

Site Construction

LEED Certification

Leadership in Environmental and Energy Design (LEED), a program spearheaded by the U.S. Green Building Council, provides guidance in many areas of building design.

They provide many recommendations to incorporate energy conservation, resource protection and renewable energy practices in **site design**

Existing Conditions

Boundaries

Topography

Site Remediation

Soil Mechanics

Demolition

Boundaries

A site has boundaries that are defined by a metes and bounds description or plat.

Boundaries (cont'd)

Metes and Bounds: A method of describing land (real property) using direction, distance and land features. The boundaries are described in a running prose style, working around the property from a point of beginning and returning back to the same starting point.

Boundaries (cont'd)

Plat: A drawing of a parcel of land (real property) drawn to scale, showing direction and distance of boundaries.

Boundaries (cont'd)

Distance is a relatively easy concept to understand. In Ohio, boundary descriptions are expressed in feet and decimal fractions of a foot. (i.e. 287.49 feet)

Inches and fractions of an inch, while frequently used to dimension buildings, are not used in boundary terminology.

Boundaries (cont'd)

Direction is normally expressed as a *bearing: the angle a line makes with the north or south meridian. It is formatted in degrees, minutes and seconds with compass points before and afterwards to indicate the compass quadrant.*

Topography

In order to build on a site, it is imperative that the designer understand the topography.

Topography: detail of the surface including relief or roughness of the land. Topographic maps usually include vegetation and the man-made features.

The relief or shape of the lands surface is indicated by contour lines: a line of equal elevation.

Site Remediation

Previous uses of a site may have contaminated the soil. An important environmental activity is to insure the site meets regulations of the Environmental Protection Agency (EPA).

Steps include:

- Sampling and Analysis

- Identifying hazardous materials

- Site Decontamination

 - Two common activities include

 - Soil Remediation

 - Underground Tank Removal

Soil Mechanics

Soil: Particles of broken rock that have been altered by chemical and environmental processes that include weathering and erosion

Particle Sizes (ASTM Standards):

Soil Type	Upper Size Limit	Lower Size Limit
Gravel	75mm (3")	4.75mm (0.2")
Sand	4.75mm	0.074mm
Silt and clay	0.074mm	none

Soil Mechanics (cont'd)

Depending on how nature deposited various amounts of these particles at any one location, soil can be identified as one of fifteen classifications.

Certain American Society for Testing and Materials (ASTM) tests can determine size of particles.

Coarse Soils, Sand

Broken from rock by mechanical means (weathering, earthquake etc)

Rounded shape

Incohesive – held together with frictional bond

Smaller void ratio than clays

Permeable

Easily compacted and consolidated

Changes behavior with addition of water from solid to liquid quickly

Generally not expansive

Fine Soils, Clay

Broken from rock by chemical means

Flat, flake like shape

Cohesive

Particles can be found in random orientation causing a large void ratio

Compressible

Difficult to consolidate (sponge like)

Can be totally impermeable

Can be expansive

Prone to change from solid to plastic to viscous with the addition of water

Soil Mechanics

Procedure:

Obtain soil samples as they exist on the site

Perform laboratory tests to determine the type of soil and its strength characteristics

As the site is prepared, field test the soil to be sure it meets laboratory test specifications

Demolition (cont'd)

Remove existing structures as required.

Small structures may be removed by hand.

Large structures may take some ingenious and creative methods.

Deconstruction, salvage and reuse of building materials is strongly recommended.

Demolition (cont'd)

Strip topsoil (store for reuse)

Topsoil is the uppermost layer of soil. It has the highest concentration of organic material from the decomposition of vegetation.

Demolition (cont'd)

Topsoil

Plants generally concentrate their roots in and obtain most of their nutrients from this layer

The organic material continues to decompose making this soil weak structurally

For these two reasons, topsoil is stripped off the footprint of a building, and is usually stored to used on areas that will have vegetation.

Earthwork

A site will seldom be shaped exactly as needed to construct a building. High spots (or hills) will have to be flattened. Low spots will have to be filled.

The operations required are:

Excavation

Embankment

Compaction

Erosion and Sedimentation Control

Foundation Construction

Earthwork (cont'd)

Excavation: The removal of earth to create the surface upon which the building is to be built. The word “cut” is often synonymous with the word excavation.

Earthwork (cont'd)

Embankment: Placing soil on the surface to raise it to the level upon which the building is to be built. The word “fill” is often used to describe this activity.

Compaction: The operations required to improve the strength of the soil so that it will support the building.

Earthwork (cont'd)

Sedimentation and Erosion Control:

Earthwork operations can expose raw soil that will be eroded from the site during rain and then deposited on adjacent sites downstream.

Efforts must be undertaken to avoid this problem.

The Ohio EPA has established standards that must be followed during earthwork operations.

Earthwork (cont'd)

Foundations: The structure that transfers the load (weight) of the building to the earth.

Foundation systems designs are tied directly to the strength of the soil.

Common types of foundation systems:

- Spread footings

- Piling

Exterior Improvements

Parking lots

Walkways

Vegetation

Irrigation Systems

Athletic Fields

Parking Lots

Most building sites will be required to provide off-street parking for automobiles.

Large campuses (i.e. colleges, hospitals etc.) may have large parking structures.

Parking Lots (cont'd)

Smaller commercial buildings may have a small surface lot.

Single family homes will be required to have one or two paved parking spaces.

Parking Lots (cont'd)

Number of required parking spaces for various uses are determined by zoning codes. (A retail store will have different requirements than a doctor's office).

Materials can range from simple crushed stone bases to asphaltic concrete or Portland cement concrete surfaces.

Large paved areas will generate large amounts of storm water runoff. Many new paving materials are being developed that allow absorption of the rain water.

Walkways

Walkways, like parking lots, can be constructed of a variety of hard surfaces.

Their purpose is to create a walking surface to connect points of interest for pedestrians.

Examples can be simple connectors of parking areas to buildings up to and including fitness walking trails developed on large campuses.

Vegetation

Buildings can be a beautiful work of art taking a variety of shapes exterior claddings can be endless.

BUT

Do not overlook the effect of the landscaping.

Trees

Shrubs

Ground Cover

Trees & Shrubs

Species of trees should be chosen to blend with their environment and compliment the building

Conifer (Evergreen)

Deciduous (Lose leaves during season changes)

Irrigation Systems

Along with planting attractive landscaping to compliment the site's appearance, consideration must be given to maintenance. Proper irrigation is critical.

Sources of water can be:

- Public water systems

- Private wells

- Reuse of rainwater collected from the site

- Reuse of "grey water"

LEED strongly advocates collection and reuse of rain water and "grey water" in irrigation systems.

Athletic Fields

Building owners have many reasons to incorporate athletic fields into their site design.

Golf Courses (may be the primary use of the site or simply a part of a larger site's amenity).

Competitive athletic fields

- Baseball - softball

- Football - soccer

- Track – cross country

Physical fitness trails

Athletic Fields (cont'd)

Physical fitness trails and athletic fields can have many surfaces

Natural

Artificial

Research the benefits and costs

Installation

Maintenance

Utilities

Storm Drainage Systems

Potable Water

Sanitary Sewage Disposal

Electric

Natural Gas

Communications

Storm Drainage Systems

Buildings and other site improvements will alter the effects of storm water runoff – probably increasing the amount.

Grading plans must be developed to assure water is directed away from buildings and other structures.

Storm sewer systems are often needed.

Storm Drainage (cont'd)

Detaining or retaining storm water are legal requirements

Detaining water is defined as temporarily storing rainwater so that the increased runoff has no ill effect on adjacent properties

Retaining water is collection of rainfall permanently in ponds or lakes

Retaining structures offers reuse of storm water:

Irrigation

Fire Protection

Potable Water

Occupants of buildings need clean water.

Sources:

On-site (Wells)

Public Systems (Networks of water lines that deliver clean, treated water to entire communities)

Sanitary Sewage Systems

Buildings must have the availability of a system to dispose of sanitary waste

On-site (Septic tanks)

Public systems (Sanitary sewers that deliver water to public treatment facilities)

Electric & Natural Gas

Electricity is a necessity in today's society. This is supplied by public distribution companies.

Natural gas is available in many areas of the State of Ohio.

Designers and owners must consider the availability and economic impacts of these utilities in the design and location of a building on a site.

Renewable Energy

Site design should not be limited to searching for the availability of existing power sources, but consideration should be given to the generation of heating, cooling and electrical resources on site:

Solar Energy

Wind Energy

Communications

Rapidly evolving methods of communication are affecting peoples' daily lives.

Good designers must make the impact of communications an integral part of the design process.

Are the necessary facilities for the technology available to the site?

Land lines? Cable? Cell?

Transportation

Streets

Driveways

Traffic Control

Streets

Streets may need to be constructed as part of a development to provide access to buildings.

Street design is usually completed by civil engineers.

The width of pavements (number of lanes) is an important traffic engineering design decision.

Proper attention must be paid to draining the pavement and disposing of the increased storm water runoff.

Streets (cont'd)

Street material can be rigid pavements or flexible pavements.

Both can be excellent pavement surfaces, but care must be exercised during construction in order to insure long life.

Streets (cont'd)

Rigid Pavements:

Portland cement concrete is the most common material considered as rigid pavement. The material makes an excellent surface on which to move traffic.

These materials have high compressive strength but very little flexural strength.

A sound base of soil is critical to the structural integrity of rigid pavements.

Streets (cont'd)

Flexible Pavements

Asphalt concrete (a mixture of sand, gravel and liquid asphalt) is considered a flexible pavement.

These pavements require sound soil bases but will deflect under pavement loads as long as the materials bond together.

Driveways

Access for vehicular traffic will probably be necessary to all buildings.

Driveways are the privately maintained pavement on a site.

Driveways can simply be the immediate access from a street to a parking area or a much longer access drives to buildings.

Driveways are constructed of paving materials used in streets.

Traffic Control

Proper control of traffic is a major safety issue.

Whether one is designing the movement of a few vehicles and limited pedestrian activity in a small parking lot or the control of large quantities of traffic on a major highway, proper traffic control devices must be incorporated into the site design.

Traffic Control Devices can range from electric traffic signals to signs.

Waterway Construction

Construction around large bodies of water (rivers, lakes, oceans) create a unique discipline of construction.

Construction operations and the completed buildings must be protected from nature's movement of water.