) Where work has to be done at the end of a wall, the working platform at such wall shall, wherever practicable, extend at least 610 millimetres beyond the end of the wall.

Regulation 88. Guard-rails and toe-boards at working place.

- (1) Subject to sub-regulations (3), (4) and (5) every side of a working platform or working place, being a side thereof from which a person is liable to fall a distance of more than 3 metres , shall be provided with a suitable guard-rail or guard-rails of adequate strength to a height of at least one metre above the platform or place and above any raised standing place on the platform, and with toe-boards up to a sufficient height being in no case less than 200 millimetres and so placed as to prevent so far as possible the fall of persons, materials and tools from such platform or place.
- (2) The guard -rails and toe-boards used on a working platform or working place shall be placed on the inside of the uprights, and the space between any toe-board and the lowest guard-rail above it shall not exceed 690 millimetres.
- (3) Guard-rails and toe-boards required by sub-regulation (1) and (2) may be removed or remain unerected for the time and to extent necessary for the access of persons or the movement of materials.
- (4) On the side of suspended scaffold facing the wall-
 - (a) guard-rails where required by this regulation need not extend to a height of more than 690 millimetres above the platform if the work is impracticable with a guard-rail at a greater height;
 - (b) guard-rails and toe-boards shall not be required if the workers sit at the end of the platform to work and ropes or chains affording all the employees a safe and secure handhold are provided.
- (5) The requirements of sub-regulations (1) and (2) regarding toe-boards shall not apply to the platform of a trestle scaffold or where the provisions of a toe-board is impracticable on account of the nature or special circumstances at the work.

Regulation 89. Working platforms at building face.

Where work at the face of a building is done from a working platform, the space between the face of the building and the working platform shall be as small a practicable and where employees sit at the edge of the platform to work, the space shall not exceed 460 millimetres.

Regulation 90. Platforms to be unobstructed and to afford safe foothold.

- (1) Every platform shall be kept free from any unnecessary obstruction, material or rubbish and from any projecting nails.
- (2) If a platform becomes slippery, appropriate steps shall as soon as reasonably practicable to taken to remedy the defect.

Regulation 91. Tube scaffolds.

The scaffold members shall be of steel tubing complying with BS 1139 "Metal Scaffolding".

Regulation 92. Scaffold locking device.

All vertical and horizontal members of a tube scaffold shall be fastened together with a coupler or approved locking device, forming a positive connection. The locking device shall be of a type having no loose parts.

Regulation 93. Locking device material.

The locking device or coupler shall be of drop-forged steel.

Regulation 94. Construction of tubular scaffold.

In the construction of tubular scaffolds, members of the following dimensions shall be used-

- (a) in a light type tubular scaffold all posts, runners, and bearers shall be of 50 millimetres outside diameter tubing with the posts spaced not more than 1.5 metres apart by 3 metre along the length of the scaffold and all bracing shall be of 50 millimetres outside diameter tubing;
- (b) in a medium type tubular scaffold, all posts and runners shall be of 50 millimetres outside diameter tubing and the bearers of 60 millimetres outside diameter tubing with the posts spaced 1.8 metres apart by 2.4 metres along the length of the scaffold and all bracing shall be of 50 millimetres outside diameter tubing; and
- (c) in a heavy tubular pole scaffold, all posts and runners to be of 50 millimetres outside diameter tubing, and the bearers of 60 millimetres outside diameter tubing with the posts spaced 1.8 metres by 2.4 metres along the length of the scaffold and all bracing to be of 50 millimetres outside diameter tubing.

Regulation 95. Size of tube scaffold.

For tubular steel scaffolds up to 22 metres in height, posts of 50 millimetres outside diameter tubing shall be used and for heights 22 metres to 61 metres, 60 millimetres outside diameter tubing shall be used.

Regulation 96. Factor of safety.

All tubular scaffolds shall be designed to have a factor of safety of not less than four.

Regulation 97. Bracing.

Posts shall be kept plumb during erection and the scaffold shall be subsequently kept plumb and rigid by means of adequate bracing.

Regulation 98. Power to prohibit the use of unsafe scaffolds.

The Inspector may prohibit the use of any scaffold or part thereof which does not comply with the requirements of these Regulations or the design of construction of which appears to be unsafe to the Inspector, by any means he deems fit.

Appendix C: Regulation of Philippines

Occupational Safety and Health Standards by Department of Labor and Employment, Republic of the Philippines,

The objective of this Standard is to protect every workingman against the dangers of injury, sickness or death through safe and healthful working conditions, thereby assuring the conservation of valuable manpower resources and the prevention of loss or damage to lives and properties, consistent with national development goals and with the State's commitment for the total development of every worker as a complete human being. This Standards shall apply to all places of employment except otherwise provided in this Standard.

Rule 1414: Scaffoldings:

- (1) Every scaffold shall be of good construction of sound materials and strength for the purpose for which it is intended.
- (2) Timber used for scaffolds shall be in good condition, the bark completely stripped off, and not painted or treated in any manner that defects cannot be easily seen.
- (3) All materials and parts of scaffold not in use or intended for re-use shall be kept under good condition and separate from other materials unsuitable for scaffolds.
- (4) Timber/bamboo scaffoldings shall be limited to a height of 20 meters from the ground or base provided that, over a height of 10 meters, the scaffolding and all other installations constructed over the scaffolding shall be designed by a structural engineer and duly approved by the appropriate authority.
- (5) At heights over 20 meters, structural metals should be used designed by a structural engineer and duly approved by the appropriate authority;
- (6) Structural steel when used as load bearing members of scaffolding shall be destressed at welded or bent joints and design construction approved by the proper authority.

1414.01: Maintenance of Scaffold:

- (1) All scaffolds shall be properly maintained and every part shall be kept, fixed and secured in position to prevent displacement.
- (2) No partly dismantled scaffold shall be used unless it is rendered stable, strong and safe for the purpose.
- (3) Scaffoldings left standing for four (4) months shall not be used until damaged members are replaced and the whole structure returned to its original strength.

1414.02: Supervision and inspection of Scaffold:

- (1) Scaffold shall be erected, added, altered or dismantled only under the supervision of the person in charge of the construction.
- (2) All materials used in any scaffold shall be inspected before use.
- (3) Lumber with two (2) nail holes aligned crosswise or four (4) nail holes along its length shall not be used as horizontal load bearing member of scaffolds.

1414.03: Strength and Stability of Scaffold:

Every scaffold shall:

- (a) be capable of supporting twice the maximum load to which it may be subjected without exceeding the allowable unit stresses of the materials used;
- (b) have all standards diagonally and horizontally braced to prevent lateral movement; and
- (c) have no splices between the points of support of horizontal members and secured to prevent lateral movement.

1414.04: Construction of Timber Scaffold:

- (a) In single scaffold, the standard shall be placed at 1.18 to 2.43 meters (4 to 8 ft.) apart at a distance of 1 m. (3 ft.) from the wall, connected horizontally by ledgers spaced vertically at 1.51 m. (5 ft.) to 1.81 m. (6 ft.) on centers. Putlogs shall be placed in the holes left in

the walls.

- (b) The size of the standard shall not be less than 8.9 cm. (3 in.) in diameter or its equivalent and when it is necessary to extend a standard, the overlaps shall not be less than 60 cm. (23 in.),
- (c) In double scaffold, the outer row shall be at a distance of 1.22 to 1.32 m. from the wall. The putlogs shall rest entirely on the ledgers. In addition to the diagonal braces, inclined supports shall be provided to prevent the scaffold from leaning away from the wall. The supports shall be strutted at intermediate heights against the standards.
- (d) The size of the standards for double scaffold shall not be less than 10 cm. in diameter or its equivalent and when it is necessary to extend a standard the overlap shall not be less than 15 cm.
- (e) Ledgers, standards and putlogs shall be securely fastened by bolts, dogs, or ropes.
- (f) The distance between two consecutive putlogs shall be designed with due regard to anticipated load and the nature of the platform flooring. As a minimum rule, the spacing shall be as follows: for 3.2 cm. thick planks, spacing shall not exceed 1 m. for 3.8 cm. thick planks spacing shall not exceed 1.5 m.
- (g) The displacement of the foot of the standard shall be prevented either by sinking it into the ground or by fixing it on a base plate.

1414.05: Types of Scaffolds:

- (1) Traveling scaffold shall ;
 - (a) be of stable construction and weighted at the base to prevent overturning,
 - (b) be used only on firm and even surface,
 - (c) be securely braced,
 - (d) not be moved when any worker is on the scaffold,
 - (e) be moved only from or near the base,
- (2) Suspended scaffold shall not be uses unless:
 - (a) the fixed support or outriggers to which it is attached are capable of supporting at least four (4) times the maximum load to which they may be subjected without exceeding the allowable unit stresses of the material used;
 - (b) the platform is at least 25 cm. wide, suspension points shall not be more than 3 m, apart, and provided with devices to keep the platform at a distance from the wall to allow working in sitting position.
 - (c) when suspended scaffold is raised or lowered, it shall have rope pulls equipped with pulley blocks, and mechanical hoisting equipment with a positive device to prevent the scaffold from falling freely.
- (3) cantilever, jib, figure and bracket scaffolds:
 - (a) every cantilever or jib scaffold shall be properly supported, fixed and anchored on opposite side of the supports, have outrigger of designed strength and properly strutted or braced to ensure rigidity and stability.
 - (b) Figure or bracket scaffold shall not be supported or held by dogs, spikes or similar fixing devices that will pull out.
- (4) Skips, brackets, boatswain chair:
 - (a) Skip, bracket, basket and boatswain chair shall not be used as substitute for a suspended scaffold unless the work is of such short duration and the work is under the supervision of the person responsible for the construction.
 - (b) No skip, bracket, or basket shall be used as a suspended scaffold unless it is:
 - i. at least 76 cm. deep and
 - ii. either constructed of metal or carried by two strong bands of metal fastened around the sides and bottom.
- (5) Ladder Scaffolds or Ladder jack Scaffolds:

A ladder scaffold shall be used only when:

- (a) the work is of such light nature and the material required for the work is light and can be hung on the ladder.
 - (b) the distance between the ladders of the scaffold is less than 3 m.
- (6) Trestle Scaffolds:
- (a) Trestle scaffolds shall not be used if the working platform is more than 5 m. from the ground or floor or other surface upon which the scaffold is erected.
 - (b) A trestle scaffold shall not be erected on a scaffold platform unless:
 - i. the platform is sufficiently wide for the transport of materials,
 - ii. the uprights are firmly attached to the platform and braced to prevent displacement, and
 - iii. designed by structural engineer and approved by the proper authority if erected on a scaffold 10 meters or over in height.
 - (c) No trestle scaffold shall be erected on suspended scaffold.
- (7) Outrigger Scaffold:
An outrigger scaffold shall have:
- (a) its platform within 8 cm. from the wall and
 - (b) shall have outrigger secured against horizontal and vertical movements.
- (8) Bamboo Scaffold:
Bamboo scaffold may be used for painting or light construction work constructed and maintained.
- (a) the material and construction shall be sufficient to carry at least four (4) times the imposed load,
 - (b) only one worker shall be allowed in any one span;
 - (c) the maximum span between posts shall be 266 cm. (8 ft.)
 - (d) when the height or fall is over 6.6 in. (20 ft.), the use of safety belt shall be required;
 - (e) when erected over a height of 10 meters (30 ft.), the design shall be by a structural engineer approved by the proper authority and construction shall be under expert supervision, and
 - (f) the maximum height allowed is 20 meters (60 ft.)

1414.06: Platform, Runways, Ramps and Stairs:

- (1) All working platforms, runways and ramps from which workers are liable to fall a distance of more than 2 m. (6 ft.) shall be:
 - (a) for platform with minimum width of 70 cm. (28 in.) the runways and ramp shall be 45 cm. (18 in.) and if runways are used for the passage of materials, the width shall not be less than 70 cm. (28 in.).
 - (b) provided with strong guard rails up to a height of 91 cm. (35 in.) above the working surface and toeboards of at least 20 cm. (8 in.) in height.
- (2) The following shall be the minimum width of platform for various types of scaffolds:
 - (a) When the platform is not more than 2 m. (6 ft.) above the ground floor:
 - i. for painters, decorators and similar types of workers, 30 cm. (12 in.);
 - ii. for all other types of workers and tools, 50 cm. (20 in.)
 - (b) When the platform is more than two 2 m. (6 ft.) above the ground or floor:
 - i. for men, tools and materials, 1 m. (3 ft.)
 - ii. for men, tools, materials and vehicles, 1.5 m. (5 ft.)
- (3) Every platform, runway, ramp or stairs shall be kept free from any obstruction, materials, rubbish and projecting nails. When they become slippery due to the nature of work, steps shall be taken by way of sanding, cleaning or by any other means to roughen the surface.
- (4) Supporting members used in the construction of platforms, runways, ramps and stairs shall be securely fastened and braced. The supporting members shall be placed in a firm and rigid

foundation to prevent lateral displacement.

- (5) The uniformly distributed minimum design load of platform, runway, ramp or stair shall be 650 kg./sq.m. (133 lbs./sq. ft.). The stress due to concentrated loads at any point in the floor shall not exceed those caused by the uniformly distributed load used in the design. Planking used shall not be less than 3 cm. (2 in.) thick.
- (6) A scaffold platform shall not project beyond its end support to a distance exceeding four (4) times the thickness of the plank, unless secured to prevent tipping.
- (7) All planks, platforms, runways and ramps shall be fixed and supported to prevent sagging and moving.
- (8) Slope of runway or ramp shall not exceed 2 in 3.
- (9) When the slope of runway or ramp requires additional foothold using stepping laths, they shall:
 - i. have a minimum section 5 x 8 cm. (2 in. x 3 in.) placed at maximum intervals of 46 cm. (18 in.) on centers;
 - ii, extend to the full width of the runway or ramp except that they may be interrupted over a width of not more than 10 cm. (4 in.) to facilitate the passage of barrows.

2. 手すり先行工法などガイドライン等に示されている工法の評価

分担研究者 高梨成次 独立行政法人労働安全衛生総合研究所主任研究員

研究要旨 建設作業所において手すり先行工法などの新たな機材を導入するにあたり、幅広く普及させるための改善点について検討することを目的として、代表的な種類の手すり先行工法に関して、建設作業員 18 名にアンケート型式による意見聴取を行なった。また、実験用の足場を設置する際に、作業員に手すり先行工法を用いて組立てを行わせた。その際、作業員の状況を観察し、作業終了後、手すり先行工法の安全性や作業性などについて意見交換を行った。その結果、作業性等を考慮して、まずは作業員に使っていただくことを考えた改良が、手すり先行工法など新しい機材の普及に有益であるということが明らかとなった。しかし、新しい機材の普及に関して重要である、機材を使用したいかどうかについては、否定的な意見が多く、これに関しては改良すべき点であると考えられる。

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対する意見聴取や、実際に同工法を用いた足場の組立て作業の観察等により評価を行った。

その結果より、手すり先行工法を使用した場合に起こりうる問題点を抽出し、墜落防止のための新たな機材を開発する上での必要な改善点について検討した。

A. 研究目的

建設業では墜落災害による死亡者数が最も多いため、その対策として、足場先行工法（軒の高さ 10m 未満の住宅等の建方前に足場を先行して設置する工法）や手すり先行工法（足場の組立・解体時に常に先行して手すりを設置する工法、構造物の高さに関係なく全ての建設工事に適用されている）のガイドライン制定（それぞれ平成 18 年、平成 21 年に改正）など順次強化され、死亡災害が減少するなど一定の効果が表れている。

前者における普及率は 90%以上と非常に高く、墜落災害の防止に大きく寄与している。しかし、後者においては、安全性の向上は見られるものの、必ずしも広く普及していないのが現状である。

このような状況から、本研究では、建設作業所において手すり先行工法などの新たな機材を導入するにあたり、幅広く普及させるための改善点について検討することを目的とした。具体的には、普及の点で問題が残る手すり先行工法について、作業員に

B. 研究方法

代表的な種類の手すり先行工法に関して、建設作業員 18 名にアンケート型式による意見聴取を行なった。被アンケート者の内、手すり先行工法を使用した経験がある者は 1 名だけであり、2 名は知っているが、使用したことがなく、残りの 15 名は、手すり先行工法自体を知らなかった。そこで、意見聴取は、以下に示す 4 種類の機材を実際に保持したり、観察していただいたりした後実施した。しかし、実際に足場の組立てまでは行わせなかった。

- ①手すり先送り方式
(手すり枠をスライドする方式)
- ②手すり先送り方式
(手すり支柱をもちかえる方式)
- ③手すり据置き方式
- ④手すり先行専用足場方式

被アンケート者の業種およびその割合を図 1 に示す。建設業と鉄工業従事者が全体の約 4 分の 1 で、約半数が塗装業者となった。被験者の年齢構成および、経験年数を

図2、図3に示す。年齢構成は30歳代を中心に、20歳代、40歳代、50歳代とバランス良く召集できた。また、経験年数を10年未満から30年以上の10年毎に4分類したところ、ほぼ同人数となり、特定の経験年数に偏ることがなく召集することができた。

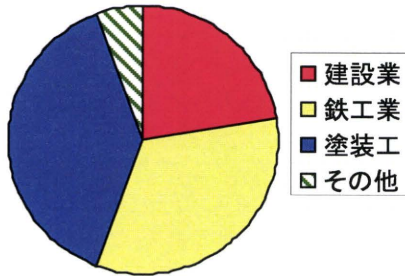


図1 被アンケート者の職種

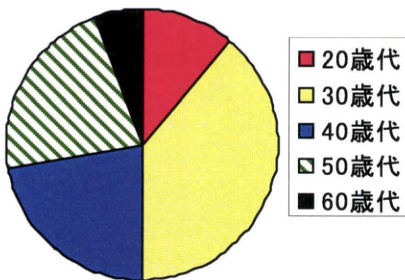


図2 被アンケート者の年齢構成

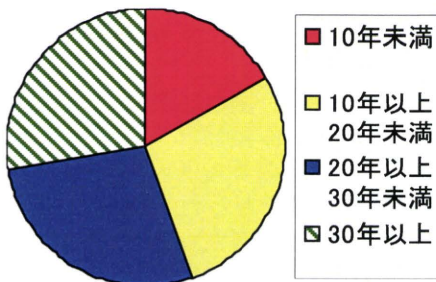


図3 被アンケート者の経験年数

また、当研究所内で実験用の足場を設置する機会を利用し、作業員に一部手すり先行工法を用いて組立てを行わせ、その際に作業員の状況（安全性、作業性）を観察するとともに、作業終了後、作業員の同意が得られたため、先述した18名に追加してアンケート型式による意見聴取を行った。手すり先行工法により組立てた、実験用足場を写真1に示す。



写真1 一部手すり先行工法により組立てた足場

なお、当該足場の組立ての際には、手すり先行工法の種類の一つである手すり据置き方式を行わせた。しかし、平成21年に改正された「手すり先行工法等に関するガイドライン」に規定されている、「働きやすい安心感のある足場」に関する部材については、足場設置の本来の目的である実験時の作業性等を考慮して設置しなかった。

組立てを行った作業員は4名で、年齢構成と足場作業の経験年数は以下のとおりである。また、4名の作業員は全員、手すり先行工法について使用した経験が少ないとのことであった。

- ①年齢30代、経験年数7年
- ②年齢30代、経験年数15年
- ③年齢50代、経験年数25年
- ④年齢60代、経験年数42年

アンケートの内容は、先行手すり機材の使用感、安全になるかどうか、使用したいかどうかの三点に絞って質問した。

以上の方法による、アンケート型式による意見聴取の結果や、手すり先行工法組立時の作業員の状況の観察などにより、墜落防止のための新たな機材を開発する上での必要な改善点について検討した。

C. 研究結果

図4～図7は、建設作業員18名に対し、手すり先行工法の機材の保持・観察の後、その作業性に関して、「取付け時間がかかるか否か」、「取り付け方が複雑であるか否か」、「重たいか否か」の3項目について質問したアンケート結果を示す。

アンケートの結果、図5の手すり支柱をもちかえる方式と図7の手すり据置き方式で非常に酷似した回答が得られた。つまり、取付け時間がかかり、取り付け方が複雑であり、重たいという回答が大勢となった。また、図4に示した手すり枠をスライドする方式に関しても、取付け時間と取り付け方が複雑であるという点において、それらとほぼ同様の回答となったが、重さに関しては、問題がないという回答が約8割を占めた。これらに対し、図6に示した手すり先行専用足場方式では、取付け時間に関しては半数以上が問題なしと回答し、取り付け方が複雑であるかに対しては半数以上が複雑であると回答しているが、その割合は他の設備に比べれば低い結果となった。重さに関しても半数が、問題なしと回答している。

また、図8は、手すり据置き方式により実際に足場を組立てた後に、4名の作業員に対し実施した、作業性に関する同様のアンケート結果を示す。図7は、同じ機材を保持・観察の後に実施したアンケート結果であるが、両図を比較すると、保持・観察の後に比べ明らかに実際の組立後の方が、3項目とも「NO」と回答した作業員の割合が高くなっている。すなわち、実際に手すり先行工法による組立てを行わせた結果、作業性に関し抵抗を感じる作業員の割合が低下したものと考えられる。

次に、図9および図10は、手すり先行工法を使用した場合において、「安全になるか否か」についての質問に対する、それぞれ保持・観察の後と実際の組立後のアンケート結果を示す。

図11および図12は、手すり先行工法を、「使用したいか否か」についての質問に対する、それぞれ保持・観察の後と実際の組立後のアンケート結果を示す。

「安全になるか否か」、「使用したいか否か」については、保持・観察の後と実際の組立後も大部分の作業員が手すり先行工法

により安全になると考えているが、手すり先行工法を使用したいと回答した作業員は約半数であった。実際の組立後は意見聴取した作業員が少ないが、実際に手すり先行工法による組立てを行わせても、これらの傾向に大きな変化はなかった。

その他、手すり先行工法に対して以下のような意見が得られた。

(改良につながる意見)

- ・妻面にも最初から手すりがあればよいと思った。
- ・手すりわくを折りたためるようすればよいと思う。(運搬面で)
- ・手すりわくを伸縮できるようにすればよいと思う。(運搬面で)
- ・部材がアルミ材であるならよい。

(否定的な意見)

- ・コストの問題がある。
- ・取り付けに時間がかかる。
- ・通常の足場で十分。

D. 考察

以上を総括すると、実際に手すり先行工法による組立てを行わせた結果、保持・観察の後の結果に比べ、作業性に関しては抵抗を感じる作業員の割合が低下したものの、使用したいかどうかについては依然として約半数が使用したくないと回答していた。

このため、まずは作業員に使っていただくことを考えた改良が、手すり先行工法など新しい機材の普及に有益であることが明らかとなった。

しかし、新しい機材の普及に関しては、作業性ととも作業員の意志として使用したいかどうか重要であり、これに関しては改良すべき点であると考えられる。

手すり先行工法の安全面に関しては、アンケート結果より問題ないと考えられるが、一部の作業員より妻面にも最初から手すりがあった方がよいとの意見があった。これについては、作業の観察でも明らかとなり、特に手すり先行工法に不慣れな作業員にとっては危険と感ぜられる場面もあり、何らかの改善が必要である。なお、手すり先行工法等に関するガイドラインでは、手すりを先行して設置できない箇所においては、安全帯を使用することが規定されているが、不慣れな作業員にとっては安全帯取付設備の設置が容易ではないと考えられる。

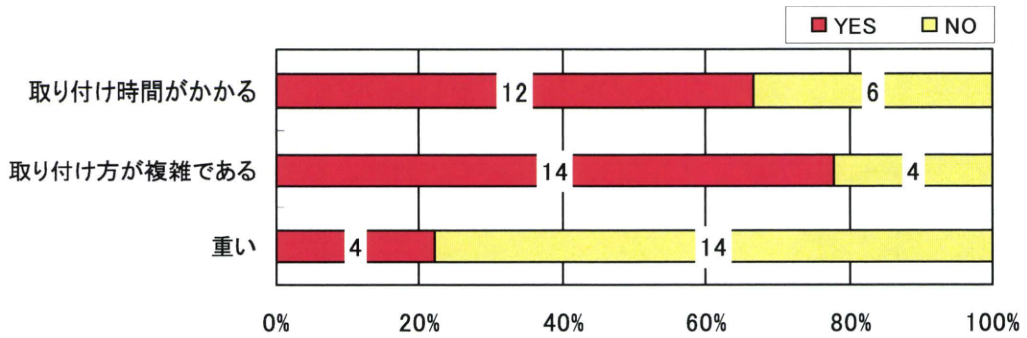


図4 手すり先送り方式（手すり枠をスライドする方式、保持・観察の後）

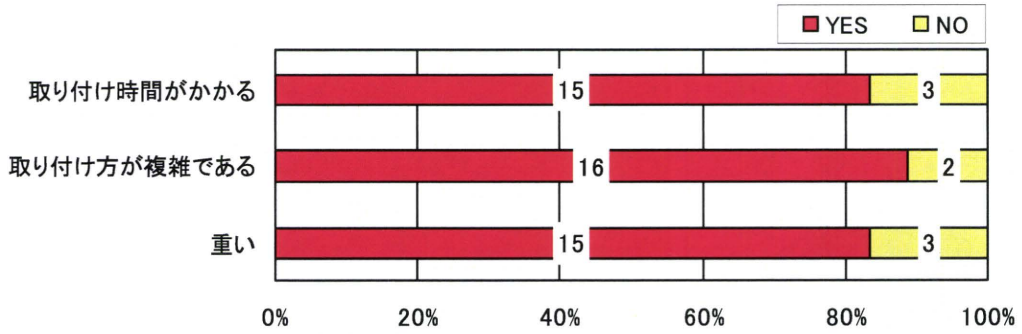


図5 手すり先送り方式（手すり支柱をもちかえる方式、保持・観察の後）

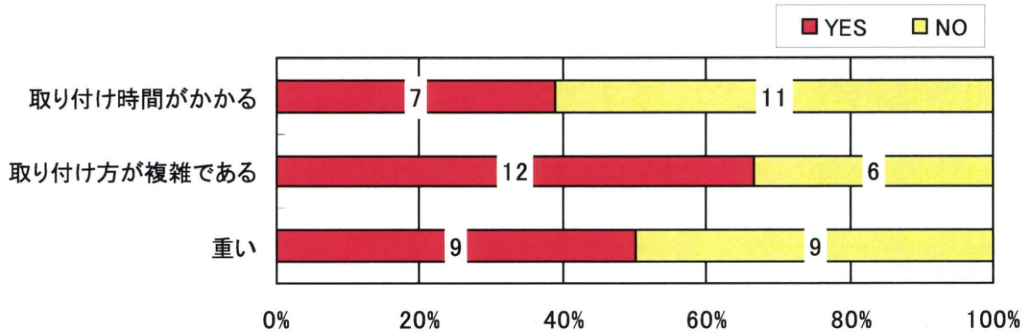


図6 手すり先行専用足場方式（保持・観察の後）

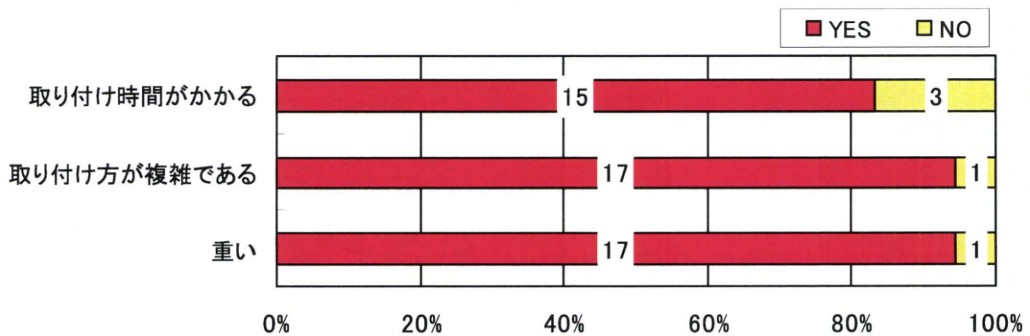


図7 手すり据置き方式（保持・観察の後）

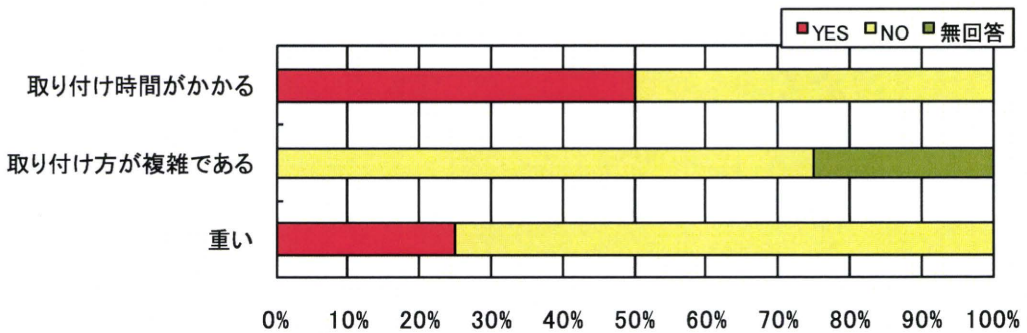


図8 手すり据置き方式（実際の足場の組立後）

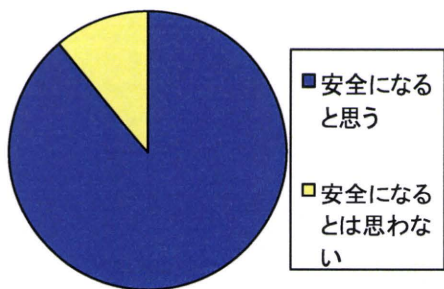


図9 手すり先行工法により安全になると思うかどうかのアンケート結果(保持・観察の後)

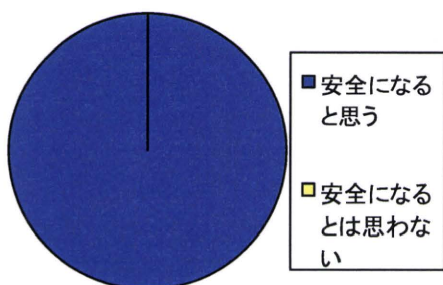


図10 手すり先行工法により安全になると思うかどうかのアンケート結果(実際の組立後)

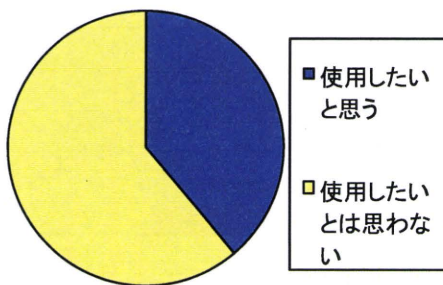


図11 手すり先行工法を使用したいと思うかどうかのアンケート結果(保持・観察の後)

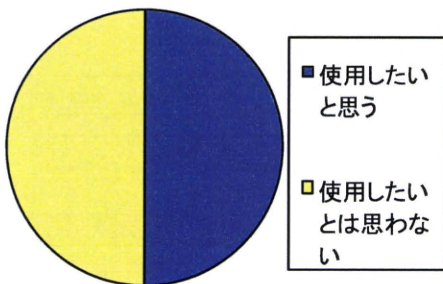


図12 手すり先行工法を使用したいと思うかどうかのアンケート結果(実際の組立後)

E. 結論

作業員に対し、手すり先行工法の機材の保持・観察の後、および実際に手すり先行工法を使用した足場の組立後に、アンケート形式により意見聴取を行った。その結果、作業性等を考慮して、まずは作業員に使っていただくことを考えた改良が、手すり先行工法など新しい機材の普及に有益であることが明らかとなった。

しかし、新しい機材の普及に関して重要である、使用したいかどうかについては、否定的な意見が多く、これに関しては改良すべき点であると考えられる。

また、妻面への手すりの設置や、運搬を考えてコンパクトにする、コストを抑える、取り付け時間を短縮するなど、作業員の意見から、新しい機材を開発する上で参考となる知見が得られた。

F. 研究発表

1. 論文発表

① Katsutoshi Ohdo, Yasumichi Hino, Seiji Takanashi, Hiroki Takahashi, Yasuo Toyosawa: Study on Fall Protection from Scaffolds by Scaffold Sheeting during Construction. Proceedings of the Twelfth East Asia Pacific Conference on Structural Engineering and Construction, Hong Kong, 2011. (CD-ROM)

2. 書籍

① 大幢勝利, 高梨成次, 日野泰道, 高橋弘樹: 足場作業の安全—労働安全衛生規則改正, 大成出版社, 2009.

G. 知的財産権の出願・登録状況

特になし。