Graduate Certificate in Design and Analysis of Tall Buildings

Foundation Systems for High-Rise Construction

AASHTO stands for American Association of State Highway and Transportation Officials, which provides guidelines and standards for foundation systems, including those used in high-rise construction. The design of foundation systems for high-rise buildings requires careful consideration of various factors, including soil type, load-bearing capacity, and environmental conditions. Related terms include ACI, ASCE, and IBC.

ACI stands for American Concrete Institute, which provides guidelines and standards for concrete foundation systems, including those used in high-rise construction. The mix design of concrete is critical in foundation systems, as it must be able to withstand the loads and stresses imposed by the building. Related terms include AASHTO, ASCE, and IBC.

Active isolations refer to the use of specialized systems to isolate the foundation of a high-rise building from the surrounding soil, in order to reduce the transfer of seismic forces and other external loads. This can be achieved through the use of specialized materials and systems, such as viscoelastic dampers. Related terms include passive isolation, seismic design, and soil-structure interaction.

AISC stands for American Institute of Steel Construction, which provides guidelines and standards for steel foundation systems, including those used in high-rise construction. The design of steel foundation systems requires careful consideration of various factors, including load-bearing capacity, corrosion resistance, and constructability. Related terms include AASHTO, ACI, and ASCE.

Allowable stress refers to the maximum stress that a foundation system can withstand without failing or experiencing excessive deformation. The allowable stress is typically determined through a combination of theoretical calculations and experimental testing. Related terms include factor of safety, load-bearing capacity, and soil mechanics.

Anchors are specialized fasteners used to secure a foundation system to the surrounding soil or rock. Anchors can be used to resist uplift forces, shear forces, and other external loads. Related terms include foundation piles, guy wires, and soil nailing.

API stands for American Petroleum Institute, which provides guidelines and standards for foundation systems used in the oil and gas industry, including those used in high-rise construction. The design of foundation systems for oil and gas facilities requires careful consideration of various factors, including load-bearing capacity, corrosion resistance, and environmental conditions.

ASCE stands for American Society of Civil Engineers, which provides guidelines and standards for foundation systems, including those used in high-rise construction. The design of foundation systems requires careful consideration of various factors, including soil type, load-bearing capacity, and environmental conditions. Related terms include AASHTO, ACI, and IBC.

Axial load refers to the compressive or tensile force acting on a foundation system, typically in the vertical

direction. Axial loads can be caused by the weight of the building, as well as external forces such as wind and seismic activity. Related terms include bending moment, shear force, and torsion.

Bearing capacity refers to the maximum load that a foundation system can withstand without experiencing excessive settlement or failure. The bearing capacity is typically determined through a combination of theoretical calculations and experimental testing. Related terms include allowable stress, factor of safety, and soil mechanics.

Bending moment refers to the rotational force acting on a foundation system, typically caused by external loads such as wind and seismic activity. Bending moments can cause flexural stresses and deformations in the foundation system. Related terms include axial load, shear force, and torsion.

Bored piles are a type of deep foundation system, consisting of a cylindrical hole drilled into the soil or rock, filled with concrete, and reinforced with steel. Bored piles can be used to transfer loads to deeper, more stable soil or rock layers. Related terms include cast-in-place piles, driven piles, and foundation piles.

Cast-in-place piles are a type of deep foundation system, consisting of a hole drilled into the soil or rock, filled with concrete, and reinforced with steel. Cast-in-place piles can be used to transfer loads to deeper, more stable soil or rock layers. Related terms include bored piles, driven piles, and foundation piles.

Cement grout is a type of mortar used to fill the space between a foundation system and the surrounding soil or rock. Cement grout can be used to improve the bond between the foundation system and the soil, and to prevent water infiltration. Related terms include epoxy grout, foundation sealant, and soil stabilization.

Column bases are the foundation components that transfer the loads from a column to the surrounding soil or rock. Column bases can be designed to resist axial loads, bending moments, and shear forces. Related terms include footings, foundation piles, and mat foundations.

Concrete slab is a type of shallow foundation system, consisting of a thick layer of concrete poured over a prepared subgrade. Concrete slabs can be used to distribute the loads from a building to the surrounding soil. Related terms include foundation walls, footings, and mat foundations.

Constructability refers to the ease with which a foundation system can be built, considering factors such as site conditions, access, and labor requirements. Related terms include buildability, construction management, and project planning.

Deep foundations are foundation systems that extend below the surface of the soil or rock, typically to depths of 10-50 meters or more. Deep foundations can be used to transfer loads to deeper, more stable soil or rock layers. Related terms include shallow foundations, foundation piles, and caissons.

Design life refers to the expected lifespan of a foundation system, considering factors such as material durability, environmental conditions, and maintenance requirements. The design life of a foundation system can range from 50-100 years or more. Related terms include service life, durability, and maintenance.

Driven piles are a type of deep foundation system, consisting of a pre-fabricated pile driven into the soil or

rock using a pile driver. Driven piles can be used to transfer loads to deeper, more stable soil or rock layers. Related terms include bored piles, cast-in-place piles, and foundation piles.

Dynamic analysis refers to the study of the behavior of a foundation system under time-varying loads, such as seismic activity or wind. Dynamic analysis can be used to determine the response of a foundation system to external forces. Related terms include static analysis, seismic design, and soil-structure interaction.

Embedment depth refers to the distance between the top of a foundation system and the surrounding soil or rock. The embedment depth can affect the behavior of a foundation system, including its ability to resist external loads. Related terms include foundation depth, soil cover, and burial depth.

Environmental conditions refer to the external factors that can affect the behavior of a foundation system, including temperature, humidity, and soil chemistry. Environmental conditions can impact the durability and performance of a foundation system. Related terms include corrosion, durability, and maintenance.

Epoxy grout is a type of mortar used to fill the space between a foundation system and the surrounding soil or rock. Epoxy grout can be used to improve the bond between the foundation system and the soil, and to prevent water infiltration. Related terms include cement grout, foundation sealant, and soil stabilization.

Factor of safety refers to the ratio of the allowable stress to the actual stress in a foundation system. The factor of safety can be used to determine the reliability of a foundation system. Related terms include allowable stress, bearing capacity, and soil mechanics.

FEM stands for Finite Element Method, which is a numerical technique used to analyze the behavior of complex systems, including foundation systems. FEM can be used to simulate the response of a foundation system to external loads. Related terms include finite difference method, boundary element method, and computational mechanics.

Footings are the foundation components that transfer the loads from a building to the surrounding soil or rock. Footings can be designed to resist axial loads, bending moments, and shear forces. Related terms include column bases, foundation walls, and mat foundations.

Foundation depth refers to the distance between the top of a foundation system and the surrounding soil or rock. The foundation depth can affect the behavior of a foundation system, including its ability to resist external loads. Related terms include embedment depth, soil cover, and burial depth.

Foundation piles are a type of deep foundation system, consisting of a column-like structure that extends from the foundation to a deeper, more stable soil or rock layer. Foundation piles can be used to transfer loads to deeper, more stable soil or rock layers. Related terms include bored piles, cast-in-place piles, and driven piles.

Foundation walls are the vertical components of a foundation system that transfer the loads from a building to the surrounding soil or rock. Foundation walls can be designed to resist axial loads, bending moments, and shear forces. Related terms include footings, column bases, and mat foundations.

Geotechnical engineering refers to the branch of engineering that deals with the behavior of soil and rock,

including their properties, mechanics, and applications. Geotechnical engineering is critical in the design and analysis of foundation systems. Related terms include geology, soil mechanics, and rock mechanics.

Gravity loads refer to the weight of a building and its contents, which can cause compressive stresses in a foundation system. Gravity loads can be affected by factors such as soil density, water table, and foundation depth. Related terms include lateral loads, seismic loads, and wind loads.

IBC stands for International Building Code, which provides guidelines and standards for foundation systems, including those used in high-rise construction.

In situ testing refers to the process of testing the properties of soil or rock in their natural state, using techniques such as borehole logging and penetrometer testing. In situ testing can be used to determine the mechanical properties of soil and rock. Related terms include laboratory testing, field testing, and geotechnical engineering.

Lateral loads refer to the forces acting on a foundation system in the horizontal direction, typically caused by wind, seismic activity, or soil movement. Lateral loads can cause shear stresses and deformations in a foundation system. Related terms include gravity loads, seismic loads, and wind loads.

Load transfer refers to the process by which the loads from a building are transferred to the surrounding soil or rock. Load transfer can occur through various mechanisms, including friction, end-bearing, and soil-structure interaction. Related terms include load-bearing capacity, foundation depth, and soil mechanics.

Load-bearing capacity refers to the maximum load that a foundation system can withstand without experiencing excessive settlement or failure. The load-bearing capacity is typically determined through a combination of theoretical calculations and experimental testing.

Mat foundations are a type of shallow foundation system, consisting of a large, thick slab that distributes the loads from a building to the surrounding soil. Mat foundations can be used to transfer loads to the soil, while minimizing settlement and deformation. Related terms include footings, foundation walls, and concrete slab.

Micropiles are a type of deep foundation system, consisting of a small-diameter pile that is drilled and grouted into the soil or rock. Micropiles can be used to transfer loads to deeper, more stable soil or rock layers. Related terms include foundation piles, bored piles, and cast-in-place piles.

Numerical analysis refers to the use of computational methods to simulate the behavior of a foundation system, including its response to external loads. Numerical analysis can be used to determine the stress, strain, and deformation of a foundation system. Related terms include finite element method, finite difference method, and boundary element method.

Passive isolation refers to the use of specialized systems to isolate the foundation of a high-rise building from the surrounding soil, in order to reduce the transfer of seismic forces and other external loads. Passive isolation can be achieved through the use of viscoelastic materials and systems. Related terms include active isolation, seismic design, and soil-structure interaction.

Pile cap is a type of foundation component that transfers the loads from a group of piles to a single point, such as a column or footing. Pile caps can be designed to resist axial loads, bending moments, and shear forces.

Pile group refers to a cluster of piles that work together to transfer the loads from a building to the surrounding soil or rock. Pile groups can be used to increase the load-bearing capacity of a foundation system.

Raft foundations are a type of shallow foundation system, consisting of a large, thick slab that distributes the loads from a building to the surrounding soil. Raft foundations can be used to transfer loads to the soil, while minimizing settlement and deformation.

Reinforced concrete is a type of construction material that consists of concrete reinforced with steel rebar. Reinforced concrete can be used to create strong and durable foundation systems, including footings, foundation walls, and mat foundations. Related terms include prestressed concrete, post-tensioned concrete, and fiber-reinforced concrete.

Seismic design refers to the process of designing a foundation system to resist seismic forces and other external loads. Seismic design requires careful consideration of various factors, including soil type, load-bearing capacity, and seismic hazard. Related terms include seismic loads, seismic analysis, and soil-structure interaction.

Seismic loads refer to the forces acting on a foundation system during an earthquake, typically caused by ground shaking and soil movement. Seismic loads can cause compressive and shear stresses in a foundation system. Related terms include gravity loads, lateral loads, and wind loads.

Shallow foundations are foundation systems that do not extend below the surface of the soil or rock, typically to depths of less than 10 meters. Shallow foundations can be used to distribute the loads from a building to the surrounding soil. Related terms include deep foundations, footings, and mat foundations.

Shear force refers to the force acting on a foundation system in a direction parallel to the surface of the soil or rock. Shear forces can cause deformations and stresses in a foundation system. Related terms include axial load, bending moment, and torsion.

Soil mechanics refers to the branch of engineering that deals with the behavior of soil, including its properties, mechanics, and applications. Soil mechanics is critical in the design and analysis of foundation systems. Related terms include geotechnical engineering, rock mechanics, and foundation engineering.

Soil-structure interaction refers to the process by which a foundation system interacts with the surrounding soil or rock, including the transfer of loads and the effects of external forces. Soil-structure interaction can be complex and nonlinear, requiring advanced analysis and modeling techniques. Related terms include seismic design, dynamic analysis, and foundation engineering.

Spread footings are a type of shallow foundation system, consisting of a wide, shallow footing that distributes the loads from a building to the surrounding soil. Spread footings can be used to transfer loads

to the soil, while minimizing settlement and deformation.

Static analysis refers to the study of the behavior of a foundation system under static loads, such as gravity and lateral forces. Static analysis can be used to determine the stress, strain, and deformation of a foundation system. Related terms include dynamic analysis, seismic design, and soil-structure interaction.

Steel piles are a type of deep foundation system, consisting of a steel column-like structure that extends from the foundation to a deeper, more stable soil or rock layer. Steel piles can be used to transfer loads to deeper, more stable soil or rock layers.

Structural integrity refers to the ability of a foundation system to maintain its shape and resist external forces, while minimizing damage and deformation. Structural integrity is critical in ensuring the safety and performance of a high-rise building.

Torsion refers to the twisting force acting on a foundation system, typically caused by external loads such as wind and seismic activity. Torsion can cause shear stresses and deformations in a foundation system. Related terms include axial load, bending moment, and shear force.

Underpinning refers to the process of modifying or repairing an existing foundation system, typically to increase its load-bearing capacity or improve its structural integrity. Underpinning can be used to address foundation problems, such as settlement and cracking. Related terms include foundation repair, foundation modification, and retrofitting.

Wind loads refer to the forces acting on a foundation system due to wind, typically causing lateral and uplift forces. Wind loads can be affected by factors such as wind speed, direction, and turbulence. Related terms include gravity loads, lateral loads, and seismic loads.

X-ray computed tomography is a non-destructive testing technique used to inspect the internal structure of a foundation system, including its material properties and defects. X-ray computed tomography can be used to evaluate the condition and integrity of a foundation system. Related terms include radiography, ultrasonic testing, and acoustic emission testing.

Yield strength refers to the stress at which a foundation material begins to deform plastically, typically marking the transition from elastic to plastic behavior. Yield strength is an important parameter in the design and analysis of foundation systems. Related terms include ultimate strength, strain hardening, and ductility.

Zero maintainence refers to the concept of designing a foundation system to require minimal or no maintenance, typically through the use of durable materials and robust construction techniques. Zero maintenance can be achieved through careful design, construction, and inspection of a foundation system. Related terms include durability, reliability, and lifespan.