STANDARD INDUSTRI PEMBINAAN
(CONSTRUCTION INDUSTRY STANDARD)

CIS 14:2019
GUIDELINES ON CONSTRUCTION WORKS AT NIGHT

Description: Planning, safety management plan, road and building construction at night, safety and health precautions

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GUIDELINES ON CONSTRUCTION
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COMMITTEE REPRESENTATION

This Construction Industry Standard (CIS) was managed and developed by the Construction Industry Development Board Malaysia with the assistance of the Technical Committee of Safety and Health in Construction which comprises representative from the following organizations:

Association of Consulting Engineers Malaysia (ACEM)
Construction Industry Development Board Malaysia
Department of Occupational Safety and Health (DOSH)
Ekovest Construction Sdn Bhd
IJM Corporation Berhad
Master Builders Association Malaysia (MBAM)
National Institute Occupational Safety and Health
Naza TTDI Sdn Bhd
Perbadanan Kemajuan Negeri Selangor
Real Estate and Housing Developers’ Association Malaysia (REHDA)
S P Setia Bhd
Universiti Malaya (UM)
Universiti Teknologi Mara (UiTM)
PREFACE

Guidelines on Construction Activities at Night was developed in 2009 as Construction Industry Standard (CIS 14:2009). This standard was revised 10 years later and now known as CIS 14:2019. The revision was carried out by Technical Committee formed by CIDB, represented by the construction industry stakeholders.

Reference were made to several documents generally used by industry players in managing construction safety and health. This revised version of CIS 14:2019 document is expected to provide clearer guidance to construction practitioners in assessing their safety and health performance at construction sites.

It should be noted that compliance with this Construction Industry Standard does not in itself confer immunity from legal obligations.
GUIDELINES ON CONSTRUCTION WORKS AT NIGHT

SECTION 1: GENERAL

1.1 Introduction

There is an increasing demand for performing construction of highways and buildings at night, specially in the urban areas to reduce conflict between the public and the stakeholders of the projects. This approach can be beneficial in particular, for reducing traffic disruptions and meeting the completion deadlines. However, contractors should consider the increased safety risk at the workplace when conducting any construction works at night. This guideline will provide essential practices that can reduce the risk of construction hazards at night.

1.2 Objective

The objective of this guideline is to provide for the protection of construction employees and the public from any potential hazards of construction works at night.

1.3 Scope

This guideline is intended as a useful tool for all those working at night and dark environments in the construction industry – providing everyone involved with useful practical information and solutions so they can create and maintain a safe working environment.

This guideline summarizes some key aspects specifically for construction activities at night. The intention put upon this guideline is to be the guidance and for the compliance of a law requirement that has been state in Occupational Safety and Health Act (OSHA) 1994 and Factories and Machineries – Building Operations and Works of Engineering Constructions (BOWEC) 1986, and other related laws – encouraging the highest possible level of health and safety when working in a construction site at night.

1.4 Normative references

The following normative reference is indispensable for the application of this construction industry standard. For dated reference, only the edition cited applies. For undated references, the latest editions of the normative references (including any amendments) apply.

iv. Code of Practice for The Lighting, Signing and Guarding of Road Works, Hong Kong Highways Department, HKSARG (2006).

xii. Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC), Department of Occupational Safety and Health Malaysia (2008).

xiii. Guidelines for Public Safety and Health at Construction Site, Department of Occupational Safety and Health Malaysia (2007).

xiv. Guidelines For Works Related To Public Utility Installations Within The Road Reserve, Road Engineering Association of Malaysia.

xv. Handbook for Hazard Identification, Risk Assessment & Risk Control (HIRARC) by MBAM.


xvii. Occupational Safety and Health Act and Regulations (OSHA), 1994 (Act 514).


xxi. The Planning Guidelines for Environmental Noise Limits and Control 2007, Department of Environmental Malaysia.

xxii. The planning Guidelines for Vibration Limits and Control.


xxiv. Zones Control, Jabatan Kerja Raya Malaysia (JKR).

1.5 Terms and definitions

i. **Act**

ii. **Client**
   Person who commissions design work for a structure.

iii. **Competent person**
   Person who has acquired through training, qualification or experience (or a combination of these) the knowledge and skills enabling that person to safely perform a specified task.

iv. **Contractor**
   A person who undertakes to carry out and complete any construction works.

v. **Construction project**
   A project involving construction work, and includes the design, preparation and planning.

vi. **Construction site**
   A place at which construction work is undertaken, and any other area in the vicinity where plant or other material used or to be used in connection with the construction work is located or kept during the construction work. It does not include a place where elements are manufactured ‘off site’ or where construction material is stored as stock for sale or for hire.
vii. **Construction works**  
The construction, extension, installation, repair, maintenance, renewal, removal, renovation, alteration, dismantling or demolition of:

   a) any building, erection, edifice, structure, wall, fence or chimney, whether constructed wholly or partly above or below ground level;
   b) any road, harbour works, railway, cable way, canal or aero drome;
   c) any drainage, irrigation or river control works;
   d) any electrical, mechanical, water, gas, petrochemical or telecommunication works; or
   e) any bridge, viaduct, dam, reservoir, earthworks, pipeline, sewer, aqueduct culvert, drive, shaft, tunnel or reclamation works, and
   f) includes any works which form an integral part of, or are preparatory to or temporary for the works described in paragraphs a) to e), including site clearance, soil investigation and improvement, earth-moving, excavation, laying of foundation, site.

viii. **Dark environment**  
The period at sunrise and sunset, and dark spaces.

ix. **Design**  
In relation to any structure means any drawing, design detail, scope of works document or specification relating to the structure.

x. **Designer**  
A person whose profession, trade or business involves them in:

   a) repairing designs for structures, including variations to a plan or changes to a structure, or
   b) arranging for people under their control to prepare designs for structures.

xi. **Director General**  
Respectively to Director General of DOSH

xii. **DOSH**  
Department of Occupational Safety and Health Malaysia.

xiii. **Hazard**  
A source or a situation with a potential for harm in terms of human injury or ill health, damage to property, damage to the environment or a combination of these.

xiv. **Highway**  
Includes all traffic lanes, acceleration lanes, deceleration lanes, shoulders, median strips, bridges, overpasses, underpasses, interchanges, approaches, entrance and exit ramps, toll plazas, service areas, maintenance areas, highway furniture, signs and other structures and fixtures and any other areas adjacent thereto, under the control and management of the Highway Authority.

xv. **Highway authority**  
The body corporate established under section 3 of the Highway Authority Malaysia (Incorporation) Act 1980.

xvi. **Illumination**  
The measure of the stream of light falling on a surface. The light may come from sun, lamps in a room or any other bright surface. The unit of measurement is the lux (lx).
xvii. **Luminance**
The measure of the brightness of a surface; the perception of brightness of a surface is proportional to its luminance. Therefore, luminance is a measure of light coming from a surface. Since it is a function of the light that is emitted or reflected from a wall, furniture and other objects, it is greatly affected by the reflectivity of the surface. The luminance of a lamp on the other hand is an exact measure of the light they emit.

xviii. **Motor vehicle**
A vehicle of any description, propelled by means of mechanism contained within itself and constructed or adapted so as to be capable of being used on roads, and includes a trailer.

xix. **Night time**
The period between 7 p.m. to 7 a.m. on the following day.

xx. **Night work**
Work carried out during night time.

xxi. **Night employee**
   a) who normally works at least 3 hours of his or her daily working time during night time and/or
   b) the number of hours worked by whom during night time, in each year, equals or exceeds 50 per cent of the total number of hours worked by him or her during that year.

xxii. **Risk**
A combination of the likelihood of an occurrence of a hazardous event with specified, period or in specified circumstances and the severity of injury or damage to the health of people, property, environment or any combination of these caused by the event.

xxiii. **Road**
   a) any public road and any other road to which the public has access and includes bridges, tunnels, lay-by, ferry facilities, interchanges, round-about, traffic islands, road lanes, side-tables, median strips, overpasses, underpasses, approaches, entrance and exit ramps, toll plazas, service areas, and other structures and fixtures to fully effect its use; and
   b) for the purposes of sections 70 and 85 (Road Transport Act, 1987), also includes a road under construction.

xxiv. **Traffic**
Includes bicycles, tricycles, motor vehicles, tram cars, vehicles of every description, pedestrians, processions, bodies of police or troops and all animals being ridden, driven or led.

xxv. **Traffic signs**
Includes all signals, warning sign posts, direction posts, signs, marks or devices erected or provided on or near a road for the information, guidance or direction of persons using the road.
SECTION 2: PLANNING

2.1 Planning for construction work at night

Working during night time by its very nature is dangerous. Employees are exposed to many high risk unsafe working conditions at construction site. Common problems that might occur are poor visibility in the working environment, working in a drowsy condition and communication problems with the day shift. This could contribute to other work related safety and health problems for example drug and alcohol abuse, psychological problems and physiological problems.

Therefore it is very important to plan any works for night time is engaged. Employers need to plan beforehand the workforce required, special arrangement for safety provision such as sufficient work area lighting, retro-reflective clothing, flashing lights on equipments/structures and retro-reflective tape at work area surroundings.

2.1.1 Safety management plan for night time work

A management plan should be well documented and structured so that both employers and employees can benefit from its use. The following are recommended components of a safety management plan for night time works:

a) Site personnel responsibility

It should be determined and stated clearly in the safety management plan the responsibility of each individual at construction site for night time works. Project Manager, Engineers, Designers, Safety Officer and Site Supervisors as well as employees each have their specific responsibility to make sure the highest level of priority are given towards safety and health issues.

b) Authorities Approval

Permission to work at night should be obtained from the relevant authority before construction works at night is carried out. Employers should submit their application for work permit to Local Government Authority and it is compulsory to follow all requirements enforced by the authority prior to executing night time construction works. Granting of Authority Permit shall be the main compliance in order for Permit to Work to be approved by the contractor.

All work at night should be conducted only after a documented approval has been obtained from the relevant local government authority stating the requirements and restrictions for night work.

It is also recommended that night work approved by the local authorities be informed to the residents/occupants of the surrounding neighbourhood.

c) Inventory preparation for safety equipments

Before night works are carried out, check the inventory of safety equipment to make sure they are sufficiently available, appropriate and in good working condition. Purchase sufficient new safety equipment for a new construction project or to add existing inventory. Equipments such as retro-reflective signage, barriers, retro-reflective tapes and lighting equipment are some example of safety equipment that should be provided for night time construction works.

Inventory for road construction specific safety equipment such as flashing amber lamp, flashing arrow panel and signage/drums/cones constructed from retro reflective materials should be made readily available.

Identifying the safety equipment needed and financial budget should be made by the principal contractor or party who has complete control of the planning and operation of the project site.
d) **Material and machine movement / coordination**

Employers should be aware that material and machine movement that is not well supervised could potentially cause serious injury and harm to employees and properties. Consider the following when planning for night time work:

i) Scheduling of construction materials delivery at specific time intervals e.g. bricks, aggregates or steels. Employees should be informed of such schedule so they can stay away from the receiving area.

ii) Construction materials should be well organized and should not be placed near employee walk ways.

iii) Large machinery movement should be directly supervised and a specific parking area should be made for the machines.

iv) Machinery for road construction should be arranged at the farthest point from travelling motorist.

Always remember to provide sufficient lighting to the materials/machine storage area and during the movement of the machineries.

e) **Tools and Machinery**

The Contractor shall ensure all tools and machinery are inspected and in good working order and condition in accordance to manufacturer’s recommendations.

f) **Emergency Preparedness and Response (EPR)**

One of the most important elements to consider before work at night is carried out is the EPR specifically for night time environment. A well established EPR can help both employer and employees to prepare; response and recover should a disaster occurs.

Items that must be considered in the EPR include:

i) Identifying the potential emergency scenario.

ii) Identifying the nearest emergency response provider, e.g. BOMBA station.

iii) Providing sufficient first aid supplies.

iv) Providing sufficient fire extinguishers.

v) Assigning a trained first aider/first responder.

vi) Access and ingress routes for rescue vehicles.

vii) Establishing a chain of command.

viii) Fire protection and prevention training for employees.

ix) Frequency of emergency/fire drill.

x) Establish escape routes and assembly points.

xi) Emergency contact number to be displayed for both internal and external parties.

g) **Public Safety**

When construction works involves public area, it is important to make sure the safety of the public. Consider the following when planning for night time work:

i) Identify the hazards for example construction vehicle movement or too much glare from lighting equipment.

ii) Plan for vehicular movement to not interrupt peak hours and make sure adequate supervision is provided for such movement.
iii) Provide sufficient signage to warn the public and put barriers at a safe distance to keep the public away.
iv) Set up a safe walk ways where it is unavoidable to work near or in public vicinity.
v) Arrange noisy equipments or machinery at farthest point from the public or adopt an engineering control to reduce the noise.
vi) When overhead crane is operating near the public, clear off the area and make sure adequate supervision is in place.
vii) Schedule for daily cleaning of the adjacent public road and filling up holes as well as uneven surfaces.

h) Working hours & manpower arrangement
Employers should identify at which construction phase the need for night time work is required. Consider the following when planning for night time work:
i) Arrange a special team to work at night and allow for shift rotation.
ii) Inform employees on the hazards related to working at night.

Contractor to ensure the workers are fit to work at night.

i) Consultation for road works
It is essential that road works are carefully planned in advance, and that proper consultations take place prior to and during the works. The works must be carried out in such a way to cause minimum disruption to traffic. Consider the following when planning for night time works:
i) Consult the local government authorities, JKR, Police and other regulatory departments in advance when works will involve major disruption to traffic.
ii) Seek expertise from JKR, LLM or other highway operators before any federal road/highway closures or reducing a two way traffic flows to one way.
iii) Make arrangement with LLM or other highway operators and relevant local government authority when working in major highways.
iv) Plan the works accordingly and try to avoid peak hours when there is a possibility of causing massive traffic obstruction.
v) Special consultation may be needed at areas where heavy trucks movement is restricted at certain time intervals.

j) Traffic Management for Road Works
Proper planning of the traffic management for road works is essential so as to minimize in convenience and prevent potential hazard to the construction employees and to road users. The requirements in respect of the arrangement of traffic management devices of road works are described in section 4.1.

k) Instruction, Information and Training
All employees shall be provided with the relevant information with respect to the Occupational Safety and Health legal requirements before or upon employment specifically for working at night. It is recommended to include the following items in the safety management plan for night time work:
i) Employee must be trained on night work hazards, risk control, safety precaution and emergency preparedness;
ii) Toolbox briefing;
iii) Effective communication system developed to define normal and emergency conditions;
iv) Supervision of employees during night work,
I) Housekeeping

Accidents can occur as a result of poor housekeeping. Hazards at construction site are the same for both day and night shift while the risks of injury are much higher during night works because of the inherent poor illumination. It is essential that the workplace is kept clean and tidy to ensure safety and prevent accidents. Consider the following when planning for night time work:

i) Provide tool box for proper storing of tools after use.

ii) Flammable material should be kept away from ignition source.

iii) Hazardous chemicals should be kept securely in designated area. Safety Data Sheet (SDS) should be readily available.

iv) Safe work methods/work instruction should include proper storing procedures after use of tools, equipments and machineries.

v) Adopt good housekeeping techniques or other best practices and establish a housekeeping schedule.

The following chapters will help to guide employers to better understand the specific requirements for night time works planning. This should be the minimum requirement and employers may add other relevant and appropriate components to make sure safety of the employees, the properties and the publics are well addressed.

2.2 Hazard identification, risk assessment and risk control (HIRARC)

The employer is required for each activity to carry out a risk assessment. All construction site personnel are expected to contribute to the improvement of safe working practices and the elimination of hazards.

All hazards that any personnel (including members of the public) could be exposed to as the result of working at night should be identified. Once identified, they should be assessed in terms of their potential to cause harm. To assess this risk, two factors should be considered:

a) the likelihood that the situation will develop or the event will occur; and

b) the severity of harm that could result.

Once hazards are identified, the hierarchy of control comes into play. These controls are not mutually exclusive but should be used to reduce the risk as far as practicable.

The following is the list of some, but not limited to the hazards that are most likely to create an accident or emergency during night time works:

a) Working at height;

b) Falling objects from height;

c) Fatigue;

d) Poor housekeeping

e) Moving machinery or public vehicles

f) Insufficient lighting and poor visibility;
SECTION 3: GENERAL SAFETY AND HEALTH PRECAUTIONS FOR CONSTRUCTION WORKS AT NIGHT

3.1 Permit to work

Contract or to implement Permit to Work System for night activities. Permit to work shall be obtained prior to start any night work.

3.2 Good administrative practices for night time work

Employer should make sure the safety, health and welfare of the employees are at all times taken care off. The followings are some recommendation that the employer may want to consider when planning for night time construction work.

a) Plan an appropriate and varied workload.
b) Offer a choice of permanent or rotating shifts and try to avoid permanent night shift.
c) Limit shifts to 12 hour including overtime, or to 8 hour if the work is demanding, monotonous, dangerous and/or safety critical.
d) Encourage employees to take regular breaks and allow some choice as to when they are taken.
e) Consider the needs of vulnerable employees, such as young or aging employees.
f) Limit consecutive night time work days to a maximum of 6 days per week.
g) Allow 2 nights full sleep when switching from day to night shifts and vice versa.
h) Build regular free weekends into the shift schedule.

3.3 Good site management practices for night time work

Besides the good administrative practice for working hours, employer should also consider as far as practicable a good site management practice when allowing employees to work at night. The followings are some recommendation for good site management practices.

a) Ensure the lighting is appropriate and preferably adjustable.
b) Provide training and information on the risks of night time work and ensure supervisors and management can recognize problems.
c) Consider increasing supervision during periods of low alertness.
d) Set standards and allow time for communication at shift handovers.
e) Encourage interaction between employees and implement a buddy system.
f) Provide free health assessments for night time employees.
g) Ensure the workplace and surroundings are well fit, safe and secure.

3.4 Visibility of work area

Illumination is one of the most important factors in night time construction work. A well illuminated work area will complement the requirement for visibility of employees and also the visibility of work vehicles. Safety in the work area, quality of work and morale of employees are all directly affected by work area illumination. Poorly illuminated work area will not only reduce the ability of employees but also increase the risk of unwanted incident/accident. The requirements for illumination are determined by the visibility requirements of the construction employees (building or road construction) as well as the public using the area.
3.5 Night time work illumination

Lighting should be adequate to provide the minimum levels of illumination required in different work areas and for different tasks. Each area, task or both must therefore be categorized as to what level of illumination is required. The recommended illumination levels for construction works during night time are shown in Annex A and briefly described below:

<table>
<thead>
<tr>
<th>Category of illumination</th>
<th>Descriptions</th>
</tr>
</thead>
</table>
| Category 1 (54 lux)      | - Recommended for the general illumination of all work operations by contractor's personnel in the areas of construction operations including layout and measurement, excavation, cleaning and sweeping, landscaping, planting and seeding.  
- Important in the areas where employees movement may take place. It is only suitable for any task that only requires low accuracy, involving slow moving equipments and that the object to be seen is large.  
- Should also be provided at the area of lane or road closures continuously throughout the period of closure, including the setup and removal of the closures. It should also be provided during the setup of lane closures or road closures installed in conjunction with night time construction operation and should be maintained until the closure is removed. |
| Category 2 (108 lux)     | - Recommended for areas on or around construction equipment.  
- The minimum illumination is necessary both for safety in operating equipment and for attaining and acceptable level of accuracy. |
| Category 3 (216 lux)     | - Suggested for tasks requiring a higher level of visual performance or for tasks with a higher level of difficulty |

3.6 Visibility of employees

High visibility apparel and temporary illumination are essential to ensure that employees are visible to all drivers including work vehicle and equipment operators. High visibility apparel should make the employee recognizable over the entire range of body motions. The following are good practices for visibility of employees:

a) Wear high visibility apparel.
b) Wear light colored clothing underneath the high visibility apparel to enhance visibility.
c) Use colors such as yellow-green for employee apparel to help to differentiate the employee from the orange colored work vehicles, signs, drums, etc.
d) Use fluorescent colors to improve visibility during dawn or dusk situations.
e) Provide temporary illumination at all work locations to make employees visible.
f) Develop an operational plan for night work to address risks associated with employee exposure to traffic, work vehicles and equipment.
g) Train employees about safety procedures to minimize hazards associated with reduced visibility

3.6.1 Personal protective equipment (PPE)

Employees should be provided with sufficient and adequate PPE when working at night. Special or extra precautions should be emphasized to all employees. Tripping hazard, risk of falling from height, drowsiness and poor visibility are among the inherent hazards associated with night time. The following PPE are the minimum recommendations, and employer may provide additional PPE to their employee.
a) **High Visibility Apparel**

The purpose of using high visibility apparel is to reduce the risk of the personnel from being struck by vehicles (in road construction work for example) and making them more visible in the construction site during night time works. Thus, good quality highly visible apparel should be worn at all times.

Good high visibility apparel may take several forms. As a minimum, vests that cover the entire body should be required. Shirts or jackets of the approved colors and incorporating retro-reflective striping may be substituted for vests.

Whatever garments the employer may choose for the employee to wear, it should in good condition and the retro-reflective material should be visible at a minimum of 300m. If any of the employee or employee is using apparel with poor condition, ask them to replace the garment immediately.

As far as practicable, high visibility apparel should meet with MS 1731:2004 high visibility warning clothing standards.

b) **Safety Helmet**

Safety helmet should be worn by all employees at all times when performing construction work activities and to provide reflector stick or self-adhesive reflective sticker onto the safety helmets to indicate the presence of person at the work area.

c) **Safety Shoe**

Inherent low visibility during night time works imposed a danger to the employees when walking around in the work area. Adequate safety shoe shall be provided to all employees in order to protect them from machinery or vehicle movements. Safety shoe can help to protect employee's feet from sharp protruding objects and from heavy objects that might falls or tripping hazards object. Safety shoe shall be worn at all times when working at construction site.

d) **Flash Light**

Employee should be provided with a portable flash light to help them in executing their task. Flash light could become handy in an emergency and often used as an indicator of presence in a dark or poorly illuminated work area.

e) **Blow Whistle**

Whistle can be used as a communication method such as alarming other employee of machinery or equipment movements and is very handy in case of an emergency. But employee should be well trained to not misuse the blow whistle as it may confuse other employees in a real emergency.

f) **Other compulsory PPE**

Employer should decide to provide their employees with other compulsory PPE especially when working at height for example. Inherent hazard when working at height and during night time could results in unwanted fatal incident.

3.7 **Visibility of vehicles**

Collisions involving work vehicles and equipment may increase at night because of reduced visibility, it is important for the vehicle operator to use the warning lights and equally important as well for other employees to understand the meaning of the warning lights. New vehicles are usually ready equipped with rotating or flashing amber beacons and emergency flashers and employer should install them at older vehicles. The following procedures may reduce the risk of crashes at night:

a) Two rotating or flashing amber beacons visible from 300m should be displayed on all trucks and equipment used at night in work areas.
b) Vehicles operated by inspectors and supervisory staff within the work area should use at least one rotating beacon.

c) In addition to rotating or flashing beacons, vehicles should display 4-way emergency flashers when stopped or moving slowly in or adjacent to a work zone.

d) Warning lights and 4-way emergency flashers should be turned off whenever the vehicle is moving at normal speeds for substantial distances or parked and protected from traffic flow.

### 3.8 Emergency response plan (ERP)

The employer should consider establishing apart from the existing emergency procedures which are normally designed for daylight work, a custom emergency response plan for night time work.

Every construction site which carries out construction work at night should be aware of the special conditions that night time construction work have. The placement of fire extinguisher for example, if not well informed to the employee and not properly signed and illuminated at night won't serve its purpose. All emergency exit routes should be properly lighted and be free from any obstruction. Assembly points should be kept well lighted at all times during night time construction work.

Every employer and employee should be well trained and informed of the emergency procedure at night. The employer may want to consider an emergency drill at night so that the employee will response in a desirable manner in case of an emergency occurs.

Emergency contact numbers and the nearest BOMBA station should be place in prominent places and the name of responsible persons to be notified should be in place as well.

#### 3.8.1 Fire fighting equipments

Due of to the inherent low illumination and dark working environment, it is necessary that all fire extinguishers are placed in well illuminated places and signage with retro-reflective stickers should be put at prominent places so that employees can have easy access to them in emergency events.

Suitable and sufficient equipment should be provided to ensure people engaged in construction work are protected in the event of fire. The following are good practices for the provisions in case of fire:

a) Building under construction shall be equipped with wet or dry rising system which shall conform to the Uniform Building By-Laws requirements.

b) Train employees on how to use fire protection equipment.

c) Do not allow combustible material to accumulate so as to constitute a fire hazard.

d) Display warning signage such as "DANGER! NO SMOKING" or "NAKED LIGHTS" at storage or handling areas for combustible materials.

e) Provide fire extinguishers in site offices and rooms and in site accommodation. This includes in every place where combustible materials are stored in every place where welding or flame cutting processes are being carried out and on every floor of a building or structure.

#### 3.8.2 Emergency drill frequency

An emergency procedure should be established for preparation in the event of an emergency. Night time emergency drill should be conducted at least once for a construction project which last for a year or less. For projects which may last for a few years, it is advisable for the employer to conduct an emergency drill on an annual basis.
Employers may want to consider conducting the emergency drill at a shorter interval when such need arises for example recruiting a new group of employees or frequent changes of shift/night time employees. The following are practices when establishing an emergency drill:

a) Provide effective warning systems to facilitate immediate evacuation.

b) Clearly defined areas where employers and other persons on site can assemble.

c) Conduct trial evacuations, at not more than three-monthly intervals.

The Site Safety Supervisor or the Safety Officer can make arrangement with BOMBA to conduct the night time emergency drill as well as awareness training on fire protection and prevention.

3.9 Drug and alcohol abuse

Employer must be able to recognized symptoms or tell tale signs of drug or alcohol abuse. Symptoms like increased absenteeism, changes in personality for the worse, deterioration of physical health & appearances are some of the tell tale signs of drug or alcohol abuse. The employer should have a Drug and Alcohol Free Workplace programme in order to effectively address this problem.

3.10 Electrical hazard

Electrical hazards are heightened during night time works because of inherent low lighting condition where employees may not able to see the exposed live cables or wires.

Any live cables or wires which are exposed could results in electrical shock if the employee accidentally touched them or an Incident where the exposed life cables or wires come in contact with conducting material e.g. water or metal.

To prevent any accidental contact it is advisable for all exposed live cables or wires to be well insulated and earthed and the surrounding area of that cables or wires are barricaded. Following any existing safety procedures and practices may help employees to stay safe from electrical shock.

The following are good practices to protect employees from being electrocuted.

a) Get the electrical technician/engineer to mark, flag and shield all live line.

b) Assume the line is live until it is tested. Have it de-energized and visibly grounded.

c) If the line must remain energized, keep equipment and load at least 3m away and use a spotter to warn the employees.

d) Communicate the electrical hazards present to all employees and provide illumination to the area whenever possible.

3.11 Hazards from trip and fall

Lighting equipments in construction site usually use electrical sources from power generators, extra precautions should be put for arrangements of the electrical cables. All the cables should be place neatly and if possible safely tied up.

All work area and employee pathways should be well illuminated and kept free from any construction materials that could potentially cause harm.

a) Display warning signage at conspicuous places to warn employee of the cables whereabouts.

b) Provide adequate illumination at the warning signage and along the cabling path whenever possible.

c) Cover and install guardrail along the excavated cable path on ground.
d) Kept work area and pathway away from protruding metal rods.

e) Arrange construction materials properly and secure with ropes when not in use.

f) Dispose used wooden plank at designated area.

3.12 Noise and vibration control

The major nuisances associated with the night time construction apart from illumination are noise and vibration. Noise problems are normally caused by the operation of heavy equipment specifically by vehicle and machinery. Vibration problems are primarily a result of pile driving or the use of vibratory rollers.

Contractors should make reference to guidelines published by the Department of Environment Malaysia and other requirements by other local authorities to get information on acceptable limits for various types of land use and human activities.

Construction site administrative personnel should use these guidelines effectively to reduce the potential impact of excessive noise and vibration affecting public health or causing disturbance. As a guide for permissible noise level for construction activities at night, contractor can make reference to Annex C (Guidelines for Environmental Noise Limits and Control, Department of Environment).

3.13 Record keeping and accident reporting

Employer should keep all night time construction work records for future references or in case of an incident happen which need to be reported to the authority. Record of equipments used, manpower and incident/accident can be useful for improving the safety and health conditions for night time employee in construction site.

Keep accurate records. If an accident occurs, make a note of it including whether or not any control devices were involved and what devices were used before and after the accident.

Any incident or accident must be recorded and reported to DOSH, as per Notification of Accident, Dangerous Occurrence, Occupational Poisoning and Disease Regulations 2004 (NADOPOD) requirements. The report must be submitted using template forms by DOSH.

3.14 Public safety

3.14.1 Construction hazards to public safety

Construction sites can pose a variety of hazards to people in the vicinity of the work. Local authorities, construction companies, and employees all have a part to play in ensuring the public are not endangered by construction work. Construction site hazards that can affect the public in the vicinity, especially at night with poor illumination, include:

a) Objects falling from height. These have included concrete debris, chisels, bolts, timber off-cuts, scaffold planks and even steel beams.

b) Bundles and trays of building materials swung above people's heads.

c) Construction trucks crossing footpaths or emerging suddenly and unseen from a site.

d) Broken and uneven footpaths, holes not filled in, footpaths covered in mud and in water.

e) Paint, water, concrete or grit sprinkled on people or cars.

f) Pedestrians having to negotiate between scaffolding tubes and possibly tripping over awkwardly placed sole plates.

g) Open excavations that a person could fall into.
h) Trucks double-parked on the roadway or with protruding loads impeding traffic.

i) Site noise, dust and welding flashes and an absence of suitable hoardings

**3.14.2 Responsibility for public safety**

Employers have a legal responsibility to ensure that their action or their employees will not endanger the members of the public. This means they should take steps to ensure that:

a) Pedestrian detours are clearly defined and pedestrians protected from the dangers of road traffic when using any detour.

b) The passage of vehicles across footpaths is to be supervised, to remove danger to the public.

c) Flagmen, barriers, signs or traffic lights are used to stop the public passing under suspended loads (unless there is a protective gantry).

d) Excavations are fenced and, if they are like to retain water, are covered and securely fenced to prevent access for public. If in public places, they should have warning signs and warning lights at night.

e) If scaffolding must intrude on to footpaths, it is to be clearly marked and padded if there is any risk of causing injury.

f) Adequate security on the site is to be provided during non-working periods. This involves ensuring excavations and openings are covered or fenced, materials are stacked safely, plant immobilized, ladders removed or lowered to the ground.

**SECTION 4: SAFETY AND HEALTH PRECAUTIONS FOR ROAD CONSTRUCTION WORKS AT NIGHT**

JKR and LLM have established a series of technical guidelines for members of the public especially for the road construction contractor to safely and effectively carry out new road/highway construction or maintenance of existing roads and highways.

All traffic signs and devices shall be maintained properly and cleaned regularly to ensure that they are lean, legible and in good working conditions at all times. The surfaces of any traffic signs and reflective materials on any devices shall be smooth and free from creases. Any unsatisfactory signs or devices shall be replaced promptly.

**4.1 Traffic management plan**

Proper planning of the traffic management for road works is essential so as to minimize inconvenience and prevent potential hazard to road users. The requirements in respect of the arrangement of traffic management devices for road works are described in the following sub topic.

The design must follow the basic concept of a typical work zone. A typical work zone should have the following areas:

a) Advance Warning Area;

b) Transition Area;

c) Buffer Space;

d) Work Area; and

e) Termination Area.
The contractor is responsible to ensure any activity involving public road to have an approved drawing of traffic management plan and valid work permit from Local Government Authority before commencing any road closure/tappering.

The contractor shall comply with all requirements stated in the approved drawing of traffic management plan.

![Figure 1: Illustration of five areas for traffic control zone](image)

4.1.1 Warning signs

All prescribed signs used for road works must be of a standard design. Full details of the standard signage layouts should be referred to standards from JKR, LLM or other equivalent standards for federal roads or highways. The signs designs are available in different sizes and shapes and a guide to the appropriate sign size are well illustrated in the guidelines.

The signs including posts, backing plates and faces shall comply with the requirement for traffic signs specified by JKR/LLM. All signs must be constructed with retro-reflective materials and be illuminated.

Temporary signs for emergency purposes and used for less than 24 hours may be mounted on flexible plastic board or other similar material. The material should be strong enough to withstand normal wind blow without excessive bending.
The weight of a free-standing sign together with its support should be sufficiently heavy to ensure that the completed sign is stable under windy condition and turbulence from moving traffic. The signage should be erected in a vertical position and facing the oncoming traffic.

4.1.2 Portable changeable message signs (PCMS)

The PCMS should only be used to supplement other signs and not to substitute for any required signs. If used during lane or ramp closure, place PCMS in advance of locations where traffic halt is expected and/or prior to exist to alternate routes which should be readable twice at the usual roadway speed limit.

4.1.3 Flashing arrow signs (FAS)

A FAS has a matrix of individual lights that can flash on and off in a control manner to show arrangements such as "arrow to the right" or "arrow to the left". It must be used to warn drivers to take special care and attention of the presence of stationary or slow moving works vehicles on an expressway. It can be mounted on either a vehicle or a trailer.

To provide advance warning, FAS should be mounted at the highest possible level. The mounting height (measured from the road surface to the bottom of sign) should not be:

a) less than 2.4m on a vehicle.

b) less than 1.5m on a trailer.

To further improve visibility, the mounting height can be increased to 3.3m.

4.2 Traffic cones and cylinders

The boundaries of all road works on carriageways must be clearly delineated by traffic cones. The aim is to guide approaching vehicles gradually into a lane passing the works by means of an approach taper and to ensure that a driver can readily judge the limits of the carriageway throughout the length of the works. Oil drums, barrels or concrete blocks must not be used to delineate road works.

The recommendations on maximum cone spacing from the guidelines published by JKR should be followed. Placing of cylinders should comply with the same requirement. Cones used for road delineation should be of the appropriate height and must have the retro-reflective portion.

a) Traffic cones or cylinders when used on one site should be of the same height.

b) Cones and cylinders should be constructed in a manner that they will yield or collapse, and will not present a hazard, when struck by vehicle.

c) Cones should be placed close enough together to give an impression of continuity.

4.3 Temporary barriers for delineation

Temporary barriers for delineation may be used as an alternative to traffic cones and cylinders to separate the high traffic roads/highways from the work area of road works.

For barriers placed adjacent to high traffic carriageways, all barrier faces adjoining the carriageways should be provided with retro-reflective stripes of alternative red and with colors or other contrasting color combination. Also, road hazard warning lights should be provided.

a) Use plastic water fill able type with interlocking features to assemble with adjoining units.

b) It is recommended that the barrier should be of minimum height of 800mm and should be filled with water according to operating instruction of the manufacturer. For safety reason, the barrier should be filled with water, up to eighty percent (80%) of the barrier's height.

c) Apply retro-reflective materials such as stripes or patches for night time usage.
4.4 Work area protection barriers

Work zone protection barriers are used to prevent off-track vehicles from penetrating into the work area. The barrier assembly and individual components must be designed to appropriate standard taking into account road conditions such as the approach speed, and be capable of absorbing the energy of colliding vehicle and thus minimizing damage and injuries to road works personnel, drivers, passengers and other road users. In particular, water filled barriers must be filled according to the manufacturer’s recommendation, if the barriers can be deflected when struck by vehicles, adequate buffer separation must be allowed for the deflection.

The barriers should stand out conspicuously and be provided with retro-reflective stripes/stickers and road hazards warning lights.

4.5 Warning lights

During night time works, all obstructions or road works must be properly delineated with prescribed road hazard warning lights to indicate to road users the limits of the works.

a) Brightness of Warning Lights

The brightness of the lights shown by the warning lights should be bright enough to catch the road user’s attention. In addition, each warning lights should be fitted with a reflector in area which must appear under headlamp illumination to be of a similar color to the light emitted by the warning lights.

b) Type of Lights

Warning lights may show an intermittent or revolving light. Flashing lights should have a flashing rate of 90-150 times per minute.

The following, is a list of warning light types indicating were they should be used:

<table>
<thead>
<tr>
<th>Type of Light</th>
<th>Function of Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low intensity battery operated lamps</td>
<td>- To delineate temporary edge of carriageways or footways.</td>
</tr>
<tr>
<td></td>
<td>- The warning lights should be the flashing type.</td>
</tr>
<tr>
<td>High intensity battery operated beacons</td>
<td>- To draw driver's attention to hazards in example at approach tapers or in conjunction with advance warning signs.</td>
</tr>
<tr>
<td></td>
<td>- The warning lights should be the flashing type.</td>
</tr>
<tr>
<td>Revolving lights</td>
<td>- To draw driver's attention in works on expressway by placing at the entry or exit points of lane closure and mounting on vehicles.</td>
</tr>
</tbody>
</table>
c) Placement of Lights

Warning lights should be placed at similar intervals along the line of the obstructions or road works. Individual lights should normally be placed midway between successive traffic cones when placed approximately parallel to the line of traffic. The following maximum warning lights should be followed.

<table>
<thead>
<tr>
<th>Road Feature</th>
<th>Distance of Light from Road Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapers and edges of temporary diversion routes</td>
<td>- 8m - normal approach tapers.</td>
</tr>
<tr>
<td></td>
<td>- 4m - on both sides of temporary traffic lane diversions and not along the edges of the existing traffic lanes, edges of temporary pedestrian ways adjoining and encroaching onto carriageway or end tapers.</td>
</tr>
<tr>
<td></td>
<td>- 1m - 45° approach tapers where traffic control is used.</td>
</tr>
<tr>
<td>Along the edges of existing traffic lanes</td>
<td>- 3m - for approach speed up to but not more than 70km/h.</td>
</tr>
<tr>
<td></td>
<td>- 3m to 9m - for approach speed more than 70km/h but not more than 85km/h, or at tight bends and near slip roads on roads with approach speed over 85km/h.</td>
</tr>
<tr>
<td></td>
<td>- 18m - for approach speed over 85km/h or expressways, expect at tight bends or near slip roads.</td>
</tr>
</tbody>
</table>

Warning lights should face oncoming vehicles and should be mounted on stands or cones, with the centre of lens not exceeding 1.2m above the road surface, except that on roads with approaching vehicle speed over 70km/h, mounting on cones is the only acceptable method. When placed in front of a sign, warning lights should not obscure the face of the sign.

When provided on highways or roads with approaching vehicle speed over 85km/h, warning lights should be mounted on cones so that the centre of the lens is about 1.2m above the road surface to make them clearly visible above the line of the traffic cones. Refer to Annex B for pictures of lighting placement for road construction.

The recommendations above only apply to construction works on federal roads. For highway purposes, reference should be made to respective highway operators.

4.6 Arrangement of traffic management devices for road works

Signs and other traffic management devices should be placed on the edge of the road under construction wherever possible. When placed adjacent to a highly traffic roads, signs and portable light signals should be at sufficient clearance from the roads, without any part of the signs, portable light signals or supports encroaching onto the roads. Signs should be provided with stands so that the sign is held in a rigid position and to prevent movement of the sign in windy conditions.
4.7 Flaggers

Flagging operators are at risk of fatal accident or serious Injury due to collisions with oncoming vehicles especially during night time road construction. A side from providing the compulsory PPE such as retro-reflective apparels, employers should consider the arrangement of work area and work area illumination requirement as well as warning signage to alert oncoming motorist. The following procedures should allow employers to help ensuring the safety and health of flagger operators:

a) Attention should be given to proper instruction of all personnel who are flaggers, starting with the basics of flagging. New flaggers should have a special introductory training session and all flaggers need periodic reminders as well as close supervision.

b) Flaggers should be visible, always face traffic and be prepared to warn the employee to get out of the way if necessary. Do not allow other employees to gather near the flagger. During lunch or other breaks, flaggers should leave their station so that drivers will know that the flaggers are not on duty, and not think they are ignoring their duties.

c) Whenever a flagger is on duty, the advance flagger sign, "PENGAWAL BENDERA 01 HADAPAN _m" should be displayed to traffic. When a flagger is not on duty remove or cover the sign.

d) Schedule both work and relief hours for flaggers, and replacement flaggers should be available. It is recommended to have a few trained flaggers available for replacement so that each flagger can have shorter working intervals. Choose flaggers, who are alert, have good eyesight, quick reflexes and a thorough understanding of their job.

e) Flaggers work area should be provided with sufficient illumination and suitable illumination equipment. It should not cause excessive glare to the flagger and the oncoming traffic.

f) Mannequins/robots can be useful to substitute human flaggers but only for simple instruction such as alerting traffic to slow down or providing warning of work in progress ahead of traffic.

4.8 Housekeeping

Construction operations will be more efficient when the work area is orderly and tidy. Observance of the following points will make road works safer and reduce the potential for accidents:

a) The site roadway and employee and public access routes should be defined to the fullest extent possible. Employees have been run over by trucks or plant which they have not heard approaching because of site noise or other distractions.

b) Plant and materials should be located in areas which do not obstruct traffic or limit driver vision.

c) Materials should be stored in an orderly manner that will prevent them falling and spreading, with easy access provided.

da) All spills of oil should be cleaned up or covered with sand. Areas which have become waterlogged or churned up, and over which people, plant and machinery have to pass should be provided with a sound working surface by drainage improvement, metalling or other means.

e) Sand and debris which could make the road slippery should be regularly clean or sprayed with water to prevent accidents especially for motorcyclist.
SECTION 5: SAFETY AND HEALTH PRECAUTIONS FOR BUILDING CONSTRUCTION WORKS AT NIGHT

Construction works during night time, the hazards and risk to employee's safety and health are still there. The only thing is that the hazards and risk are heightened due to the inherently poor illumination of the surrounding environment at night.

The following sub topic will address some key issue with regards to safety and health of employees when working at construction site at night.

5.1 Signage

Hazard signage should be posted in conspicuous places to warn employees about any hazard that is present in the surrounding areas. Signage should be well illuminated so that it could serve its purpose. Broken signage should be replaced immediately and maintenance of all hazard signage must be performed accordingly.

Any openings on the ground or in the building structure should be guarded and a hazard signage should be posted. Warning sign of proper use of PPE such as a fall restraint devices when working at any level subjected to fall from height must be posted. A warning signage alerting employees about machinery/vehicle movements should be posted as well in conspicuous places.

5.2 Plant/machinery/vehicle movement

Movement of any plant/machinery/vehicle onsite during night time construction work should be constantly monitored and controlled by a designated person. Warning light or siren should be used to inform all employees prior to any movement.

a) Use a better equips plant/machinery/vehicle with sensors to detect employees movement in the surroundings.

b) Establish a dedicated pathway for all machinery/vehicle movement.

c) Establish a safe walkway for pedestrian.

d) Both pathway and walkway must be kept well illuminated and if possible a guardrail must be in place.

5.3 Consultation

Construction works which has a high potential of causing serious harm to employees should be prohibited. Employer should decide with consultation with the competent person on what scope of work should be allowed during night time particularly, but not limited to:

a) Erection or dismantling of scaffolding at high rise structure.

b) Erection or dismantling of crane.

c) External wall plastering or brick laying at high rise structure.

d) Work in confined spaces at night.
Recommended target illumination levels and lighting guidelines

<table>
<thead>
<tr>
<th>Description of Construction and Maintenance Task.</th>
<th>Average Maintained Illumination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Category *</td>
</tr>
<tr>
<td>Asphalt Pavement Rolling</td>
<td>I</td>
</tr>
<tr>
<td>Asphalt Paving and Resurfacing</td>
<td>II</td>
</tr>
<tr>
<td>Barrier Wall, Traffic Separators</td>
<td>II</td>
</tr>
<tr>
<td>Base Course Grading and Shaping</td>
<td>II</td>
</tr>
<tr>
<td>Base Course Rolling</td>
<td>I</td>
</tr>
<tr>
<td>Bridge Decks</td>
<td>II</td>
</tr>
<tr>
<td>Concrete Pavement</td>
<td>II</td>
</tr>
<tr>
<td>Crack Filling</td>
<td>III</td>
</tr>
<tr>
<td>Drainage Structures and Drainage Piping</td>
<td>II</td>
</tr>
<tr>
<td>Embankment, Fill and Compaction</td>
<td>I</td>
</tr>
<tr>
<td>Excavation - Regular, Lateral Ditch, Channel</td>
<td>I</td>
</tr>
<tr>
<td>Guard Rails and Fencing</td>
<td>II</td>
</tr>
<tr>
<td>Highway Lighting Systems</td>
<td>III</td>
</tr>
<tr>
<td>Highway Signs</td>
<td>II</td>
</tr>
<tr>
<td>Landscaping, Sod and Seeding</td>
<td>I</td>
</tr>
<tr>
<td>Maintenance of Embankments</td>
<td>I</td>
</tr>
<tr>
<td>Milling, Removal or Pavement</td>
<td>II</td>
</tr>
<tr>
<td>Other Concrete Structures</td>
<td>II</td>
</tr>
<tr>
<td>Pot Hole Filling</td>
<td>II</td>
</tr>
<tr>
<td>Repair of Concrete Pavement</td>
<td>II</td>
</tr>
<tr>
<td>Repair of Guard Rails and Fencing</td>
<td>II</td>
</tr>
<tr>
<td>Reworking Shoulders</td>
<td>I</td>
</tr>
<tr>
<td>Sidewalk Construction</td>
<td>II</td>
</tr>
<tr>
<td>Striping and Pavement Marking</td>
<td>II</td>
</tr>
<tr>
<td>Sub-grade, Stabilization, and Construction</td>
<td>I</td>
</tr>
<tr>
<td>Surface Treatment</td>
<td>II</td>
</tr>
<tr>
<td>Sweeping and Cleaning</td>
<td>I</td>
</tr>
<tr>
<td>Traffic Signals</td>
<td>III</td>
</tr>
<tr>
<td>Waterproofing and Sealing</td>
<td>II</td>
</tr>
</tbody>
</table>

NOTE:

**Category I** is recommended for the general illumination in the work zone, primarily from the safety point of view, in the area where crew movement is expected or taking place. This category is also recommended for tasks requiring low accuracy, involving slow-moving equipment, and having large sized objects to be seen.

**Category II** is recommended for illumination on and around construction equipment and the visual tasks associated with the equipment. The primary concern in suggesting the minimum luminance value for this category is equipment safety and medium accuracy desired for the task. For certain tasks, such as resurfacing, not only are the safety around the paver and roller crucial but quality of the finished surface is also important.

**Category III** is suggested mainly because of the efficient visual performance required for certain tasks. Highway tasks which present higher visual difficulty and require increased attention from the observer include crack and pothole filling, joint sealing, critical connections, and tasks involving maintenance of electrical connections and moving mechanical parts.
ANNEX B
(Informative)

Lighting placement for road construction

<table>
<thead>
<tr>
<th>Estimated Approach Speed of Vehicle (km/h)</th>
<th>Distance of First Sign in Advance of Road Works (m)</th>
<th>Minimum Number of Signs in Advance of Road Works</th>
<th>Minimum Visibility Distance of Driver to First Sign (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 50</td>
<td>Not less than 40</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>50 to 70</td>
<td>40-100</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>70 to 85</td>
<td>100-300</td>
<td>3</td>
<td>70</td>
</tr>
<tr>
<td>Over 85</td>
<td>300-600</td>
<td>3</td>
<td>80</td>
</tr>
<tr>
<td>Expressway</td>
<td>600</td>
<td>3</td>
<td>80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Estimated Approach Speed of Vehicle (km/h)</th>
<th>Distance Beyond the Works (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 50</td>
<td>10-30</td>
</tr>
<tr>
<td>50 to 85</td>
<td>30-35</td>
</tr>
<tr>
<td>Over 85</td>
<td>45-90</td>
</tr>
</tbody>
</table>

Length of Approach Tapers

<table>
<thead>
<tr>
<th>Width of Hazard (m)</th>
<th>Up to 50</th>
<th>50-70</th>
<th>70-85</th>
<th>Over 85</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4</td>
<td>20</td>
<td>30</td>
<td>45</td>
<td>60</td>
</tr>
<tr>
<td>2.7</td>
<td>23</td>
<td>34</td>
<td>51</td>
<td>69</td>
</tr>
<tr>
<td>3.0</td>
<td>26</td>
<td>38</td>
<td>58</td>
<td>76</td>
</tr>
<tr>
<td>3.4</td>
<td>29</td>
<td>42</td>
<td>63</td>
<td>84</td>
</tr>
<tr>
<td>3.7</td>
<td>32</td>
<td>46</td>
<td>69</td>
<td>91</td>
</tr>
<tr>
<td>4.3</td>
<td>36</td>
<td>52</td>
<td>78</td>
<td>108</td>
</tr>
<tr>
<td>4.9</td>
<td>40</td>
<td>60</td>
<td>90</td>
<td>122</td>
</tr>
<tr>
<td>5.5</td>
<td>44</td>
<td>68</td>
<td>102</td>
<td>138</td>
</tr>
<tr>
<td>6.1</td>
<td>49</td>
<td>76</td>
<td>114</td>
<td>152</td>
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<tr>
<td>6.7</td>
<td>54</td>
<td>84</td>
<td>126</td>
<td>168</td>
</tr>
<tr>
<td>7.3</td>
<td>60</td>
<td>90</td>
<td>138</td>
<td>182</td>
</tr>
</tbody>
</table>

Minimum of Height of TrafficCones/Cylinders (mm): 750

Maximum Spacing of TrafficCone/Cylinder (m): 2
Environmental noise limits

SCHEDULE 1

<table>
<thead>
<tr>
<th>Receiving Land Use Category</th>
<th>Time 7.00 am – 10.00 pm</th>
<th>Time 10.00 pm – 7.00 am</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise Sensitive Areas, Low Density Residential, Institutional (School, Hospital), Worship Areas.</td>
<td>50 dBA</td>
<td>40 dBA</td>
</tr>
<tr>
<td>Suburban Residential (Medium Density) Areas, Public Spaces, Parks, Recreational Areas.</td>
<td>55 dBA</td>
<td>45 dBA</td>
</tr>
<tr>
<td>Urban Residential (High Density) Areas, Designated Mixed Development Areas (Residential – Commercial).</td>
<td>60 dBA</td>
<td>50 dBA</td>
</tr>
<tr>
<td>Commercial Business Zone</td>
<td>65 dBA</td>
<td>55 dBA</td>
</tr>
<tr>
<td>Designated Industrial Zone</td>
<td>70 dBA</td>
<td>60 dBA</td>
</tr>
</tbody>
</table>

SCHEDULE 2

<table>
<thead>
<tr>
<th>Receiving Land Use Category</th>
<th>Time 7.00 am – 10.00 pm</th>
<th>Time 10.00 pm – 7.00 am</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise SensitiveAreas, Low Density Residential</td>
<td>L₉₀ + 10 dB</td>
<td>L₉₀ + 5 dB</td>
</tr>
<tr>
<td>Suburban and Urban Residential Area</td>
<td>L₉₀ + 10 dB</td>
<td>L₉₀ + 10 dB</td>
</tr>
<tr>
<td>Commercial, Business</td>
<td>L₉₀ + 10 dB</td>
<td>L₉₀ + 10 dB</td>
</tr>
<tr>
<td>Industrial</td>
<td>L₉₀ + 10 dB</td>
<td>L₉₀ + 10 dB</td>
</tr>
</tbody>
</table>

L₉₀ is the measured ninety percentile sound level for the respective time period of the existing areas of interest in the absence of the proposed new development.
ANNEX C (Continued)
(Informative)

Environmental noise limits (Cont’d)

**SCHEDULE 3**

<table>
<thead>
<tr>
<th>Maximum permissible sound level (L_{Aeq}) to be maintained at the existing noise climate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

**SCHEDULE 4**

<table>
<thead>
<tr>
<th>Limiting sound level (L_{Aeq}) from road traffic (for proposed new roads and/or redevelopment of existing roads)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving Land Use Category</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Noise Sensitive Areas, Low Density Residential</td>
</tr>
<tr>
<td>Suburban Residential (Medium Density)</td>
</tr>
<tr>
<td>Urban Residential (High Density)</td>
</tr>
<tr>
<td>Commercial, Business</td>
</tr>
<tr>
<td>Industrial</td>
</tr>
</tbody>
</table>

**SCHEDULE 5**

<table>
<thead>
<tr>
<th>Limiting sound level (L_{Aeq}) for railways including transits (for new development and re-alignments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiving Land Use Category</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Noise Sensitive Areas, Low Density Residential Areas</td>
</tr>
<tr>
<td>Suburban and Urban Residential Areas</td>
</tr>
<tr>
<td>Commercial, Business</td>
</tr>
<tr>
<td>Industrial</td>
</tr>
</tbody>
</table>
Environmental noise limits *(Cont’d)*

**SCHEDULE 6**

<table>
<thead>
<tr>
<th>Receiving Land Use Category</th>
<th>Noise Parameter</th>
<th>Time 7.00 am – 10.00 pm</th>
<th>Time 7.00 am – 10.00 pm</th>
<th>Time 10.00 pm – 7.00 am</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial (Note 2 **)</td>
<td>$L_{90}$</td>
<td>60 dBA</td>
<td>55 dBA</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>$L_{10}$</td>
<td>75 dBA</td>
<td>70 dBA</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>$L_{\text{max}}$</td>
<td>90 dBA</td>
<td>85 dBA</td>
<td>*</td>
</tr>
<tr>
<td>Commercial (Note 2 **)</td>
<td>$L_{90}$</td>
<td>65 dBA</td>
<td>60 dBA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>$L_{10}$</td>
<td>75 dBA</td>
<td>70 dBA</td>
<td>NA</td>
</tr>
<tr>
<td>Industrial</td>
<td>$L_{90}$</td>
<td>70 dBA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>$L_{10}$</td>
<td>80 dBA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

**NOTES:**

1. At these times the maximum permissible levels as stipulated in the Schedule 1 for the respective residential density type shall apply. This may mean that no noisy construction work can take place during these hours.

2. A reduction of these levels in the vicinity of certain institutions such as schools, hospitals mosque and noise sensitive premises (apartments, residential dwellings, hotel) may be exercised by the local authority or Department of Environment. Where the affected premises are noise sensitive, the limits of the Schedule 1 shall apply.

3. In the event that the existing ambient sound level ($L_{90}$) without construction, maintenance and demolition works is higher than the $L_{90}$ limit of the above Schedule, the higher measured ambient $L_{90}$ sound level shall prevail. In this case, the maximum permissible $L_{10}$ sound level shall not exceed the Ambient $L_{90}$ level + 10 dBA, or the above Schedule $L_{10}$ whichever is the higher.

4. NA = Not Applicable.
ACKNOWLEDGEMENT

Construction Industry Development Board Malaysia would like to extend our sincere appreciation to all those involved in the development of this Standard.

Advisor of Construction Industry Standard
Dato' Ir. Ahmad 'Asri Abdul Hamid
Chief Executive CIDB Malaysia

Chairman of Construction Industry Standard Main Committee
Datuk Ir. Elias Ismail
Senior General Manager CIDB Malaysia

Technical Committee

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ir. M. Ramuseren (Chairman)</td>
<td>Construction Industry Development Board Malaysia</td>
</tr>
<tr>
<td>Puan Norhidayah Razali (Secretary)</td>
<td></td>
</tr>
<tr>
<td>Puan Elaini Binti Wahab</td>
<td>Department of Occupational Safety and Health</td>
</tr>
<tr>
<td>Encik Mohammad Fakharozi Bin Ahmad Tarmizi</td>
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</tr>
<tr>
<td>Encik Ahmad Firdaus Bin Mohd Noh</td>
<td>Perbadanan Kemajuan Negeri Selangor</td>
</tr>
<tr>
<td>Encik Mohd Noraiman Bin Jaafar</td>
<td>Ekovest Construction Sdn Bhd</td>
</tr>
<tr>
<td>Encik Mohd Syafiq Bin Mohd Yusof</td>
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<tr>
<td>Encik Rozaimy Bin Amiruddin</td>
<td>IJM Corporation Berhad</td>
</tr>
<tr>
<td>Encik Kamaruzaman Bin Mohamed Isa</td>
<td>Naza TTDI Sdn Bhd</td>
</tr>
<tr>
<td>Encik W. Vincent Rajkumar</td>
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<tr>
<td>Encik Kamarul Faezai Bin Salim</td>
<td>S P Setia Bhd</td>
</tr>
<tr>
<td>Ir. K. Sundraraj</td>
<td>Association of Consulting Engineers Malaysia</td>
</tr>
<tr>
<td>Major (R) Leong Yee Keong</td>
<td>Master Builders Association Malaysia</td>
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<tr>
<td>Encik Wong Kheng Siew</td>
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<tr>
<td>Encik Nor Azahar Md Husain</td>
<td>Real Estate and Housing Developers’ Association Malaysia</td>
</tr>
<tr>
<td>Puan Siti Noor Aziah Yaacub</td>
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<tr>
<td>Encik Mohamad Redzuan Shah Bin Masri</td>
<td>National Institute Occupational Safety and Health</td>
</tr>
<tr>
<td>Dr. Yap Soon Poh</td>
<td>Universiti Malaya</td>
</tr>
<tr>
<td>Encik Nasaruddin Bin Abd Rahman</td>
<td>Universiti Teknologi Mara</td>
</tr>
</tbody>
</table>