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DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

This test is concerned with the measurement of the amount and rate of compression under vertical and axial pressure by drainage from the upper and lower surfaces of a water-saturated disc-shaped, undisturbed soil specimen with restricted lateral strain.

Standard: ASTM D2435

PROJECT and SAMPLE INFORMATION

Project: Sunrise Residential Complex – Phase II Geotechnical Investigation

Location of the sample: Block C Parcel, North Expansion Zone, Greenfield City

Description of the sample: One-dimensional consolidation (oedometer) test on undisturbed clay sample from 12.00 m depth.

Borehole No: BH-1

Depth= 12m

Specific gravity= 2,68 gramf/cm³

Micrometer= 0,001

Date: 17.12.2023 11:05:29

Initial Reading= 0

Final Reading= 1702

Ring no= 3

Ring weight= 77,21 gramf

Ring height= 20mm

Ring diameter= 50mm

Sample area= 19,63 cm²

Initial sample volume= 39,27 cm³

Final sample volume= 35,93 cm³

PHYSICAL PROPERTIES

Property	Before Test	After Test
Ring and Sample Weight [gramf]	155,41	151,51
Sample Weight [gramf]	78,2	74,3
Water Weight [gramf]	16,99	13,09
Dry Sample Weight [gramf]	61,21	61,21
Water Content [%]	27,76	21,38
Natural Unit Volume Weight [kN/m ³]	19,53	20,28
Dry Unit Volume Weight [kN/m ³]	15,29	16,71
Degree of Saturation [%]	100	99,99

CONSOLIDATION STATUS

Property	Before Test	After Test
Sample Height [mm]	20	18,3
Equivalent Solid Height [mm]	11,63	11,63
Equivalent Height of Voids [mm]	8,37	6,67
Equivalent Height of Water [mm]	8,65	6,67
Void Ratio	0,72	0,57

Downtown Excavation Support System

Zoning Information: Seattle Province, Capitol Hill District District, PL-874233 Layout, 47A Block, 112 Parcel, 5 / 13

Voids Height Change [mm]	0	1,7
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Prepared By:

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COMPRESSION AMOUNT

Laboratory compression indexes and preconsolidation pressure:

Compression index $C_c=0,126$

Recompression Index $C_r=0,023$

Pre-consolidation pressure $\sigma_c=276,77\text{kPa}$

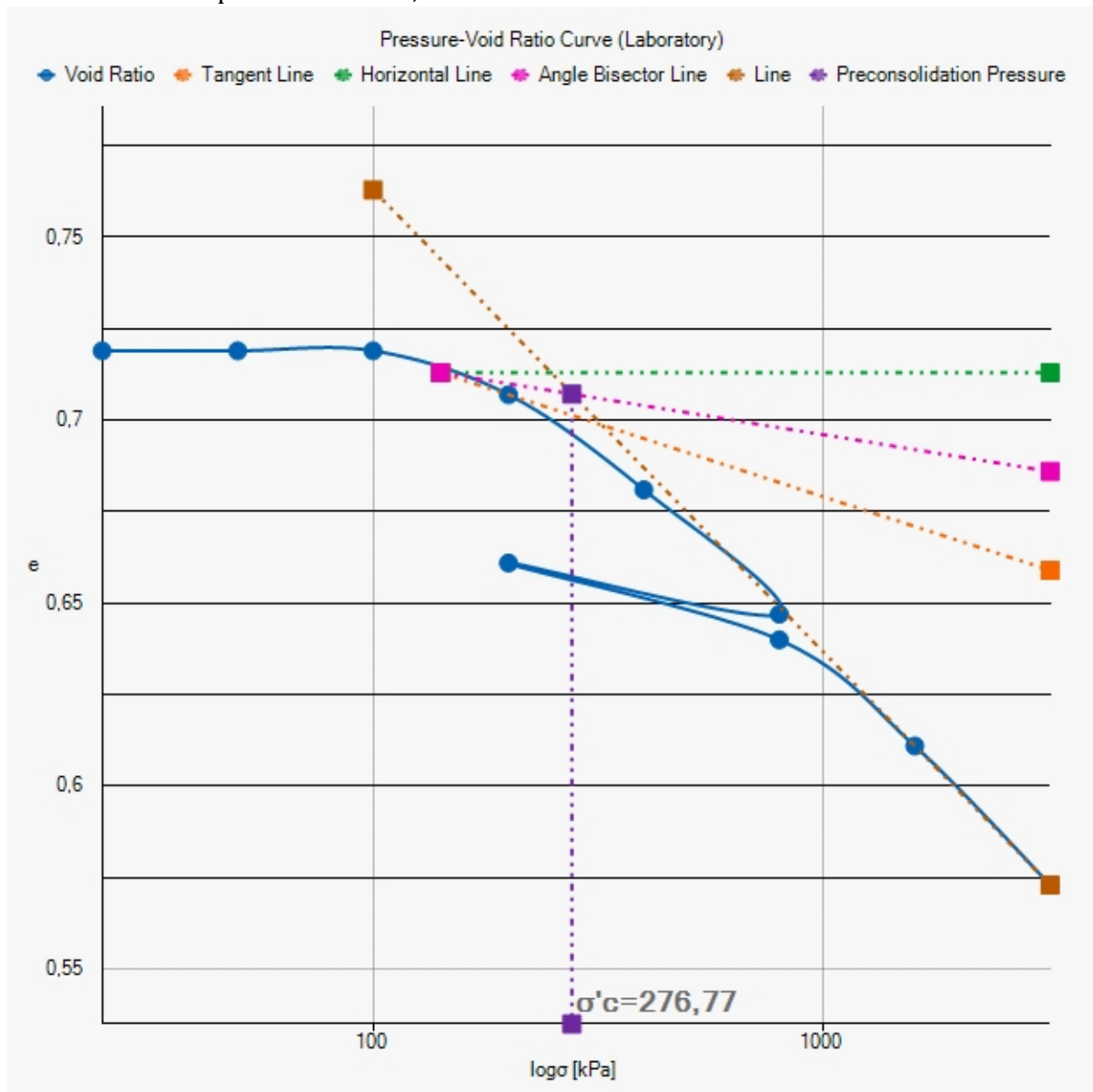


Figure 1. Determination of Pre-consolidation Pressure by Casagrande Method on Pressure-Void Ratio Curve

Table 1. Compression Calculations

σ [kPa]	Reading	ΔH	Actual [mm]	H_e [mm]	e	av [m ² /kN]	mv [m ² /kN]
25	0	0	0	8,368	0,719	0	0
50	1	1	0,001	8,367	0,719	1,183E-05	6,88E-06
100	2	1	0,001	8,366	0,719	4,2E-06	2,44E-06
200	140	138	0,138	8,228	0,707	0,00011654	6,78E-05
400	448	308	0,308	7,92	0,681	0,00013066	7,654E-05
800	842	394	0,394	7,526	0,647	8,501E-05	5,057E-05
200	676	-166	-0,166	7,692	0,661	2,378E-05	1,444E-05
800	924	248	0,248	7,444	0,64	3,509E-05	2,113E-05
1600	1264	340	0,34	7,104	0,611	3,66E-05	2,232E-05
3200	1702	438	0,438	6,666	0,573	2,371E-05	1,472E-05

400kPa LOADING COMPRESSION RATE

Time for 50% consolidation by Casagrande method $t_{50} = 14,28\text{min}$

Coefficient of consolidation $cv_{t_{50}} = 0,001987\text{m}^2/\text{day}$

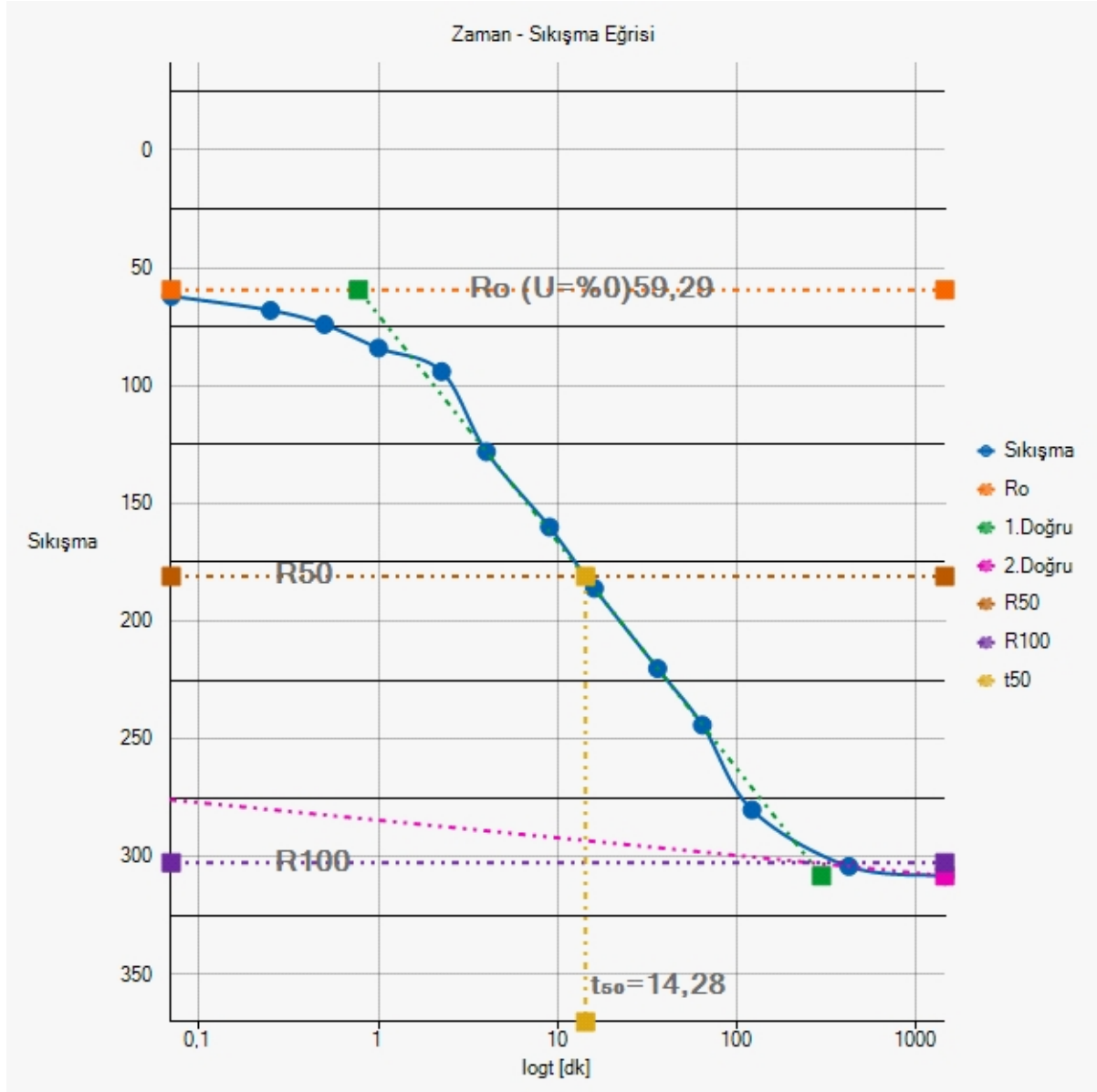


Figure 2. [400kPa] Loading Compression-logt Curve

With the Taylor method, the time for 90% consolidation $t_{90} = 55,32\text{min}$
Coefficient of consolidation $cv_{t90} = 0,002207\text{m}^2/\text{day}$

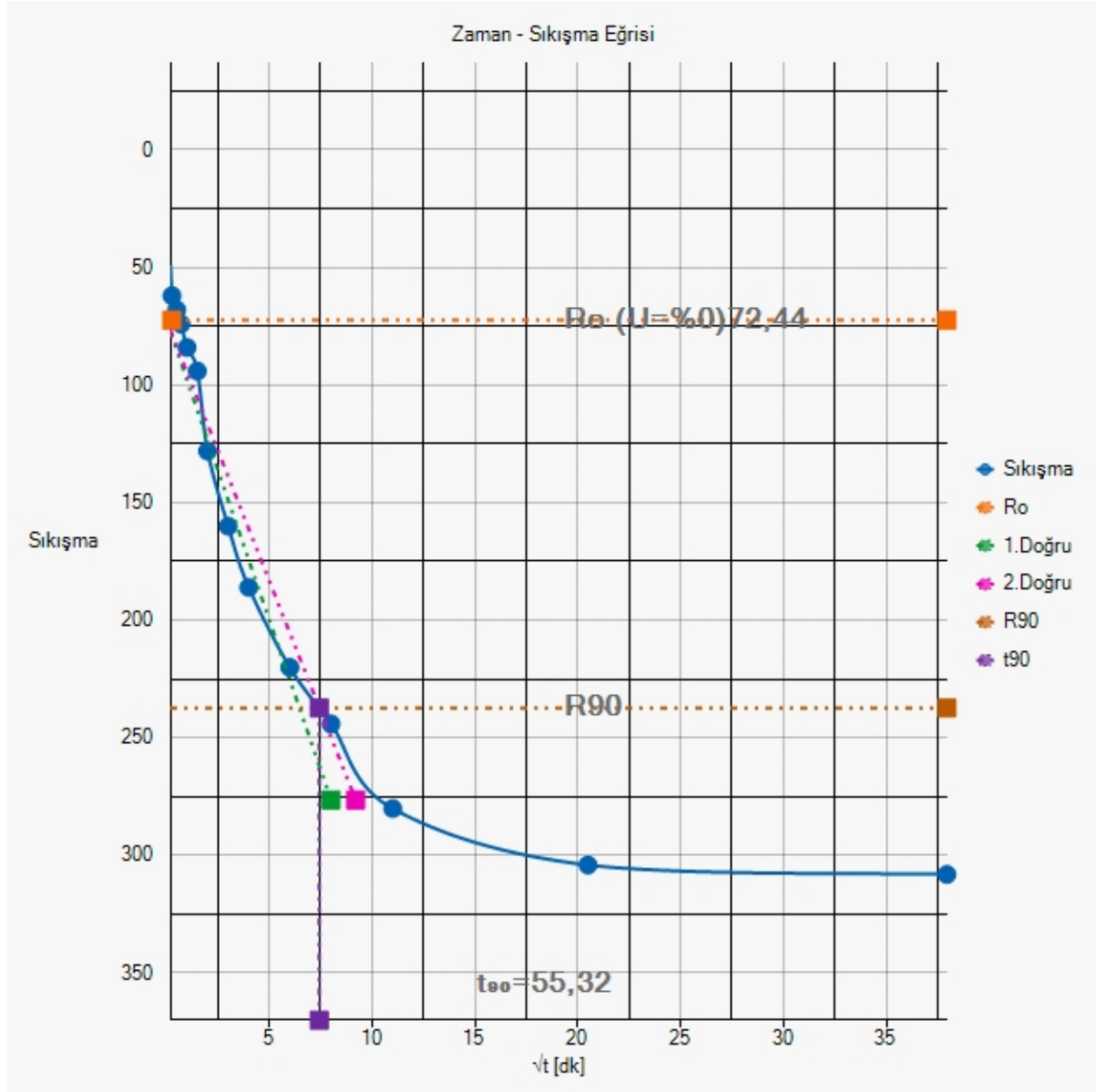


Figure 3. [400kPa] Loading Compression- \sqrt{t} Curve

Table 2. [400kPa] Loading Fast Readings

t [dk]	\sqrt{t} [dk]	Reading	Compression
0	0	140	0
0,07	0,265	202	62
0,25	0,5	208	68
0,5	0,707	214	74
1	1	224	84
2,25	1,5	234	94
4	2	268	128
9	3	300	160
16	4	326	186

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36	6	360	220
64	8	384	244
121	11	420	280
420	20,494	444	304
1440	37,947	448	308

800kPa LOADING COMPRESSION RATE

Time for 50% consolidation by Casagrande method $t_{50} = 10,8 \text{min}$

Coefficient of consolidation $c_{v_{t50}} = 0,002627 \text{m}^2/\text{day}$

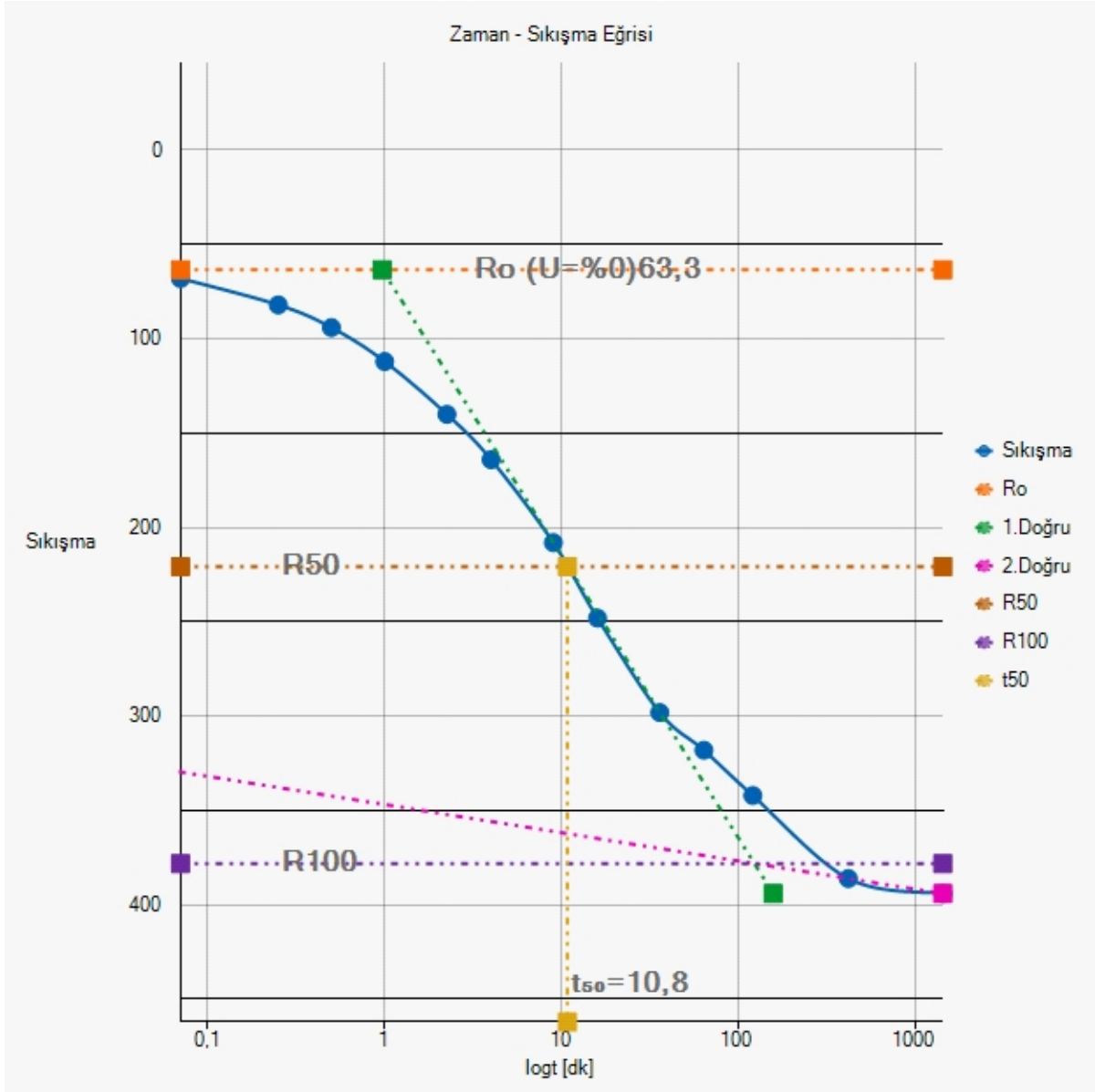


Figure 4. [800kPa] Loading Compression-logt Curve

With the Taylor method, the time for 90% consolidation $t_{90} = 27,76 \text{ min}$
Coefficient of consolidation $cv_{t_{90}} = 0,004398 \text{ m}^2/\text{day}$

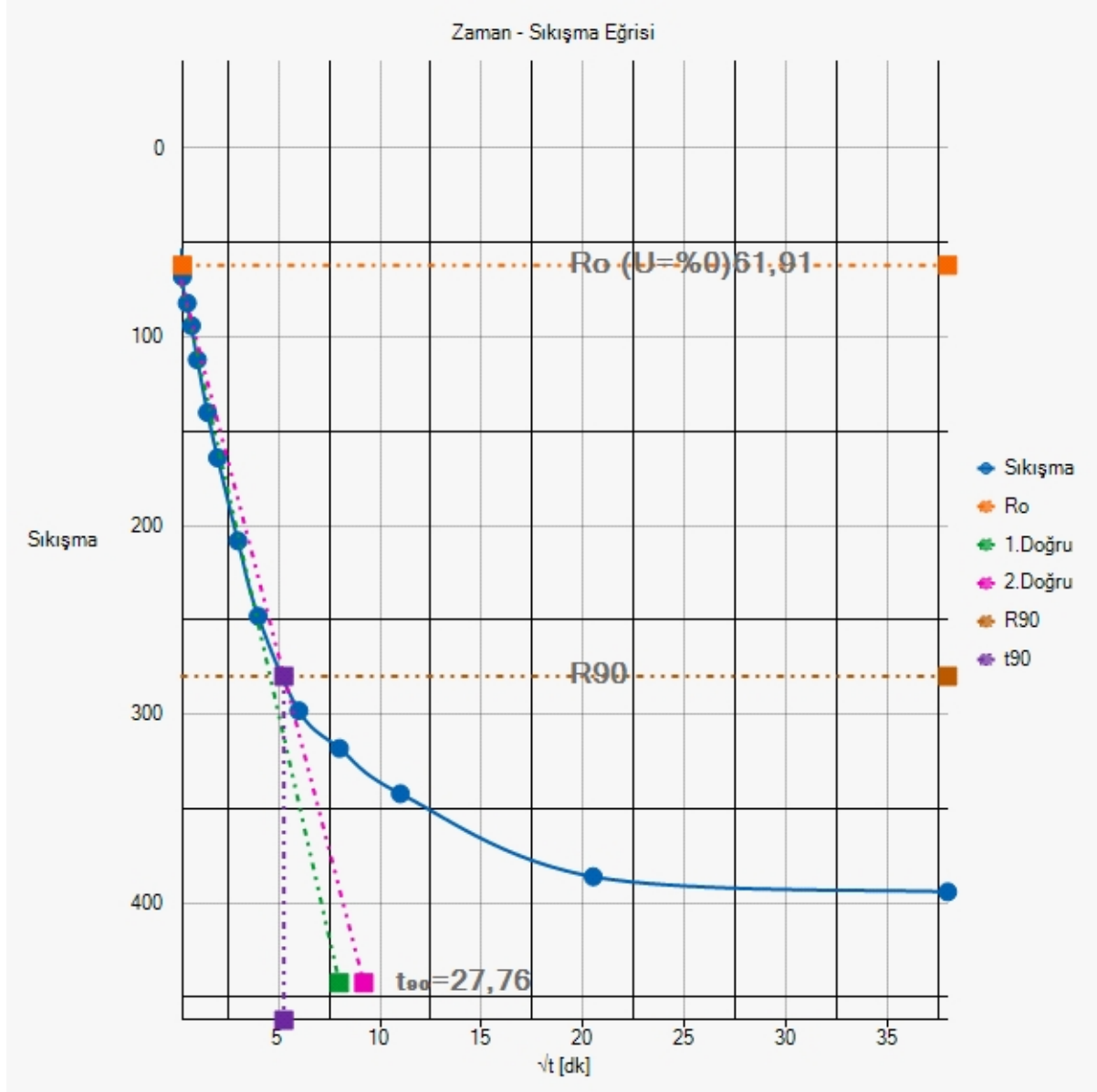


Figure 5. [800kPa] Loading Compression- \sqrt{t} Curve

Table 3. [800kPa] Loading Fast Readings

t [dk]	\sqrt{t} [dk]	Reading	Compression
0	0	448	0
0,07	0,265	516	68
0,25	0,5	530	82
0,5	0,707	542	94
1	1	560	112
2,25	1,5	588	140
4	2	612	164
9	3	656	208
16	4	696	248

Downtown Excavation Support System			
Zoning Information: Seattle Province, Capitol Hill District District, PL-874233 Layout, 47A Block, 112 Parcel, 13 / 13			
36	6	746	298
64	8	766	318
121	11	790	342
420	20,494	834	386
1440	37,947	842	394

PARAMETER SUMMARY

Table 4. Consolidation Parameters

Definition	Parameter	Value
Pre-consolidation pressure	σ_c [kPa]	276,77
Effective Stress	σ'_o [kPa]	150
Overconsolidation ratio	OCR	1,85
Laboratory compression index	C_c	0,126
Laboratory recompression index	C_r	0,023
400kPa loading time for 50% consolidation [min]	t_{50}	14,28
400kPa loading coefficient of consolidation [m ² /day]	cv_{t50}	0,001987
400kPa loading time for 90% consolidation [min]	t_{90}	55,32
400kPa loading coefficient of consolidation [m ² /day]	cv_{t90}	0,002207
800kPa loading time for 50% consolidation [min]	t_{50}	10,8
800kPa loading coefficient of consolidation [m ² /day]	cv_{t50}	0,002627
800kPa loading time for 90% consolidation [min]	t_{90}	27,76
800kPa loading coefficient of consolidation [m ² /day]	cv_{t90}	0,004398