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Better Work Jordan Programme

**Enhancing the Structural Integrity of Dormitory
Buildings in Jordan's Garment Sector - Phase II**

Typical Defects Identification Report

Assessment of Existing Dormitories

July 2021



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1. Executive Summary

The “Typical Defects identification report” is the first task assigned to Engicon, under Phase II of Better Work Jordan's (BWJ) project “Enhancing the Structural Integrity of Dormitory Buildings in Jordan's Garment Sector”.

Stemming from the belief that decent living conditions are a right to all workers, and that it is directly proportional with raising their productivity and as a result benefit the business as a whole, the project aims to set guidelines related to assessing and mitigating defects against certain health and safety measures within existing dormitories, as well as develop design regulations related to building new dormitories in the future, to ensure surpassing previously identified mistakes and defects which can form risks to the health and safety of inhabitant workers.

This report helps non-technical members mimic the exercise done by Engicon's technical team related to the first task, which was to identify typical defects in existing dormitory buildings against certain Occupational Safety and Health (OSH) measures and recommend corrective actions to enhance conditions of the assessed dorms.

This report briefs findings for 14 inspection visits to existing Dorms, documented in “Existing Dormitories Assessment Report” prepared by Phase I service providers. It is also based on basic data collected from site visits and visual inspection conducted by Engicon's Team (Phase II service providers) of 4 additional samples of existing dormitory buildings in Jordan which were decided upon in cooperation with The Jordan Garments, Accessories and Textiles Exporter's Association (JGATE), and it presents the findings and observations of the assessments.

The steps of assessing the existing dormitories were as follows:

- Reference to national and international building codes and standards related to the OSH requirements in dormitory buildings, to utilize as a baseline and set the minimum requirements in dorms.
- Review Assessment Report developed at Phase I.
- Develop an Inspection Checklist to help assess the conditions of the dormitories with relevance to 4 main assessment measures: Structural Integrity, Electrical Safety, Fire Safety, and Public Health.
- Inspection visits to the existing dormitory buildings assigned by JGATE.
- Checklists filled and remarks recorded during the visits for each visited dorm.
- Assessment results were analysed in comparison to the codes mentioned above. Defects were categorized with reference to severity of accompanied risks, and documented in a way that is efficient and effective to review and handle by executives, to help them set priorities to the corrective actions needed, and prepare an implementation plan with relevance to budgets.

At the end of this report the findings were extracted, and conclusions were formed related to the most recurring mistakes, and the severity of typical defects related to the accompanied risks to the health and safety of workers living in dorms.

In order to ensure proper OSH measures are met in any dormitory building, the inspection of any dorm is to undergo four main assessment measures:

- **Structural Integrity:**

Dormitory buildings go under structural assessment following two categories:

- *Seismic Loading Resistance*; which cannot be identified for most buildings but the regular shape of buildings as well as the good conditions of the fire escape stairs' structural elements could make the building behaviour against the lateral forces of earthquake less dangerous and help mitigate any relevant risk to the occupants.
- *Structural Integrity*; which is mostly sound but periodic maintenance should be applied. Overloading by adding water tanks above slabs should be avoided, any minor defects and cracks need to be handled by the structural recommendations for each case.

- **Electrical Safety:**

An overview of electrical systems (power system, lighting system and low current systems) is required in dormitory buildings according to Jordanian and international codes requirements. Periodic maintenance should be applied.

- **Fire Safety:**

Dormitories go under fire safety assessment following three categories:

- *Architectural Configuration*: Checking corridor lengths, limits of dead ends and traveling distance of escape routes if exceeding the allowed in the fire codes. Escape routes to be clear, safe, provided with proper directional and emergency signage, and protected against fire and smoke, and leading towards safe exits/assembly areas. Also, doors at fire exit points to be fire rated doors and equipped with self-closing devices as the code requires. Furthermore, some vertical shafts and storage rooms to be provided with fire rated doors and enclosures, as per codes.
- *Mechanical Firefighting Systems*: Overview of the mechanical firefighting system requirements that are required by National Fire Protection Association (NFPA) and Jordanian National Firefighting Code (2004). In dorms, this system mainly consists of fire hose reel cabinets and portable fire extinguishers (Powder and CO2), as well as fire hydrant and sprinklers wherever required.
- *Electrical Fire Alarm System*: Overview of the electrical fire alarm system (emergency lights and sirens, gas leakage and smoke detectors) required by the Jordanian National Firefighting and NFPA codes. Ensure continuous maintenance of the system.

- **Public Health**

Dormitories go under Public Health assessment following three categories:

- *Architectural Aspects:* Study locations of dormitories, if in a location near to industrial zones, it is safe to assume that workers could be affected by air pollutions and other health hazards. Also, investigate buildings' geographic orientations and openings to ensure adequate natural daylight and ventilation within different rooms. Proper finishing materials to be used inside dorms (complying with fire codes, especially for exit routes, easy to clean and complying with the function of the room), non-slippery floor tiles along emergency routes to prevent hazards during evacuation.
- *Mechanical Systems:* Overview of the requirements of mechanical systems (Sanitary drainage, domestic water supply, ventilation, central heating and/or air-conditioning and LPG systems) in dormitory buildings according to the Jordanian and international codes and standards. Ensure no occlusion of internal sewage network, sufficient ventilation in toilets, bathrooms and bedrooms, compliance with safety requirements related to LPG systems.
- *Public Health Issues:* Ensure cleanliness within different rooms, toilets and food preparation areas; kitchen and cafeterias/dining rooms included, in addition to the insects and stray animals that need to be controlled. Trash bins and first aid boxes with the medicaments distributed sufficiently.

It should be noted that assessment findings included in this report were based solely on what was observed, investigated, and analysed after Inspection visits conducted by engineers. Further inspection is needed by professionals, craftsmen, or contractors to define costs needed for implementing the recommended corrective actions and improvements related to the structural integrity of the existing dormitories (proper operation of different systems). Prioritization of the corrective actions can be decided based on the defect classification (Insignificant, Minor, Moderate, Major and Fatal) with relevance to the severity of the accompanied risks and repetitiveness of defects (Typical Defects) identified in inspected dormitory buildings, based on the previously illustrated assessment measures.

The main typical defects identified related to non-compliance with health and safety requirements were:

- Lack of cleanliness and organization.
- Used dormitory buildings were not originally designed for this purpose, or certain rooms were added to the original building (non-compliance to original blueprints).
- Non-compliance to national and international fire protection codes.
- Improper conditions of kitchens, dining rooms, drinking water coolers, wet areas (sanitary fixtures and water closets), furniture, doors and windows and clothes hanging wires. (No repair works for broken items)
- Improper drainage, insulation, and utility of wet areas and roofs.
- Overloading and lack of maintenance for the electrical fixtures and systems.

Finally, raising awareness for OSH quality between different stakeholders is needed to guarantee continual improvement to the Environment Health and Safety management and maintaining the structural integrity of dormitories.

2. Abbreviations

2.1. List of General Abbreviations and Acronyms

BWJ	Better Work Jordan Programme
EU	European Union
EHS	Environmental Health and Safety
FTA	Free Trade Agreement
GoJ	Government of Jordan
IFC	International Finance Corporation
ILO	International Labour Organization
JCI	Jordan Chamber of Industry
JEA	Jordan Engineers Association
JRP	Jordan Response Plan
JTUCU	General Trade Union for Workers in Textile, Garments & Clothing
MoE	Jordanian Ministry of Education
MoH	Jordanian Ministry of Health
MoL	Jordanian Ministry of Labour
MoPWH	Jordanian Ministry of Public Works and Housing
MoSD	Jordanian Ministry of Social Development
MoU	Memorandum of Understanding
OSH	Occupational Safety and Health
PAC	Project Advisory Committee
PPE	Personal Protective Equipment
QIZ	Qualified Industrial Zone
RoO	Rules of Origin
SEZs	Special Economic Zones

2.2. List of Technical Abbreviations and Acronyms

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BS	British Standards
DB	Dry Bulb Temperature
FACP	Fire Alarm Control Panel
FFL	Finish Floor Level
FR	Fire Rated
HVAC	Heating, ventilation, and air conditioning
ID	Interior Design
IMRF	Intermediate moment-resisting frame
MCB	Miniature Circuit Breaker
MEP	Mechanical, Electrical and Plumbing
MMRWF	Masonry moment-resisting wall frame
NFPA	National Fire Protection Association
OMRF	Ordinary moment-resisting frame
SMRF	Special moment-resisting frame
TN System	Terre Neutral Earthing System
TT System	Terre-Terre Earthing System
UL	Underwriters Laboratories
U Values	Thermal Transmittance
WB	Wash Basin
WC	Water Closet

3. Introduction

3.1. Project Background

The Better Work Jordan Programme (BWJ) was launched in Jordan in 2008 and at the request of the Government of Jordan (GoJ). BWJ is a partnership between the International Labour Organization (ILO) and the International Finance Corporation (IFC). The comprehensive programme brings together stakeholders from all levels of Jordan's garment manufacturing industry to improve working conditions, enhance respect for labour rights, and boost the competitiveness of the sector. Factories participating in BWJ are monitored and advised through factory assessments, advisory visits, and training services.

The programme remains committed to contributing to Jordan's long-term economic and social resilience through livelihoods programming and promotion of decent work for all.

Stemming from its commitment to enhance the capacity of stakeholders to sustain decent working conditions in the sector, BWJ and the Social Security Corporation (SSC) signed a Memorandum of Understanding (MoU) in August 2017, which enacted cooperation to improve the provision of safer working conditions, especially around occupational safety, and health across manufacturing enterprises across Jordan. As per the agreement, the agencies will cooperate on raising awareness and education on occupational safety and health (OSH) across the sector, verify its implementation, help improve where needed, and exchange technical expertise. More so, and in 2020, BWJ signed a MoU with the Ministry of Labour for the purpose of strengthening their collaboration to enforce the legal provisions relating to inspection works, labour inspectors, and conditions of work in order to protect workers while engaged in their work.

A key object of this programme is to demonstrate that good working conditions and decent technical investment can help make factories and their satellite units become more productive.

From all the above descended the main objective of this programme, which is "Enhancing the living environment in the world of work through ensuring decent dormitory conditions" and consequently emerged the sub-project "Enhancing the Structural Integrity of Dormitory Buildings in Jordan's Garment Sector".

3.2. Assigned Tasks

Engicon was assigned to complete four main tasks related to the “Enhancing the Structural Integrity of Dormitory Buildings in Jordan's Garment Sector” Project:

1. Prepare a Typical Defects Identification Report. (Which this report represents)
2. Provide Guidance for Assessment and Repair of Typical Defects Report.
3. Set a methodology for identification of other non-typical defects.
4. Suggest standards to be used for rectification of defects in existing dormitory buildings and design of new dormitory buildings.

3.3. Project Main Objectives

The project aims at achieving the following four main objectives:

- Awareness raising among factory owners on typical building safety requirements.
- Guidance to identify safety defects and the level of expertise needed for rectification.
- Identification of national codes requirements for dormitories.
- Identification of safety issues not covered by national codes, with reference to international good practices.

4. References

This report represents the first task titled “Typical Defects Identification Report”. To prepare this report, Engicon team investigated variable standards and codes related to the assigned task, in order to develop a checklist against which the typical defects in the existing dormitories will be evaluated.

4.1. OSH Related Documents and Procedures

Comprehensive guide - MoL - Work procedures for safety and health prevention measures to limit the spread of the corona virus: Applying the standard work procedures manual for textile and apparel manufacturing establishments and companies in development zones and qualified industrial zones

Dormitories Inspection/Assessment Guide (Jordanian MoL, MoH, BWJ)

The Public Health Law

4.2. National and International Technical Codes and Standards

National Fire Protection Association (NFPA)

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

Jordanian National Building Codes

British Standards

American Standards

2015 International Building Code® (IBC), by the International Code Council, Inc (ICC)

5. Influencing Factors

5.1. COVID-19 Pandemic

The COVID-19 pandemic has had a human and monetary impact on the garment sector in Jordan. Over 6,000 employees (workers and managers) were infected with COVID-19 as of February 2021 across 46 factories. While the factories remained virus-free for the majority of 2020, some cases were identified in the fall and spread rapidly through the factories despite the efforts to control them.

In addition to the struggle to contend with COVID-19 cases in the workforce, factories faced other issues due to government-imposed lockdowns including postponements as well as cancellations of orders from buyers.

More so, and as a result of the nationwide lockdown, workers had to spend more time in the dormitories, so increased attention was directed towards safety and health hazards that exist there.

Consequently, PPE requirements have rapidly evolved to mitigate the risks of COVID-19, and factories were assessed against these strict guidelines. General OSH regulations and procedures were implemented at different facilities and workplaces to mitigate the risks associated with the pandemic. While the same should have been conducted for dormitories, this has not been initiated yet.

The following diagram illustrates how some general procedures related to COVID-19 raised the need for some operational and design requirements within dormitories.



Figure 5-1: Design and Operational Requirements Related to COVID-19

5.2. Indoor Environment Quality

One of the main influencing factors affecting Occupational Safety and Health within a facility is the indoor environment quality, as presented in the figure below.

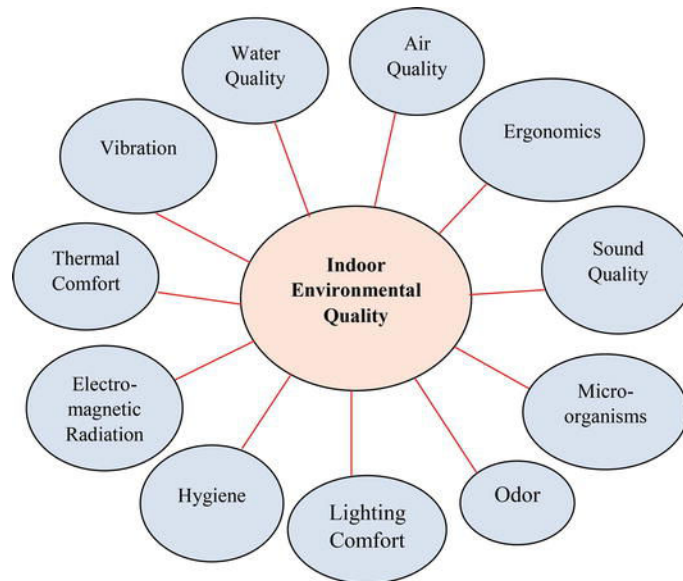


Figure 5-2: Aspects Affecting the Indoor Environmental Quality

Different aspects affect the indoor environment quality, which consequently defines the comfort levels of facility occupants. Certain measures should be taken to ensure these aspects are adequate and sufficient, including, but not limited to the following:

- Ventilation (Sufficient balance between natural and mechanical ventilation) to achieve sufficient room temperature levels, non-polluted and odor-free atmosphere.
- Acoustical Insulations (for example, dorms should not be adjacent to loud machinery, or massive vehicular movement, this is to reduce undesired vibrations as well).
- MEP systems designed as per national and international codes.
- Occupancy/Capacity rates. (Room area vs no. of occupants).
- Visual comfort, adequate lighting, visibility with reference to room usage and emergency lighting.
- Fire protected zones (clear and safe emergency routes, smoke and gas detectors, FR doors...etc.).
- Cleanliness (with relevance to odors, air, food, and water quality, hygiene within toilets and rooms).

5.3. The Link Between Operational Excellence, Indoor Environment Quality and EHS Management

The connection between health, safety and quality is represented in the overlap among requirements of ISO 9001 for Quality Management, ISO 14001 for Environmental Management and ISO45001 for Occupational Health and Safety.

Operational excellence is closely tied to Indoor Environmental Quality and EHS performance. Workers cannot produce quality goods while working or living unsafely or if being unhealthy. This means OSH management leads to certain business benefits, as shown in the figure below.



Figure 5-3: Business Benefits of OSH Management

With reference to the business benefits gained from implementing OSH Management, a certain quality management system should be adopted to ensure quality continuum, as illustrated in the figure to the right.

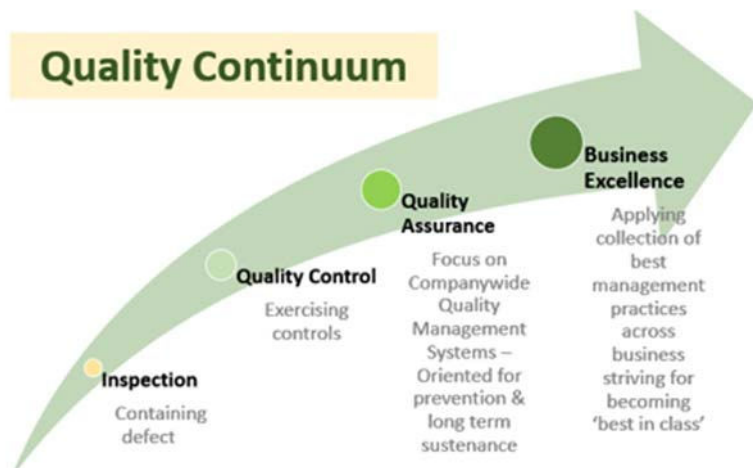


Figure 5-4: Steps to Ensure Quality Continuum

The following diagram represent the suggested Strategic Plan for Continuous Improvement related to the structural integrity of the dormitories, ensuring appropriate OSH levels are met:



Figure 5-5: The Suggested Strategic Plan to Continuous Improvement (OSH Management System)

6. Assessment Methodology

6.1. Assessment Measures

With reference to all relevant procedures, documents and codes related to the OSH in dormitories, the following basic measures were taken to assess conditions of existing dorms:

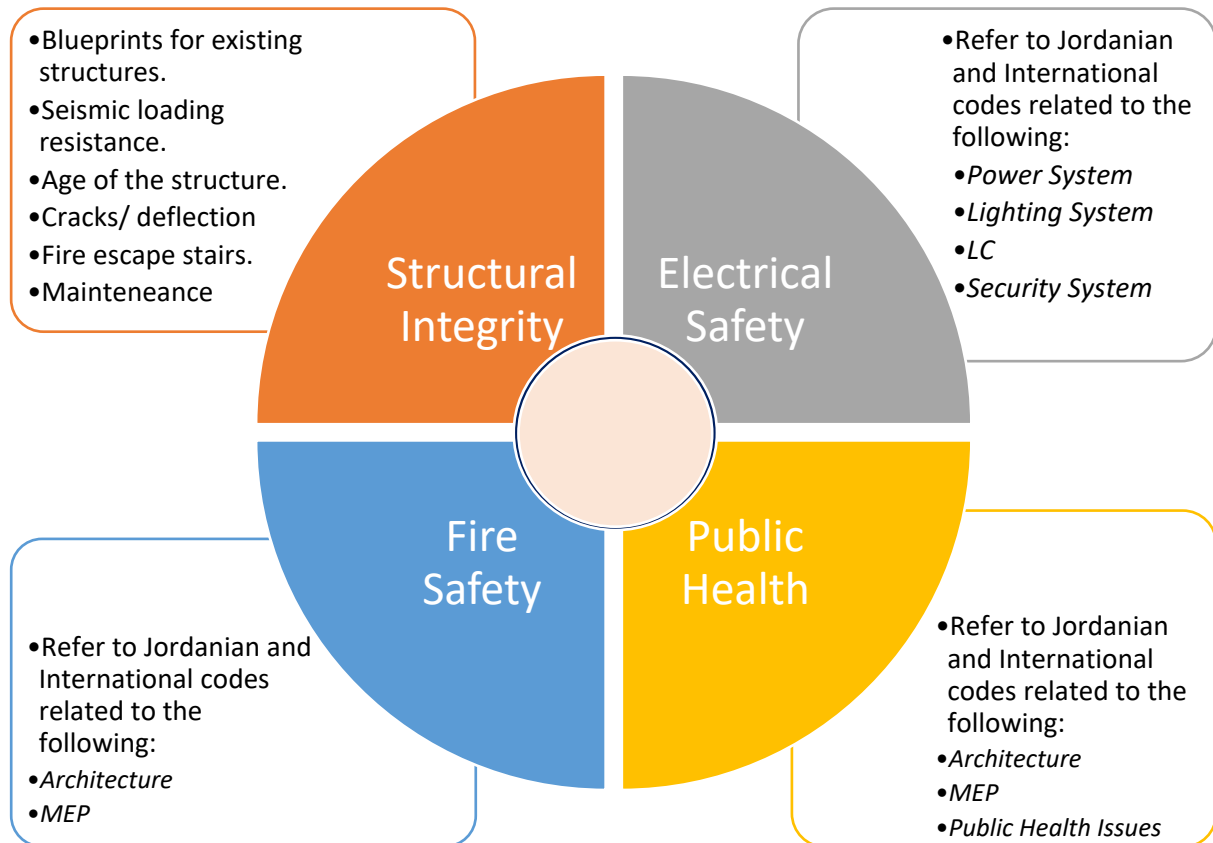


Figure 6-1: Assessment Measures Related to OHS in Dormitories

6.1.1. Structural Integrity

6.1.1.1. Criteria

- Review all available design documents (collected blueprints, reports, calculations, etc...) for the existing structures.
- Check the designed function of the building (as shown on blueprints) and compare with the currently used one to ensure that no additional loads or differences in spaces occur (no change of use / function of space).
- Also, insure that the spans between columns are in accordance with the blueprints.
- Visual inspection of the structure to check all the following:

- Shape regularity, existence of reinforced concrete shear walls (ex: Reinforced concrete staircases or any individual shear wall) and integrity to resist the seismic loading as per the adopted codes.
- Check of loading on the existing slabs as per the adopted codes, especially for water tank loads on roof slabs and live loads on floor slabs.
- Check of all structural elements (Slabs, Beams, Columns, etc...) for seen cracks, concrete spalling, reinforcing bars corrosion, steel structures dimensions, welding, and connections.
- Check of roof floors insulation and any damage in the concrete due to water leakage.
- Check of all external site structures (Stairs, Retaining walls, Concrete tanks, etc...).
- List all non-typical defects which can be decided only by visual inspection for each structure individually.
- Define minimum requirements for all above mentioned topics with reference to the latest versions of codes yet considering the date of construction of the facility/structure inspected).
- Check for any additions or modifications to the original designs/structures.
- Prepare a checklist form to be filled with the situations of all abovementioned items.

6.1.1.2. References

For the structural integrity inspection, the following national and international codes and standards are followed:

- For regularity of the structure and resisting of seismic loading:
 - Jordanian National Building Code- Earthquake Resistant Buildings.
 - (International) Uniform Building Code (UBC 1997).
- For all loads on structures and minimum loading as per the function:
 - Jordanian Code of Loads and Forces, 2006.
- For the design of the reinforced concrete structures and the serviceability:
 - Jordanian Code for Plain and Reinforced Concrete JBC5-93 (All Parts).
 - (International) Building Code Requirements for Structural Concrete ACI 318M-19.

- (International) British Standard- Structural use of concrete - BS 8110.
- For steel structures design:
 - Jordanian Code for Steel Structures.
- For rehabilitation and retrofitting:
 - The Handbook of Repair and Rehabilitation of RCC Buildings. Published by: Director General (Works), Central Public Works Department, Government of India, Nirman Bhawan, 2002.

6.1.2. Electrical Safety

6.1.2.1. Criteria

- Review all available as-built dormitory documents (collected blueprints, reports, calculations, etc...) (if available).
- Define and prepare a reference electrical checklist to be ready for every site visit.
- Compare available blueprints against existing design and modifications “any increment in final electrical connected load of building, all electrical systems are well implemented as per approved blueprints, etc... “.
- Check electrical regular maintenance plan for each dormitory such as: lighting fixtures replacement, out of order circuit breakers replacement, earthing system actual value regular measurement, electrical cables general condition visual inspection, etc...
- Check for compatibility with National and International codes and regulations related to power, lighting, earthing systems.

6.1.2.2. References

For the electrical safety inspection, the following national and international codes and standards were followed:

- For earthing and lighting systems:
 - Jordanian local Earthing and Lightning code.
 - British standards (BS 7430 Code of Practice for Earthing).
- For Electrical installation “cables, socket outlet “:
 - Jordanian local Electrical Installation code.
 - International Electrotechnical Commission (IEC).

- British standards (BS7671 Requirements for electrical installations. IEE Wiring Regulations. Seventeenth edition).
- For lighting system “recommended lux level and the IP (Ingress Protection) rating of a bulb or light fixture:
 - CIBSE 2012 SLL CODE FOR LIGHTING.
 - British standards (BS526 Code of Practice for Emergency Lighting).

6.1.3. Fire Safety

6.1.3.1. Criteria

- Fire Safety systems shall be designed and installed for dormitories as per Jordanian codes (Jordan National Building Council), life safety, Fire Fighting and Fire Alarm System codes and applicable NFPA standards, as well as Civil Defence Directorate (CDD) requirements. These codes/standards shall be considered during assessments, design, and implementation stages.

6.1.3.1.1. Architectural assessment related to fire safety

- Ensure compatibility with national and international fire safety codes and standards, including the major issues below:
 - Lengths of escape routes and dead ends: (Ensure all occupants can exit their floor within acceptable travel distance, then enter a protected zone (normally staircases in multi-storey buildings) which leads directly to an assembly area, protected all the way from smoke and fire.
 - FR doors with all related hardware and self-closing accessories installed wherever needed. (The fire doors shall be checked if in good working order and closing correctly and that the frames and seals are intact.)
 - Adequate number of exits with relevance to room area/occupancy rates. (Alternative means of escape provided from each floor)
 - Adequate widths and finishes (non-slippery materials) for corridors and pathways used as emergency routes (safe routes with no obstacles) (not going through common areas such as eating, cooking, entertainment rooms.
 - Location of gas closet/cylinders (needed for cooking/ kitchens) to take all precautions against fire hazards.
 - Finishes of different spaces (Finishing materials categorization related to fire spread class, smoke developed, fire rating needed with reference to the function, capacity, and use of space, or if the area is a part of an exit route).

- Clear guidance/signage towards emergency exits (evacuation plans) (Check that all safety signs and notices are legible).
- A sign at the dormitory bearing emergency and Civil Defense numbers and instructions for handling accidents, using the language of the dormitory residents.
- Safety officer shall carry daily check as following:
 - Ensure that doors on escape routes swing freely, close fully and are in a good state of repair.
 - Where security devices are fitted to fire exits, these should be checked for correct operation. (Security devices should not impede easy opening from inside in the direction of travel)

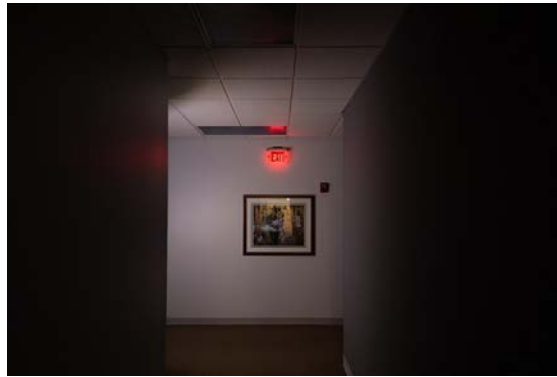
6.1.3.1.2. Mechanical assessment related to fire safety

- Ensure compatibility with national (Jordanian Firefighting code) and international fire safety codes (NFPA), including the adequate distribution and existence of items below:
 - Hose reel cabinets.
 - Portable fire extinguishers.
 - Sprinklers, wherever needed (with reference to room area and occupancy rates).
 - Ventilation and room temperature sensors/ monitoring systems wherever needed.
 - Gas leakage detectors.

6.1.3.1.3. Electrical assessment related to fire safety

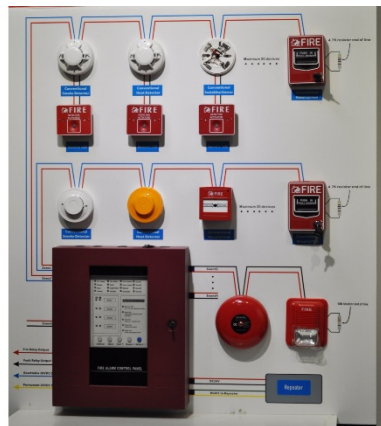
- Ensure compatibility with national (Jordanian Fire Detection & Fire Alarm code) and international fire safety codes (NFPA72 and 101), including mainly the following:
 - Adequate distribution of lighting (Proper lighting for escape routes).
 - Emergency lights (to cover the entire escape route leading to final exit from the building): (Where practicable, safety officer is to visually check on a daily basis that emergency lighting units are in good repair and working properly).
(Safety officer shall carry monthly tests of all emergency lighting systems to make sure they have enough charge and illumination according to the CDD requirements and manufacturers or supplier's instructions).

People in Dormitories must be able to find their way to a place of total safety if there is a fire by using escape routes that have enough lighting.



- Installation monitoring and security systems to give notification when emergency situations occur (or to notify whenever maintenance is needed to prevent major damage).
- Connection to smoke and gas detectors.
- Alarm systems.

Dormitories mainly need an automatic fire detection and warning system distributed at corridors, staircases, kitchenette, electrical and mechanical rooms and other utilities with a control panel which can identify either the zone or the specific location where the alarm has been raised. The control panel (or a repeat panel) should be located near the entrance to the premises or where there would be 24-hour vigilance.



- Installation, testing and maintenance of Fire and safety system:
Fire precautions should be installed by a fire specialist. Safety officer must keep any existing equipment, devices or facilities that are provided in dormitories for the safety of people, such as fire detection and alarm systems, fire extinguishers, lighting, signs, fire exits and fire doors, in effective working order and maintain separating elements designed to prevent fire and smoke entering escape routes.
Safety officer must ensure that regular checks, periodic servicing and maintenance are carried out whatever the size of any defects is put right as quickly as possible. (Daily Check-ups over the fire alarm panel are needed to ensure the system is active and fully operational).

Tests for the fire detection and warning systems and manually operated warning devices should be conducted weekly following the manufacturers or installer's instructions. Check the batteries of safety torches and that fire extinguishers and hose reels are correctly located and in apparent working order. Fire pumps and standby diesel engines should be tested for 30 minutes each week.

Further maintenance may need to be carried out by a contractor. Where contractors are used, third party i.e., Civil Defence Directorate (CDD) Officer certification is one method where a reasonable assurance of quality of work and competence can be achieved.

6.1.3.2. References

6.1.3.2.1. Fire Safety related to architecture and interior design

- Jordanian Fire Protection Code 2004

6.1.3.2.2. Fire safety related to MEP

- Fire Detection and Fire Alarm System/ Jordan National Building Council/2004
- NFPA 72/ National Fire Alarm and Signalling Code/2019
- BS 5839-1/ Fire Detection and Fire Alarm System for Building/2017
- Jordanian Firefighting Code
- Jordanian Fire Protection Code
- NFPA14/ Standard for the Installation of Standpipe and Hose System

6.1.4. Public Health

6.1.4.1. Criteria

Public health has been defined as "the science and art of preventing disease", prolonging life and improving quality of life through organized efforts and informed choices of society, organizations (public and private), communities and individuals.

Every day, there are health epidemics affecting our populations. Some of these public health concerns have been made even more challenging as a result of COVID-19.

According to the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO), the following are among the top public health problems of modern day: Covid-19, Food Safety, Healthcare-Associated Infections, Heart Disease and Stroke, and Motor Vehicle Injuries.

Common public health initiatives include promotion of hand-washing, delivery of vaccinations and medication, smoking cessation, increasing healthcare accessibility, and nutrition related education.

As a result, certain implementations are to be present in all dorms to ensure main public health measures are met, such as cleanliness, proper ventilation and indoor environment quality and safety.

Dormitory conditions are to comply with all MoH regulations, international and national codes related to OSH to ensure public health is considered, which as a result will increase worker productivity and benefit the industrial sector in general.

6.1.4.1.1. Architectural assessment related to public health

- Location of dorms with relevance to factories:
 - o To be away from loud machinery noises.
 - o Pathways connecting between dorms and factories/workplaces to be secured and safe (to prevent accidents or injuries).
 - o To be away from chemicals, smokes, gases produced in the workspace or any source of pollution.

The dormitory must be at least 500 meters away from any source of pollution, including carbon monoxide, sulphur dioxide, nitrogen oxides or exhaust emissions; sewerage systems; wastewater; and noise pollution.

- Study orientation of new structures to ensure adequate exposure to day light and nice views.
- Ensure adequate exposure to daylight and natural ventilation in existing occupied structures/rooms.
- Study windows and openings in building boundaries to ensure natural ventilation.
- Provide laundry areas (by hand or by machine):
 - o If washing machines and dryers are provided, assessors must ascertain whether all washing machines, dryers, and electric irons (if available) are safely connected. Also, chemical substances that are used for cleaning, such as acids and other cleaning materials, must be stored safely to avoid burns, especially to the eye. These materials must be stored in a self-closing plastic container for waste collection.
 - o The washing and drying area must not be slippery.
 - o The dormitory must have a place designated for washing (by hand or by machine), with hangers and lines for hanging clothes outside the sleeping quarters and the kitchen at an average of 1 meter of clothesline per worker.
- Ensure adequate number of changing rooms, toilets, bathrooms, washing areas and drinking fountains/coolers with reference to occupancy rates. (The sanitary facility must contain at least one toilet, one shower and one sink per 15 workers).

- Proper places designated for cooking food (Kitchen/Cafeteria) that may be available on each floor in the dormitory, or in one place for cooking food for the entire dormitory, including the following:
 - Walls with ceramic tiles that are not less than 2 meters high.
 - Safe source of drinking water and sink(s) for dishwashing.
 - Separate cabinets for storing food and detergents.
 - A refrigerator for keeping food.
 - A cooker/oven for cooking food (zone to be protected against fire hazards or gas leakage).
 - A self-closing screen door.
 - Suction fans/ducts.
 - Pest and rodent control devices.
 - Proper waste baskets with a lid.

The door of the sanitary facility must not open directly onto the kitchen or the dining room and the distance between the door of the sanitary facility and the kitchen or dining room door must not be less than 4 m.

- Ensure the proper finishing materials are installed with reference to the function/use of space (For example, no slippery tiles for emergency routes or within wet areas).

6.1.4.1.2. Mechanical assessment related to public health

- Ensure compatibility with National and International codes and standards related to the following considering usage of different spaces and occupancy rates; to ensure no deficiency or pollution caused of any leakage or damage in the systems:
 - Sanitary / Drainage/ Sewage
 - Domestic Water Supply
 - HVAC
 - LPG (with gas leakage detectors/ Security System)

6.1.4.1.3. OSH assessment

- Ensure compatibility with National and International codes and standards related to OSH:
 - Cleanliness/ Hygiene/ Order.
 - Water quality (Drinking and domestic water): The available water for consumption per person must not be less than 60 litres per day for personal consumption including drinking water.
 - Food quality (Kitchen cleanliness and food preparation process).

- Indoor air quality (Comfortable levels of temperature, humidity and ventilation/ atmosphere free of odour and pollution caused by toxic materials, fumes, smoke, gas, or dust).
- Insect control (Soft metal screens on the windows and doors, especially in hot areas where flies abound, and insect killers wherever needed).
- Stray animals control (self-closing doors) (surveillance cameras and frequent inspections to ensure no stray animals exist indoors).
- First-aid boxes with medicaments provided within (along with a healthcare giver/ clinic if needed, with reference to the usage of the facility and the capacity loads of different loads).
- Health supervisor office.
- Occupancy rates within a room with reference to its area and usage.
- Washing areas, toilets, bathrooms, changing rooms and dining rooms are adequate with reference to occupancy rates and equipped with all the necessary fixtures and accessories.
- Trash collecting area and adequate distribution of trash bins:
 - A waste basket of proper size must be available at each sanitary facility. Self-closing plastic containers are to be used for waste collection.
 - Each floor must be provided with one container or more for solid waste (3 litres per worker) and must be emptied at least once a day.

The premises must be clean and free from waste, rubble, and stagnant water. Stagnant water, waste, insects, and rodents can lead to mosquito-borne diseases, such as malaria and dengue fever, which are considered among the greatest hazards of stagnant water.

- Good illumination (sufficient lighting provided by natural and artificial sources).
- Noise free atmosphere (dorms to be away from any source of loud machinery/ facility boundaries to be well insulated acoustically).
- Certain design requirements on the ground floor, related to workers with special needs, are to be considered with reference to updated Jordanian National Building Codes (Handbook of special building requirements for people with special needs).

6.1.4.2. References

- Uniform plumbing code/ 2018
- ASHRAE standard/ 2009
- Jordanian code for gas system installation in buildings
- Jordanian National Building Codes (Space requirements in buildings code, Natural ventilation and Health Assets code, Natural Light code)

7. Applications

Engicon was assigned to review the assessment report prepared by Phase I service providers for 14 existing dorms distributed across the Kingdom and build on the assessment exercise for 4 additional existing dorms for Phase II.

In order to inspect the dormitory conditions based on the previously explained methodology, Engicon proposed an Inspection Checklist to be filled for each dorm upon visit, to define typical defects with reference to standards and suggest corrective actions.

The following table represent the checklist suggested for inspecting conditions and typical defects in dormitories:

Dormitories Health and Safety Inspection Checklist

Format no. 1

Dorm number	Name of Dorm/Factory	Location
Date of Inspection Visit		Inspector Name:

Defect Classification guide with reference to OHS standard parameters	
Fatal	The parameters of the defect are comparatively high and combined in a manner that causes, or could result in death, permanent total disability, or irreversible damage that violates law or regulation.
Major	The parameters of the defect exist at a level that does or will result in permanent partial disability, injuries or occupational illness that may result in hospitalization of at least three personnel, or reversible damage causing a violation of law or regulation.
Moderate	The parameters of the defect exist at recognizable levels and may result in injury or occupational illness resulting in one or more lost workdays, or damage without violation of law or regulation where restoration activities can be accomplished.
Minor	Some of the parameters exist at recognizable levels and can result in injury or illness not resulting in a lost workday or not violating law or regulation. The defect is easily recoverable.
Insignificant	None of the relevant parameters exist at a level that can cause injury or illness.

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
General requirements/ Architecture				
Reference Code/ Standard				
Jordan National Building Codes	- Accessibility (Pathways and corridors of appropriate widths and conditions)			
	- HC accessibility (HC toilet provided) (Design adopts requirements for users with special needs)			
Dormitories Inspection/ Assessment Guide (2019)	<p>- Proper occupancy rates for different areas. (3.5sq.m. per worker) (Ensure no overcrowding occurs)</p> <p>(If bunk beds are used, 3.5sq.m. applies for both workers in the lower and the upper bed. The distance between bunks ≥70cm and they must meet safety standards)</p>			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
Dormitories Inspection/ Assessment Guide (2019)	- Laundry room and drying area provided. (1m length of hanging wire per worker outside)			
	- Adequate room heights (min. 2.8m - max. 3.2m)			
	- Adequate number of toilets, showers, and washbasins with reference to occupancy rates. (1toilet, 1 shower, 1 washbasin for 15 workers)			
Boiler Workbook provided by BWJ Jordan National Building Codes	- Easy accessibility to refilling gas and diesel tanks. (Separated, well-ventilated and safe gas closets, diesel storage tanks and boiler rooms)			
	- Guard houses provided. (For safety/ security surveillance/ Access controls)			
	- Steel/ secured doors for main gates and entrances. (Secured Facility borders including boundary walls and main entrance gates)			
	- Proper Indoor Environment Quality			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
	(Odors, Temperature and Humidity levels are comfortable as per international standards)			
	- Finishing materials. (Suitable selection for different activities conducted)			
	- Building envelope (from the exterior) and room surroundings (walls, floors, and ceiling from the inside) in safe and good condition.			
	- Roof/Top of Roof in proper conditions (Insulation, Lighting, and rainwater drainage)			
	- Ensure furniture in proper conditions (shelves and cupboards to be secured to ensure stability) (fixed seats in cafeteria if provided to be adequate and in good condition)			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
	- No change for the use of space. (Compliance with the original design)			
	- Clinic provided within or close to the facility.			
	- Cafeteria/ Dining room/ Kitchen provided within or close to the facility and in good and safe conditions.			
	- Drinking Fountains/coolers provided and in good working conditions.			
	- Signage provided (Facility name, room usage or number, directional or any other signs needed provided in all languages of resident workers).			
	- OSH supervisor and HR Officer hired (Administrative Offices close to the dormitory) (Their contact numbers available, to be used after working hours in case of emergency.)			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
	<ul style="list-style-type: none"> - Doors, windows, locks, and latches are in good working order. - Special concern related to doors mechanism along emergency routes. 			
	<ul style="list-style-type: none"> - Check schedules and records of maintenance and repair works conducted by the facility management. - (Repair works for finishes, MEP fixtures, equipment, furniture, accessories and hardware of windows and doors). (Preferably to be conducted and recorded every 6months and upon detecting damage) 			
Structural Integrity				
General Data				
	<ul style="list-style-type: none"> - Available Documents (Accuracy of blueprints; the building is built according to the design 			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
	approved plans with no deviations.)			
	- Periodic Maintenance (Structural Only).			
Structural Integrity Against Seismic Loading				
	- Shape Regularity.			
	- Shear Walls Existence and continuation to ground. And occurrence of soft story.			
	- Excessive gravity loads. (Especially in upper stories).			
General Design Loading				
	- Floors Slabs Loading.			
	- Roof Slab Loading.			
Check of structural elements against typical defects (Concrete / Steel)				

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
	- Water leakage in slabs.			
	- Spalling in concrete cover and plastering.			
	- Cracks in Non-Structural elements and roofs parapets.			
	- Cracks in Structural elements and signs of corrosion.			
	- Position of nearby plants (ex: boilers rooms), possibility of explosion and their proximity to critical structural elements.			
	- Steel Structures general conditions			
	- Settlement in ground S.O.G and differential movement across expansion joints (if any). And column - foundation settlement.			
	- Insulation of roof slab.			
	- External site reinforced concrete structures.			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
Electrical Safety <i>(Refer to Jordanian and International codes)</i>				
Reference Code/ Standard				
British standards (BS7671)	- Ensure no overloading.			
Jordanian local Electrical installation code	- Exposed covered wires and DB/ not missing covers for sockets/outlets.			
	- Waterproof outlets provided within kitchens or wet areas/ outdoor.			
	- Ensure safe connection to DB and boards are not exposed/ controlled/ located in a way to avoid vandalism.			
Jordanian local Earthing and lightning code	- Earthing system provided.			
Lighting System				
Jordanian local lighting code.	- Adequate lighting/ distribution of lighting fixtures.			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
Jordanian local Electrical installation code.	- Lighting fittings, fixtures and ceiling fans are properly installed and in good working condition.			
Security System				
CCTV code (Jordan National Building council)	- Cameras provided where needed.			
Fire Safety				
Architectural Applications	As per Jordanian Fire Protection Code			
	- Lengths of corridors at dead ends as per codes (not more than 10m long if no sprinklers are provided).			
	- Widths of emergency pathways/ corridors to be adequate, safe, considering occupancy rates and free of obstacles. (≥0.9m wide)			
	- Finishes of different spaces complying to codes (Materials categorization			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
	related to Fire Spread Class, Smoke developed, Fire Rating needed with reference to the function, capacity, and use of space, or if the area is part of an exit route)			
	- Stairsteps and ramps are in safe conditions/ of appropriate dimensions ($\geq 1.1\text{m}$ wide tread)/ non-slip surfaces/ secured with handrails wherever needed/ protected against fire and smoke along escape routes.			
	- Partitions’ heights in bedroom to reach ceiling (full height)/ separation between rooms/ protection against vast fire spread.			
	- Doors at fire exits to be FR and equipped with self-closing devices and hardware as per codes. (Free opening width			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
	≥0.8m for a single leaf door and 1.6m for a double leaf door)			
	- Vertical shafts and storage rooms to be provided with FR enclosures and doors as per codes.			
	- Clear directional signs to emergency exits/ evacuation plans and emergency contact lists provided in all languages of resident workers.			
	- Safe and sufficient area identified as an assembly point/ refuge area.			
	- Lengths of escaping routes towards exits as per codes (≤15m from the furthest room door to the stairs door/ exit on the same floor). (Full travel distance to the outside ≤55m)			
	- Number of exits comply with codes with reference to room area and capacity loads.			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
	<ul style="list-style-type: none"> - Alternative means of escape provided from each floor. (The distance between two alternatives not to be less than half of the distance between the two furthest points in the room or floor) 			
	<ul style="list-style-type: none"> - Easy accessibility for Civil Defense vehicles and ambulance. 			
Mechanical Systems	(As per NFPA and Jordanian firefighting code)			
	<ul style="list-style-type: none"> - Distribution of Hose Reel Cabinets. 			
	<ul style="list-style-type: none"> - No vandalism of cabinets occurring. 			
	<ul style="list-style-type: none"> - Distribution of Portable fire extinguishers (Powder and CO2) 			
	<ul style="list-style-type: none"> - Distribution of sprinklers and smoke detectors as per code. Connected to a fire alarm system. 			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
Jordanian fire protection code section 2/1/5 and section 6/3/5	- Existence of fire hydrant			
Electrical Systems (As per NFPA and Jordanian firefighting code)				
	- Ensure continuous/ periodic maintenance documented and applied to different systems.			
Fire Detection & Fire Alarm System Code (Jordan National Building council), NFPA 72 & BS 5839-1	Provide fire alarm system include detectors, sirens, break glass along corridors, staircases, electrical and mechanical rooms, storages, kitchens, cafeterias, shafts and wherever needed as per Jordanian code and CDD requirements.			
Fire safety code (Jordan national Building Code)	Provide built-in batteries emergency lighting along corridors, staircases, electrical and mechanical			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
British standards (BS5266)	rooms and wherever needed as per Jordanian and CDD requirements, as well as exit signs at escape routes			
Public Health				
Architectural Configuration				
	- Location of Dorm (<i>with reference to adjacency to the manufactory and exposure to pollution or any other health hazard.</i>)			
	- Openings and Orientation of Dorm (<i>with reference to adequate exposure to daylight and ventilation</i>)			
Mechanical Systems				
	- Sanitary Drainage (<i>Ex. Occlusion of internal sewage network</i>)			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
	- Domestic water supply (potable water for drinking and washing)			
	- (Providing mixers for hot and cold-water systems) (ensure water cabinets are closed/controlled)			
	- Ventilation (<i>Ex. Insufficient ventilation in toilets, bathrooms, and bedrooms</i>)			
	- Central heating/ AC			
	- Adequate temperature and Humidity levels within different spaces.			
	- LPG System (Check for Safety Requirements/ Gas leakage detectors/ location away from highly occupied areas)			
	- Rainwater drainage			
Public Health Issues	as per codes and MoH requirements.			
	- Cleanliness and order.			
	- Food preparation and kitchen safety,			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
	cleanliness, and locations (sufficient and properly working equipment) - No cooking allowed within sleeping rooms.			
	- Insects Killers distributed wherever needed. - Steel wire mesh screens provided for windows.			
	- Control over existence of stray animals within facility (surveillance and frequent inspection/ self-closing devices for doors).			
	- First-aid boxes with medicaments provided.			
	- Trash collecting area and adequate distribution of trash bins provided. - A waste basket of proper size at each toilet. - Self-closing plastic containers to be used. - Each floor has 1 container or more for solid waste (3liters/ worker).			

Discipline/Subject of Assessment	Point to be checked	Defects Identified/ Remarks	Photos from Inspection Visit	Defect Classification/ Corrective action suggested
	- Trash emptied at least once a day.			
	- Clean wet areas with all the needed sanitary fixtures, fittings, and accessories in good working conditions.			

7.1. Findings

The annexes brief findings for the 18 inspected dorms (from both phase I and II):

- Annex A: Including inspection checklists for 4 inspected dorms filled by Engicon's technical team in July, 2021 (Phase II).
- Annex B: Including inspection for 14 dorms, assessed by Phase I service providers in July 2020, yet inspection checklists (as per the suggested checklist) were filled by Engicon's team with reference to previously submitted reports provided by BWJ.

Respecting the privacy of dormitories, assessment findings (filled inspection checklists) included in Annexes (A and B) are not intended for public use.

8. Conclusions

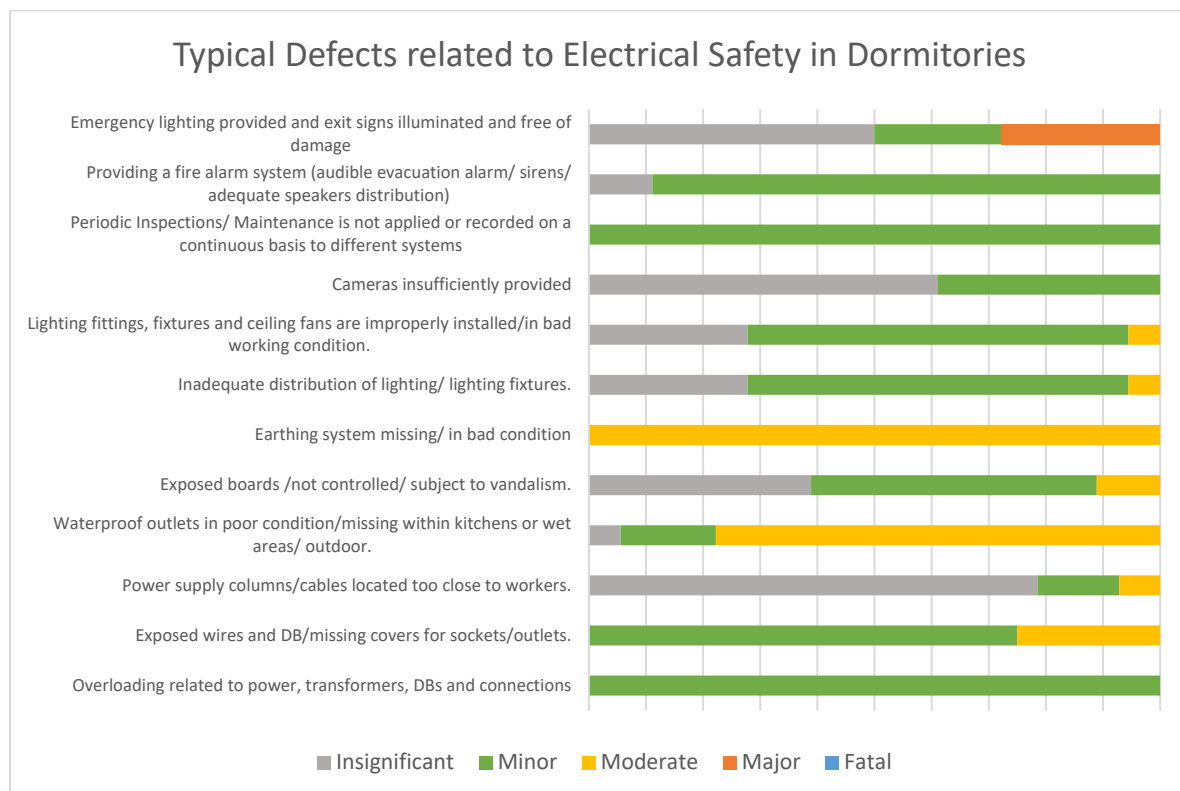
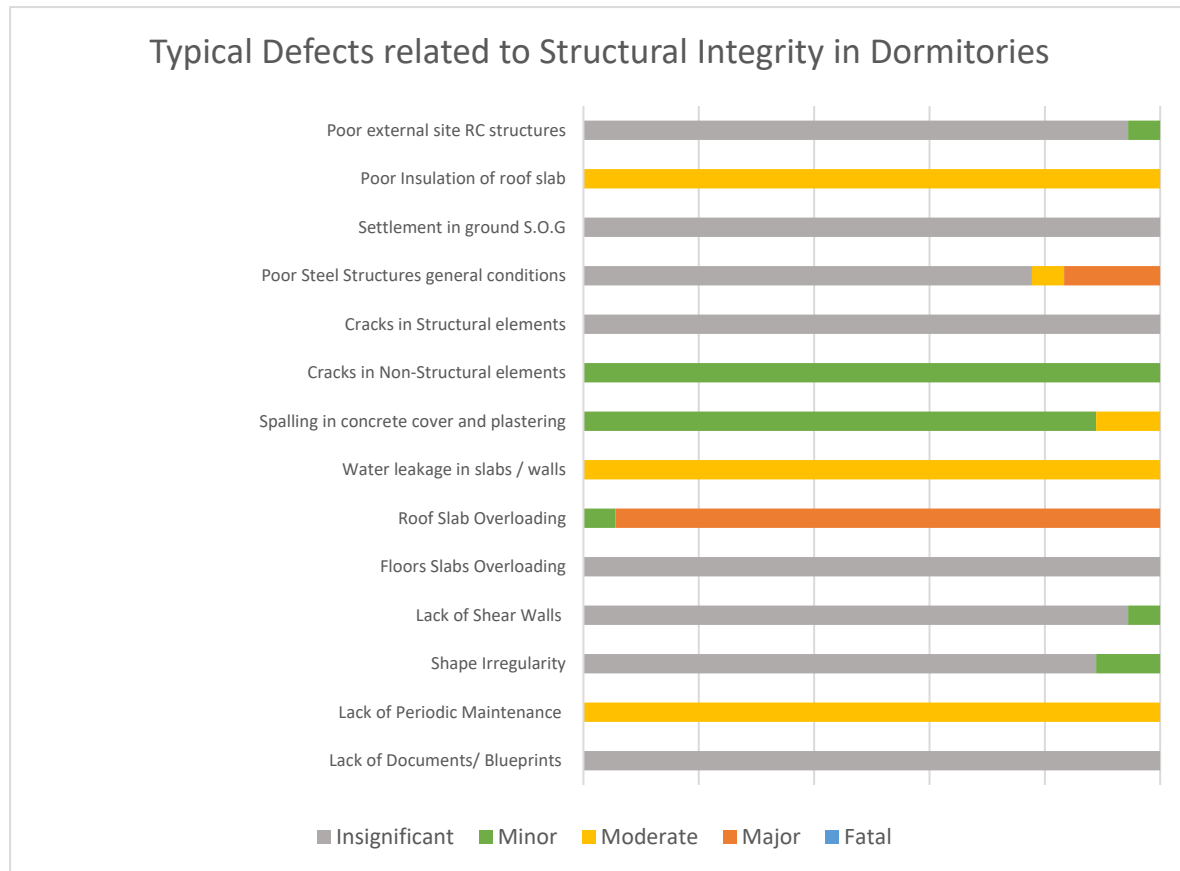
In conclusion, the identified defects can be classified into 4 groups based on the severity of impacts as follows:

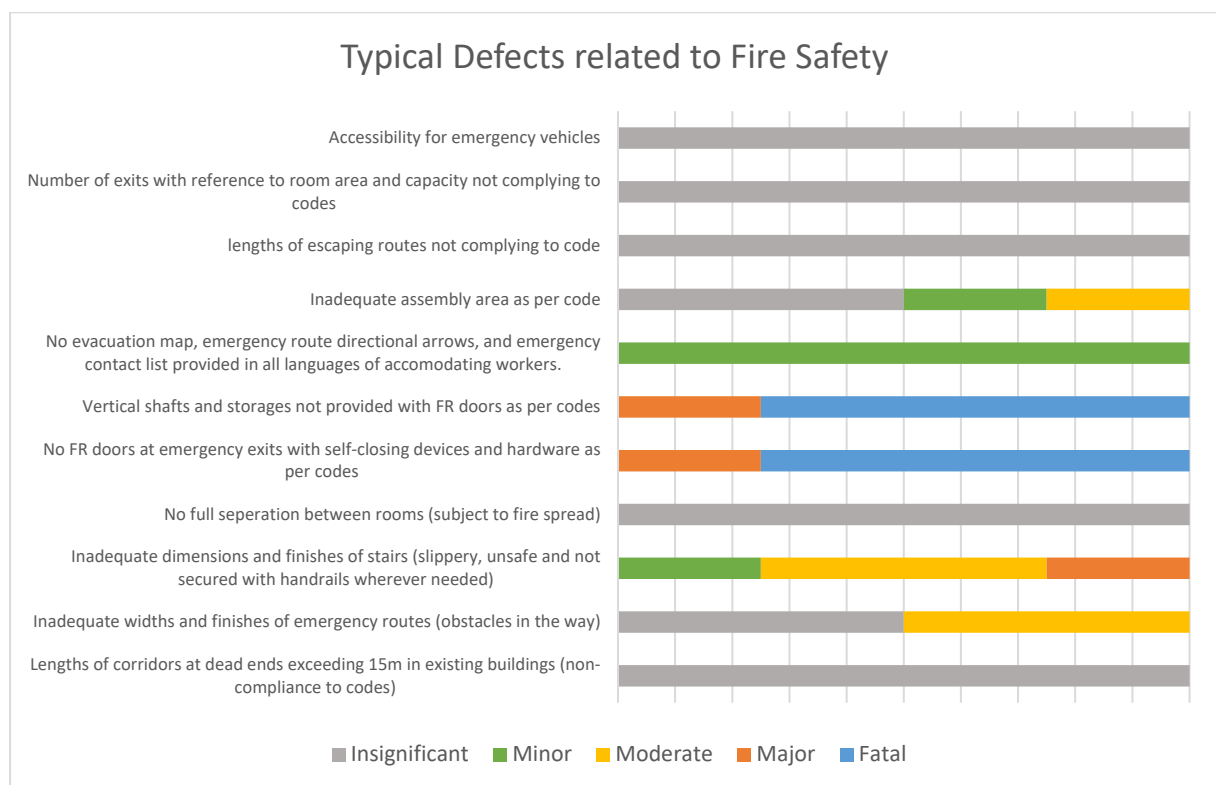
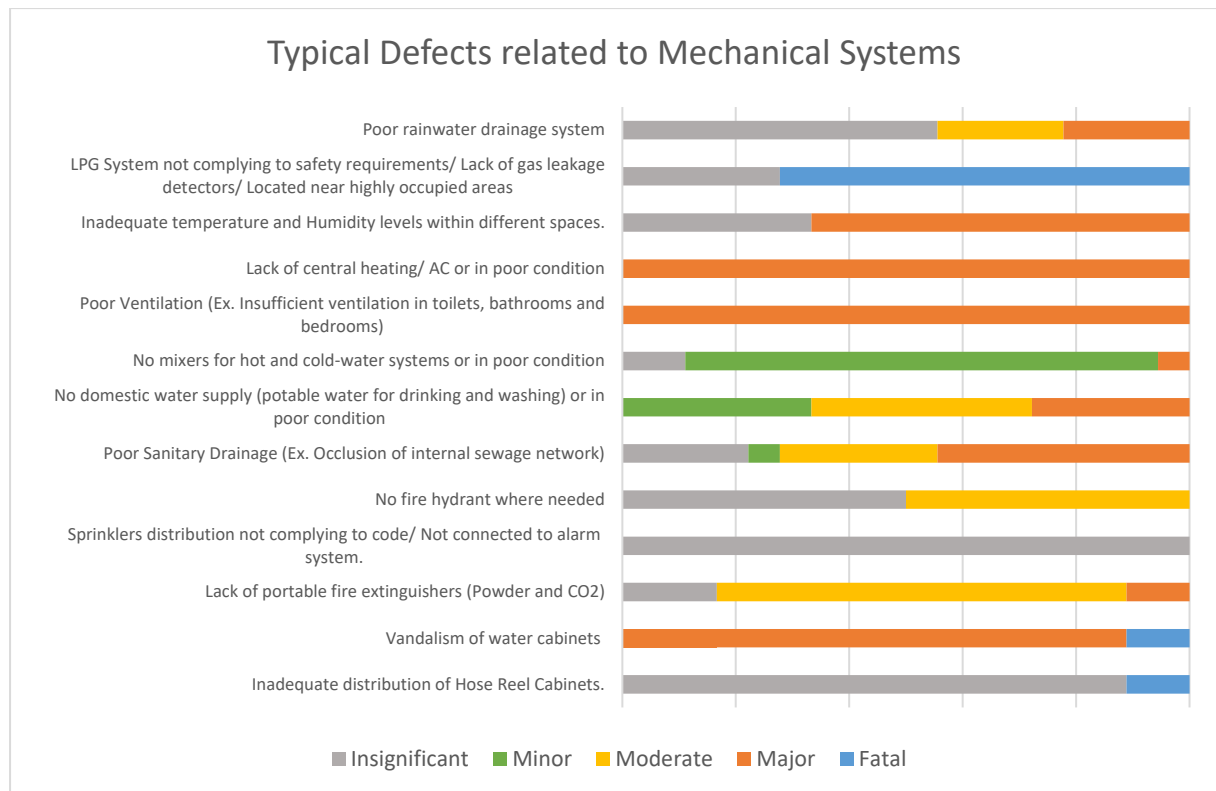
- FATAL: The parameters of the defect/risk are comparatively high and combined in a manner that causes, or could result in death, permanent total disability, or irreversible damage that violates law or regulation.
- MAJOR: The parameters of the defect/risk exist at a level that does or will result in permanent partial disability, injuries or occupational illness that may result in hospitalization of at least three personnel, or reversible damage causing a violation of law or regulation.
- MODERATE: The parameters of the defect/risk all exist at recognizable levels and can result in injury or occupational illness resulting in one or more lost workdays, or damage without violation of law or regulation where restoration activities can be accomplished.
- MINOR: Some of the parameters exist at recognizable levels and can result in injury or illness, not resulting in a lost workday or not violating law or regulation. The effect of such change is easily recoverable or self-recovering, and there is no lasting impact.
- INSIGNIFICANT: None of the relevant parameters exist at a level that can cause injury or illness.

Note

Assessments were based solely on what was observed and investigated during Inspection visits conducted by engineers. Further inspection visits might be needed by professional members, craftsmen or contractors to define accurate level and budget needed for recommended corrective actions and improvements related to the structural integrity of existing dormitories.

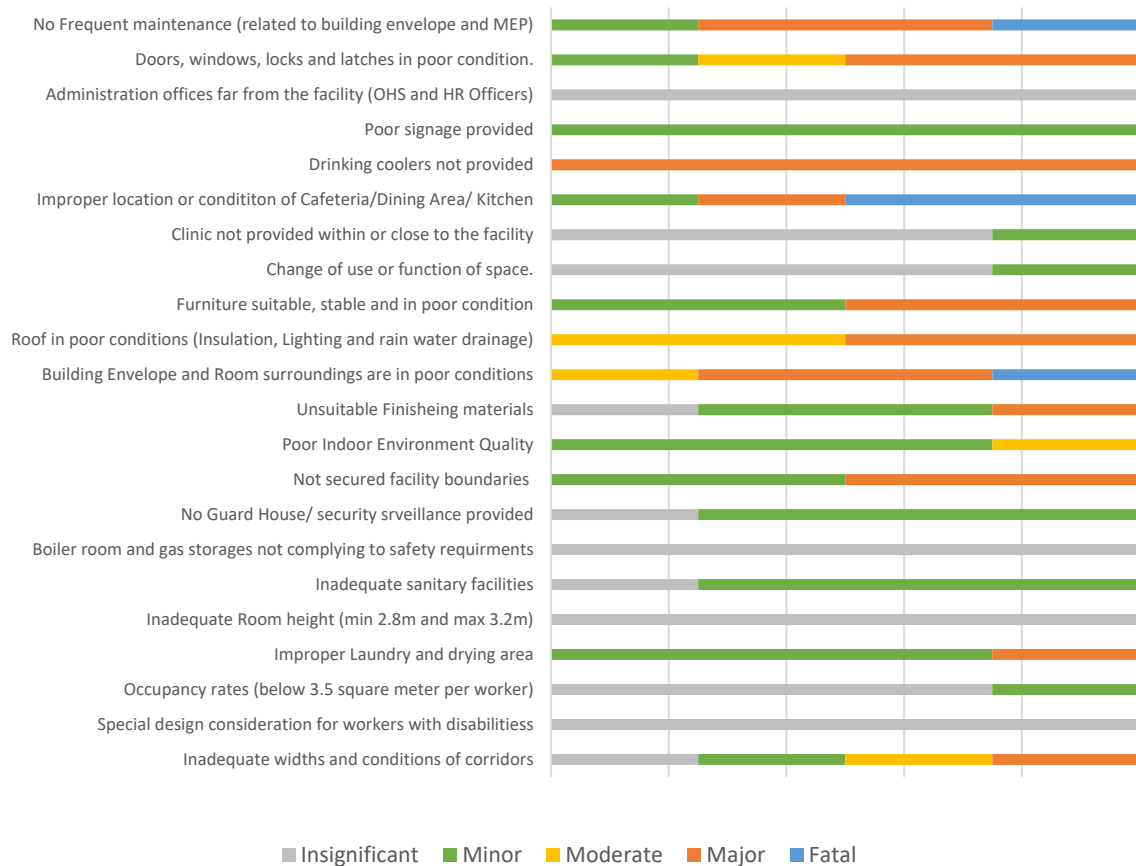
The following charts represents severity and repetitiveness of defects (Typical Defects) detected in existing dormitories, related to the previously illustrated assessment measures:



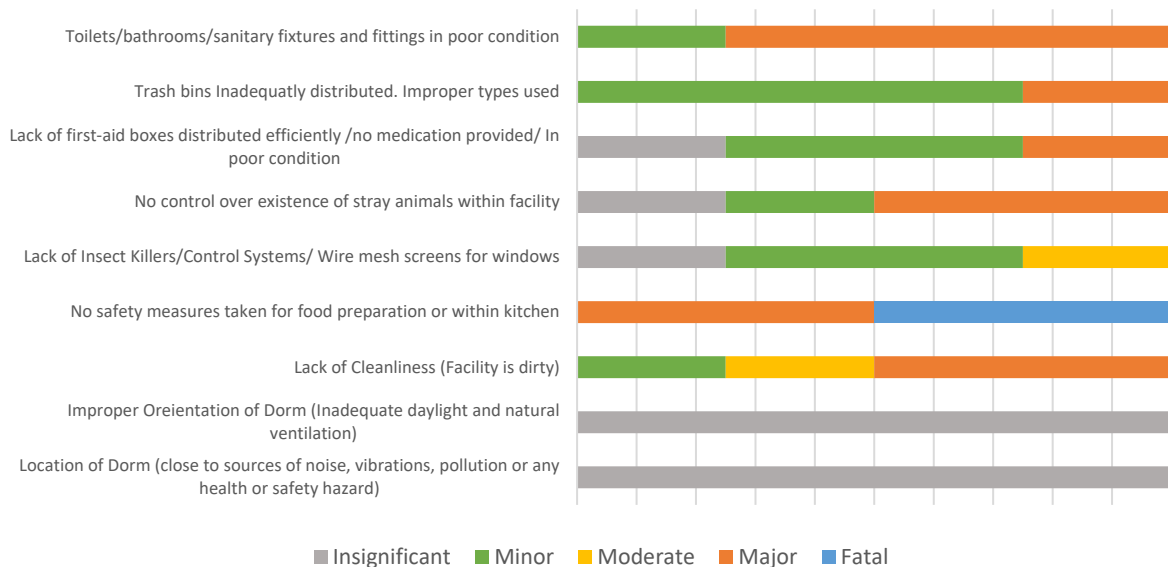


Note: All Typical Defects are assessed with relevance to Jordanian national and international building, firefighting, OHS codes and standards.

Typical Defects related to Architectural and Interior Aspects



Typical Defects related to Public Health



Defect classification will allow for deciding on which corrective actions to prioritize, and on devising an implementation plan with reference to the accommodated budgets.

It was noted that major defects were related to poor maintenance and non-compliance to health and safety requirements (lack of cleanliness, organization, fire-rating or proper functioning of fire doors where needed, lack of fire protection on vertical service shafts, in boiler rooms and kitchens, and improper conditions of cooking areas, dining rooms, drinking water coolers, wet areas and hanging wires, as well as improper insulation and utility of roofs).

At the end, corrective actions are necessary to address defects as an essential first step to enhance the current unacceptable conditions, but frequent maintenance and raising awareness is needed to prevent the occurrence of new problems on the long run.

Continuous improvements are needed to maintain the structural integrity within any facility, and raising the awareness towards the importance of OSH quality between different parties and stakeholders is highly needed to guarantee continual improvement to the HSE management within dormitories, which can be achieved if some procedures are adopted, as illustrated in the figure below.



Figure 8-1: Procedures to Guarantee Continual Improvement in HSE Management