

## SITE LAYOUT ONE: DIFFERENTIAL LEVELING

**Module 27401-14** describes differential leveling—differences in elevation between two or more points on a surface. This module is the first of two modules that focus on site layout.

### Objectives

#### Learning Objective 1

1. Describe the responsibilities of the carpenter relative to construction drawings, control points, and hand signals.
  - a. Read and interpret a set of civil plans and how they relate to elevations on a job site.
  - b. Identify the types of control points and explain their use on a job site.
  - c. Describe how to use hand signals to communicate.

#### Learning Objective 2

2. Recognize, use, and properly care for tools and equipment associated with differential leveling.
  - a. Identify the instruments commonly used for differential leveling.
  - b. Explain how to set up and calibrate a leveling instrument.
  - c. Explain how to use a builder's level and differential-leveling procedures to determine site and building elevations.

#### Learning Objective 3

3. Record site-layout data and information in field notes using accepted practices.

#### Learning Objective 4

4. Describe the applications involving differential leveling.
  - a. Explain how to transfer an elevation up a structure.
  - b. Discuss applications for profile, cross-section, and grid leveling.

### Performance Tasks

#### Performance Task 1

- Set up, adjust, and field-test leveling instruments.

#### Performance Task 2

##### (Learning Objective 2)

- Convert measurements given in feet and inches to equivalent decimal measurements stated in feet, tenths, and hundredths, and vice versa.

#### Performance Task 3

##### (Learning Objective 2)

- Use a builder's level, leveling rods, and/or laser level with appropriate differential-leveling procedures to determine site and building elevations.

#### Performance Task 4

##### (Learning Objective 3)

- Record differential-leveling data in field notes in accordance with accepted procedures.

#### Performance Task 5

##### (Learning Objective 4)

- Use differential-leveling procedures to transfer elevations up a structure.

### Teaching Time: 20 hours

(Eight 2.5-hour Classroom sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

### Prerequisites

*Core Curriculum, Carpentry Level One, Carpentry Level Two, and Carpentry Level Three*

### Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the Module Examinations and Performance Profile Sheets from [www.nccerirc.com](http://www.nccerirc.com). The passing score for submission into NCCER's Registry is 70 percent or above for the Module Examination; performance testing is graded pass or fail.



## Safety Considerations

This module requires that trainees perform site layout tasks. Safety is paramount in the carpentry trade and safe habits and practices must be emphasized whenever possible. Performance Tasks must be completed under your supervision. Each trainee must use required PPE and follow safe tool practices and procedures.

### Classroom Equipment and Materials

Whiteboard/chalkboard  
Markers/chalk  
Pencils and paper  
*Carpentry Level Four*  
PowerPoint® Presentation Slides  
Computer  
Copies of the Module Examination and Performance Profile Sheets  
Vendor-supplied videos/DVDs showing differential leveling (*optional*)  
TV/DVD player

### Equipment and Materials for Laboratories and Performance Testing

Personal protective equipment:  
Eye protection  
Gloves  
Hard hat  
Steel-toe boots  
Auto level  
Blank set of field notes  
Builder's level  
Calculator  
Copy of OSHA regulations for construction  
Direct elevation rod  
Examples of good and bad field notes  
Field notes with backsight and foresight measurements  
Laser beam detector  
Laser level  
Leveling rod  
Leveling rod target  
Operator's manuals for leveling instruments  
Permanent markers  
Plumb bob  
Scrap stakes and laths  
Set of construction drawings, including site plans  
Stakes  
Tape measure  
Tripod

### Additional Resources and References

This module presents thorough resources for task training. The following resource material is suggested for further study:

*Construction Surveying and Layout*, Wesley G. Crawford. West Lafayette, IN: Creative Construction Publishing, 2002.

*Surveying*, Jack McCormac, Wayne Sarasua, and William Davis. New York, NY: John Wiley & Sons, 2012.

There are a number of online resources available for trainees who would like more information on differential leveling. A search for additional information may be assigned as homework to interested trainees.

# SITE LAYOUT ONE: DIFFERENTIAL LEVELING

The lesson plan for this module is divided into eight 2.5-hour sessions. Each session includes 10 minutes for administrative tasks and one 10-minute break.

## SESSION ONE

Session One introduces construction drawings, control points, and hand signals.

1. Show Session One PowerPoint® presentation slides.
2. Discuss the use of site plans and have trainees identify elements shown on site plans.
3. Discuss the types of control points used on a construction site.
4. Describe hand signals commonly used in the field for site-layout work.

## SESSION TWO

Session Two introduces distance measurement tools.

1. Show Session Two PowerPoint® presentation slides.
2. Identify the instruments commonly used for differential leveling.
3. Explain how to set up and calibrate a leveling instrument.
4. Discuss the proper care and handling of leveling instruments.
5. Describe how to use leveling rods and direct elevation rods.
6. Explain how to set up, calibrate, and use laser levels.

## SESSIONS THREE AND FOUR

Sessions Three and Four introduce site layout instruments and equipment.

1. Show Sessions Three and Four PowerPoint® presentation slides.
2. Discuss the importance of accurately converting between measurement systems.
3. Explain how to use a builder's level and differential leveling procedures to determine site and building elevations.

## SESSIONS FIVE THROUGH SEVEN

Sessions Five, Six, and Seven introduce laying out building lines.

1. Show Sessions Five, Six, and Seven PowerPoint® presentation slides.
2. Explain how to record field notes according to accepted practices.
3. Describe the applications involving differential leveling.
4. Explain how to transfer an elevation up a structure.
5. Discuss applications for profile, cross-section, and grid leveling.

## SESSION EIGHT

Session Eight is a review and testing session. Have trainees complete the module Review Questions and Trade Terms Quiz. (Alternatively, these may be assigned as homework at the end of Session Seven.) Answer any questions that trainees may have.

1. Have trainees complete the Module Examination. Any outstanding performance testing must be completed during this session.
2. Record the testing results on Training Report Form 200, and submit the report to your Training Program Sponsor.



**Materials Checklist for Module 27401-14, Site Layout One: Differential Leveling**

Equipment and Materials					
<b>Personal protective equipment:</b>		Auto level		Leveling rod	
Eye protection		Blank set of field notes		Leveling rod target	
Gloves		Builder's level		Operator's manuals for leveling instruments	
Hard hat		Calculator		Permanent markers	
Steel-toe boots		Copy of OSHA regulations for construction		Plumb bob	
Whiteboard/chalkboard		Direct elevation rod		Scrap stakes and laths	
Markers/chalk		Examples of good and bad field notes		Set of construction drawings, including site plans	
Pencils and paper		Field notes with backsight and foresight measurements		Stakes	
<i>Carpentry Level Four</i> PowerPoint® Presentation Slides		Laser beam detector		Tape measure	
DVD player		Laser level		Tripod	
Computer					
Copies of the Module Examination and Performance Profile Sheets					
Vendor-supplied videos/DVDs showing differential leveling ( <i>optional</i> )					

To the extent possible, and as required for performance testing, provide a selection of the tools listed for each session; alternatively, photos may be used to teach tool identification.