



Expect the unexpected

Excavations are a necessary part of many projects. That makes it important to manage the risks associated with them – and designers play a key part in this process.

The two most common reasons for excavating a site are to lay foundations and install drainage works. Since these are two essential elements of many builds, it is rare that designers will be able to eliminate the risks associated with excavations.

What you can do, though, is adopt strategies that will limit the hazards associated with them. That way, you can make an inherently dangerous aspect of the construction process much less risky.

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The hazards

Side collapse

The biggest hazard associated with excavations is collapse of the sides. This often happens without warning, especially if:

- **The sides of the excavation are not sufficiently self-supporting**
- **The ground adjacent to the excavation is overloaded by surcharges from spoil, neighbouring foundations, stored materials, plant or temporary works**
- **Groundwater ingress reduces the strength of the ground (this can also lead the excavations to be inundated with water)**
- **Excavation supports are removed prematurely, to facilitate backfilling or compaction**

The risk of collapse is especially great when excavations are located close to existing foundations, other excavations or voids.

Other hazards

These include the risk of exposure to potentially harmful contaminants, whose levels cannot always be measured by sight or smell.

There is also a risk of gases migrating into excavations, and creating explosive or poisonous atmospheres. It is worth remembering that excavations are confined spaces, so suitable precautions need to be taken when workers are in them.

Buried utility services may pose a further hazard, if they are unexpectedly exposed by the excavation.

Moreover, consideration needs to be given to adjacent structures, which may be undermined or have their stability compromised by excavations.

Avoiding excavations

Designers should consider alternative construction and installation methods, to obviate the need to make an excavation on a site. For example:

- **Replace containing walls with bored contiguous piles, which can be installed from the existing ground level**
- **Design services to allow installation using trenchless techniques, such as directional drilling**
- **Make use of piling techniques on poor ground, rather than excavating down to a level where there is the required loadbearing strength**
- **Use cantilever foundations when excavations, if made, would be close to existing foundations**

Making excavations safer

Designers should help contractors to avoid foreseeable risks. One way of doing this is by ensuring that you provide detailed information about the site conditions – stating, for example, the proximity of other excavations and foundations.

Site investigations

You should either carry out, or commission, a detailed site investigation (SI) to determine whether the proposed excavation is hazardous. If it is, the contractor can then make appropriate arrangements to minimise the hazards.

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You may also consider providing information about the location of utility services, the maximum depth of excavations, and your design assumptions about load bearing and the location of plant. This information should be passed on to the contractor and the CDM coordinator.

Side collapse

You can adopt a number of practical design solutions to help mitigate the risk of side collapse in excavations:

- **Determine the engineering properties of the ground. Then use this information to reduce the depth to which foundations are taken**
- **Keep the depth of foundations to a minimum. You can do this by using reinforced bases that are wide and thin, instead of deeper mass concrete ones**
- **Minimise the depth of drainage runs by specifying back-drop manholes at connections into existing sewers**
- **Do not specify destabilising processes that may undermine the slope. For example, you should move shear-toes for walls away from the foot of the slope**
- **When space, site layout and other restrictions permit, you should design permanent works to allow any excavations to be constructed with safe side slopes or batters that do not require additional support. Where this is not possible, allow sufficient working space to install effective temporary supporting works**
- **If your design requires items, such as drains, to be lifted into excavations, carefully plan the position of the lifting device in relation to the trench. For more information see CON302.1 Crane information**

Exposure to contaminants and groundwater

Try not to specify excavations on contaminated ground. If this is not possible, consider using trenchless techniques to install services.

The same advice applies in relation to sites where groundwater is likely to be a hazard.

Try to minimise the amount of time workers have to spend in any excavation. This will reduce their exposure to harmful substances that may be present. You can do this by:

- **Specifying prefabricated work items like manhole rings and reinforcement for bases**
- **Designing permanent shuttering, so that it can be left in place**
- **Casting the concrete against natural ground**

What the site investigation tells you

A site investigation should provide the following information:

- **Details of the nature of the ground, including its engineering properties. This facilitates the design of support works**
- **The location of hidden obstructions on the site**
- **An assessment of whether groundwater could be a problem in excavations**
- **An assessment of whether there is likely to be a gas migration issue**
- **Full details of ground contamination**
- **Information about the stability of adjacent structures**



Don't spoil your site

The volume of soil increases by about 50 per cent once it is extracted from the ground. That means machinery will often be required to move spoil – posing a further risk to workers and the public, as well as bringing an additional project cost.

You should specify a means of removing spoil at an early stage in your project. This enables the contractor to plan for it, as well as ensuring its cost is accounted for.

If contaminants are found in soil that is to be excavated during a project, you may need to specify remediation processes that make it safe to store and move.

Useful resources

HSG 185 – Be Safe and Shore – Health and Safety in Excavations

See elsewhere on SID:

CON302.1 Crane information