EARTHWORK

Profile Leveling

Profile Leveling

- To collect data about topography along a reference line.
- Mainly to compute volumes of cut and fill for a proposed linear structure, such as: highways, railroads, transmission lines, canals. Then the best route can be chosen.
- The result: elevations at definite points (stations) along a reference line, usually the center line.

Staking and Stationing the Reference Line

- First, topography is studied, a center line is chosen.
- Second, points (stations) are marked (staked). Stations are set at starting and ending points, then intermediate stations.
- Distance between the intermediate stations is usually 100ft, could be less if topography is rough.
- Stationing: a system adopted to specify the relative positions of points along the reference line.
- Distances are written in the form of a sum: A + B.
- A is hundreds of feet, B is feet.

- For example station K is (10+24.5) = 1024.5ft from a certain zero, may not exist.
- First station is usually designated with arbitrary value: 10+00, 100+00
- To compute distances along the line, erase the + sign, and subtract the two numbers
- Distance between the stations:(20+68) and (30+34) = 3034 - 2068 = 966 ft

- First a backsight at a BM is observed.
- Then, a number of intermediate foresights are observed at the stations needed, do not have to be at equal distances.
- When the distance becomes too long, or readings become hard to observe, a turning point is constructed.
- You cannot keep the backsight distance equal to the foresight distance.

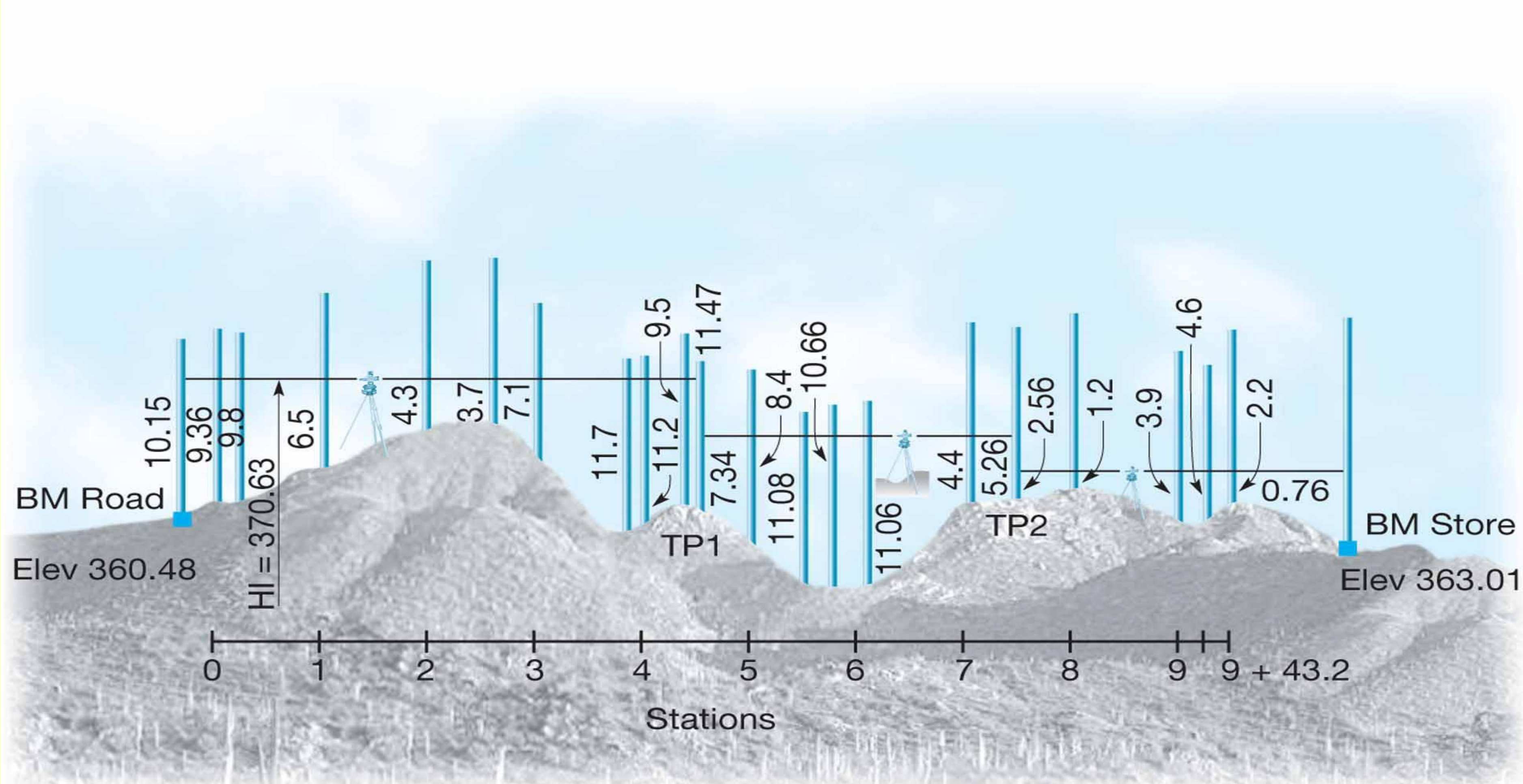
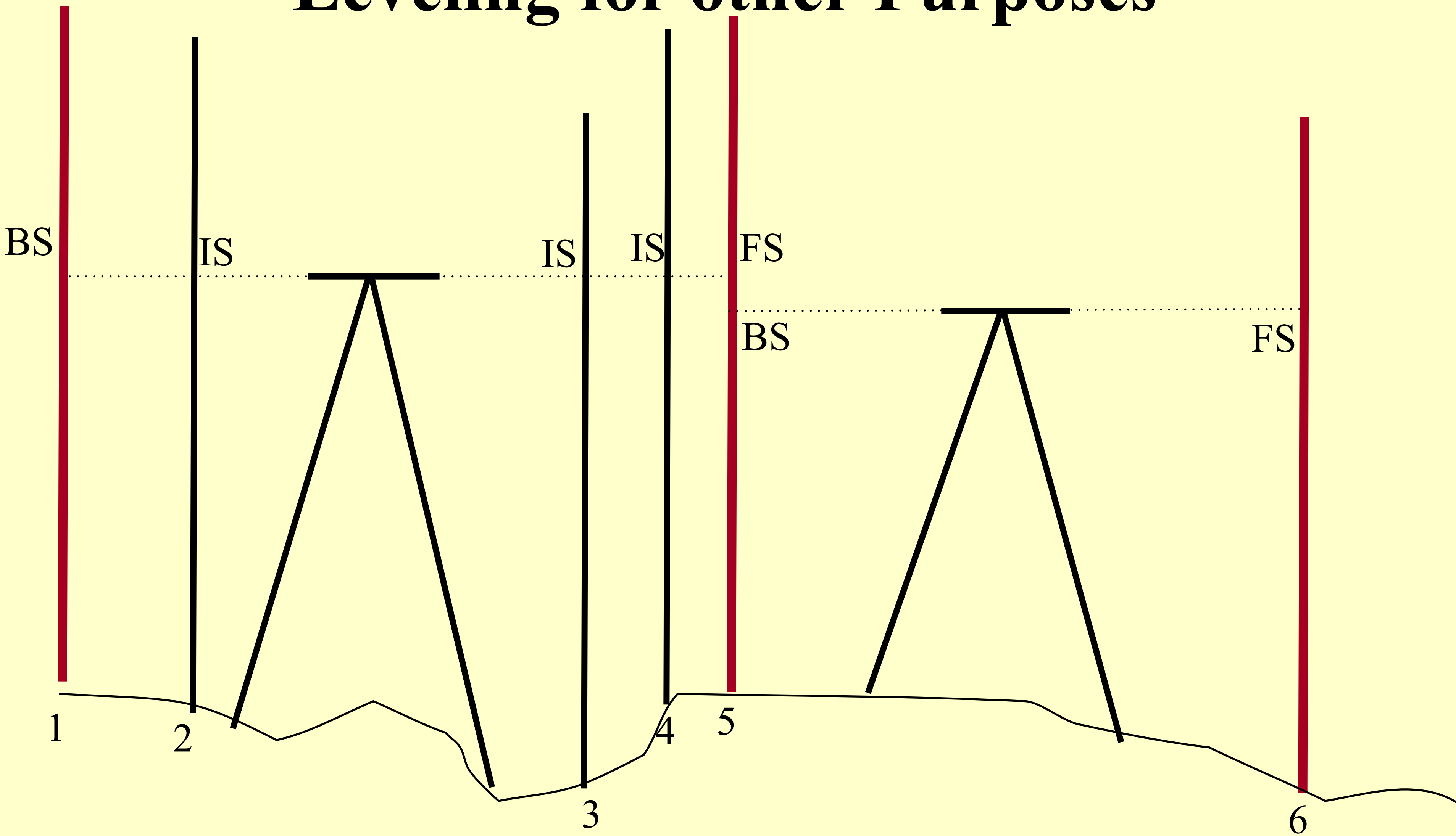


Figure 5-11 Profile Leveling

- Elevation computation:
  - Elevation of line of sight (LS) = E_{BM} + $BS_{BM.}$
  - Elevation of any intermediate point = E_{LS} - $FS_{IP.}$
  - Handle new level positions as in differential leveling, construct a turning point and knowing BS and FS readings, compute a new elevation of line of sight.
- See figure (5-12) page 119 for example of field data and adjustment.

Leveling for other Purposes



A LEVELING PROCESS THAT INCLUDED 6 POINTS AND 7 READINGS.

Example: Compute the elevations of points 1 through 5 if the elevation of the BM is 22.13 ft

Point	BS	IS	FS	HI = E + BS	Elevation (E) = HI – (IS or) FS
BM 761	2.11				22.13
1		1.14			
2		0.95			
3	1.76		0.84		
4	2.01		1.55		
5			1.88		

Answer

Point	BS	IS	FS	HI = E + BS	Elevation (E) = HI – (IS or FS)
BM 761	2.11			= 2.11 + 22.13 24.24	22.13
1		1.14			= 24.24 – 1.14 23.10
2		0.95			= 24.24 – 0.95 23.29
3	1.76		0.84	= 23.40 + 1.76 25.16	= 24.24 – 0.84 23.40
4	2.01		1.55	= 23.31 + 2.01 25.32	= 24.86 – 1.55 23.31
5			1.88		= 25.32 – 1.88 23.44

PROFILE LEVELS

Station	+ Sight	HI	− Sight	Int. Sight	Elev.
BM Road	10.15	(370.62) 370.63			360.48
0+00				9.36	361.26
0+20				9.8	360.8
1+00				6.5	364.1
2+00				4.3	366.3
2+60				3.7	366.9
3+00				7.1	363.5
3+90				11.7	358.9
4+00				11.2	359.4
4+35		(366.48)		9.5	361.1
TP1	7.34	366.50	11.47		359.16
5+00				8.4	358.1
5+54				11.08	355.40
5+74				10.66	355.82
5+94				11.06	355.42
6+00				10.5	356.0
7+00		(362.77)		4.4	362.1
TP2	2.56	368.80	5.26		361.24
8+00				1.2	362.6
9+00				3.9	359.9
9+25.2				3.4	360.4
9+25.3				4.6	359.2
9+43.2				2.2	361.6
BM Store			0.76		363.04
Σ	20.05		17.49		(363.01)

BM ROAD to BM STORE

BM Road 3 miles SW of Mpls. 200 yrds. N of Pine St. over pass 40ft. E of ¢Hwy. 169 Top of RW conc post No.268. — SW Minneapolis on Hwy 169

6 Oct. 2000

¢Hwy. 169, painted "X" — Cool, Sunny, 50° F

West drainage ditch — R.J. Hintz N

N.R. Olson ϕ

R.C. Perry ⊼

Summit — Wild Level #3

Sag

COPY

Summit

Page Check:

E gutter, Maple St. — +20.05

¢Maple St. — −17.49

W gutter, Maple St. — + 2.56

360.48

363.04

Summit 363.04-363.01= Misclosure = 0.03

Top of E curb, Elm St.

Bottom of E curb, Elm St.

¢ Elm St.

BM Store. NE corner Elm St. & 4th Ave. SE corner

Store foundation wall. 3″ brass disc set in grout.

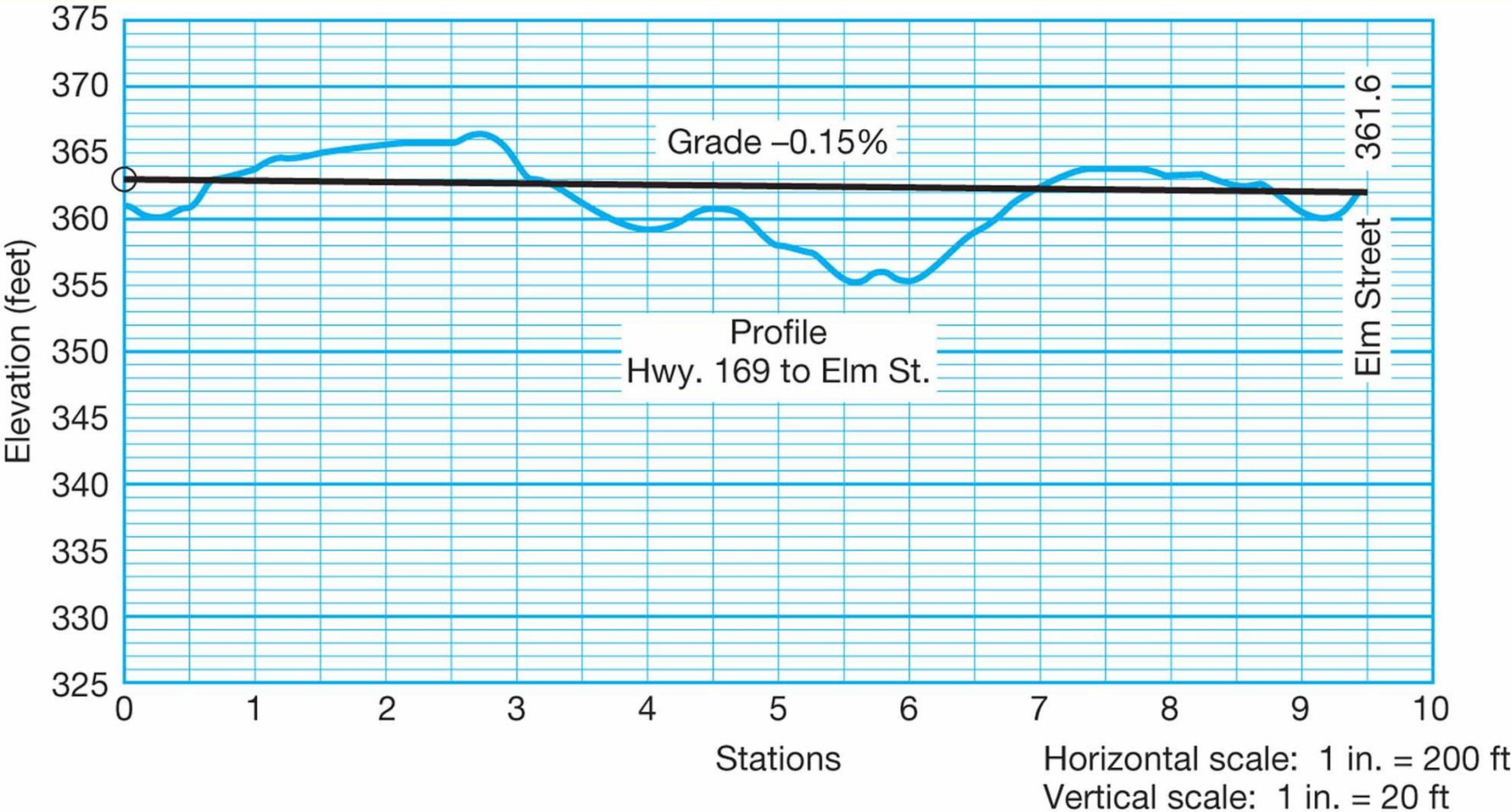
BM store elev. = 363.01

Drawing and Using Profiles

- Drawn using a software now.The following is for reference only, will not be in exams.
- To manually draw a profile and compute earthwork:

  {*the following is for reference only, will not be included in exams*}

  – Assume the horizontal axis is the distance and the vertical axis is the elevation.
  – Use a larger scale for the elevation than the distance scale, usually 10 times larger.
  – Draw the design line at the proposed grade.
  – Compute the areas of cut and fill.
  – Multiply area by width to get volumes.
  – Gradient (percent grade) is the rise or fall in ft per 100 ft, or meter per 100 meter.



375
370
365
360
355
350
345
340
335
330
325
Elevation (feet)
Grade –0.15%
361.6
Elm Street
Profile
Hwy. 169 to Elm St.
0
1
2
3
4
5
6
7
8
9
10
Stations
Horizontal scale: 1 in. = 200 ft
Vertical scale: 1 in. = 20 ft