



## **Green Roof Professional (GRP) Accreditation**

### **Exam Study Guide**

#### **Organization Background**

In 1999, Green Roofs for Healthy Cities (GRHC), a small network consisting of public and private organizations, was founded as a direct result of a research project on the benefits of green roofs and barriers to industry development. In 2004 GRHC was incorporated as a 501(c)(6) and is now a rapidly growing not for profit industry association working to promote the green roof industry throughout North America

#### **GRHC Mission**

Green Roofs for Healthy Cities' mission is to increase the awareness of the economic, social, and environmental benefits of green roof infrastructure across North America and rapidly advance the development of the market for green roof products and services.

Although the current market does not value many of the tangible public and private benefits of green roofs to their full potential, we are striving to facilitate changes that will bring green roof technologies to the forefront of high performance green building design, implementation and maintenance. The development of the green roof market requires that we:

- Research the public and private community building and community-wide benefits of green roofs in various cities and climate zones across North America.
- Develop and provide value added products and services to our *Corporate, and Individual* membership base.
- Engage a wide variety of stakeholders and educate the general public on the many social, economic and environmental benefits of green roof infrastructure.
- Establish cost effective public policies to recognize the public benefits and fund the widespread implementation of roofs thereby helping to reduce the higher upfront capital costs associated with green roof technology.
- Develop professional training and accreditation courses to facilitate excellence in green roof design, implementation and maintenance.
- Facilitate the international exchange of information on policies, products, science and research.



## Occupational Standards

The first step in the process of establishing a Green Roof Professional (GRP) accreditation was completed in January of 2007 when a group of 16 subject matter experts met in Toronto for a two-day work session. Their deliberations resulted in the development of a set of Occupational Standards for an accredited Green Roof Professional (GRP). These standards identify the specific skills and knowledge, across a number of professions, required to become a GRP. The Occupational Standards are used to inform all of our courses and provide the basis for the exam.

During the Occupational Analysis process, it was determined that *Green Roof Professionals* will come from any number of professional backgrounds, including architects, landscape architects, landscape designers, engineers, contractors, horticulturalists, manufacturers, and roofing consultants, to name a few. *Green Roof Professionals* may:

- Identify and pull the project team together.
- Function as a team leader for the green roof portion of a project.
- Understand the different options for green roof design and implementation.
- Maximize the benefits of green roofs during the design process (e.g., by identifying multiple design and implementation opportunities).
- Understand the major challenges and best practices associated with green roof design, installation and maintenance.

Subsequent work sessions of the Occupational Analysis Steering Committee were conducted in consultation with Prometric Services for examination development and security.

## Accreditation Objectives

The Green Roof Professional (GRP) designation does not imply comprehensive knowledge applicable to all of the challenges facing this rapidly emerging industry. It does not provide any guarantee of professional competency, which is the responsibility of agencies that provide licensure for professionals.

Successful green roofs require a combination of knowledge and expertise in the so-called 'black arts' and 'green arts'. The 'black arts' focus on the critical, nonliving elements of a green roof assembly such as water proofing, structural engineering and project management, while the 'green arts' deal with the living architectural components such as water management, growing media, plants and maintenance. Very few industry professionals currently have the knowledge and expertise that



encompass all of these disciplines. Green Roof Professionals (GRPs) will be well versed in the design, waterproofing and the horticultural arts in order to gain this professional distinction of green building expertise.

The Green Roof Professional (GRP) accreditation and professional courses that support the program provide a number of important benefits that are key to the long-term health and growth of the green roof industry. These include:

- Enabling professionals to differentiate themselves in the marketplace.
- Establishing a high-level of professionalism and improved multidisciplinary collaboration.
- Increasing customer confidence in green roof technology.
- Better green roof design and installation practices.
- Protecting the industry from the inevitable failures that result from inappropriate design, installation, and maintenance practices.

### **Exam Areas of Concentration**

Exam questions are based on the key areas of knowledge for a Green Roof Professional (originally defined in the Occupational Standards for Green Roof Professionals) as follows:

#### **Pre-Design**

1. Assess client expectations and program requirements
2. Determine scope of work
3. Identify the core competencies needed for design team and trades
4. Develop preliminary critical path/schedule
5. Develop preliminary budget based on proposed scope of work
6. Analyze existing conditions
7. Review documentation relative to all existing conditions

#### **Design**

1. Formulate design strategies and options with team members
2. Review drawings and construction documents developed by design team with respect to green roof design
3. Review green roof construction cost estimates
4. Identify green roof financial benefits
5. Finalize, update, and review and finalize critical path document as it relates to green roof



### **Contract Management**

1. Assist in the development and implementation of the construction contracting process.
2. Assist in the bidding process
3. Assist in contract review and negotiations
4. Assist with pre-construction planning

### **Quality Assurance Support**

1. Recognize site-specific safety requirements applicable to an accredited GRP
2. Promote compliance with the quality assurance team
3. Promote best management practices for the installation of green roof System

### **Maintenance**

1. Promote compliance with maintenance plan
2. Promote standardized performance monitoring and record keeping

### **Exam Format and Sample Questions**

The exam will be delivered in an online format. The two-hour exam consists of 100 multiple-choice questions.

### **Online Exam Fee and Registration**

The fee for the exam is \$249 USD and covers the cost of developing, administering, Scoring. Registration is available through the Green Roofs for Healthy Cities web site at [www.greenroofs.org/grp-accreditation-exam](http://www.greenroofs.org/grp-accreditation-exam).



## **Green Roof Professional (GRP) Accreditation Exam**

### **Practice Exam**

1. Some waterproofing membranes may also function as a:
  - (A) Structural deck
  - (B) Root barrier
  - (C) Drainage layer
  - (D) Filter fabric
  
2. Which of the following types of vegetation is best suited to extensive green roofs?
  - (A) Low-growing drought tolerant perennials
  - (B) Small deciduous trees
  - (C) Large shrubs
  - (D) Mosses
  
3. Which of the following is not an example of a lightweight aggregate used in green roof growing media?
  - (A) Expanded shale
  - (B) Compost tea
  - (C) Pumice
  - (D) Expanded slate
  
4. Green roofs can be installed on structural decks made of which of the following materials?
  - (A) Concrete
  - (B) Steel
  - (C) Wood
  - (D) All of the above



5. Membrane flashings are an element of waterproofing assemblies used to:
  - (A) Seal the edges of a membrane at terminations and create redundancy in the waterproofing system
  - (B) Make waterproofing membranes more visually appealing
  - (C) Prevent waterproofing membranes from expanding or contracting
  - (D) Improve water retention
  
6. Which of the following materials would not be used for waterproofing in green roof assemblies?
  - (A) Modified bitumen
  - (B) Polyvinyl chloride (PVC)
  - (C) Asphalt shingles
  - (D) Hot rubberized asphalt
  
7. In budgeting for a green roof, which of the following is a safe assumption:
  - (A) It will have a higher upfront cost than conventional roof
  - (B) An extensive green roof will cost less than \$15/ft<sup>2</sup> (\$161/m<sup>2</sup>)
  - (C) Installers will try to cut costs
  - (D) Routine maintenance will be performed by the client
  
8. Which of the following types of incentives have been used to encourage green roof implementation and leverage private roof space for public gain in North America:
  - (A) Tax credits
  - (B) Fast-track permitting
  - (C) Density bonusing
  - (D) All of the above
  
9. Which of the following techniques would be most appropriate for stabilizing modular green roof systems on sloped roofs:
  - (A) Reinforcement fabric
  - (B) Stepping
  - (C) Strapping
  - (D) Incorporating tackifiers in the growing medium



10. Which type of specification cites specific products to be used for a construction project:

- (A) Destructive specifications
- (B) Proprietary specifications
- (C) Reference Specifications
- (D) Performance Specifications

11. Which of the following is not a desired outcome of pre-construction training:

- (A) To develop a safety plan
- (B) To implement changes to the design that will not impact the overall performance of the green roof
- (C) To establish clear channels of communication
- (D) To develop and outline strategies for problem resolution

12. When safety anchors are secured to the roof deck rather than a parapet wall, they are more likely to:

- (A) Decrease the cost of the waterproofing installation
- (B) Be used by maintenance personnel
- (C) Enable safety lines to damage the plant material
- (D) Prevent damage from other trades

13. In a Protected Membrane Roof Assembly (a.k.a. Inverted Roof Membrane Assembly), where is insulation installed in relation to waterproofing?

- (A) Between the waterproofing membrane and roof deck
- (B) Above the waterproofing membrane
- (C) Either above or below the waterproofing membrane
- (D) Beneath the roof deck

14. One of the advantages of using a bonded waterproofing membrane versus a loose-laid membrane is that bonded membranes:

- (A) Will typically cost less
- (B) Can prevent the migration of water should the membrane be compromised



- (C) Are easier to remove
- (D) Are easier to install

15. Metal counterflashings should be:

- (A) Accessible to facilitate maintenance and repair
- (B) Made of the same material as membrane base flashings
- (C) Fastened to parapet walls below the water table of the roof
- (D) All of the above

16. Which of the following environmental factors would be least likely to affect the long-term performance of green roof waterproofing?

- (A) Heat
- (B) UV Exposure
- (C) Air quality
- (D) Thermal cycles

17. Factors that affect the selection of a waterproofing membrane for a green roof include:

- (A) Composition, track record, durability, compatibility with other components
- (B) Composition, track record, conductivity, compatibility with other components
- (C) Track record, extensibility, permeability, air-filled porosity
- (D) Track record, water holding capacity, recyclability, standards approval

18. The term 'thermoset' is used to describe roofing materials that:

- (A) Can be heat welded at seams
- (B) Contain polymers that irreversibly cure, and therefore cannot be heat welded at seams
- (C) Perform best at high temperatures
- (D) Reflect incoming solar radiation

19. Which of the following is not an advantage of using hot rubberized asphalt as a membrane for green roofs?

- (A) It can be solidly bonded to the substrate/deck





- (B) It has a long history of performance in waterproofing applications
- (C) Cost of materials
- (D) Installation requires no specialized equipment

20. Which of the following types of waterproofing would be most appropriate for a retrofit project in a region with extremely cold winters where the client would like to use a conventional roof assembly along with Electric Field Vector Mapping leak detection?

- (A) Hot rubberized asphalt
- (B) EPDM
- (C) Modified bitumen
- (D) Cold fluid-applied waterproofing

21. Which of the following attributes would be considered advantages of Thermoplastic PVC membranes?

- (A) They do not require an additional root barrier
- (B) They can be installed in a wide variety of configurations
- (C) Their ability to be heat welded provides an effective and permanent sealing method for flashings and seams
- (D) All of the above

22. Which of the following types of insulation are best suited to protected membrane roof assemblies?

- (A) Expanded Polystyrene
- (B) Extruded Polystyrene
- (C) Polyisocyanurate Foam
- (D) Mineral Wool

23. Which of the following factors affect drainage system design?

- (A) Roof slope
- (B) Local stormwater management regulations
- (C) Number of surfaces that contribute to water on the roof
- (D) All of the above



24. Which of the following would not be considered a pre-qualification criterion for roofing contractors?

- (A) Past projects of similar size or value
- (B) Financial capacity
- (C) Projects the contractor has bid on but not yet secured
- (D) Qualifications and expertise of personnel

25. With respect to health and safety, contractors are typically required by law to supply their employees with training in the areas of:

- (A) Hazards associated with roofing
- (B) Safety practices to be followed on the job
- (C) Information relating to the communication of hazards
- (D) All of the above

26. Which of the following fall protection systems would most likely be used by maintenance personnel working on a mature green roof?

- (A) Personal fall-arrest systems tied off to anchor points
- (B) Post and flag systems
- (C) Safety nets
- (D) Temporary guardrails

27. Which of the following is not a disadvantage of flood testing:

- (A) It's difficult or impossible to conduct on sloped roofs
- (B) It's not as effective at finding larger breaches in the membrane
- (C) Creating partitions for flood tests can be time intensive and therefore costly
- (D) It may be impossible to conduct in the winter in colder climates

28. In the vascular system of plants, which type of vessel transports raw materials and water to areas of the plant for digestion and processing?

- (A) Phloem
- (B) Vascular Cambium
- (C) Xylem
- (D) Chloroplast



29. Which of the following factors will decrease plant transpiration rates?

- (A) High temperatures
- (B) High relative humidity
- (C) Wind
- (D) Growing medium at field capacity

30. Test results indicate that the growing medium on a 1-year old green roof has a pH of 9.5. This could lead to:

- (A) Plants' inability to access nutrients
- (B) An increase in the depletion rate of nutrients
- (C) Increased cation exchange capacity
- (D) All of the above



## Practice Exam Answer Key

1. B
2. A
3. B
4. D
5. A
6. C
7. A
8. D
9. C
10. D
11. B
12. C
13. B
14. B
15. A
16. C
17. A
18. B
19. D
20. C
21. D
22. B
23. D
24. C
25. D
26. A
27. B
28. C
29. B
30. A