

## Construction Industry Council CDM Guidance for Designers

Designing to make management of hazards associated with excavations easier

## Technical Guidance Note

# T 10.002

### INTRODUCTION

1. Designers can play a major part in making it easier to manage the hazards associated with excavations.
2. The most effective way of eliminating the hazards associated with excavations is to design excavations out. However, with current state-of-the-art foundations and drainage this is not possible. Therefore, designers should concentrate on not creating conditions, which increase the likelihood of the hazard occurring.
3. An incident in an excavation is often serious. Therefore, designers need to consider modifying their designs to ensure excavations can be eliminated or significantly reduced where it is reasonably practicable to do so.
4. This guidance note aims to make designers aware of the issues and gives information on how they can help to make excavation work safer through their designs.

### HAZARDS ASSOCIATED WITH EXCAVATIONS

5. The most common form of hazard associated with excavations is collapse of the sides, which often happen without warning. Excavations can collapse if:
  - a) The sides of the excavation are not sufficiently self-supporting;
  - b) Surcharges from spoil, adjacent foundations, stored materials, plant or temporary works-imposed loads overload the ground adjacent to an excavation;
  - c) Groundwater ingress reduces the strength of the ground and can lead to unexpected inundation of excavations;
  - d) Excavation supports are removed prematurely, to facilitate backfilling or compaction.
6. Other hazards of working in excavations include:
  - a) The presence of contaminants, which may be harmful to health, whose levels cannot always be assessed by sight or smell;
  - b) Gases migrating into excavations and creating explosive or poisonous atmospheres. Remember, excavations could be defined as confined spaces;
  - c) The presence of buried utility services;
  - d) The presence nearby of other excavations or other voids.

7. Work in an excavation may involve kneeling down to carry out a task and thus increase the hazard for the person(s) working in it, ie, what is a relatively shallow excavation becomes a “deep” one, simply because the person is completely within it.

### WHAT DESIGNERS SHOULD DO

8. Designers should give adequate regard to ensuring that an excavation can be constructed safely and that work required to be done in that excavation can also be carried out safely. Designers can help in making working in excavations safer in several ways including:
  - a) Avoidance of foreseeable risks in excavation work from the hazards listed in 5; or
  - b) Reducing the risks from the hazard; and
  - c) Providing sufficient information to allow persons in control of the excavation work to manage the hazard effectively;
  - d) Carrying out, or commissioning, a proper site investigation [SI] to determine whether the hazards listed in 6 could be significant.

### Designing to avoid foreseeable hazards

9. The risk of side slope collapse can only be avoided by not requiring excavations, thereby not creating slopes. While this is difficult to achieve, designers should consider alternatives to run-of-the-mill solutions, which require the excavation of a trench first. For example, they could consider:
  - a) Replacing retaining walls by bored contiguous piles, installed from the existing ground level;
  - b) Designing services so that their installation can be by the use of trenchless techniques, such as directional drilling;
  - c) Piling, where the ground is poor rather than excavating down to a level where the ground offers the required bearing strength.
10. The risks associated with hazardous materials [on contaminated sites] can be eliminated by designing to avoid excavations in contaminated areas, if it is possible to do so. However, if this is not possible and the installation lends itself to trenchless techniques, they should be given serious consideration. Remember that excavations can initiate the migration of contaminants, especially gases.
11. Similarly, where groundwater would be within designed excavation depths, avoid the requirement to excavate and give serious consideration to alternative techniques for foundations, if it is possible to do so.

12. Design trench supports to be stable without intermediate supports, if it is possible to do so.

13. Carry out proper site investigations to identify utilities and avoid, the need for excavating close to them, if it is possible to do so.

14. Excavating close to existing foundations is always hazardous. Therefore, designers should consider the effects of excavations on any adjacent structures and, if necessary, provide solutions, which would move excavations away from them, eg:

- a) By using cantilever foundations; or
- b) Bored piles;
- c) By routing drain and other service runs a safe distance away.

#### Designing to reducing the hazards

15. When it is not possible to eliminate excavations, designers should give consideration to design solutions, which would reduce the risks from the hazard.

#### Side collapse

16. Practical design solutions could include reducing the depth of the excavation by:

- a) Determining, as accurately as possible, the engineering properties of the ground and using this information to reduce the depth that any foundations have to be taken to;
- b) Designing foundations with the minimum depth by, for example, using reinforced bases, which are wider and thin, instead of deeper mass concrete ones;
- c) Minimising the depth of drainage runs by the use of back-drop manholes at connections into existing sewers;
- d) Not requiring destabilising processes, which may undermine the slope, eg, moving shear-toes for walls away from the foot of the slope;
- e) And, when space, site layout or other restrictions allow, the design of the permanent works should allow excavations to be located so that they can be constructed with safe side-slopes or batters, which do not require additional support. Where this is not possible, allow for sufficient working space to install effective temporary supporting works.

17. Where the design allows for items to be lifted into trenches, eg, drains and backfill, consider the position of the lifting device in relation to the excavations. Lifting devices need space - see General Information Series I 002 **Safe Working with Cranes**.

#### Reducing risks by reducing exposure to a hazard

18. The risks can also be reduced by minimising the time that people have to spend in an excavation. Therefore, designers should consider:

- a) Detailing work items so that they can be fabricated away from the excavation and lifted in, eg, reinforcement for bases, pc manhole rings, etc.

- b) Designing permanent shuttering, which can be left in place;
- c) Casting the concrete against natural ground.

#### Providing information to allow the risk to be managed

19. Designers, as appropriate, should pass onto the Planning Supervisor and the Contractor information about residual risks. This could, include:

- a) The location of utility services;
- b) The results of any site investigations [SI] – see 8(d) to allow the Contractor, to:
  - i) identify the nature of the ground [type and engineering properties], to allow proper design of the support works,
  - ii) locate hidden obstructions confirmed by the site investigation,
  - iii) assess whether groundwater could be a problem [it would be useful to know rate of seepage],
  - iv) assess whether there is a gas migration problem,
  - v) the extent, nature and concentrations [ppm, mg/ml, etc] of all ground contamination,
  - vi) information about stability of adjacent structures [including how close an excavation can come to them];
- c) The maximum depth of excavations;
- d) Any assumptions that the design is based on, eg, space allowed for plant;
- e) Maximum permissible surcharges;

#### USEFUL REFERENCES

HSG 185 Health and safety in excavations – *Be safe and shore* 0-7176-1563-5