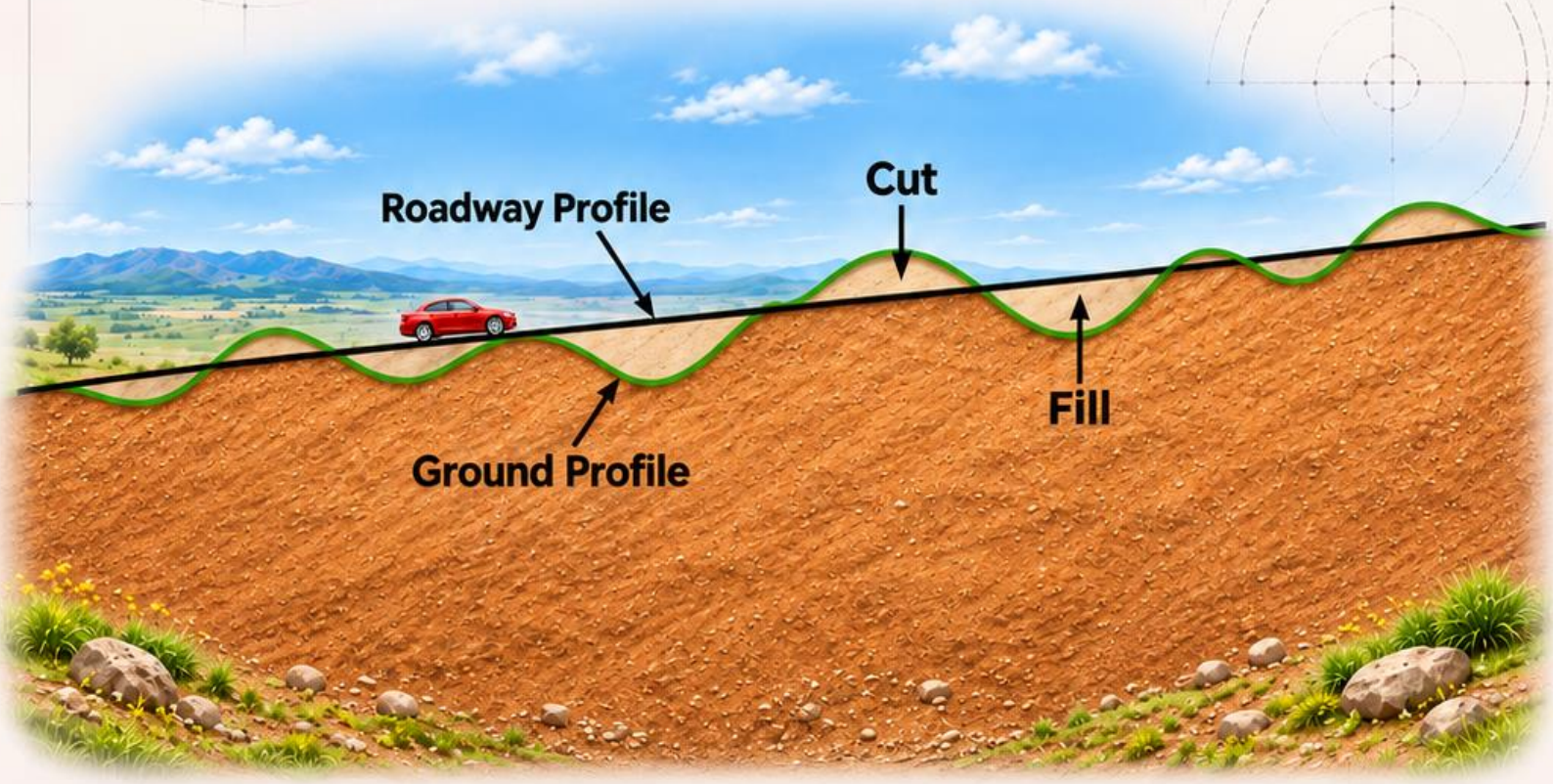
Mustansiriyah University
College of Engineering
Highway and Transportation Engineering Department

Engineering Surveying Laboratory

Second Year - First Semester

Experiment 7

Longitudinal Leveling



Prepared by:

Asst. Lect. Hussein Mohammed Noor
Asst. Prof. Teba Tariq
Lect. Dr. Wafaa Khudhair

2027-2026

General Objective

To develop students' skills in performing profile leveling, determining ground elevations along a route and preparing longitudinal ground profiles.

Learning Objectives

By the end of this experiment, students will be able to:

1. Identify the purpose and equipment used in profile leveling.
2. Set up the level and take backsight, intermediate sight, and foresight readings.
3. Record staff readings at regular stations and points of slope change.
4. Calculate ground elevations using the Height of Instrument (HI) method.
5. Draw the longitudinal ground profile and determine cut and fill depths.

Introduction

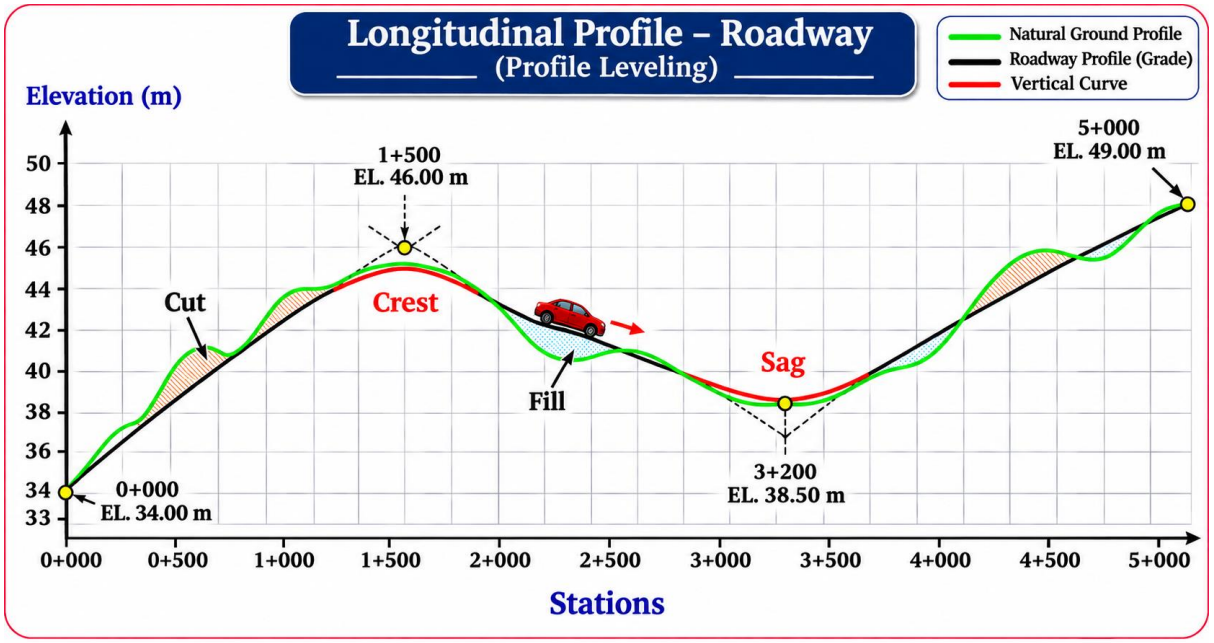
Profile leveling is a surveying method used to determine ground elevations at successive points along a proposed route. In this experiment, students use a level and staff to take readings at regular intervals and points where the ground slope changes. These readings are used to calculate elevations and draw the longitudinal ground profile, which is compared with the proposed roadway profile to determine cut and fill depths.

Experiment 7: Longitudinal Leveling

1. Purpose(الغرض)

Profile leveling is used to determine ground elevations at specific points along a proposed route and prepare a longitudinal ground profile for designing highways, railways, canals, pipelines, and other linear facilities.

تُستخدم التسوية الطولية لتحديد مناسيب الأرض عند نقاط محددة على طول المسار المقترح، وإعداد المقطع الطولي للأرض الطبيعية لغرض تصميم الطرق والسكك الحديدية والقنوات وخطوط الأنابيب وغيرها من المنشآت الخطية.



2. Equipment (الأجهزة والأدوات)

1. Level Instrument (جهاز التسوية).
2. Leveling Staff (قامة التسوية).
3. Measuring Tape (شريط القياس).
4. Pegs (الأوتاد).

3. Field Procedure (خطوات العمل الحقلي)

1. **Set up the level and take a BS on a BM.**

نصب الجهاز وأخذ قراءة خلفية على نقطة معلومة المنسوب

2. **Take readings at regular intervals along the centerline.**

أخذ قراءات عند مسافات منتظمة على طول محور المسار

3. **Take a FS on TP_1, then move the instrument.**

أخذ قراءة أمامية على نقطة تحويل ثم نقل الجهاز

4. **Take a BS on TP_1 and continue leveling.**

أخذ قراءة خلفية على نقطة التحويل ومواصلة التسوية

5. **Take additional readings at slope changes.**

أخذ قراءات إضافية عند تغير ميل الأرض

6. **Calculate elevations and draw the ground profile.**

حساب المناسيب ورسم المقطع الطولي للأرض الطبيعية

Example

The following staff readings were taken with a level between kilometers 14.00 km and 14.50 km and the horizontal distances between the points were equal. The instrument was moved after third, sixth, ninth twelfth and last reading and the height readings were as follows: The elevation of First reading on BM is (18.40 m), 1.52, 1.91, 2.41, 2.59, 1.92, 1.48, 1.12, 0.44, 1.50, 1.16, 1.82, 1.91, 1.22, 2.30, and 3.85. Draw the longitudinal section between kilo meter14.00 and kilo mter14.50, if the slope is 0.4% in down and elevation of first point is the same elevation of B.M. Calculation height of cut and fill?

الحل:

عدد النقاط= عدد القراءات – عدد نقاط التحول

15-4=11

Distance between station =Total Distance (m)/ No.of point-1 = 500/10 =50m

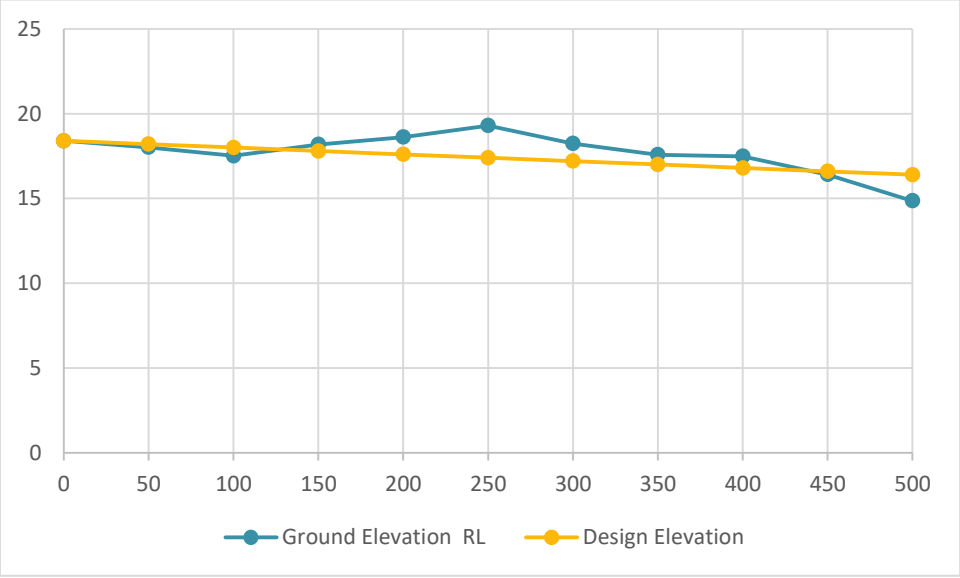
Point	St.	B.S	I.S	F.S	HI	Elevation or RL	Design Elevation	Cut +	Fill -	Remarks
1	0	1.52			19.92	18.40	18.40	0	0	B.M
2	50		1.91			18.01	18.20		0.19	
3	100	2.59		2.41	20.1	17.51	18.00		0.49	TP
4	150		1.92			18.18	17.80	0.38		
5	200	1.12		1.48	19.74	18.62	17.60	1.02		TP
6	250		0.44			19.30	17.40	1.90		
7	300	1.16		1.50	19.40	18.24	17.20	1.04		TP
8	350		1.82			17.58	17.00	0.58		
9	400	1.22		1.91	18.71	17.49	16.80	0.69		TP
10	450		2.30			16.41	16.60		0.19	
11	500			3.85		14.86	16.40		1.54	Last Reading
SUM		7.61		11.15						

1. No. of B.S= No. of F.S=5=5√
2. SUM B.S-SUM F.S= Rl. of last reading – Rl. of first Reading

   7.61-11.15= 14.86-18.40 ⇒ -3.54=-3.54 √

Slop = $\frac{elevation\ last - elevation\ first}{distance}$ * **100 = - 0.4%**

Elevation unknown= elevation known ± $\frac{slop}{100}$ * **distance between point**



Mustansiriyah University
College of Engineering
Highway and Transportation Engineering Department
Asst. Lect. Hussein Mohammed Noor / Asst. Prof. Teba Tariq / Lect. Dr. Wafaa Khudhair

Data Sheet

Experiment 7: Longitudinal Leveling

Student Name: Date: / /

Stations	B.S	I.S	F.S	Remarks

Group Names

No.	Student Name
1	
2	
3	
4	
5	
6	
7	
8	

Supervisor signature