Class Objectives

- Identify and correct leveling mistakes and errors
- Adjust closing the line benchmark elevations
- Apply trigonometric leveling principles

Exam 1

- ONE (two-side) equation sheets
- Four problems covering chapter 2, chapter 3, and chapter 4.

HW assignment – chapter 5

- 5-3(a), 5-5(a), 5-7 (a) 5-9(a), 5-13, 5-15
- Due at the beginning of class Friday (9/16)
A precise level with parallel plate micrometer enables vertical displacement to be measured to 0.1 mm. An accuracy of ±0.2 mm in 1 km of leveling (±0.001 ft/ml) can be obtained. (Courtesy of The Lietz Company.)

Example

- Below are rod readings in the order in which they were taken. The elevation of the starting benchmark is listed at the top of the column. The last reading is taken on the starting benchmark. Put into proper field note form, include arithmetic check. If the B.S. & F.S. distances are 150 feet, what is the order of accuracy? Balance the bench run error.

<table>
<thead>
<tr>
<th>BM</th>
<th>Elevation, m</th>
<th>Distance, km</th>
<th>Correction, m</th>
<th>Adjusted Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM 10</td>
<td>345.567</td>
<td>0</td>
<td>0</td>
<td>345.5671</td>
</tr>
<tr>
<td>BM 101</td>
<td>365.498</td>
<td>3.61</td>
<td>0.010</td>
<td>365.488</td>
</tr>
<tr>
<td>BM 102</td>
<td>385.430</td>
<td>6.13</td>
<td>0.017</td>
<td>385.452</td>
</tr>
<tr>
<td>BM 103</td>
<td>419.580</td>
<td>9.06</td>
<td>0.026</td>
<td>419.586</td>
</tr>
<tr>
<td>BM 25</td>
<td>432.320</td>
<td>12.20</td>
<td>0.035</td>
<td>432.321</td>
</tr>
</tbody>
</table>

*Adjusted elevation = elevation - correction.
*Note that these are the given fixed elevations.

Table 5-2. Adjusting (Closing) a Line of Benchmark Elevations
PROFILE LEVELING

- Field Procedure
- Plotting the Profile
- Cross-Section Leveling

**FIGURE 5-25.** Profile leveling; several rod shots are taken from each instrument position.

**FIGURE 5-26.** Example of profile-leveling field notes.

**FIGURE 5-27.** (a) Top view showing the route centerline and the line for cross-section leveling at station 1 + 50. (b) The cross section, showing ground elevations at points left and right of the centerline.
Example 1

The following sets of field note data were taken in the order given during profile leveling. Place each set of data in standard field book form.

On graph paper, draw the profile to the following scales: horizontal 1 in = 100 ft; vertical 1 in = 10 ft.

Example 2

Reduce and plot at a scale of 1”=200’ horizontal and 1”=20’ vertical, the following set of profile notes.
TRIGONOMETRIC LEVELING

- The difference in elevation between two points may be obtained indirectly by measuring a vertical or zenith angle and the horizontal or slope distance between the points.
  - This is called *trigonometric leveling* because the vertical distance is computed using right-angle trigonometric formulas.

**Example**

- The slope distance and zenith angle measured from point P to point Q were 1823.316 m and 84°23′16″, respectively. The instrument and rod target heights were equal. If the elevation of point P is 487.623 m above datum, what is the elevation of point Q?