SITE PLANNING & DESIGN

OVERVIEW

DIVISION STATEMENT
The application of knowledge and skills of site planning and design including environmental, social, and economic issues, project and practice management.

Content Areas

1. PRINCIPLES  
   (22-30 percent of scored items)

2. ENVIRONMENTAL ISSUES  
   (24-32 percent of scored items)

3. CODES & REGULATIONS  
   (18-26 percent of scored items)

4. MATERIALS & TECHNOLOGY  
   (16-20 percent of scored items)

5. PROJECT & PRACTICE MANAGEMENT  
   (4-8 percent of scored items)

Vignettes

SITE GRADING  
Modify a site’s topographical characteristics responding to programmatic and regulatory requirements.

SITE DESIGN  
Design a site, including building placement, parking, and vehicular and pedestrian circulation, responding to programmatic, functional, environmental, and setback requirements utilizing general site planning principles.
SITE PLANNING & DESIGN

The division has been broken down into a listing of knowledge and skills directly related to each major content area.

1. **PRINCIPLES**
   
   (22-30 percent of scored items)

   A. Review and assess sites. Incorporate the implication of human behavior, historic precedent, and design theory in the selection of systems, materials, and methods related to site design and construction.

   1. **Site Planning**
      
      Use physical, contextual, and regulatory characteristics, in combination with programmatic requirements, to evaluate project sites.

   2. **Site Design and Design Principles**
      
      Use site evaluation data and programmatic requirements to develop and evaluate alternative site designs.

   3. **Implications of Design Decisions**
      
      Use architectural, engineering, and construction principles and procedures to evaluate site design.

   4. **Adaptive Reuse of Buildings and/or Materials**
      
      Apply principles for adaptive reuse of facilities and materials to site design.

   5. **Architectural History and Theory**
      
      Analyze and evaluate the project site with respect to its regional, local, and site-specific historical context.

2. **ENVIRONMENTAL ISSUES**

   (24-32 percent of scored items)


   1. **Interpreting Existing Site/Environmental Conditions and Data**
      
      Assess site layout and proposed materials and systems with respect to environmental context.

   2. **Design Impact on Human Behavior**
      
      Assess site layout and proposed materials and systems with respect to human behavior, safety, and security.

   3. **Hazardous Conditions and Materials**
      
      Assess the site with respect to the presence of hazardous conditions and materials, and identify mitigation options.

   4. **Sustainable Design**
      
      Identify and apply sustainable strategies and technologies to site layout and selection of materials and systems.

   5. **Alternative Energy Systems and New Material Technologies**
      
      Identify and apply alternative energy systems and new material technologies to site layout and selection of materials and systems.
3. **CODES & REGULATIONS**  
(18-26 percent of scored items)  

A. Incorporate building codes, specialty codes, zoning and other regulatory requirements in site design and construction.  

1. **Government and Regulatory Requirements and Permit Processes**  
Identify and apply relevant land use, building codes, and regulations into the site design, and assist in permitting.  

2. **Accessibility Laws, Codes and Guidelines**  
Identify and apply relevant specialty codes and regulations into the site design, and assist in permitting.  

4. **MATERIALS & TECHNOLOGY**  
(16-20 percent of scored items)  

A. Analyze the implication of design decisions in the selection of systems, materials, and methods incorporated in site design and construction.  

1. **Construction Details and Constructability**  
Incorporate appropriate materials into site details, systems, and assemblies.  

2. **Construction Materials**  
Evaluate and select appropriate site products, materials, and systems based on programmatic, performance, and sustainability requirements.  

3. **Fixtures, Furniture, Equipment, and Finishes**  
Evaluate and select appropriate site fixtures, furniture, equipment, and finishes based on programmatic and performance requirements.  

4. **Thermal and Moisture Protection**  
Manage the impact of temperature, water, and climatic conditions on site design.  

5. **Natural and Artificial Lighting**  
Apply principles of natural and artificial lighting in site design.  

6. **Implications of Design Decisions**  
Use architectural, engineering, and construction principles and procedures to evaluate site materials, assemblies, and systems.  

5. **PROJECT & PRACTICE MANAGEMENT**  
(4-8 percent of scored items)  

A. Assess and administer site design, including construction sequencing, scheduling, cost, and risk management.  

1. **Construction Sequencing**  
Determine site phasing based upon prioritized programmatic requirements and anticipated construction sequencing.  

2. **Cost Estimating, Value Engineering, and Life-cycle Costing**  
Analyze site development costs relative to programmatic and budgetary requirements.
1. Which of the following is generally NOT given in a written subsurface investigation report?
   - Results of field tests
   - Results of laboratory tests
   - Recommended types of foundations
   - Soil sieve analysis

2. Which of the following defines the sudden loss of shearing resistance in a cohesionless soil?
   - Plasticity
   - Liquefaction
   - A collapsing soil
   - An expansive soil

3. The purpose of the element X in the diagram above is to
   - Increase hydrostatic pressure on the wall
   - Reduce hydrostatic pressure on the wall
   - Maintain uniform hydrostatic pressure on the wall
   - Decrease vapor pressure in the basement room

4. A measure of the ease with which a particular fluid flows through the voids of a soil is called
   - Permeability
   - Compressibility
   - Osmosis
   - Cohesion

5. The diagrams above indicate which of the following about the relationship between wind and the mass of high-rise buildings?
   - Wind acts the same on all vertical surfaces regardless of mass and material differentiation.
   - More wind turbulence is created at the street level of wide, smooth-surfaced facades.
   - Wind turbulence is increased at street level by stepped building forms.
   - Wind turbulence is of minimum concern in the relationship between high-rise buildings and the street.
6. Building failure can often be traced to unstable subsoil conditions. Which of the following subsurface conditions is likely to cause differential settlement of building foundations?
   - Large beds of clay contained in gravel
   - Small boulders dispersed in gravel
   - Stratified rock
   - A deep layer of dry sand and gravel

7. In a residential development composed of large building lots, on-site sewage disposal for each lot is permitted subject to the suitability of the soil. Which of the following soil investigations should the architect request?
   - Percolation test
   - Evaporation test
   - Test for soil alkalinity
   - Test for soil density

8. Which of the following would be the best design-with-climate strategy in the layout of a new town in a cool region such as Winnipeg or Minneapolis?
   - The town structure should be densely grouped; larger building units may be grouped close together but spaced to utilize sun-heat effects, and the layout should provide a sheltering effect against winds.
   - The preferred design is an open and free layout of buildings that tend to merge with nature.
   - The town structure should be dense and provide shade, and unit dwellings or groups of buildings should create court-like areas.
   - Buildings should be separated to utilize air movements, and the character of the town fabric should be loose and scattered.

9. Which of the following loads defines the force fluids exert on structures?
   - Hydrostatic
   - Dynamic
   - Water
   - Wedge

10. Assume a project site of 50,000 square feet of land area and 10,000 square feet of gross building floor area. At a ratio of 3 square feet of parking area to 1 square foot of gross building area, how many parking spaces are required at 400 square feet per car?

11. Easements are generally placed on private property to accommodate which of the following?
   - Daylight
   - Landscaping
   - Access
   - Setbacks

12. The characteristic of an existing structure that will directly affect the thermal environment of adjacent new construction is its
   - mechanical systems
   - texture
   - shadow pattern
   - footprint
13. Costs for cutting and filling earth on site are typically calculated by which of the following?
   - Square yards
   - Cubic yards
   - Acres
   - Tonnage

17. Land use restrictions imposed by local governmental authorities include all of the following EXCEPT
   - set backs
   - covenants
   - height and area limitations
   - zoning

14. The most important factor for locating a new retail center is
   - accessibility to market area traffic
   - the availability of utilities
   - a well-drained level site
   - its proximity to employment zone areas

18. All of the following are considered land use restrictions EXCEPT
   - height and area limitations
   - accessibility regulations
   - zoning ordinances
   - set back regulations

15. In cold climates, vapor barriers are desirable below attic insulation because they
   - minimize moisture migration
   - serve as secondary waterproofing
   - support the insulation
   - provide protection from insect infestation

19. Foundation design in northern climates can require footings to be as deep as 5 feet below grade for which of the following reasons?
   - Protect against snow drifts
   - Rest on undisturbed soil
   - Be below frost level
   - Resist earthquakes

16. The process of stripping existing vegetation from a site can cause
   - pollution
   - disorientation
   - defoliation
   - erosion

20. The practice of balancing cut and fill is used in
   - site grading
   - sediment control
   - land reclamation
   - footing excavation
21. A roof overhang on which of the following façades of a building built in the northern hemisphere will provide seasonal adjustment for solar radiation?
   - North
   - South
   - East
   - West

22. Assuming a constant slope between the two contour lines shown, what is the elevation of point A?
   - 70.25 ft
   - 71.25 ft
   - 72.50 ft
   - 73.25 ft

23. What is the term for the boundaries, property lines, or limits of a parcel of land, as defined by distances and compass bearings?
   - Chaining
   - Datum
   - Benchmarks
   - Metes and bounds

24. Since contamination in soil typically leads to groundwater contamination, which of the following cleanup technologies can be used to remediate the unsaturated zone?
   - Vapor extraction
   - Biodegradation
   - In situ incineration
   - Photolysis

25. Which of the following technologies is most commonly used in groundwater remediation projects?
   - Extraction/treatment
   - In situ aeration
   - Biological barriers/filters
   - Gas chromatography

26. After sight, which of the following senses is primary to conveying information about a site?
   - Touch
   - Hearing
   - Smell
   - Taste

27. The development potential of a parcel of land can be affected by the presence of all of the following EXCEPT
   - wetlands
   - endangered species
   - acid rain
   - hazardous waste
28. Zoning ordinances promote social vitality within a city when they include
   - strict zoning by land-use category
   - high-rise buildings in a park-like setting
   - mixed use and overlay zoning
   - flexible car-parking ratios

29. Which of the following is the most important factor in orientation of residential units?
   - Bedrooms should face away from harsh winds.
   - As many units as possible should be entirely masked from breezes.
   - West facing units are at a premium.
   - Each unit should receive sun for at least part of a winter day.

30. Restrictive covenants are typically developed on behalf of
   - property owners
   - city officials
   - design professionals
   - civil engineers

31. The term “right-of-way” is used to describe
   - the right to have first opportunity to purchase real estate when it becomes available
   - the right of taking of land by entering on it in a peaceable manner
   - a right belonging to a party to pass over land of another
   - a right to cross a picket line during a strike

32. A nonconforming but legal structure that existed prior to the enactment of a land use ordinance is said to be
   - an easement
   - dedicated
   - aggrieved
   - grandfathered

33. Which of the following is correct concerning residential zoning adjacent to a typical central business district?
   - It should be prohibited because land costs are too high.
   - It should be maintained as a viable community asset.
   - All substandard existing units should be converted to commercial use.
   - Future units should be available to low-income and elderly families only.

34. Topography is the most critical criterion when routing which of the following utility lines?
   - Water
   - Electrical
   - Natural gas
   - Storm sewer
35. On which of the proposed sites would the use of solar energy be most limited?
   - Site A
   - Site B
   - Site C
   - Site D

36. Water-detention areas are used primarily for which of the following?
   - To create swimming and recreation areas
   - To provide aesthetically pleasing vistas
   - To control surface water runoff
   - To act as reservoirs in periods of drought

37. Which of the following is NOT considered an environmental impact issue for site analysis?
   - Reflections
   - Air movement
   - Archeological finds
   - Sun and shadow patterns

38. Increased moisture content in bearing soils can have which of the following effects? Check the two that apply.
   - Change in volume
   - Reduction in bearing capacity
   - Increased cohesion
   - Decreased compatibility

39. Methods to reduce potential vertical movement to a proposed building due to expansive clay soil conditions would include the following? Check the four that apply.
   - Over-excavate below footing grade and fill with compacted gravel.
   - Waterproof the foundation to reduce filtration
   - Extend footings and foundations to a depth of consistent ground moisture
   - Drain surface water away from building foundation
   - Plant trees near the building to stabilize the ground
   - Control roof water runoff
SITE PLANNING & DESIGN

SAMPLE MULTIPLE-CHOICE ANSWERS

1. Soil sieve analysis
2. Liquefaction
3. reduce hydrostatic pressure on the wall
4. permeability
5. More wind turbulence is created at the street level of wide, smooth-surfaced facades.
6. Large beds of clay contained in gravel
7. Percolation test
8. The town structure should be densely grouped; larger building units may be grouped close together but spaced to utilize sun-heat effects, and the layout should provide a sheltering effect against winds.
9. Hydrostatic
10. 75
11. Access
12. shadow pattern
13. Cubic yards
14. accessibility to market area traffic
15. minimize moisture migration
16. erosion
17. covenants
18. accessibility regulations
19. Be below frost level
20. site grading
21. South
22. 71.25 ft
23. Metes and bounds
24. Vapor extraction
25. Extraction/treatment
26. Hearing
27. acid rain
28. mixed use and overlay zoning
29. Each unit should receive sun for at least part of a winter day
30. property owners
31. a right belonging to a party to pass over land of another grandfathered
32. It should be maintained as a viable community asset.
33. Storm sewer
34. Site C
35. To control surface water runoff
36. Archeological finds
37. Change in volume; Reduction in bearing capacity
38. Over-excavate below footing grade and fill with compacted gravel; Extend footings and foundations to a depth of consistent ground moisture; Drain surface water away from building foundation; Control roof water runoff
SITE GRADING VIGNETTE

General Tips for Taking Site Grading

Directions
On the work screen you will see a topographic representation of an existing site that is to have a built object placed on it and the site regraded. The tools available will allow you to place the built object and manipulate and identify contour lines. Your completed work should show the placed built object and should show the site plan with contours that will successfully allow water to flow from the site in accordance with the program and site conditions.

Before beginning your solution, you should review the program that can be accessed through the Vignette Index screen and familiarize yourself with the site plan on the work screen.

Program
A steam engine Locomotive Display is to be located within a fenced area in a city park. The park is surrounded by private properties on all sides.

1. Place the Locomotive Display on the site within the building limit lines.
   - Regrade the site to create a level area for the Locomotive Display.
   - Indicate the finish floor elevation of the Locomotive Display. The finish floor elevation must be 6” above the nearest contour line.

2. Regrade the site so that water will flow around and away from the Locomotive Display.
   - The slope of the regraded portions of the site shall be at least 2 percent and no more than 20 percent.
   - Contour lines between property lines and building limit lines may be manipulated.

3. The existing smokestack, rocks, and trees shall not be disturbed.

4. Changes in site topography not required for proper drainage should be avoided.
This solution shows a clean, simple answer to the problem presented. The program requires that water be directed around and away from the Locomotive Display, while leaving the smokestack and trees undisturbed. The candidate has created a level pad for the Locomotive Display and properly set the finish floor elevation. The sketch tool was used here to lay out the swales (not required, but a good method for locating swales). Using the sketch lines as a guide, the existing contours were altered to provide a level pad for the Locomotive Display and swales to divert the water running downhill from the east side of the site.
This solution is laid out similarly to the passing solution, except that the swales are drawn as berms. While berms may prevent some surface water from reaching the Locomotive Display, they also direct water that falls between the berms toward the Locomotive Display. Additionally, the candidate has not created a level pad for the Locomotive Display.
General Tips for Taking Site Design

Directions
You have been assigned the task of developing a schematic site plan based on a program that includes legal requirements and other site influences.

The plan on the screen presents a site on which to place buildings, related site elements, and vegetation in relation to orientation and environmental conditions. You are to use the tools provided to develop your solution. On the plan you are required to draw and locate:

- Two buildings
- An outdoor space
- Vehicular access and service drives
- Required parking spaces
  - Only spaces drawn with the “Handicap Spaces” tool will be counted as universally accessible spaces.
- Pedestrian walkways
- Vegetation

Before beginning your solution, you should review the program that can be accessed through the Vignette Index screen and familiarize yourself with the site plan on the work screen.
SITE PLANNING & DESIGN

SITE DESIGN VIGNETTE

Program
Design an environmentally responsive site plan that meets all of the client’s requirements given below.

A developer plans to build a 5-story, 60 ft high Office Tower; a 1-story, 20 ft high Restaurant; a Pedestrian Plaza; and parking to serve the new buildings.

1. The Office Tower and the Pond shall be no more than 125 ft apart.
   ▶ The main entrance shall be visible from Bentley Avenue.

2. The Restaurant and the Office Tower shall be at least 210 ft apart.

3. The Pedestrian Plaza is to be 8,000 ft².
   ▶ Locate the Pedestrian Plaza within the building limit lines so that the main entrance to the Office Tower opens directly onto the Pedestrian Plaza.

4. The view of the service entrance on the Restaurant shall be blocked from the Pedestrian Plaza.
   ▶ The view of the service entrance shall be blocked by buildings and/or trees, as appropriate.

5. The Restaurant shall have a view of the Pond.

6. The Pedestrian Plaza shall receive the noonday summer sun.
   ▶ Assume a 45° solar altitude angle.

7. The Pedestrian Plaza shall be blocked from the prevailing winter winds.
   ▶ The wind shall be blocked by buildings and/or trees, as appropriate.

8. Draw a total of 33 parking spaces.
   ▶ 30 standard (9 ft x 18 ft) parking spaces are required.
   ▶ 3 universally accessible (12 ft x 18 ft) parking spaces are required.
   ▶ Locate the universally accessible parking spaces within 100 ft of the main entrance of the Office Tower.
   ▶ All parking spaces shall be perpendicular to the traffic aisles.
   ▶ No parallel parking is permitted.

9. Draw all traffic aisles and drives required to connect parking to the street.
   ▶ Drive-through circulation is required.
   ▶ Dead-end parking is prohibited.
   ▶ Parking along the service drive is prohibited.
   ▶ All drives and traffic aisles are automatically drawn at a width of 24 ft.
   ▶ The intersection of the access drive with the street must be perpendicular to the street for at least the first 20 ft of the drive.

10. Provide only one 24 ft wide curb cut located no closer than 120 ft from the intersection of the centerlines of the two existing public streets.

11. Draw vehicular circulation to access the parking and service entrance.
    ▶ A service drive shall attach to the service entrance of the Restaurant.
    ▶ A turnaround or drive-through circulation is not required for the service drive.
12. Connect the Pedestrian Plaza, the universally accessible parking spaces, and the main entrances of the two buildings to each other and to the existing public walk with a continuous walkway system.
   - The Pedestrian Plaza may be considered part of the walkway system.

13. Adhere to the following general conditions:
   - Paving on the site shall be minimized.
   - Drives, traffic aisles, and parking spaces shall be no closer than 5 ft to a building.
   - Buildings must be separated by a minimum of 20 ft.
   - Provide a 30 ft setback from the Pond for all construction or built improvements.
   - No more than 6 existing trees may be removed or disturbed.
   - No construction or built improvements of any kind shall occur over any other existing site feature.
   - No construction or built improvements of any kind shall occur outside the building limit line except for direct vehicular and pedestrian access.
   - Buildings shall not overlap the Pedestrian Plaza or parking.
This solution incorporates all of the program requirements into a workable design. The Office Tower is located near the Pond with the main entrance visible from Bentley Avenue. The Restaurant is located an appropriate distance away from the Office Tower and has a view of the Pond. The service entrance of the Restaurant is shielded from the Pedestrian Plaza by the addition of evergreen trees. The Pedestrian Plaza receives full noonday summer sun as required. The Pedestrian Plaza also connects to the main entrance of the Office Tower and connects the Tower, the Restaurant, parking area and other walkways. The curb cut for the driveway is located far enough from the intersection of the roads and the required setback from the Pond is maintained. One of the most important program items in this vignette is the requirement for a drive-through circulation pattern. This solution shows a well-designed, efficient layout that adequately meets that requirement.
This solution generally follows the program requirements, but falls short in a few critical areas. First, the corner of the Office Tower is located within the required 30-foot setback from the Pond. The building locations and paved areas also require the removal of seven trees, which exceeds the program's general conditions. The accessible parking was not created with the “Handicap Spaces” tool. Another problem is the missing perpendicular segment of the entrance drive.

Warnings
- In order to connect your driveway to any other driveway or road, the dashed centerline of your road must connect to the dashed centerline of the other road.
- Walkways must be attached to elements where a connection is required.
- Only spaces drawn with the “Handicap Spaces” tool will be counted as universally accessible spaces.

Tools You Might Find Useful
- Zoom to adjust driveways or walkways
- Sketch line tool to align and measure spaces and to determine clearances since the length of the line is displayed in the element information area at the bottom of the work screen
References
The references are presented as a guide in preparing for the examination. It was developed by the committee that prepares the examination. They are not intended to be an exhaustive list of all possible reference materials for the subject area of any given division. NCARB makes no guarantee that the various references are currently in print.

- **The Architect’s Handbook of Professional Practice**
  Joseph A. Demkin, AIA, Executive Editor
  The American Institute of Architects
  John Wiley & Sons, latest edition

- **Architectural Graphic Standards**
  The American Institute of Architects
  John Wiley & Sons, latest edition

- **Cracking the Codes: An Architect’s Guide to Building Regulations**
  Barry D. Yatt
  John Wiley & Sons, 1998

- **Dictionary of Architecture and Construction**
  Cyril Harris
  McGraw-Hill, latest edition

- **Landscape Architectural Graphic Standards**
  Leonard J. Hopper, Editor
  John Wiley & Sons, 2007

- **Mechanical & Electrical Equipment for Buildings**
  Walter T. Grondzik, Alison G. Kwok, Ben Stein, and John S. Reynolds, Editors
  John Wiley & Sons, latest edition

- **Site Engineering for Landscape Architects**
  Steven Strom, Kurt Nathan, and Jake Woland, Editors
  John Wiley & Sons, latest edition

- **Site Planning, Third Edition**
  Kevin Lynch and Gary Hack
  MIT Press, 1984

- **Site Planning & Design Handbook**
  Thomas H. Russ
  McGraw-Hill, latest edition

- **Sustainable Construction: Green Building Design and Delivery**
  Charles J. Kibert
  John Wiley & Sons, 2005