

Code of
Practice on

Safe Use of Excavators



This Code of Practice is prepared by the
Occupational Safety and Health Branch
Labour Department

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1. Introduction

1.1 Purpose

- 1.1.1 Excavators have wide applications on construction sites. However, not all of them are safely and properly used. Each year, a number of accidents involving excavators occur, resulting in bodily injuries to workers and other persons, as well as damage to properties. Excavators can be safely used if the primary parties concerned observe and follow suitable safety precautions.
- 1.1.2 This Code of Practice (hereinafter referred to as the Code) is issued by the Commissioner for Labour (hereinafter referred to as the Commissioner) under Section 7A of the Factories and Industrial Undertakings Ordinance, Chapter 59 of the Laws of Hong Kong (hereinafter referred as the FIUO). The Code provides practical guidance to proprietors/contractors, management personnel and workers for compliance with provisions of relevant safety regulations for protection of workers in relation to operation of excavators on construction sites.
- 1.1.3 The guidance in this Code should not be regarded as exhausting those matters which need to be covered by the relevant safety legislation, nor is it intended to relieve persons undertaking the work of their statutory responsibilities. Compliance with this Code does not of itself confer immunity from legal obligations.
- 1.1.4 This Code has a special legal status. Although failure to observe a provision of this Code is not in itself an offence, such failure may be relied on by any party in the criminal proceedings as tending to establish or to negative any liability which is in question in the

proceedings if compliance with the said provision is found by the court to be relevant to a matter to which a contravention or failure alleged in the proceedings relates (section 7A(5) of the FIUO).

1.1.5 Attention is drawn to the following provisions/regulations -

- (i) sections 6A and 6B of the FIUO, concerning the general duties of proprietors and persons employed;
- (ii) the Factories and Industrial Undertakings (Loadshifting Machinery) Regulation (hereinafter referred to as the LSMR);
- (iii) the Construction Sites (Safety) Regulations (hereinafter referred to as the CSSR); and
- (iv) the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations (hereinafter referred to as the LALGR).

1.1.6 The statutory provisions referred to or cited in this Code are those in force on 15 December 2004.

1.2 Scope of Application

1.2.1 This Code provides practical guidance on the safe use and operation of excavators for excavating and earth moving operations on construction sites.

1.2.2 The Code focuses on the safe operation of excavators installed with bucket attachments. However, the guidance herein is, in general, applicable to excavators installed with other attachments as well. When using an excavator installed with attachments, in addition to the guidance in this Code, the relevant safety precautions in the manufacturer's manuals specific to the attachment used should be followed.

2. Definitions

For the purposes of this Code, the definitions given in the FIUO, the LSMR, the CSSR and the LALGR apply. The following definitions also apply:

"attachment" (附屬裝置) means a removable device (working tool) mounted either directly to the linkage or on an attachment bracket of an excavator to fulfill the primary function of the excavator (Fig. 1).

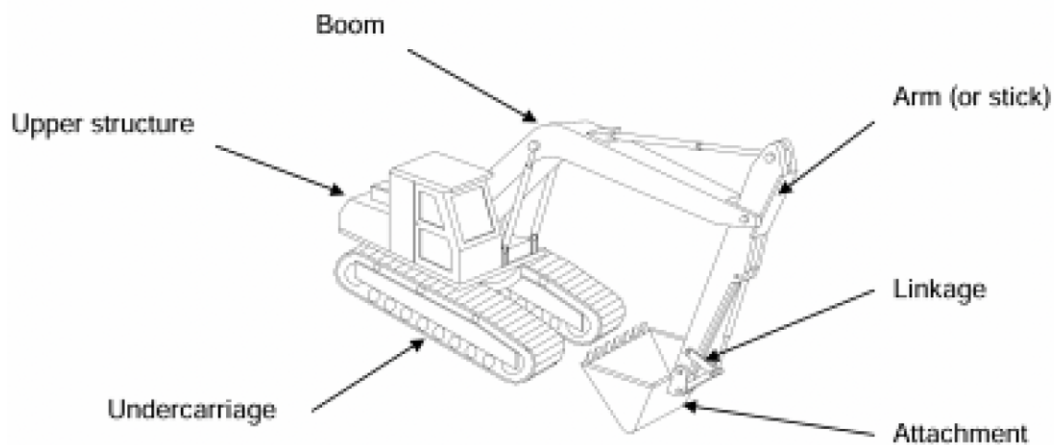


Fig.1 Excavator

"automatic safe load indicator" (安全負荷自動顯示器) means a device intended to be fitted to an excavator that automatically gives an audible and visible warning to the operator thereof that the excavator is approaching its safe working load and that automatically gives a further audible and visible warning when the excavator has exceeded its safe working load.

"certificate" (證書) means a certificate issued to a person by the organizer of a training course which evidences that, by virtue of his attendance at the training course designed for that purpose, he is trained and competent to operate an excavator (section 2(1) of the LSMR).

"competent examiner" (合資格檢驗員) in relation to the carrying out of any test and examination required by the LALGR, means a person who is -

- (a) appointed by the owner required by the LALGR to ensure that the test and examination is carried out;
- (b) a registered professional engineer registered under the Engineers Registration Ordinance (Cap. 409) within a relevant discipline specified by the Commissioner, which include Mechanical Engineering and Marine and Naval Architecture as at the date of this Code; and
- (c) by reason of his qualification, training and experience, competent to carry out the test and examination.

(regulation 3(1) of the LALGR).

"competent person" (合資格的人) in relation to any duty required to be performed by him under the LALGR, means a person who is -

- (a) appointed by the owner required by the LALGR to ensure that the duty is carried out by a competent person; and
- (b) by reason of training and practical experience, competent to perform the duty.

(regulation 3(1) of the LALGR).

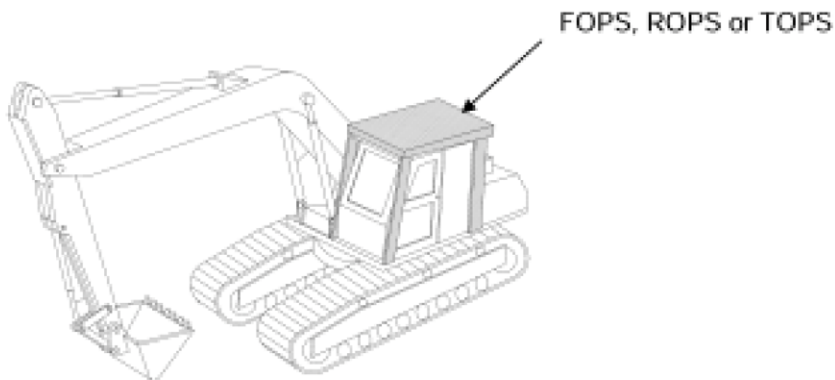
"construction site" (建築地盤) means a place where construction work is undertaken and includes any area in the immediate vicinity which is used for the storage of materials or plant used or

intended to be used for the purpose of the construction work (regulation 2(1) of the CSSR).

"contractor" (承建商), in relation to construction work, means any person or firm engaged in carrying out construction work by way of trade or business, either on his own account or pursuant to a contract or arrangement entered into with another person, including the State and any public body (section 2(1) of the FIUO).

"excavator" (挖土機) means a self-propelled machine on crawlers or wheels, having an upper structure capable of 360° swing with a mounted supporting excavator linkage, primarily designed for excavating and earth moving, including raising and lowering of excavated materials, with an attachment, without moving the undercarriage (Fig. 1).

"falling-object protective structure (FOPS)" (下墜物保護結構) means a system of structural members arranged on a machine in such a way as to provide operators with reasonable protection from falling objects (Fig. 2).



Note: FOPS, ROPS and TOPS have similar appearance. Details can be obtained from certification by the excavator manufacturer and in the certification label attached on the structure.

Fig. 2 Excavator fitted with a falling-object protective structure (FOPS), roll-over protective structure (ROPS) or tip-over protective structure (TOPS)

"manufacturer's manuals" (製造商手冊) include any instruction, operation, maintenance, service or safety manuals issued by the manufacturer for a specific excavator.

"operator restraint system" (操作員穩定系統) means a seat belt assembly with anchorages (Fig. 3).

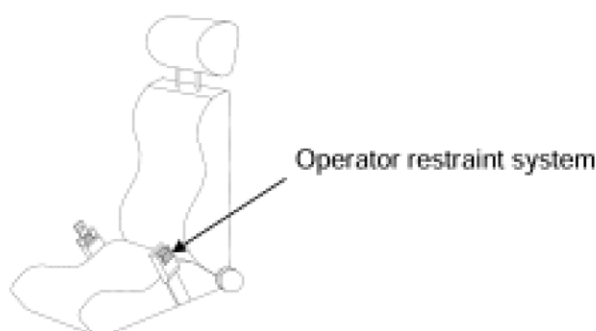


Fig. 3 An adjustable seat with operator restraint system

"owner" (擁有人), in relation to any lifting appliance or lifting gear, includes the lessee or hirer thereof, and any overseer, foreman, agent or person in charge or having the control or management of the lifting appliance or lifting gear and, in the case of a lifting appliance situated on or used in connection with work on a construction site, also includes the contractor responsible for the construction site (regulation 3(1) of the LALGR).

"proprietor" (東主), in relation to any construction work includes the person for the time being having the management or control of the business carried on in such construction work and includes a body corporate and a firm and also the occupier of any construction work and the agent of such occupier (regulation 2(1) of the FIUO).

"proprietor/contractor" (東主／承建商), means either of the following:

- (a) proprietor, when the context is concerned about legal responsibility under the FIUO;
- (b) responsible person, when the context is concerned about legal responsibility under the LSMR;
- (c) contractor, when the context is concerned about legal responsibility under the CSSR; and
- (d) owner, when the context is concerned about legal responsibility under the LALGR.

"responsible person" (負責人), in relation to an excavator, means a person who is having the management or in charge of the machine but does not include a person who operates the machine and, in the case of an excavator situated on or used in connection with work on a construction site, also means the contractor responsible for the construction site (section 2(1) of the LSMR).

"roll-over protective structure (ROPS)" (翻滾保護結構) means a system of structural members arranged on a machine in such a way as to accomplish its primary purpose of reducing the possibility of an operator, when wearing a seat belt of an operator restraint system, being crushed should the machine roll over (Fig. 2).

"tip-over protective structure (TOPS)" (翻側保護結構) means a system of structural members arranged on a machine in such a way as to accomplish its primary purpose of reducing the possibility of an operator, when wearing a seat belt of an operator restraint system, being crushed should the machine tip over (Fig. 2).

"training course" (訓練課程) means a training course that is -

- (a) recognized by the Commissioner;
- (b) conducted for the purpose of instructing a person in the operation of an excavator; and
- (c) designed to ensure that a person is adequately trained and competent to operate an excavator.

(section 2(1) of the LSMR)

3. Responsibilities

3.1 Share of Responsibilities

- 3.1.1 Responsibilities relating to the safe use of excavators on a construction site should be shared among the primary parties: the proprietor/contractor, the management personnel, and the workers concerned, including the operators of the excavators.

3.2 Responsibility of Proprietor/Contractor

- 3.2.1 It is the general duty of a proprietor to ensure, so far as is reasonably practicable, the health and safety at work of all persons employed by him at a construction site (section 6A(1) of the FIUO). The proprietor/contractor responsible for a construction site, and, if applicable, the proprietor/contractor who has direct control over any construction work, process, excavation, or operation on the site are also bound by provisions of safety legislation controlling use of excavators (paragraph 1.1.5 items (ii), (iii) and (iv)) to take care of the safety and health of workers on the site.

- 3.2.2 For any operation involving the use of an excavator, the proprietor/contractor has the responsibility to:

- (a) assess the risks associated with the operation;
- (b) provide and maintain a system of work for the operation that is safe and without risk to the health of any worker;
- (c) provide a suitable excavator with a suitable attachment, in terms of design, type and capacity, for the work involved;
- (d) ensure that the excavator has been inspected, thoroughly

examined and tested in accordance with the provisions of the LALGR;

- (e) ensure that the excavator is in safe working condition when being used;
- (f) ensure that the excavator is properly maintained by technicians with competence and experience in accordance with manufacturer's manuals;
- (g) ensure that training course as required under the LSMR is provided to any employee who is instructed to operate the excavator;
- (h) ensure that the excavator is operated by a suitable operator who has been authorized to operate excavators;
- (i) ensure that the excavator is used properly, safely, and with full observation of the limitations and restrictions as stated in the manufacturer's manuals;
- (j) ensure that personnel assigned to the work team for the operation are competent in their respective work;
- (k) ensure that every place of work on the site is made and kept safe for any person to work;
- (l) provide adequate information, instruction, training and supervision to ensure the safety and health at work of workers;
- (m) provide and maintain a safe working environment;
- (n) provide adequate procedures to deal with emergency situations;
and
- (o) provide for use of workers adequate supply of personal protective equipment as required, and take measures to ensure

that workers use them.

3.3 Responsibility of Management Personnel

3.3.1 Management personnel include managers, engineers, site agents, safety personnel, supervisors and foremen. By nature of their positions, they are duty bound to assist their proprietor/contractor in ensuring the safety and health of workers. The management personnel who have responsibility for operation of any excavator have a vital part to play in ensuring the safety in use of the machine. They should involve in the development, implementation, monitoring and reviewing of the relevant systems of work, work methods and work procedures.

3.3.2 Apart from the above involvements, the management personnel have the responsibility to ensure that:

- (a) the workers involved have knowledge of details of the system of work;
- (b) the excavator used is suitable for the work to be performed, in design, type and capacity;
- (c) valid certificates in the approved forms under the LALGR in respect of inspection, examination and test of the excavator, issued by the competent person and the competent examiner, are available;
- (d) the excavator is in safe working order;
- (e) the excavator is properly maintained such that every part of the machine functions normally when being operated;
- (f) the manufacturer's manuals of the excavator are available for reference by operation and maintenance personnel;

- (g) the servicing and maintenance records for the excavator are readily available for reference;
- (h) the workers involved have the necessary training and competency to carry out the work in a safe manner;
- (i) the workers involved are provided with adequate supervision to prevent occurrence of unsafe acts or hazardous situations;
- (j) the workers involved are given the necessary information and instructions for safe execution of work;
- (k) the operator of the excavator is trained and competent in operating excavators and that he has been authorized to operate the machine;
- (l) the operator has attained the age of 18 years who holds a valid certificate under the LSMR applicable to excavators;
- (m) a signaller is provided where necessary for safe operation of the excavator; and
- (n) the person assigned to give signals to the operator of the excavator has received relevant training and has attained the age of 18 years.

3.4 Responsibility of Worker including Excavator Operator

- 3.4.1 A person employed to work on a construction site has the general duty of care for the safety and health of himself and of other persons. He also has the duty to co-operate with the proprietor/contractor, including the management personnel, to enable them to discharge their responsibilities in ensuring the safety and health of workers on the construction site (section 6B(1) of the FIUO).

3.4.2 In order to achieve safe operation of the machine and prevention of accidents, each worker engaged in work associated with an excavator, including the operator, has the responsibility to:

- (a) understand and follow instructions and information given by his supervisor on system of work, work procedures and safety precautions;
- (b) attend safety training provided by the proprietor/contractor;
- (c) understand and follow the relevant in-house rules and legal requirements on safety at work;
- (d) report to his supervisor about any unsafe conditions observed in connection with operation of the excavator;
- (e) refrain from operating the excavator unless so authorized by the proprietor/contractor and in possession of the certificate required under the LSMR;
- (f) refrain from riding on the excavator;
- (g) refrain from performing any unsafe act that may endanger himself or other persons;
- (h) make proper use and report defects of any safety device and protective equipment provided by proprietor/contractor; and
- (i) understand and follow procedures for emergency as specified in the contingency plan.

3.5 Additional Responsibility of Operator

3.5.1 A suitable operator of an excavator should be a person who:

- (a) has attained the age of 18 years (section 3 of the LSMR and regulation 45(2) of the CSSR);
- (b) is trained and competent to operate an excavator (regulation 45(1) of the CSSR) and holds a valid certificate applicable to

excavator (section 3 of the LSMR);

- (c) is authorized by the proprietor/contractor of the site to operate an excavator; and
- (d) has the ability to understand and follow instructions and information contained in the manufacturer's manuals concerning safe operation of the machine.

3.5.2 The operator of an excavator has a very important role to play in safe operation of the machine. In addition to that described in paragraph 3.4.2, he has the responsibility to:

- (a) attend training course for excavator provided by the proprietor/contractor as required under the LSMR;
- (b) produce his certificate, issued by the organizer of a training course for excavator, for inspection when required to do so by management personnel or law enforcement officers;
- (c) refrain from operating the excavator unless the relevant certificates in the approved forms under the LALGR, issued by the competent person and the competent examiner, indicating that the excavator is in safe working order, are available;
- (d) check to ensure that the site condition is safe for the excavator to be operated thereon;
- (e) understand the functions and performance of the excavator, including operating characteristics, limitations and restrictions of the machine;
- (f) understand and follow instructions in manufacturer's manuals on safe operation of the excavator and operate the excavator in a controlled and safe manner;
- (g) make proper use of the excavator and never use it beyond its safe working load or designated purpose;
- (h) inspect, service, and lubricate the excavator as prescribed by

- the manufacturer's manuals, if assigned such duties;
- (i) record in a logbook particulars concerning inspection, servicing and lubrication of the excavator;
 - (j) stop using and report to his supervisor any damage, malfunctioning or suspected defect of the excavator, the symptoms of which include abnormal noise, vibration, smoke, smell, temperature and movements;
 - (k) ensure that he is physically, mentally and emotionally fit to operate the excavator safely; and
 - (l) refuse to let anyone travel on the excavator.

4. Safe System of Work

4.1 General

- 4.1.1 For an operation involving the use of an excavator, the proprietor/contractor, in consultation with the management personnel and workers, should carry out a detailed analysis of the operation so as to devise a system of work that is safe and without risk to health to workers. A system of work should lay down proper and safe work method and procedures for workers to follow.
- 4.1.2 Workers concerned should be given knowledge of details of the system of work. Where necessary, the proprietor/contractor should arrange suitable training for the workers to impress upon them the importance of following the work method and procedures in the system of work.

4.2 Establishing a Safe System of Work

- 4.2.1 Before commencement of work with an excavator, the proprietor/contractor should identify all potential hazards associated with the work to be performed, so as to assess the risks. The following factors should be considered:
- (a) type of excavator used and type of protective structure installed;
 - (b) limitations and restrictions of the excavator;
 - (c) ground profile and condition at the work location;
 - (d) proximity hazards at the work location;
 - (e) work requirements; and
 - (f) competence of the work team.

- 4.2.2 After identifying the potential hazards, the proprietor/contractor should assess the risks of each hazard to determine the need for preventive measures, then establish means to reduce the hazards, safe work method and work procedures.
- 4.2.3 With collective input from personnel of different levels, the proprietor/contractor should devise a safe system of work for the operation which should be documented. For an operation that has been assessed to involve high risk of serious injuries to workers, the proprietor/contractor should consider adopting a permit-to-work system.
- 4.2.4 The proprietor/contractor should provide adequate communication of the system of work to every personnel involved in the work. Where additional training for particular or necessary skill is required for the workers to carry out their jobs, such training should be provided to them before commencement of the work.
- 4.2.5 The proprietor/contractor should make efforts to ensure that every personnel involved follows strictly the system of work when work is being carried out. After implementation of the system of work, the proprietor/contractor should arrange regular monitoring and review of the effectiveness of the system. The proprietor/contractor should consider modifications, or alterations, if necessary, to improve effectiveness of the system, or in case there are changes in circumstances. Any modification or alteration required after implementation should be adequately communicated, as soon as possible, to the personnel involved.

5. Design and Safety Features

5.1 Conform to Standards

5.1.1 Excavators for use on construction sites should conform to international or national standards applicable to excavators, in terms of principles for design, provisions of specifications and safety requirements (please refer to "List of Reference" for examples of some of the international or national standards).

5.2 Important Safety Features

5.2.1 An excavator should have proper and safe means of access to as well as egress from the operator's cabin and the maintenance areas.

5.2.2 An excavator with provision for a seated operator should have an adjustable seat that retains the operator in a stable position and allows him to control the machine under all expected operating conditions.

5.2.3 An excavator should have service braking system for slowing down and stopping. A parking brake should also be available to hold the stopped machine immobile. The parking brake should be able to retain the excavator in the applied position by its own and may combine with the service braking system. The service braking system and the parking brake should be effective and efficient during operation of the excavator.

5.2.4 An excavator should have sufficient visibility at the operator's seat to allow operation of the machine. Aids such as mirrors, ultrasonic devices, TV devices, etc. should be available to remedy inadequate direct view.

- 5.2.5 An excavator should be fitted with illumination lights to provide sufficient lighting for traveling and working purposes.
- 5.2.6 The main controls and indicators of an excavator should have clear indications and identification to show their functions.
- 5.2.7 An excavator should be able to be fitted with an operator's protective structure, such as a falling-object protective structure (FOPS), a roll-over protective structure (ROPS), or a tip-over protective structure (TOPS), according to the risks of an application.
- 5.2.8 An excavator fitted with a roll-over protective structure (ROPS) or a tip-over protective structure (TOPS) should be equipped with an operator restraint system.
- 5.2.9 The operator's cabin of an excavator should be provided with an emergency exit which is in a different direction from the regular exit.

5.3 Machine Markings and Warning Signs

- 5.3.1 Machine markings affixed to an excavator by its manufacturer generally include information on manufacturer, machine identification, engine power, conditions of use, etc. The markings should be preserved in legible condition.
- 5.3.2 The warning signs affixed to an excavator by its manufacturer to alert users on potential hazards at different locations of the machine should be preserved in legible condition (Fig. 4).



Fig. 4 Examples of warning signs

- 5.3.3 If the machine markings and warning signs are in language other than Chinese, or which are incomprehensible to workers associated with operation of the excavator, their meanings should be brought to the knowledge of the workers through effective means such as training, instruction, or provision of translated markings and warning signs.

6. Selection of Excavator

6.1 Suitable Excavator and Attachment

- 6.1.1 There are different makes and types of excavators available in the market. Within the same type, there are different capacities to cater for the varying requirements of work. Some machine manufacturers supply interchangeable attachments for excavators to suit different work purposes or capacities. In planning an operation, it is essential to select the most suitable excavator and attachment to be used.
- 6.1.2 The excavator and the attachment selected for a particular operation should be suitable in design, type and capacity for the purpose. In the selection process, the proprietor/contractor may obtain valuable contributions from the machine manufacturer, and experienced site personnel.

6.2 Protective Structures

- 6.2.1 Depending on the work nature and condition at the work area, using an excavator installed with a suitable protective structure, such as a roll-over protective structure (ROPS) or a tip-over protective structure (TOPS), and an operator restraint system should be considered for protection of the operator. The proprietor/contractor should determine the type of protective structure according to outcome of the risk assessment for the application.

6.3 Modifications

- 6.3.1 An excavator should be used for the purpose it is designed for. The proprietor/contractor should consult the machine manufacturer on

any attempt to modify the excavator or its attachment, or to use an attachment of a different make, to suit a specific work purpose.

7. Inspection, Examination, Testing and Maintenance

7.1 Inspection, Examination and Testing

7.1.1 An excavator is a lifting appliance under the LALGR. The regulations require the proprietor/contractor to ensure that an excavator has been tested, thoroughly examined and certified safe by a competent examiner (regulation 5 of the LALGR); and periodically inspected by a competent person (regulation 7A of the LALGR) when being used. For guidance on inspection, examination and testing of lifting appliance, reference should be made to the Guidance Notes on Inspection, Thorough Examination and Testing of Lifting Appliances and Lifting Gear issued by the Labour Department.

7.2 Maintenance Programme

7.2.1 For an excavator to be used safely, the proprietor/contractor should ensure that it is properly maintained (regulation 4 of the LALGR) so as to keep it in good working order.

7.2.2 A planned maintenance programme is essential in order to ensure proper maintenance of an excavator. As a minimum requirement, every excavator should be maintained according to recommendations given in the manufacturer's manuals. The maintenance jobs such as routine inspection, servicing, lubrication, and renewal of parts should be carried out at regular intervals.

7.2.3 All safety features in an excavator should be frequently inspected and tested on its condition and effectiveness. Remedial actions should be taken once any deficiency is found in any safety feature.

7.2.4 Routine inspection, servicing and lubrication of an excavator should

be performed by competent persons, or workers who have been adequately trained to perform such work. However, renewal of parts or repair of an excavator should only be assigned to technicians with competence and experience who possess sufficient knowledge and skills to complete the work safely.

7.3 Maintenance Records

- 7.3.1 Proper records of routine inspection, servicing, lubrication, renewal of parts and repair of every excavator should be maintained. Such records provide important information for reference in subsequent maintenance work of the excavator. The maintenance logbooks or records should be readily available for reference and examination by relevant personnel.

8. Safe Operation of Excavator

8.1 Ground Condition

- 8.1.1 Excavators are often used on slopes, rough terrain or soft ground. To prevent instability and overturning of an excavator on such work surfaces, measures such as leveling or compaction of ground, or provision of load-bearing supports, as appropriate, should be taken before moving the excavator into position.

8.2 Before Operation

- 8.2.1 The operator of an excavator should read and understand the safety information relating to the excavator concerned from the relevant manufacturer's manual. It is important that the operator, apart from possessing the necessary qualifications, has sufficient knowledge in safe procedures and safety precautions in operating the excavator.
- 8.2.2 Reference should be made to the relevant maintenance records to verify whether the excavator is in a condition suitable for use.
- 8.2.3 The operator should carry out an inspection of the excavator in a safe position, followed by a functional test. The operator should stop operating the excavator and report to his supervisor if the excavator is found not working normally or that it has any operating problem. A notice stating that the machine is out of order should be attached to such excavator.
- 8.2.4 The operator should check the work area to verify situations such as:
- (a) location of slope, opening, trench and overhang;
 - (b) compactness of ground and condition of haul road; and

(c) presence of persons, obstacles and public utilities.

8.2.5 Checking of the work area provides information that assists the operator to make a final evaluation of the safety of the work method and procedures. In case any unexpected unsafe condition is revealed, the operator should report to his supervisor so that revision of the work method and procedures may be initiated.

8.3 During Operation

8.3.1 The operator should engage the operator restraint system of the excavator, if provided.

8.3.2 Before operating any control of the excavator, the operator should check the surroundings of the mechanism involved to make sure that no one is endangered by the mechanism once it starts moving.

8.3.3 The operator should operate controls of the excavator steadily and avoid sudden or abrupt operation.

8.3.4 The operator should follow the operating procedures of the excavator as recommended in its manufacturer's manuals.

8.3.5 The excavator should not be loaded beyond its safe working load as specified in the certificates in the approved forms issued by the competent examiner under the LALGR.

8.3.6 When handling load with the attachment of the excavator, the weight of the attachment and attachment bracket, if fitted, should be considered as part of the loading on the excavator.

8.3.7 In situations where the operator of the excavator does not have a clear and unrestricted view of the attachment during work, a signaler should be made available to give signals to the operator (Fig. 5).

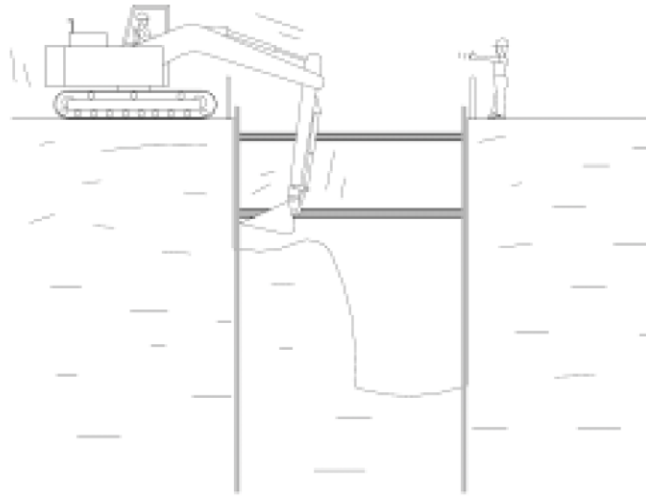


Fig. 5 A signaler giving signals to the operator of an excavator

- 8.3.8 During excavating with the excavator, the excavator and the position at which spoils are dumped should be at sufficient distances away from the edge of the excavation. The distances should be determined by a registered professional engineer competent in geotechnics.

8.4 After Operation

- 8.4.1 Before shutting down the excavator, the operator should lower its attachment onto the ground.
- 8.4.2 Before leaving the excavator unattended, the operator should have it parked on a flat and stable ground with its engine stopped, the parking brake applied, the engine start switch key removed, the windows and door of the operator's cabin closed with the door locked, and the door key removed.
- 8.4.3 The position at which the excavator is parked should not cause any obstruction to the traffic, traffic signs, the view of other vehicle drivers, or other site activities.

- 8.4.4 If it is necessary to park the excavator on a slope, the crawlers or wheels should be chocked on the downhill side (Fig.6).

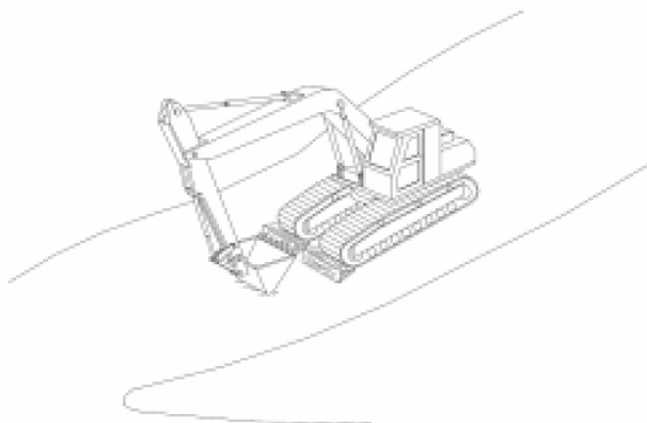


Fig. 6 When an excavator is parked on a slope, the crawlers should be chocked on the downhill side

8.5 Operation on Slope

- 8.5.1 If it is necessary for an excavator to work or travel on a slope, the proprietor/contractor should find out the angle of inclination of the work area, and ascertain, from manufacturer's manuals or, if not specified, from the manufacturer, the recommended maximum angle of inclination for the excavator to work or travel on.
- 8.5.2 The angle of inclination of the slope should be ascertained by suitable methods such as surveying, use of angle measuring equipment on the slope, or use of angle indicating equipment installed on the excavator.
- 8.5.3 The operator should strictly follow the safety precautions recommended in the manufacturer's manuals for the excavator to work and travel on slopes if the work area is within the acceptable

angle of inclination. If the angle of inclination of the work area is greater than the recommended value, the proprietor/contractor should not permit operation of the excavator there until leveling of the area by suitable engineering method has adequately reduced the angle of inclination.

- 8.5.4 When traveling on a slope, an excavator should be driven straight up and down the slope at low speed (Fig. 7). It should not be driven across the slope (Fig. 8). For maximum stability while at work on a slope, the crawlers or wheels, and the undercarriage of the excavator should also be placed along, instead of across the slope (Fig. 9 and Fig. 10).

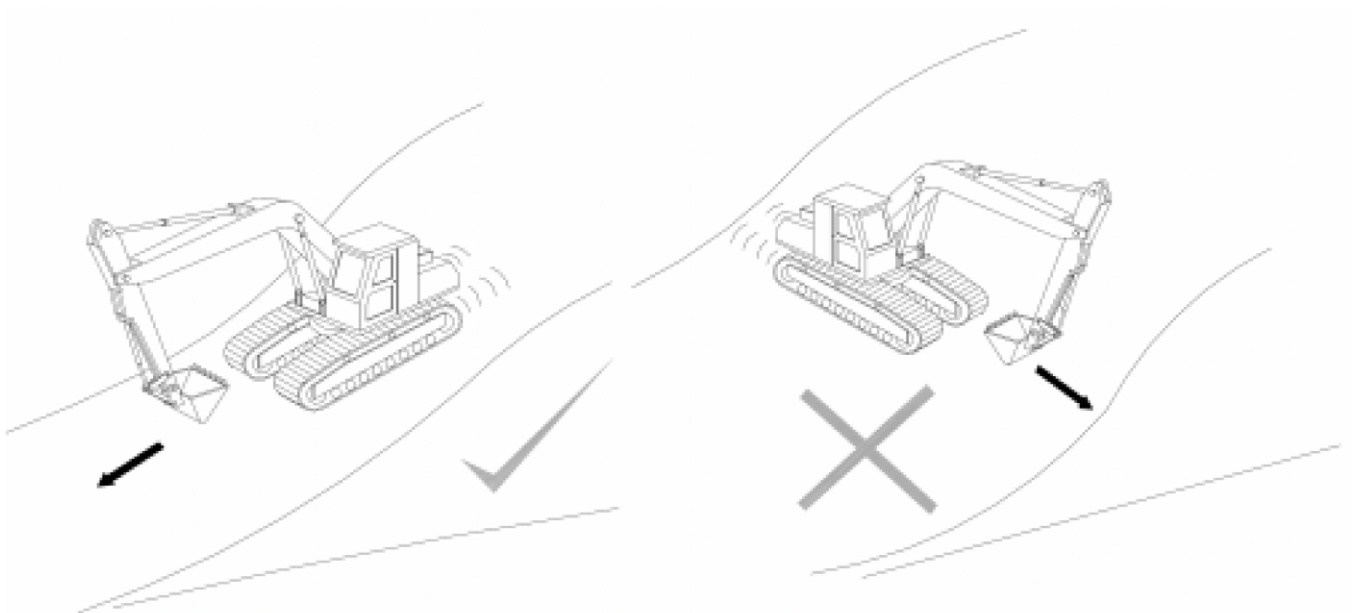


Fig. 7 When traveling on a slope, an excavator should be driven straight up and down the slope at low speed

Fig.8 When traveling on a slope, an excavator should not be driven across the slope

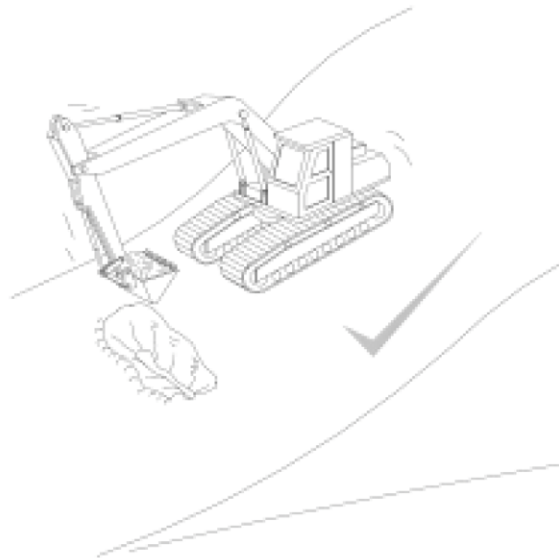


Fig. 9 While at work on a slope, the crawlers of the excavator should be placed along the slope

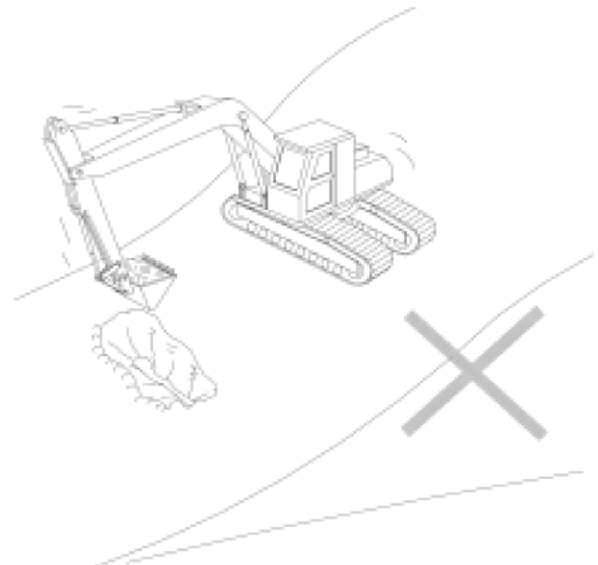


Fig. 10 While at work on a slope, the crawlers of the excavator should not be placed across the slope

- 8.5.5 When driving an excavator down a slope, the operator should keep the travel speed in low speed. For excavator with gearshift, the operator should maintain in low gear, and under no occasion should he shift to neutral.
- 8.5.6 To prevent slipping of an excavator during operation on a slope within the acceptable angle of inclination, the crawlers or wheels should be chocked on the downhill side.
- 8.5.7 To prevent overturning or tipping of an excavator on a slope, the operator should take extreme caution when slewing the boom of the excavator.
- 8.5.8 Where an excavator has to be operated near the edge of a slope, embankment, or excavation, the proprietor/contractor should take preventive measures such as provision of a signaler or erection of fencings, stop blocks, warning signs, etc. at the edge to alert the operator.

- 8.5.9 Excavators for operation on slopes should have roll over protective structure (ROPS) and operator restraint system.

8.6 Miscellaneous Safety Precautions

- 8.6.1 Anyone making access to or egress from the operator's cabin or maintenance areas on an excavator should make use of the steps and handholds on the machine designated for such purposes.
- 8.6.2 When warning of thunderstorm or lightning is issued by the Hong Kong Observatory, no one should stay on an excavator. The proprietor/contractor should suspend operation of the excavator and the operator should retreat to a safe place. The proprietor/contractor should also suspend use of an excavator under inclement weather if working condition becomes potentially hazardous due to the weather.
- 8.6.3 To prevent moving in the wrong direction when driving an excavator, the operator must make clear the front/rear positions of the upper structure and the undercarriage before operating the drive control.
- 8.6.4 When an excavator is working near any fixed structure, the proprietor/contractor should maintain an unobstructed passageway of not less than 600 millimetres wide between the excavator and the structure, or take reasonable measures to prevent persons from having access to that place, such as by fencing off the place.
- 8.6.5 When an excavator is used in road works, requirements under the Road Traffic (Traffic Control) Regulations (Cap. 374 sub. leg.) concerning lighting, signing and guarding of road works should be complied with. For guidance in this respect, reference should be made to the Code of Practice for the Lighting, Signing and Guarding of Road Works issued by the Highways Department. If vehicles and pedestrians passing by are likely to pose hazards during the use of the excavator, the proprietor/contractor should assign a banksman to

regulate traffic and pedestrians so as to prevent accidents.

- 8.6.6 For an excavator to be operated in a building, the proprietor/contractor should verify the floor loading to ensure that it is sufficient to support the machine. The proprietor/contractor should also check headroom and clearances to ensure that no unsafe condition occurs when using the excavator.
- 8.6.7 When an excavator is operated in an area with insufficient natural lighting or poor visibility condition, the proprietor/contractor should provide artificial illumination to supplement the lights mounted on the excavator.
- 8.6.8 When an excavator is operated in an area with insufficient natural ventilation, the proprietor/contractor should take measures to prevent harm due to accumulation of toxic gases or fumes.
- 8.6.9 When an excavator is moving, the operator should lower the attachment to prevent it from obstructing sight and to increase stability.
- 8.6.10 The tyres of a wheel-mounted excavator should be inflated to and maintained at the recommended pressure as given in the manufacturer's manuals.
- 8.6.11 For a wheel-mounted excavator with outriggers, the outriggers should be used whenever possible during operation to level the machine and to improve stability.
- 8.6.12 For a crawler-mounted excavator with extendable crawler frames, the crawler frames should be extended during operation for maximum stability.
- 8.6.13 The proprietor/contractor should effectively guard all exposed moving parts of an excavator, including moving parts of any prime mover and transmission machinery that may pose hazards to any worker under

normal operating conditions.

- 8.6.14 Depending on the work condition, the proprietor/contractor should consider the need for suitable personal protective equipment for the operator of an excavator and the associated workers. The proprietor/contractor should also provide such equipment and ensure their use by the operator and associated workers.

8.7 Unsafe Practices to Avoid

- 8.7.1 Unsafe practices in using an excavator pose unnecessary hazards not only to the operator, but also to workers nearby. In order to prevent accidents, the proprietor/contractor should take measures to ensure that the operator of an excavator does not perform the following unsafe practices:

- (a) leaving the excavator unattended with its engine running;
- (b) leaving the excavator unattended with its attachment raised up;
- (c) applying a lateral load to the bucket and arm of the excavator during work;
- (d) driving the excavator with the bucket thrust into the ground;
- (e) excavating with the excavator on unstable surface;
- (f) positioning the excavator too close to the edge of a slope or trench;
- (g) undercutting the area beneath the excavator;
- (h) using the bucket as a support for moving the excavator across excavated trench or obstacle;
- (i) jacking up the excavator with the boom as a way to rescue the machine from instability;
- (j) using the bucket of the excavator to hammer sheet pile into the ground and /or to extract sheet pile from the ground;

- (k) slewing the boom of the excavator while traveling on a slope;
- (l) hitting the bucket of the excavator hard against the work surface;
- (m) using the bucket of the excavator for a working platform or passenger carrier, and
- (n) using the bucket of the excavator to carry or transport materials and objects that cannot be securely held on the bucket, such as pipes, timber boards and battens.

9. Excavator Used for Lifting

9.1 Suitability

- 9.1.1 Excavators are sometimes used on construction sites to perform lifting operations for materials such as pipes, battens, etc. The general practice is that the load is suspended through a set of lifting gear to the arm or bucket of an excavator.
- 9.1.2 An excavator used for lifting operation should by design be suitable for the purpose. In addition, designated lifting point should be available from the original manufacturer on its bucket, arm or boom for attaching of lifting gear. The proprietor/contractor should refer to the manufacturer's manuals to ascertain suitability of an excavator for use in lifting operation.
- 9.1.3 When performing lifting operation with an excavator that is suitable for the purpose, the relevant instructions, information, conditions and restrictions as provided in the manufacturer's manuals should be observed.

9.2 Safety Precautions

- 9.2.1 Before using an excavator for any lifting operation, the proprietor/contractor should comply with the legal requirements regarding testing, thorough examination and inspection of the excavator (as described in 7.1.1). The lifting gear, such as chain, rope, etc., to be used in the lifting operation should also be tested, thoroughly examined and certified safe by a competent examiner in the approved forms (regulation 18 of the LALGR).
- 9.2.2 The excavator should be positioned on solid and level ground. For

excavators with outriggers or extendable crawlers, the outriggers or extendable crawlers should be extended.

- 9.2.3 Only the manufacturer's designated lifting points on the excavator should be used for lifting of load.
- 9.2.4 The safe working load of the excavator should not be greater than the load which the machine is designed to lift safely at its least stable configuration, i.e., side-loading with the greatest working radius. The safe working load should be the same for every working radius at which the excavator is operated.
- 9.2.5 The safe working load applicable to the excavator as prescribed in the certificates in the approved form, issued by the competent examiner under the LALGR, should be clearly and legibly marked on the machine (regulation 11(1) of the LALGR).
- 9.2.6 The excavator and the lifting gear used should not be loaded beyond their safe working loads (regulations 12 and 18(1)(c) of the LALGR).
- 9.2.7 An excavator having a safe working load of more than 1 tonne should not be used to perform lifting operation unless the excavator satisfies the following conditions:
- (a) it is fitted with an automatic safe load indicator;
 - (b) the competent examiner, during each test and thorough examination of the excavator as required under the LALGR, has also tested the automatic safe load indicator and confirmed that it is in good working order, and that the result of the test has been recorded in the relevant certificate in the approved form;
 - (c) the competent person, during each inspection of the excavator as required under the LALGR, has also inspected the automatic safe load indicator and determined that it is in safe working order, and that the result of the inspection has been recorded in

the relevant certificate in the approved form; and

- (d) for hydraulic excavator, it has been fitted with check valves in the hydraulic lifting cylinder, or other suitable device, to prevent a gravity fall of the load in the event of a hydraulic failure.

10. Transportation of Excavator

10.1 Transportation by Trailer

- 10.1.1 Excavators are often transported by trailers to different work sites. The excavators are loaded to or unloaded from the trailers by self-drive, without the need for disassembly. To carry out transportation of an excavator, the procedures recommended in the manufacturer's manuals should always be followed.
- 10.1.2 For an excavator with extendable crawler frames, the crawler frames should be fully retracted for transportation.

10.2 Precautions in Loading and Unloading

- 10.2.1 Loading or unloading of an excavator to or from a trailer should be done on a level surface. The trailer should be chocked before loading or unloading.
- 10.2.2 The proprietor/contractor should provide and use a suitable ramp with sufficient strength for loading or unloading of an excavator. The ramp should have an angle of inclination less than the maximum angle recommended in excavator manufacturer's manuals. The ramp should be kept clean and free from mud, oil or debris so as to prevent slipping of the excavator during its movement. To prevent slippage due to rain, matting should be used.
- 10.2.3 Loading or unloading of an excavator by manoeuvring the boom to jack up or lower the excavator should never be attempted.
- 10.2.4 If the attachment of an excavator has been dismantled, the center of gravity of the excavator shifts towards the rear. When loading or unloading such excavator, the excavator should be positioned with its

counterweight located at the higher end of the ramp.

10.3 Precautions during Transportation

- 10.3.1 To prevent slippage of an excavator during transportation, the trailer bed should be kept clean and clear of mud, oil or debris. The excavator should be adequately secured on the trailer. The boom and the attachment of the excavator should be lowered and secured.
- 10.3.2 During transportation of an excavator, provisions under the Road Traffic Ordinance (Cap. 374) and its subsidiary legislation should be complied with. For guidance on safe transport of an excavator and the correct method of securing the excavator on the trailer, reference should be made to the "Code of Practice for the Loading of Vehicles" issued by the Transport Department.

11. Public Utilities

11.1 Electricity Supply Lines

- 11.1.1 Where an excavator is required to work in the vicinity of any electricity supply line, whether overhead electricity line or underground electricity cable, the proprietor/contractor should take precautions to prevent any worker from being endangered by it (regulation 47 of CSSR). Common precautions include rendering dead the electricity supply line or placing of barriers.
- 11.1.2 All electricity supply lines should be treated as live unless certified dead and safe by the relevant authority.

11.2 Overhead Electricity Lines

- 11.2.1 Where any part of an excavator, including loaded material, has a chance of coming close within a horizontal distance of 9 metres from the outermost conductor of an overhead electricity line, the proprietor/contractor should take precautions against electrical hazards. The precautions include:
- (a) ascertaining the alignment, ground clearance and voltage of the overhead electricity line through prior planning and consultation with the electricity supplier;
 - (b) obtaining safety advice from the electricity supplier and following the advice given; and
 - (c) requesting the electricity supplier to temporarily isolate the overhead line in case the safe working distance between the overhead electricity line and any part of the excavator, including loaded material, cannot be maintained at all times.

- 11.2.2 Please see also the Electricity Supply Lines (Protection) Regulation (Cap. 406 sub, leg.) and the "Code of Practice on Working near Electricity Supply Lines" issued by the Electrical and Mechanical Services Department.

11.3 Underground Electricity Cables

- 11.3.1 For using an excavator in the vicinity of underground electricity cables, the proprietor/contractor should take the following precautions:

- (a) request a competent person approved by Director of Electrical and Mechanical Services Department to ascertain the positions of all underground electricity cables within the work site and provide a written report;
- (b) provide a copy of the written report to the operator of the excavator and other relevant working personnel;
- (c) maintain 1 metre clearance between any underground cable and the point where the excavator is used, in case the underground cable is of 66kV or above, the adequate clearance should be extended to 3 metres.

- 11.3.2 Please see also the Electricity Supply Lines (Protection) Regulation (Cap. 406 sub. leg.) and the "Code of Practice on Working near Electricity Supply Lines" issued by the Electrical and Mechanical Services Department.

11.4 Gas Pipes

- 11.4.1 Before use of an excavator in the vicinity of a gas pipe, the location and the position of the gas pipe should be ascertained. The excavator should not be used too close to the gas pipe.

- 11.4.2 Reference should be made to the Gas Safety (Gas Supply) Regulations (Cap. 51 sub. leg.) for legal requirements, and the "Code of Practice on Avoiding Danger from Gas Pipes" issued by the Electrical and Mechanical Services Department for guidance on precautions against damage to the gas pipe. The Code has set out a safe system of work which consists of four basic elements: plans, pipe locating devices, trial holes and safe excavation practice. The Code requires that a clearance of 1 metre must be maintained between any gas pipe and the point where an excavator is used.

11.5 Other Underground Utilities

- 11.5.1 Other underground utilities such as water pipes, sewage pipes, telephone lines, etc. can easily be damaged during excavation work, resulting in personal injuries as well as disruption of utility services. To prevent damage to the facilities, suitable precautionary measures should be taken.
- 11.5.2 Before excavating in the vicinity of the underground utilities with an excavator, the proprietor/contractor should consult the utility authorities concerned for advice on their locations and the safety measures required.
- 11.5.3 In general, before use of an excavator in the vicinity of the underground utilities, the proprietor/contractor should ascertain positions of the utilities by the use of locating devices and trial holes. The excavator should not be used too close to the underground facilities and a clearance of 1 metre should be maintained between any facility and the point where the excavator is used.

List of References

1. Safe System of Work - Occupational Safety and Health Branch, Labour Department
2. Guidance on Safe Use of Earth-Moving Machinery - Occupational Safety and Health Branch, Labour Department
3. Guidance Notes on Inspection, Thorough Examination and Testing of Lifting Appliances and Lifting Gear - Occupational Safety and Health Branch, Labour Department
4. Code of Practice Safety and Health at Work (Land-based Construction over Water - Prevention of Fall) - Occupational Safety and Health Branch, Labour Department
5. BS EN 474-1: 1995 Earth-moving Machinery - Safety, Part 1: General Requirements, British Standard Institution
6. BS EN 474-5: 1995 Earth-moving Machinery - Safety, Part 5: Requirements for Hydraulic Excavators, British Standard Institution
7. BS 6912-6: 1992/ISO 3449: 1992 Safety of Earth-moving Machinery - Part 6: Specification for Falling-object Protective Structures on Earth-moving Machinery: Laboratory Tests and Performance Requirements, British Standard Institution
8. BS 6912-14: 1996/ISO 3471: 1994 Safety of Earth-moving Machinery - Part 14: Specification for Laboratory Tests and Performance Requirements of Roll-over Protective Structures, British Standard Institution
9. BS 6914-8: 1993/ISO 7135: 1993 Terminology for Earth-moving Machinery, Part 8: Terminology and Commercial Specifications for Hydraulic Excavators, British Standard Institution

10. BS EN 13531: 2001 Earth-moving Machinery - Tip-over Protective Structure for Excavators - Laboratory Tests and Performance Requirements, British Standard Institution
11. GB/T 6572.1 - 1997 Hydraulic Excavators - Terminology, National Standard of The People's Republic of China
12. GB 9139.2 - 88 Hydraulic Excavators - Technical Specifications, National Standard of The People's Republic of China
13. Safety Manual for Operators and Mechanics for Hydraulic Excavator, Equipment Manufacturers Institute, USA
14. Code of Practice for the Loading of Vehicles - Transport Department
15. Code of Practice on Working near Electricity Supply Lines - Electrical and Mechanical Services Department
16. Code of Practice on Avoiding Danger from Gas Pipes - Electrical and Mechanical Services Department

Enquiry

If you wish to enquire about this Code of Practice or require advice on occupational safety and health, you can contact the Occupational Safety and Health Branch of the Labour Department through:

Telephone : 2559 2297 (auto-recording after office hours)

Fax : 2915 1410

E-mail : enquiry@labour.gov.hk

Information on the services offered by the Labour Department and on major labour legislation can also be found by visiting our Home Page on the Internet. Address of our Home Page is <http://www.labour.gov.hk>