Guidelines

on

Safe Use of Lifting Frames and Launching Girders

for

Bridge Construction

Labour Department

November 2017

The Guidelines on Safe Use of Lifting Frames and Launching Girders for Bridge Construction is prepared by the Labour Department, in consultation with and support of the Development Bureau, the Highways Department and the Civil Engineering and Development Department.

The provisions in this set of guidelines should not be regarded as exhaustive. It is important to note that compliance with this set of guidelines does not in itself confer immunity to persons undertaking the work concerned from legal obligations.

Contents

1. Introduction

Lifting frames ("LF") and launching girders ("LG") are developed and used for placing precast post-tensioned concrete bridge segments to form viaducts and bridges. They are specially designed for use in restrictive construction environment to overcome limited access from ground.

LF/LG is designed to comprise lifting devices with mechanical, electrical and/or hydraulic components, and a supporting structure. Due to its sophisticated nature, it is necessary to develop detailed procedures, and limit their strict implementation by experienced operatives and workers to ensure safety of the personnel working at or nearby the machines and the public.

The guidelines provide a framework of safe system of work for the use and operation of LF/LG for bridge construction for the reference of all stakeholders including the project client, designers/ manufacturers, engineering consultants, resident site staff, safety personnel, contractors, subcontractors, supervisory staff and operatives.

The Occupational Safety and Health Ordinance ("OSHO") and the Factories and Industrial Undertakings Ordinance ("FIUO") also impose general duties on contractors as employers/occupiers with regard to the health and safety at work of their employees at workplaces or in industrial undertakings which cover construction sites. These include the legal requirements to provide their employees with plant and system of work that are, so far as reasonably practicable, safe and without risk to health. The general duties extend to include, amongst others, that the employer and the contractor should provide all necessary information, instruction, training and supervision for operators and workers.

Section 8 of the OSHO and Section 6B of the FIUO also impose duty on an employee to take reasonable care for the health and safety of himself and of other persons who may be affected by his acts or omissions at work.

LF/LG is under the purview of the Factories and Industrial Undertakings

(Lifting Appliances and Lifting Gears) Regulations ("LALGR"). The guidelines provide the essential safety guidelines to the responsible person of LF/LG, mechanics, operators and other stakeholders in the construction industry for improving the safety standard in connection with the use of LF/LG. Reference should be made to the publications in Section 8 of this guidelines, individual operation and maintenance manual for handling a specific machine to ensure the safety of the site personnel in the vicinity and the public.

2. Definitions

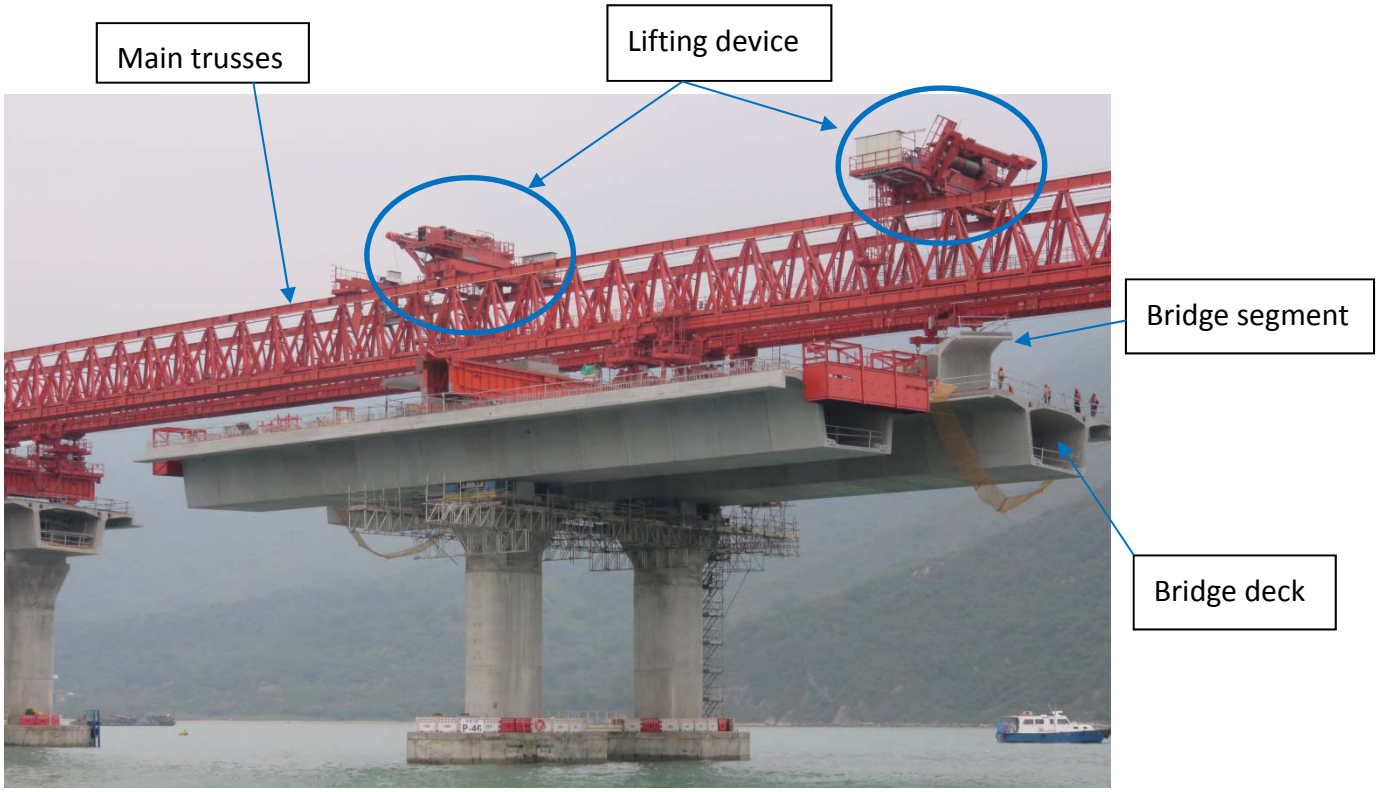
Automatic safe load indicator
It means a device intended to be fitted to a LF/LG that automatically gives an audible and visible warning to the operator thereof that the LF/LG is approaching its safe working load, and that automatically gives a further audible and visible warning when the LF/LG has exceeded its safe working load.

Competent examiner
A competent examiner, in relation to the carrying out of any test and examination required by LALGR, means a person who is appointed by the owner required by those regulations to ensure that the test and examination is carried out; a registered professional engineer registered under the Engineers Registration Ordinance (Cap. 409) within a relevant discipline specified by the Commissioner for Labour; and by reason of his qualifications, training and experience, competent to carry out the test and examination. Mechanical Engineering and Marine and Naval Architecture are the disciplines specified by the Commissioner for Labour.

Competent person
A competent person, in relation to any duty required to be performed by him under LALGR, means a person who is appointed by the owner required by those regulations to ensure that the duty is carried out by a competent person; and by reason of training and practical experience, competent to perform the duty.

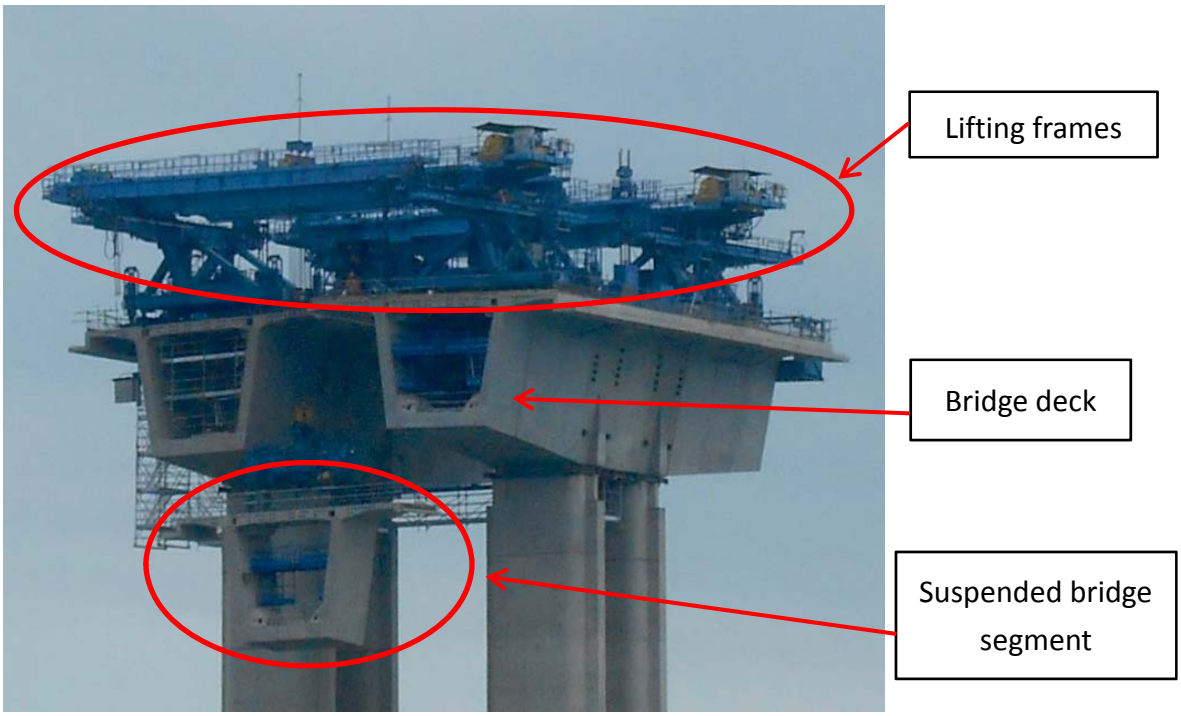
Launching Girder

Launching Girder is also known as Launching Gantry. A launching girder is in general a design-and-built machine used in precast post-tensioned bridge construction. It consists of lifting devices and a supporting structure for lifting precast beams and precast bridge segments in position for assembling. A launching girder usually consists of main trusses ("girders") and lifting devices that would move horizontally along the trusses while suspending/lifting the precast beam, bridge segments and/or working platforms for assembling.



Lifting Frame

A lifting frame is in general a design-and-built machine used in segmental bridge construction. It consists of lifting devices and metal structures for lifting bridge segments in position for assembling. Some LFs are mobile machines moving forward or backward on the connected bridge deck, and anchored to the bridge deck when reaching its working position. A lifting frame usually consists of two main cantilever beams fixed to the main structure and a lifting device that could move horizontally along the cantilever beams while suspending/lifting bridge segments for assembling. The suspended bridge segment may be moved horizontally or vertically by the machine during assembling.



Registered Professional Engineer

A registered professional engineer ("RPE") means a person whose name is currently entered in the register of registered professional engineers established and maintained under section 7 of the Engineers Registration Ordinance (Cap 409).

Owner

In relation to any lifting appliance or lifting gear under LALGR, owner includes the lessee or hirer thereof, and any overseer, foreman, agent or person in charge or having the control or management of the LF/LG, and the contractor who has control over the way any construction work which involves the use of the LF/LG is carried out and, in the case of a LF/LG situated on or used in connection with work on a construction site, also includes the contractor responsible for the construction site. Under the Construction Sites (Safety) Regulations, a contractor is responsible for a construction site if he is undertaking construction work there or, where there is more than one contractor undertaking construction work at the site, if he is the principal contractor undertaking construction work there.

Note: Responsibilities/requirements of the personnel can be referred to Section 4.

3. Safe System of Work

3.1 General requirements

3.1.1 At construction stage, a safe system of work should be established and implemented for use of LF/LG, which should cover every operation cycle including the lifting operation as well as the erection/re-erection, dismantling and re-location ("EDR") operations*. The safe system of work should be formulated and endorsed by the owner, with the input from relevant competent persons ("CP"), engineering and safety professionals and/or other relevant personnel including the LF/LG designer/manufacturer, independent checking engineers ("ICE"), engineers involved in the LF/LG operation, competent examiners and/or consultant engineers, etc. The safe system of work should be documented and effectively communicated to all parties concerned by the owner.

3.1.2 The safe system of work for the LF/LG should include, but not limited to, the following:

(a) the owner consulting the consultant engineers appointed by the project client together with the designer/manufacturer during the design stage of LF/LG, particularly concerning the safety devices, precautions and requirements for the installation, erection, re-location and use of the LF/LG;
(b) task-specific and comprehensive risk assessments (in case of repetitive operations, the risk assessment may only be required prior to the first operation, with periodic reviews to ensure that no key factor has changed. If such situation occurs, a fresh task-specific and comprehensive risk assessment should be conducted);
(c) planning of the lifting and EDR operations;

*Note: LF/LG after each relocation shall be certified safe by an ICE before put into use. (See Cl. 4.7.3 and 7.5.3.2).

(d) method statement (including safety rules/procedures) which should be communicated in graphical format and in languages known to all workers involved in the lifting and EDR operations to ensure that they understand the method statement before these operations commence. The method statement should cover but not limited to the following:
    i) all measures for avoiding or mitigating the hazards identified in the risk assessment ;
    ii) step-by-step procedures supplemented with diagrammatic illustrations;
    iii) safety procedures and instructions;
    iv) procedures for avoiding hazards to personnel working adjacent to the operations;
    v) clear delineation of role and tasks of members of the working crew by written statements; and
    vi) arrangement for effective communications.
(e) inspection, testing, thorough examination and maintenance of the LF/LG;
(f) means to ensure the availability of all necessary test and examination certificates, operational and maintenance manual(s) and other documents (as specified in Annex 1);
(g) mechanical integrity programme to ensure the proper design,erection/re-erection, re-location and operation of the LF/LG;
(h) checking and confirmation by ICE of the strength and stability of the LF/LG after erection/re-erection and re-location;
(i) approval of the LF/LG's designer/manufacturer and ICE for installation of additional accessories affecting safety or stability of the LF/LG, if necessary, to the LF/LG ;
(j) provision of properly trained and competent personnel who are aware of their respective responsibilities under sections 6A and 6B of the Factories and Industrial Undertakings Ordinance;
(k) appointment of supervising engineer to supervise the EDR operations of LF/LG and the associated works in safe manner;
(l) appointment of competent person (EDR) [CP(EDR)] to

supervise the carrying out of the EDR operation and the associated works in safe manner;

(m) appointment of competent workman (EDR) [CW(EDR)] to carry out the EDR operation and the associated works in safe manner;

(n) by reason of qualification, training and practical experience, appointing CP(EDR) and CW(EDR) who are competent to perform the duty;

(o) means to observe for any unsafe conditions such as adverse weather conditions that may arise during EDR and lifting operations;

(p) prevention of any unauthorized movement or use of the LF/LG at all times;

(q) contingency plans providing procedures to be followed in case of emergency situation including inclement weather;

(r) provision of a log-book or else for entering the details of maintenance/repair works carried out on the LF/LG; and

(s) if a specialist contractor is employed for the operations, involvement of such specialist contractor in the preparation of the method statement.

3.1.3 To ensure the effective implementation of the safe system of work, lifting supervisor(s) and supervising engineer(s) should be appointed to exercise overall control of the lifting operation and EDR operation of the LF/LG respectively. They should possess the necessary training, experience and competency, as described in Annex 2, to carry out their duties competently.

3.2 Planning

3.2.1 All operations (including lifting and EDR operations) of the LF/LG should be well planned to ensure that they are carried out safely and that all foreseeable risks have been taken into account. Planning should be carried out by the owner, in consultation with relevant personnel. If major changes to the planned operations are to be considered, the planning process should be re-conducted before making such changes.

3.2.2 Contingency planning should be part of the planning process. The owner should consider all the potential emergency situations and formulate the relevant procedures/instructions. The emergency situations should include typhoon, thunderstorm, heavy rainstorm, lightning, failure of lifting devices, etc. Reference should be made to the designer's/manufacturer's instructions as appropriate.

4. Responsibilities/Requirements of Personnel

4.1 Owner

4.1.1 The owner is responsible for formulating and implementing the safe system of work, educating all personnel concerned on the safe practices and assigning definite and individual safety responsibilities to them. The owner should plan all phases of operation involving LF/LG.

4.1.2 The owner of LF/LG shall strictly observe the provisions regarding safe operation of cranes under the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations if the LF/LG is equipped with mechanical means of raising and lowering a load and transporting the load while suspended, except for the LF/LG that only has a hoist block running on a fixed rail or wire for the lifting operation.

4.1.3 The owner should ensure the full implementation of the safe system of work for all the operations of LF/LG and the execution of the lifting plan.

4.1.4 The owner should ensure that all persons who are engaged in preparation for use of the LF/LG, erection, operation, dismantling, re-location and any other associated work are well trained in both safety and operating procedures.

4.1.5 The owner should appoint in writing the supervising engineer(s), ICE, competent examiner, competent person(s) (EDR/others), operator(s), lifting supervisor(s), competent workmen (EDR) and other site personnel involved in the operation of LF/LG. The appointment letters should include the particulars of the LF/LG to be used, such as its model and identification. The appointment letter should be made available for inspection by all relevant parties at all reasonable times.

4.1.6 The owner should ensure the loading capacity of tie-downs or anchorages of the LF/LG fulfill the requirements specified by the manufacturer or designer and certified by ICE to be in safe working order, in conjunction with test and examination requirement in Section 6.2.1.

4.1.7 The owner should ensure the installation (including erection/re-erection and dismantling), operation and maintenance manual(s), maintenance records/logbooks of the LF/LG are available on site for use by all relevant parties.

4.1.8 The owner should have obtained all the documents, as stated in Annex 1, before the LF/LG is put into service.

4.1.9 The owner is required to make available all documents including the test and examination certificates or reports of the LF/LG and the non-destructive test results to the competent examiner, ICE and resident site staff.

4.1.10 The owner should receive the pre-use checking report or certificates issued by the ICE before he allows the LF/LG to be put into service.

4.2 Supervising engineer

4.2.1 A supervising engineer should be appointed by the owner in writing to supervise the on-site EDR operations of LF/LG. Before EDR operations, comprehensive briefing sessions should be conducted by the supervising engineer with the CP(EDR) for EDR operations, the safety professional(s), the LF/LG operator and other associated working personnel to discuss the whole process of the EDR operations and to ensure a safe system of work for the operation (including the working procedures and checklists) is properly in place and fully implemented. Upon completion of each EDR operation, the supervising engineer should issue a report to the effect that the LF/LG is structurally safe and suitable to use.

4.2.2 If it is necessary to make any change to the planned EDR procedures, the supervising engineer should immediately suspend the work and consult the owner/manufacturer/designer about the appropriateness and safety of the change.

4.2.3 The qualification, experience and competency requirements of a supervising engineer are set out in Annex 2.

4.3 Competent person (Erection/Re-erection, Dismantling and Re-location Operations) [CP(EDR)]

4.3.1 A CP(EDR) should be appointed by the owner to supervise the carrying out of each of the EDR operations, travelling of LF, launching of LG, connection work of LF/LG to bridge deck, connection work of spreader to bridge segment and connection work of stressing platform to bridge deck.

4.3.2 The qualification, experience and competency requirements of a CP(EDR) are set out in Annex 2.

4.4 Competent workman (Erection/Re-erection, Dismantling and Re-location Operations) [CW(EDR)]

4.4.1 CW(EDR)s should be appointed by the owner to carry out EDR operations who are supervised by a CP(EDR) and monitored by a supervising engineer.

4.4.2 Connection of the LF/LG to the bridge deck and connection of the stressing platform to bridge deck should only be conducted by CW(EDR)s under the supervision of a CP(EDR) to ensure the LF/LG and the stressing platform are properly anchored at a suitable location with adequate strength.

4.4.3 The qualification, experience and competency requirements of a CW(EDR) are set out in Annex 2.

4.5 Lifting supervisor

4.5.1 A lifting supervisor should be appointed by the owner to oversee the whole lifting operation and ensure the safe system of work for lifting operation is fully implemented.

4.5.2 The qualification, experience and competency requirements of a lifting supervisor are set out in Annex 2.

4.6 Lifting frame/launching girder operator

4.6.1 A LF/LG operator should be assigned by the owner to operate/control the LF/LG at all time during the lifting operation. He should follow the safety procedures/safe system of work for operating the LF/LG as well as the designer/manufacturer's instructions.

4.6.2 The qualification, experience and competency requirements of a LF/LG operator are set out in Annex 2.

4.7 Independent checking engineer

4.7.1 An ICE, should be appointed by the owner to check the design of LF/LG. He should check the structural safety of every individual structural members as well as the overall safety and stability of the LF/LG to ensure that individual structural members can safely sustain the designed loads including effects of dynamic loads. After the erection/re-erection of a LF/LG, he should check the erected LF/LG against the design and issue a certificate to the effect that the LF/LG is safe to sustain -design loading, including loading tests on the LF/LG. The ICE should be independent of the owner and should have no association with the design of the LF/LG.

4.7.2 The ICE should immediately notify the owner, the consultant engineer and relevant parties if he observes any design problems or defects in the erected LF/LG during checking.

4.7.3 The ICE should certify the tie-downs or anchorages of the LF/LG are in order after each re-location operations and it is safe to apply loads on the LF/LG.

4.7.4 The qualification, experience and competency requirements of an ICE are set out in Annex 2.

5. Erection/Re-erection, Dismantling and Re-location

5.1 General precautions

5.1.1 The following general safety measures for the erection/re-erection, dismantling and re-location of LF/LG should be observed:

(a) the owner should follow the safety procedures specified in the designer/manufacturer's instructions;
(b) an exclusion zone should be demarcated which should be kept clear of other personnel not involved in the EDR operations. The zone should be large enough to allow the components to be stacked and handled without interfering with or risking other personnel at the workplace. Sufficient area should be set aside for the mobile crane(s) or other lifting appliances that will assist in the EDR operations. Safe access and egress should be provided for goods vehicle to deliver the components to the erection/re-erection, dismantling and re-location spot or vice versa. Adequate lighting should be provided for all these working areas;
(c) copies of the risk assessment report (including the method statement) should be distributed to the specialist contractor who should be advised of the estimated duration of the EDR operations and the boundary of the exclusion zone;
(d) EDR operations should preferably be conducted during day time; where works have to be conducted during night time, all areas should be adequately illuminated;
(e) no EDR operations beyond the limit of wind velocity specified by designer/manufacturer should be undertaken; and
(f) if erection and re-erection procedures require part or all of the electrical installation to be in service during the operation, all associated electrical work should be carried out by a qualified electrical worker registered with Electrical and Mechanical Services Department under the Electricity Ordinance (Cap. 406).

5.2 Designer's/Manufacturer's instructions

5.2.1 It is essential that LF/LG designer/manufacturer's instructions for EDR operations should be strictly adhered to. It should be ensured that:

(a) the designer/manufacturer's instruction manuals are always made available to the working personnel who will carry out the EDR operations of the LF/LG for reference;
(b) the relevant instruction manual(s), appropriate to the particular LF/LG, are used (Note: the manual(s) should bear the manufacturer's LF/LG serial number and the owner's plant number); and
(c) approval has been obtained from the LF/LG's designer/ manufacturer before any adjustment/deviation is made to/from the prescribed procedures in the designer/ manufacturer's instruction manuals.

5.3 Pre-use checking

5.3.1 Pre-use checking on structural safety after erection/re-erection of a LF/LG should be done by the ICE, who should check the LF/LG built against the specifications of the LF/LG design. Among others, the ICE should check the design stress calculation of individual structural members, structural safety of the LF/LG and interaction of bridge structure under construction. The ICE should provide written confirmation that the erection/re-erection of LF/LG has fulfilled the design specifications and is ready to take on loading, before the load test to be conducted by the competent examiner.

5.3.2 The owner should ensure pre-use checking, including dynamic load test, of the LF/LG has been carried out by the competent examiner meeting both LALGR and designer's/manufacturer's instruction before the LF/LG is put into use.

5.4 Deflection checking

5.4.1 Deflection checking for LF/LG required by the manufacturer or

designer should be conducted in the pre-use checking to ensure the LF/LG built conforming to the design specifications, and such checking is usually carried out by load testing the LF/LG as per manufacturer/designer acceptance criteria.

5.4.2 Remote deflection checking method should be adopted for deflection checking. No person should stay, as far as practicable, on or near the LF/LG where they might be endangered by any displaced/collapsed/overturned objects or machine part(s) when the LF/LG is under load test.

5.5 Appointment of supervising engineer

5.5.1 The supervising engineer should be appointed by the owner in writing to directly supervise the EDR operations of LF/LG on site.

5.6 Competent person for Erection/Re-erection, Dismantling and Re-location Operations

5.6.1 The EDR operations should be carried out under the supervision of CP(EDR).

5.6.2 A register of the specific training provided by the owner of the LF/LG to the CP(EDR) should be kept.

5.7 Competent workmen for Erection/Re-erection, Dismantling and Re-location Operations

5.7.1 The EDR operations should only be carried out by the CW(EDR)s.

5.7.2 All EDR operations should only be carried out by the CW(EDR)s under the supervision of CP(EDR) and monitored by the supervising engineer.

5.7.3 A register of the specific training provided by the owner of the LF/LG to the CW(EDR)s should be kept.

6. Inspection, Testing and Thorough Examination

6.1 General requirements

6.1.1 Because of its operational characteristics, LF/LGs are specially designed machines governed by LALGR. Thus, the LF/LG and other associated lifting appliances and lifting gear shall be inspected by the competent person ("CP") and tested and thoroughly examined by the competent examiner under LALGR.

6.1.2 In addition to the statutory requirements, other inspections, tests, examinations or other relevant pre-use checking of the LF/LG should be conducted in accordance with the operation and maintenance manual(s) issued by the designer/manufacturer.

6.1.3 An exclusion zone should be demarcated and should be kept clear of other personnel not involved in the inspection, testing and thorough examination of LF/LG. The inspection, testing and examination programme should fulfill the requirements as stated in the operation and maintenance manual(s) issued by the designer/manufacturer.

6.1.4 Arrangement should be made to minimize the number of persons involved in the inspection, testing and examination of LF/LG.

6.2 Test and thorough examination

6.2.1 In addition to certifying the structural safety of LF/LG by ICE (paragraph 5.3.1), the LF/LG and the associated lifting appliances and lifting gear shall be thoroughly examined and tested by the competent examiner as required under LALGR. The relevant certificates to the effect that the lifting appliances and lifting gear are in good working order issued by the competent examiner shall be obtained.

6.2.2 The owner should prepare a method statement detailing the safety procedures and safety requirements to be adopted during the inspection, test and thorough examination. When preparing such method statement, the owner should seek the advice from the consultant

engineer(s), ICE, safety officer(s), operator(s), RPE and other professionals as appropriate.

6.2.3 The LF/LG operator(s) involved in the test and examination process should have the qualification and experience as stipulated in Section 4 of this guide.

6.2.4 The owner should ensure that no person stay, as far as reasonably practicable, on or near the LF/LG where they might be endangered by any displaced/collapsed/overturned objects or machine part(s) during the load test.

6.3 Inspection

6.3.1 The LF/LG shall be inspected within the preceding 7 days prior to use by a CP. A certificate in the approved form in which CP has made a statement to the effect that the LF/LG is in safe working order shall be obtained.

6.3.2 The owner should prepare a comprehensive inspection checklist for the inspection of the LF/LG, with reference to the operation and maintenance manual(s) of the LF/LG.

7. Operation and Maintenance

7.1 General requirements

7.1.1 The owner of the LF/LG shall provide and maintain the LF/LG that is safe and without risks to health.

7.2 Daily pre-work checking

7.2.1 At the beginning of each shift or working day, a pre-work checking should be carried out by the operator who is competent and authorized to ensure the LF/LG is in a good working order.

7.3 Operational features

7.3.1 LF/LG should be equipped with, but not limited to, fail-safe brakes, suitable operating controls, emergency stops, suitable machine guarding, and limit switches etc.

7.3.2 Brakes

7.3.2.1 Fail-safe brakes should be provided so that they will be applied automatically to prevent any “free fall” of the hook or load during the operation.

7.3.2.2 Fail-safe brakes should be provided for the transverse carriages of the LF/LG.

7.3.2.3 Fail-safe brakes should be provided to hold the LF stationary under normal working condition or on the maximum gradient for travelling recommended by the designer/manufacturer.

7.3.3 Operating controls and emergency buttons

7.3.3.1 The controls should be of dead man switch type in that they would return to neutral automatically when released. The main power switch should be lockable and located within easy reach of the operator. Each control shall be clearly labelled and marked to show the motion

and the direction of movement that it controls. Where practicable, controls shall be so arranged and/or constructed that accidental displacement or inadvertent pressing can be prevented

7.3.3.2 If the LF/LG is operated with remote control, the owner should ensure the LF/LG has a built-in safety feature to revert to automatic safe mode or suspend operation when the signal is interfered.

7.3.3.3 Emergency buttons should be provided at easily accessible locations, so that workers could stop the LF/LG immediately, in case of emergency.

7.3.4 Guards and protective structures

7.3.4.1 All exposed moving parts of the LF/LG such as gears, pulleys, belts, chain, shafts, and flywheels which may constitute trapping or crushing hazards under normal operation conditions shall be effectively guarded.

7.3.5 Safety devices

7.3.5.1 Every LF/LG should be equipped with automatic overloading warning devices. An automatic safe load indicator, which automatically gives an audible and visible warning to the operator thereof that the LF/LG is approaching its safe working load, and that automatically gives a further audible and visible warning when the LF/LG has exceeded its safe working load, shall be equipped.

7.3.5.2 Every LF/LG should be provided with physical safety devices and preferably electronic controls and switches. The electronic controls and switches include, but not limited to, the following-

i) a spreader height limit switch;
ii) a trolley travel limit switch; and
iii) an overload limit switch.

7.4 Travelling / launching

7.4.1 The travelling of LF and the launching of LG should be

supervised by the CP(EDR).

7.4.2 The specified maximum gradient for stability and the specified maximum travelling/launching speed of the LF/LG should not be exceeded. Reference should be made to the designer/manufacturer's instructions.

7.4.3 When the LF arrives at the operation position, safety measures (e.g. tie-downs, placing wheel chocks in front/rear of LF) should be taken to prevent accidental movement of the machine.

7.4.4 If the LF is supported by tyres, the tyre replacement procedures should follow the procedures stated in the designer/manufacturer's instructions.

7.5 Safe working loads and operating conditions

7.5.1 Safe working loads

7.5.1.1 The LF/LG shall not be used unless the safe working load is clearly and legibly marked on it (in English and Chinese). In warranted circumstances, markings in appropriate language(s) with respect to the working personnel (e.g. ethnic minority workers) should be made.

7.5.1.2 Except for the purpose of enabling tests, the LF/LG should not be loaded beyond the maximum safe working load, which is specified in the current certificate of test and thorough examination delivered in the approved form by the competent examiner in respect of that LF/LG (Please see Section 6).

7.5.2 Mode of operation and control

7.5.2.1 The LF/LG should only be operated by an operator who fulfills the requirements in Section 4 and the qualifications, experience and competencies in Annex 2. The operation of the LF/LG should also make reference to the Code of Practice for Safe Use of Mobile Cranes issued by the Labour Department and the designer/manufacturer's manual.

7.5.2.2 Travelling clearances for LF

(i) Where the LF is in use or travelling, an unobstructed passageway, not less than 600 millimetres wide, shall be maintained between any part of the LF liable to move and any nearby guard rail, fence or other fixture.

(ii) Where it is not practicable to maintain such clearance or where only limited travelling motion of the LF is possible, special precautions should be taken to avoid a trapping hazard:

- Personnel should not be allowed to approach the LF when it is operating or travelling as there is a danger of being struck or trapped between the fixed and moving parts of the LF;
- Counterweight or rear-end of the LF should be painted distinctively; and
- A notice in English and Chinese should also be displayed on the LF to the effect:
  "NO PERSON IS ALLOWED ACCESS TO ANY PART OF THE LIFTING FRAME WITHOUT THE PERMISSION OF THE LIFTING SUPERVISOR."
  "沒有吊運督導員的許可，任何人士都不能進入起重橋架任何部份的範圍."

7.5.3 Stability of the LF/LG

7.5.3.1 Appropriate precautions shall be taken to ensure the stability of LF/LG before it is used. Reference should be made to the designer/manufacturer's instruction manual(s).

7.5.3.2 Before lifting a bridge segment, the LF/LG should be properly tied-down to the bridge deck by anchors or other effective means according to the manufacturer's/designer's instructions. The anchoring work should only be conducted by the CW(EDR)s, who have been trained on the proper anchoring procedures provided by the specialist contractor/designer/manufacturer, and under the supervision of the CP(EDR). Where the tie-downs are designed to sustain loadings, the

anchorages should be certified by ICE to ensure it can sustain the designed pull-out stress, in accordance with the operation and maintenance manual(s).

7.5.4 Travelling of suspended loads by LF/LG

7.5.4.1 Travelling of suspended load by the LF/LG should be supervised by a lifting supervisor. The area under the path of a suspended load should be cordoned off to prevent any risk of fall of materials and objects.

7.5.4.2 The owner should take into account any special restrictions imposed by the designer/manufacturer if the LF/LG is designed to travel with suspended load.

7.5.4.3 Operation of the LF/LG on sloping ground should be in strict accordance with the design of the LF/LG. Extreme care should be exercised not to operate the LF/LG beyond the gradient limit (both longitudinal and cross fall limits). Reference should be made to the designer/manufacturer's instruction manual(s).

7.5.5 Use of working/stressing platform

7.5.5.1 The working/stressing platform should be of good construction and adequate strength and of sound material. They shall be safely suspended by the LF/LG with adequate arrangement to prevent undue tipping, tilting or swinging movements, before properly anchored to the bridge deck, in accordance with the relevant method statement. The anchoring work of the working/stressing platform should only be conducted by the CW(EDR)s, who have been trained on the proper anchoring procedures and under the supervision of CP(EDR).

7.5.5.2 The anchorage points connecting the working/stressing platform to the bridge deck should be certified by ICE to ensure that they are structurally safe.

7.5.5.3 Suitable guardrails and toe boards should be provided on the working/stressing platform. Safe access to and egress from the

working/stressing platform should also be properly provided and maintained.

7.5.5.4 The working/stressing platform should be clearly and legibly marked with the safe working load and the maximum number of persons that may be carried at any one time.

7.5.6 Weather conditions

7.5.6.1 LF/LG shall not be used under weather conditions likely to endanger its stability or affecting its safe operation. Before the LF/LG is taken into use after exposure to the aforesaid weather conditions, its stability should be checked by an ICE. If the ICE assesses that the stability of the LF/LG would likely be affected by the weather conditions, the LF/LG and its anchorage shall be tested by the competent examiner before it is taken into use.

7.5.6.2 LF/LG should not be operated under weather conditions with wind speeds in excess of that specified in the designer/manufacturer's instructions. Reference to the effects of wind may also be made to the "Structures Design Manual for Highways and Railways" issued by the Highways Department.

7.5.7 Securing of loads before lifting

7.5.7.1 Before the lifting of a bridge segment, the spreader of LF/LG should be properly anchored to the segment. The anchorage work should only be conducted by trained workmen, who have been trained on the proper anchoring procedures and under the supervision of the CP.

7.5.8 Permit to lift

7.5.8.1 A permit-to-lift system regarding to the lifting operation of LF/LG should be provided and fully implemented. The permit-to-lift system should be reviewed regularly.

7.6 Maintenance

7.6.1 Statutory requirements

7.6.1.1 LF/LG shall be properly maintained. After substantial repair, LF/LG shall be undergone the testing and examination as mentioned in section 6 above before the commencement of its operation.

7.6.2 Planned preventive maintenance

7.6.2.1 A preventive maintenance programme should be formulated and implemented to ensure the LF/LG is in safe and efficient state at all times. Reference should be made to the designer/manufacturer's instruction manual(s).

8. Reference

(a) Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

(b) Code of Practice for Safe Use of Mobile Cranes issued by the Labour Department, Hong Kong SAR

(c) Code of Practice for Safe Use of Tower Cranes issued by the Labour Department, Hong Kong SAR

(d) Guidance Notes on Inspection, Thorough Examination and Testing of Lifting Appliances and Lifting Gear issued by the Labour Department, Hong Kong SAR

(e) Project Administration Handbook for Civil Engineering Works issued by the HKSAR Government

Annex 1

The following documents should be made available before the LF/LG is put into service:

(a) report on pre-use checking;
(b) ICE certifications of supporting structure;
(c) risk assessment report on the operation and method statement;
(d) record of the qualifications and experience of the supervising engineer(s), competent person(s), competent workmen and other personnel involved in the EDR and use of the LF/LG;
(e) all test and thorough examination certificates; and
(f) maintenance records/logbooks.

Annex 2

1. The supervising engineer should have the following qualifications, experience and competencies:

   (a) An engineering degree of relevant discipline and have not less than 6 years of working experience in supervision of bridge construction, or registered professional engineer, or a member of the Hong Kong Institution of Engineers or the Institution of Civil Engineers, UK or equivalent;
   (b) have not less than 4 years of relevant working experience in EDR operation of LF/LG;
   (c) be capable of tackling the critical hazards and administering safety precautions specified in the method statement prepared by the owner;
   (d) be capable of communicating with the competent person and the LF/LG operator throughout the EDR operation and is empowered to stop work if necessary; and
   (e) be capable of conducting visual inspection on the parts of LF/LG to ensure that they are in good working order before commencement of any operation.

2. The CP(EDR) should have the following qualifications, experience and competencies:

   (a) at least 2 years of relevant experience in the EDR operation, anchorage work, bridge segment erection and stressing platform erection/dismantling work of LF/LG; and
   (b) completed the following specific training provided by the owner/designer of the LF/LG in the following aspects-
      - erection/re-erection, dismantling, re-location procedures of LF/LG;
      - proper anchoring procedures of LF/LG to bridge deck;
      - proper anchoring procedures of spreader to bridge segment; and
      - proper anchoring procedures of stressing platform to bridge deck.

3. The CW(EDR) should have the following qualifications, experience and competencies:

   (a) at least 1 year of relevant experience in the EDR operation, anchorage work, bridge segment erection and stressing platform erection/dismantling work of LF/LG; and if the aforesaid experience requirement could not be met, the worker not being a CW(EDR) carrying out such duties should work under the immediate supervision of a CP(EDR); and
   (b) completed specific training provided by the owner/designer of the LF/LG regarding erection/re-erection, dismantling, re-location, proper anchoring procedures of LF/LG, bridge segment erection and stressing platform erection/dismantling work.

4. The lifting supervisor should have the following qualifications, experience and competencies:

   (a) be fully conversant with LF/LG operation;
   (b) have adequate practical experience in heavy lifting operations;
   (c) be familiar with hazards, limitations and precautions associated with LF/LG operation;
   (d) have been properly trained in the safe use of LF/LG including the principle of its operation;
   (e) be familiar with the provisions of the LALGR and the contents of this set of Guidelines;
   (f) ensure the safe system of work is fully understood by the personnel associated with the lifting operation by LF & LG; and
   (g) be capable of performing inspections on LF/LG and tests in accordance with the designer/manufacturer's instruction manual(s).

5. The LF/LG operator should have the following qualifications, experience and competencies:

   (a) have attained the age of 18 years and held a valid certificate of crane operation issued by either the Construction Industry Council or by any other person specified by the Commissioner

for Labour;

(b) have attended the plant specific and site specific training on the operation of LF/LG provided by the owner;
(c) be fit, with particular regard to eyesight, hearing and reflexes;
(d) have been trained in the general principles of slinging and be able to establish weights and judge distances, heights and clearances;
(e) have been adequately trained in the operation of the type of LF/LG and have sufficient knowledge of the LF/LG and its safety devices;
(f) understand fully the duties of the slinger and be familiar with the signal code in order to implement safely the instructions of the slinger or signaler; and
(g) understand fully the radio/tele-communication signals between the parties concerned.

6. The ICE should:

(a) be a RPE of the civil or structural discipline, and a member of the Hong Kong Institution of Engineers or the Institution of Civil Engineers, UK or equivalent; and
(b) have adequate experience in checking the design specifications of LF/LG and should be approved by the consultant engineer appointed by the project client.