

DEP SPECIFICATION

REQUIREMENTS FOR MOBILE AND CONSTRUCTION CAMPS

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DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements for design and engineering of (mobile modular) camps and gives recommendations for their layout, design and in-place integrity. These camps include construction camps in the broadest sense, e.g., construction sites, seismic camps, drilling camps and the pioneer camps used for the camp site preparation and camp construction period. This DEP does not cover permanent residential areas, temporary or permanent office units, nor buildings located inside the fence of hydrocarbon processing or chemical plants. Camps in Arctic areas are also not covered by this DEP.

- The camps may encompass accommodation units, canteen units, units for a clinic, equipment containers, power generation and emergency power units, water supply, roads and an airstrip and/or a helicopter landing area.

The purpose of this DEP is to ensure that HSSE standards are met and technical integrity of the camp is established and maintained for all design conditions, including transport and operations.

This DEP contains the following main sections:

1. Section (2) describes the overall procedure for establishing technical integrity, underpinned by a HAZID, and following a fit-for-purpose approach.
2. Section (3) describes the design criteria for the camp design and assessment, giving amongst others the design wind velocities to be used in the analysis of the technical integrity.
3. Section (4) describes the requirements for the technical integrity, giving a description of design conditions, load calculation and analysis.
4. Section (5) describes in general the requirements for layout and the facilities as to be provided.
5. Section (6) gives more specific requirements and design guidance for the camp in detail.

The Appendices contain a checklist for the HAZID, a questionnaire and standard technical solutions for integrity under wind loading and example calculations for the wind force.

A HAZID shall always be performed as part of the project, and it shall be attended by Representatives from the Contractor and the Principal. Where necessary, specialist advice shall be sought to establish the risks.

For the management of construction camps during operations, refer to the Best Practice Guideline GS.09.53151.

Background and additional information of how the several facilities could be equipped is given in the Informative of this DEP.

This is a revision of the DEP of the same number dated January 2008; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

Term	Definition
Building	Any roofed structure, either framed or self-supporting, including external stairs, steps or landings, canopy, balcony, etc.
Building Line	Imaginary line on a unit of land, which defines a distance from a specified boundary, beyond which the erection of buildings or structures are completely or partially prohibited.
Boundary	Cadastral lines enclosing and defining a unit of land.
Dormitory Building	Building consisting of one or more dormitory rooms.
Engineering Services	Infrastructure for the provision of potable water, electrical power, lighting, lightning protection, domestic sewage, storm water collection and disposal, telecommunications, fire detection and alarm, CCTV, intruder detection, access control, fire fighting services and equipment, solid waste collection and disposal.
General Facilities	All engineering/technical, facility management and/or other services required to support the residing of construction personnel at the facility complex.
Land	Land or plot in natural state without site preparation or improvements.
Living Quarters	Living quarters are enclosed spaces such as cabins, mess facilities/dining, recreation rooms, first aid room/clinic, offices, toilets ablution or wash room areas and similar spaces used for the accommodation and welfare of personnel.
Parking Area	Dedicated place for parking of vehicles consisting of one or more parking bays.

Term	Definition
Parking Bay	Area measuring not less than 5.0 m x 2.5 m (6 yd x 3 yd) for perpendicular parking and 6.0 m x 2.8 m (7 yd x 3 yd) for parallel parking, which is clearly outlined and demarcated for the parking of one motor vehicle or an area measuring not less than 13 m x 4 m (15 yd x 4.5 yd) for the parking of a bus.
Portakabin	Originally a brand name used in general for a prefab standardised movable unit.
Recreational Facilities	Facilities required to entertain residents and to enable them to carry out certain sports or games.
Resident and/or Occupant	Any person or group who physically inhabits a building, a structure or land, or any person or group having the charge or management thereof.
Sanitary Facilities	Washing and toilet facilities consisting of showers, washbasins, urinals and water sealed toilets.
Clinic/ First Aid	A centralised medical facility where sick or injured persons can be treated. This includes a first aid centre.
Solid Waste	Food waste and refuse other than sewage.
Trailer	Movable unit on wheels
Waste Disposal Site	A place where any non-hazardous household, commercial or industrial waste products are stored, salvaged, treated or disposed of in a lawful manner.

1.3.3 Abbreviations

Term	Definition
ALARP	As Low As Reasonably Practicable
ASCE	American Society of Civil Engineers
BBA	British Board of Agrément
CCTV	Closed Circuit Television
DEP	Design and Engineering Practise
ESHMP	Environmental, Social and Health Management Plan
HAZID	Hazard Identification
HVAC	Heating, Ventilation and Air Conditioning
HSE	Health, Safety, Environment
HSSE	Health, Safety, Security, Environment
HEMP	Hazard and Effects Management Process
IRPA	Individual Risk Per Annum
NDE	Non Destructive Examination
NFPA	National Fire Protection Association
RAM	Risk Assessment Matrix
RT	Road Transport
SRA	Safety Risk Assessment
UDL	Uniformly Distributed Load

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets (). Other documents referenced by this DEP are listed in (7).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated January 2008. The major change is the incorporation of the requirements which are applicable to construction camps which can be considered in general as less mobile. Most of the changes can be found in (5) and (6).

The majority of the new text is derived from the Best Practice Guideline for Design, Construction and Management of Living Quarters / Construction Camps Onshore (GS.09.53151, Issue 7 dated November 2010).

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
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DEP Standard Form (Other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

2. SITE SAFETY ASSESSMENT

2.1 GENERAL

The approach to the campsite safety assessments is underpinned by the HEMP process. This process comprises:

- A HAZID to identify all potential hazards
- A risk evaluation
- Mitigation of risks to a level as low as reasonably practicable.

The application of the HEMP process to the assessment of a campsite is summarized in Figure 1.

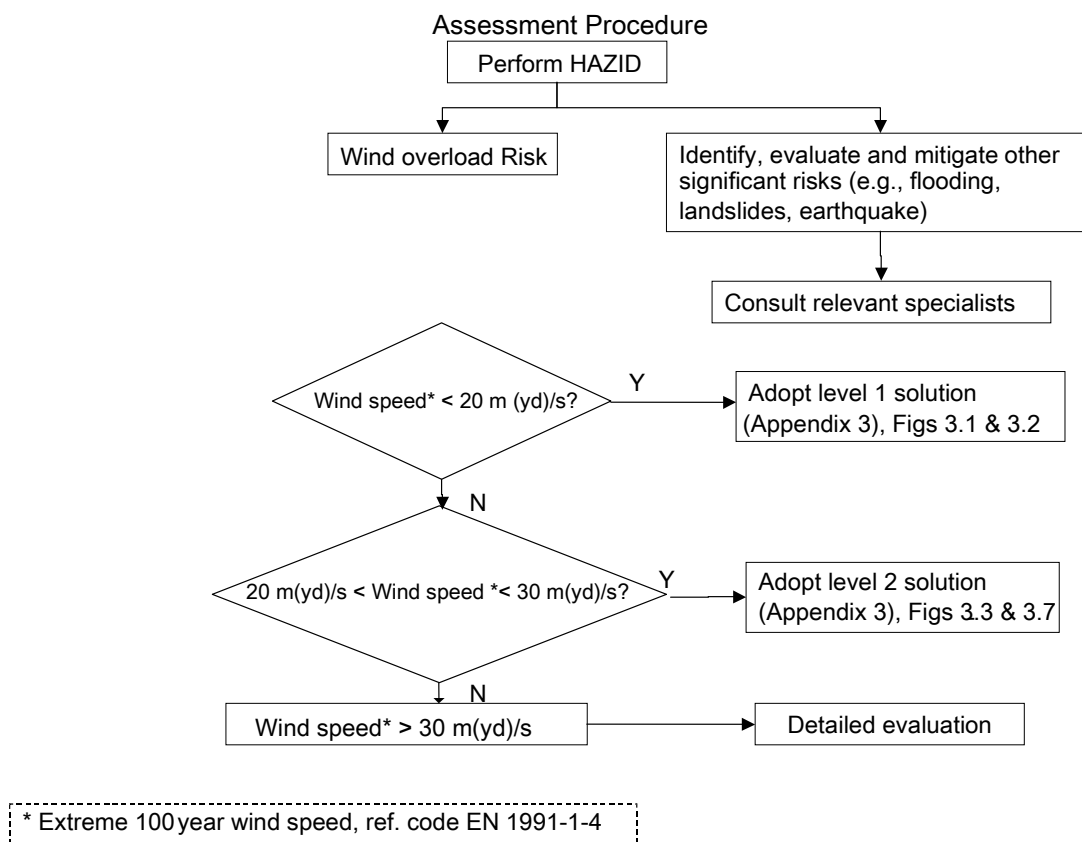


Figure 1 Assessment procedure

The objective is to provide fit-for-purpose solutions by focussing the effort in the high-risk areas and adopting standard technical solutions, where appropriate. For instance, a standard Level 1 solution is recommended for applications where the design wind speed is less than 20 m(yd)/s. In contrast, in rare cases, where the extreme wind velocity exceeds 30 m(yd)/s, advice shall be sought from relevant engineering specialists.

For other environmental hazards, e.g., flooding, steep slopes, landslides, earthquakes, snow and blizzards, the importance shall be determined during the HAZID process and, if needed, further specialist advice should be sought to develop appropriate solutions.

2.2 HAZID

As part of the overall HAZID when planning the camp, the risks and mitigation of the civil aspects shall be discussed. Designers, Contractor staff and discipline specialists shall attend this HAZID. The HAZID shall be performed in line with EP 95-0312.

A checklist of notional hazards for the camp is given in the HAZID table in (Appendix 1).

Further civil engineering issues to be addressed in the HAZID are: roads, fencing, escape routes, local topography and orientation of any airstrip.

At least the following discipline specialists shall attend the HAZID: meteorological, HSE, civil engineering.

For guidance during a pre-start up discussion a questionnaire is included in (Appendix 2).

As part of the HAZID the following exposure levels shall also be addressed:

- Potential level of heat radiation
- Potential level of explosion pressures

These subjects shall be addressed in separate HSE reviews of the operations. The effects of any heat radiation and explosions shall be included in the civil/structural review of the camp.

2.3 RISK EVALUATION AND MITIGATION

The risk level for each hazard category in the list shall be evaluated in accordance with the Group RAM. The actual risk levels shall be developed in the HAZID. Recommended minimum evaluations for each risk level:

- For low risk level (blue in the RAM) manage for continuous improvement
- For the medium risk level (yellow in the RAM) the camp design shall be evaluated and solutions adopted as per the technical guidance.
- For the high-risk level an in-depth design and analysis shall be performed to ensure the risks are all below Principal acceptance level ($IRPA < 10^{-3}/yr$). Where necessary, the Principal's civil technical specialist shall be consulted.

All risks shall be made ALARP by considering risk mitigation measures and implementing those measures that are cost effective. Further guidance on this subject can be found in EP 2005-0300.

2.4 WIND LOADING CLASSIFICATION

Standard technical solutions have been developed in this DEP to ensure the stability of the units under wind loading. Three levels have been identified, based on the magnitude of the extreme (100-year return period) wind velocity:

- **Level 1:** the extreme wind velocity is equal or less than 20 m(yd)/s and allows standard accommodation units (Portakabin type), containers and trailers to be adopted.
- **Level 2:** the extreme wind velocity lies between 20 m(yd)/s and 30 m(yd)/s and requires precautions to be taken. Technical guidance is given in the DEP for the precautions.
- **Level 3:** In cases where the extreme wind velocity is higher than 30 m(yd)/s, the detailed guidance in (3) and (4) shall be followed.

NOTE: The limit of 30 m(yd)/s has been chosen because it will cover the majority of locations and up to this wind speed simple solutions will ensure integrity.

For Level 1:

Units (containers and Portakabins) and trailers may be used, applying normal installation practice as specified by the Manufacturer, without additional requirements for extreme

winds up to Level 1. Adopt solutions in accordance with (Appendix 3), Figure 3.1 and Figure 3.2.

For Level 2:

For extreme winds within Level 2, the following precautions have to be taken:

- a) The units and trailers will have to be stabilized by means of concrete slabs or big bags. With trailers big bags can be attached, via cables, to the chassis or strong points on the cabin. The preference is to attach them to strong points on the cabin.
- b) The big bags could be filled with rock or sandbags. The weight will ensure the stability of the units and prevent them from rolling over.
- c) Units and trailers can be connected in pairs to increase stability.
- d) Alternatively, the units can be placed as a combination of three units on a steel sub-frame. This is a standard solution used in the field.
- e) Units and trailers can be placed in a row (recommended distance 1.5 m(yd)). It is recommended not to place more than 10 intermediate units between two stabilized units.
- f) Adopt solutions as per (Appendix 3), Figure 3.3 through Figure 3.7.

It is not recommended to place the units in close proximity in two directions because of the risk of spreading of fire. Further, the possibility shall be maintained to pull out a trailer from the row at any time.

For Level 3:

Design criteria and requirements for structural analysis are given in the following sections, to establish the engineering designs beyond the extreme wind velocity of 30 m(yd)/s.

3. DESIGN CRITERIA

3.1 SAFETY CRITICAL ELEMENTS

SCEs are those items of equipment or structures whose failure could lead to a major accident or whose purpose is to prevent or limit the consequences of a major accident.

Safety critical elements (SCEs) shall be:

1. defined or confirmed in the HAZID.
2. designed to satisfy key performance standards, e.g., withstand the extreme conditions.

This shall be discussed in the HAZID and action parties identified to address the agreed activities, e.g., meteorological specialists shall be consulted.

3.2 ENVIRONMENTAL CONDITIONS

3.2.1 General

The extreme environmental conditions shall be established for the camp location. For safety critical elements, extreme design conditions with a return period of 100 years should be defined separately to cover extreme situations for (amongst others) wind loading, rainfall, flooding and snow and winter storms.

It is advised to consult the local Meteorological office or a Metocean engineer to establish the extreme values of the environmental conditions at the location. It is also advised to seek local knowledge for instance regarding flood levels.

3.2.2 Wind conditions

The integrity of equipment and accommodation units on site shall be evaluated for the extreme (100-year return) environmental conditions. Phenomena to be considered are as follows:

Extreme wind velocity:

- 100-year return 10 minutes sustained wind speed at 10 m(yd) height for integrity of the overall unit
- 100-year return 3 seconds gust at 10 m(yd) height for small elements and fixings
- The wind velocities shall be determined in accordance with EN 1991-1-4.

Wind directionality shall be established for prevailing wind conditions and for extreme wind conditions.

Include associated rain and/or snow contribution as 1-year rain and 1-year snow.

3.2.3 Rain, flooding and snow

Extreme values of rainfall, snow and resulting flooding shall be determined:

- a) Rainfall: 100-year return interval maximum seasonal rainfall
- b) Flooding: 100-year return interval maximum flooding level in the area, with corresponding current velocities, if relevant.
- c) The accommodation units shall be placed at least 0.50 m(yd) above the design flood level.
- d) Snow: 100-year return interval maximum snow level
- e) Freezing rain

3.2.4 Earthquake conditions

Earthquake risks shall be addressed. The facilities critical to personnel safety shall be designed to withstand an earthquake event with a return period of 2500 years.

3.2.5 Landslides

The risk of landslides shall be addressed in a location assessment.

3.3 DESIGN CRITERIA FOR OPERATIONS

3.3.1 Transport

The feasibility of transport by road to the location shall be evaluated for the containers, accommodation units and trailers:

- Maximum dimensions of the units shall be verified with the local authorities
- Limitations of weight on roads and bridges along the transport route

Logistics experts shall be consulted for the transport operation.

The transportation operation and conditions shall be agreed with the Contractor and relevant design criteria and conditions assessed.

3.3.2 Lifting of units

The Portakabin type units and containers shall be capable of withstanding the lifting operations, where lifted units are used.

Normally the integrity of the padeyes of all units (containers and accommodation units) is to be confirmed for the lift weight multiplied with a factor of 1.25 for dynamic loading. Using the lift weight, an unequal split of the forces in the lifting slings shall be based on a ratio 75 % to 25 %.

For lifting operations reference is made to the lifting and hoisting standard EP 2005-0264-ST. Further information about lifting engineering can be found in API RP 2A-WSD.

4. STRUCTURAL INTEGRITY

4.1 DESIGN CONDITIONS

4.1.1 General

The integrity of the camp equipment shall be evaluated for all relevant design conditions. The design conditions should be derived from the risk evaluation. A design condition is a combination of relevant loading effects with an accepted probability of exceedance.

4.1.2 Extreme weather conditions – Wind

The facilities on the campsite (units, containers, trailers and equipment) shall be designed and analysed for extreme wind conditions, i.e., wind with associated rain and wind with associated snow, as defined in (3.2).

The analysis shall include considerations of minimum and maximum operating loads:

- For rolling/overturning stability of the container or accommodation unit use dead load only.
- For sliding stability of the container or accommodation unit use dead load only.
- For foundation stability use the unit dead load combined with maximum operating load, including snow load and appropriate ground water level.

The detailed analysis need only cover a campsite with extreme wind velocities corresponding to Level 3 of the technical guidance. For Levels 1 and 2, solutions from the technical guidance may be directly adopted.

4.1.3 Extreme weather conditions - Flooding

The facilities at the campsite shall be designed and analyzed for potential flooding.

The design and analysis shall cover the following considerations for flooding:

- A campsite shall preferably not be planned in an area with potential for flooding, e.g., in a wadi.
- If the intended location is in an area with potential flooding and cannot be altered, it is recommended to consult civil and meteorological engineering specialists on the risk mitigation measures (e.g., build a berm to place the units above flood level).
- For flooding the design flooding level and the corresponding currents shall be evaluated.

4.1.4 Earthquake design

For earthquake design, the following design condition shall be considered:

- Integrity of the accommodation units in seismic conditions. The unit shall survive the design earthquake, while allowing for ductility in the structure.
- Integrity of the foundation in seismic conditions. The foundation shall survive the design earthquake and accommodate the movements imparted on the structure by the design ground motions.

The seismic design conditions shall be determined in line with ASCE 7.

4.2 LOADING

4.2.1 Dead loads and operational loading

Dead loads and all operational loading shall be considered in the design.

Operational loading:

- Normal operational loading: UDL of 3.0 kN/m² (0.5 psi)
- Heavy operational loading: UDL of 5.0 kN/m² (0.7 psi)