

Indagine con riflessione Ibrida



Indagine SRI01



Indagine SRI01

Indagine con riflessione Ibrida



Indagine con riflessione Ibrida



Indagine SRI03



Indagine SRI03

Indagine Down Hole



Postazione

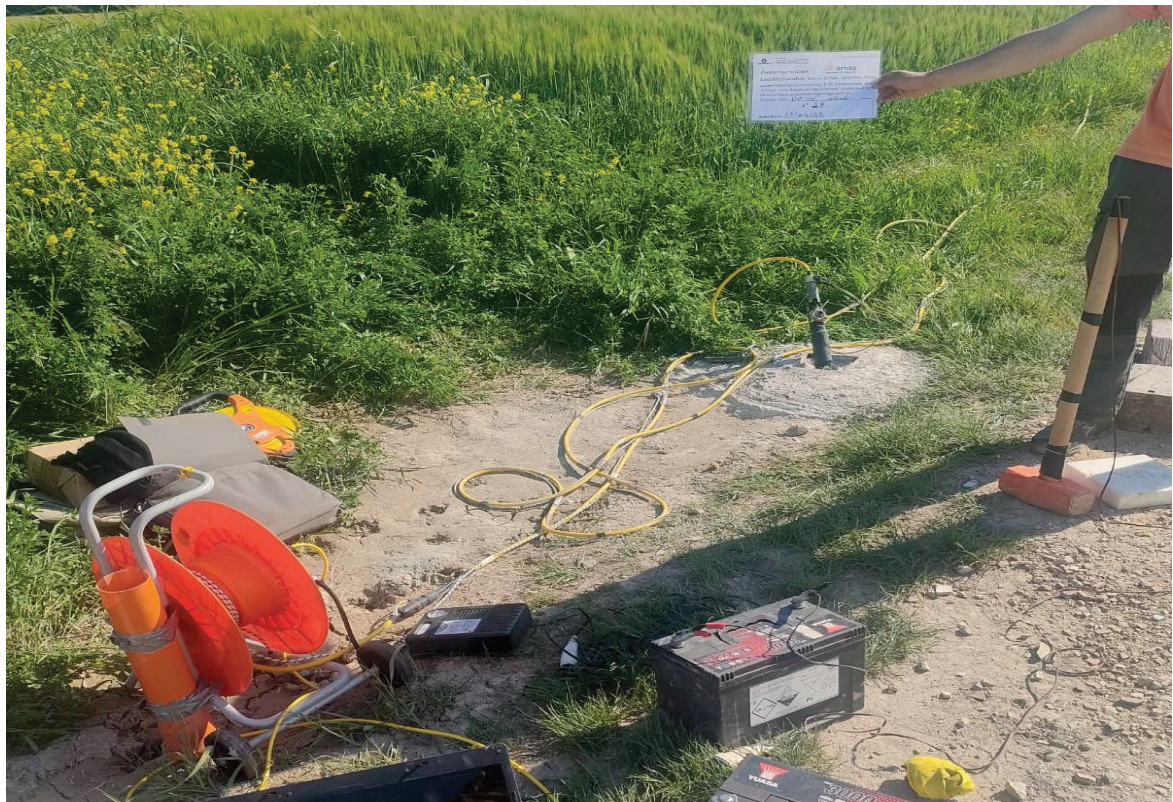
Indagine S3



Postazione

Indagine S4

Indagine Down Hole



Postazione

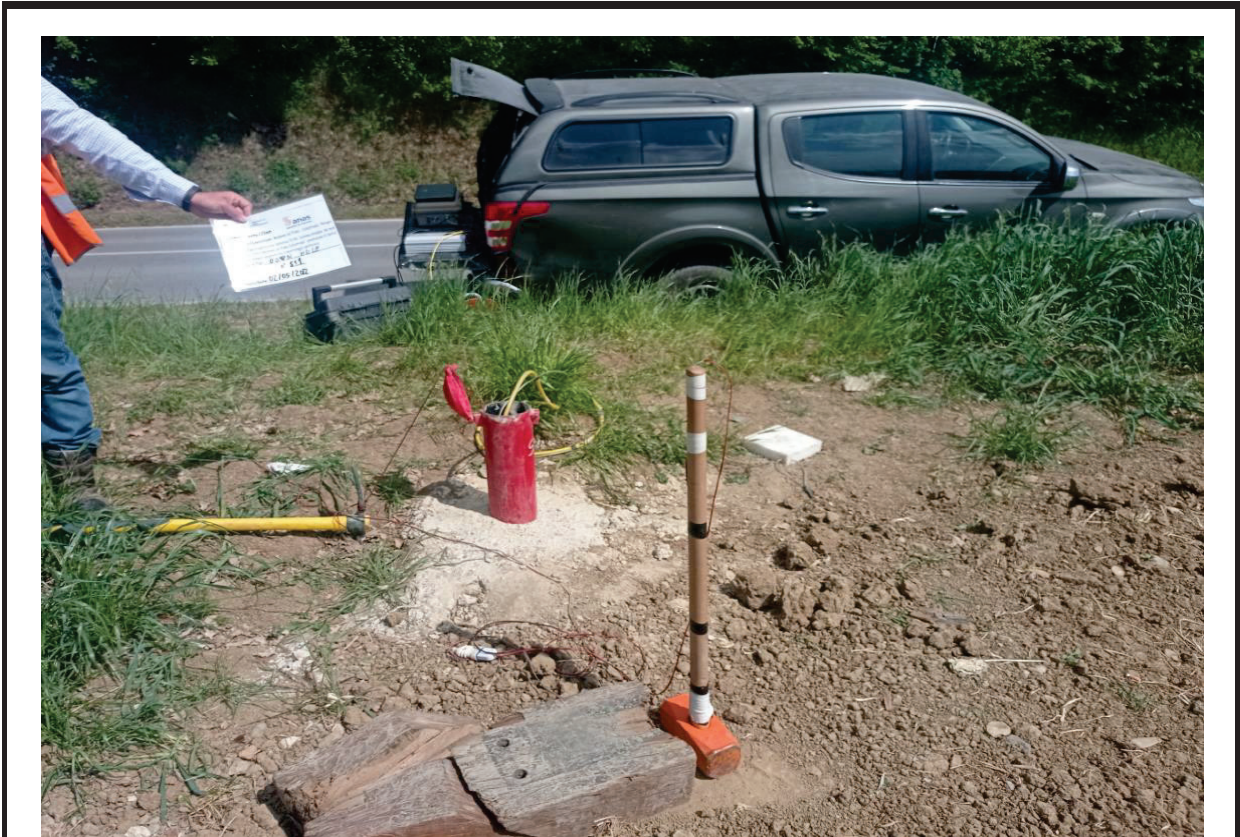
Indagine S7



Postazione

Indagine S9

Indagine Down Hole



Postazione

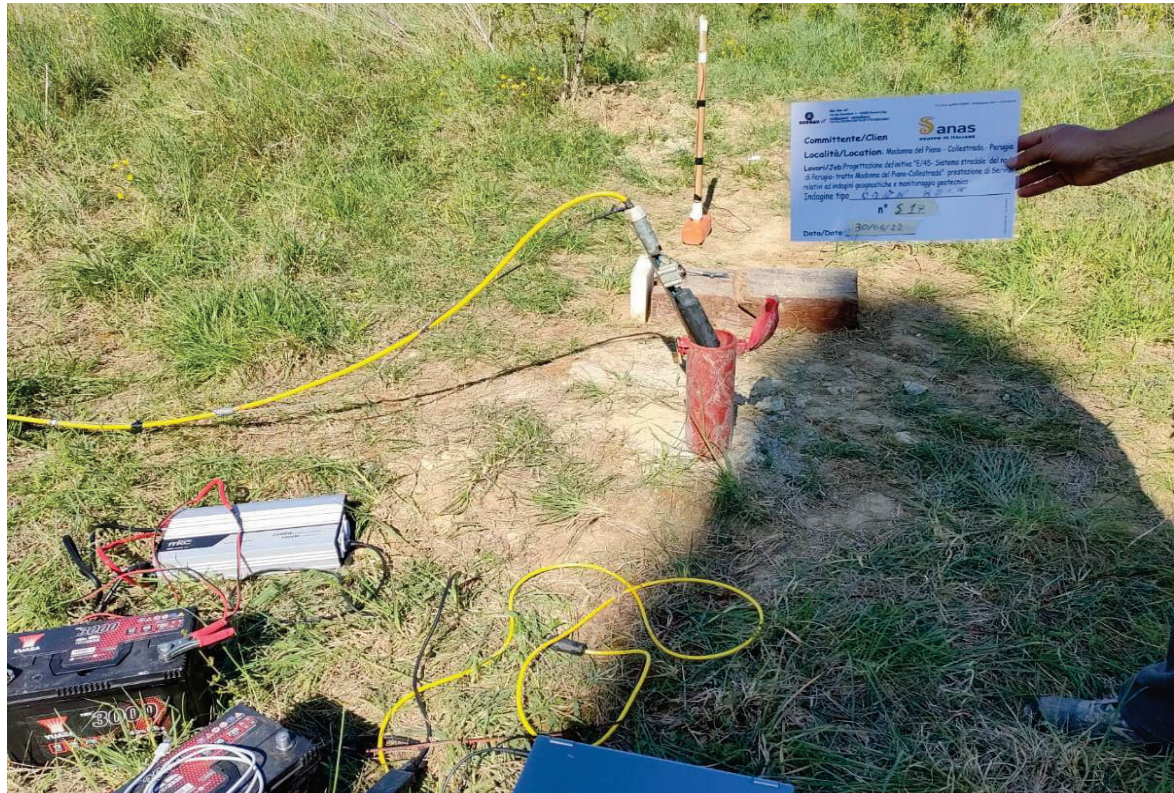
Indagine S11



Postazione

Indagine S16

Indagine Down Hole



Postazione

Indagine S17



Postazione

Indagine S19

Indagine Down Hole



Postazione

Indagine S20

LETTURE INCLINOMETRICHE DI CONTROLLO IN AMBITO DI PROGETTO DEFINITIVO

PROGETTAZIONE DEFINITIVA E 45 - SISTEMAZIONE STRADALE DEL NODO DI PERUGIA
TRATTO MADONNA DEL PIANO - COLLESTRADA (PG) PRESTAZIONE DI SERVIZI RELATIVI
AD INDAGINI GEOGNOSTICHE E MONITORAGGIO GEOTECNICO PER LA PROGETTAZIONE
DEFINITIVA RIFERITA ALL'ACCORDO QUADRO DG28/17



maggio 2022

Report relativo ai tubi inclinometrici

MISURA DI ESERCIZIO N 2-S17in

CARATTERISTICHE STRUMENTAZIONE DI MISURA



DIGITAL MEMS
INCLINOMETER SYSTEMS

INCLINOMETERS
& PENDULUMS



Caratteristiche della strumentazione utilizzata

**inclinometers
& pendulums**

**SERVO-INCLINOMETER
PROBES**

INCLINOMETER SYSTEM PERFORMANCES (with ARCHIMEDE datalogger)

Readout value:	20.000 sin alpha	It is the amplified value of angle that can be read on the digital readout unit, expressed in sin alpha
Repeatability:	0.01%FS	It is the difference between two or more repeated readings taken at the same inclination
Reading resolution:	± 0.05mm x 500mm (for probe with measuring range of ± 30 dg)	It is the smallest increment in angle resolution change that can be read on the readout display as 1 digit
Sensor orientation:	0.5 dg	It is the maximum azimuthal rotation between the probe wheels and sensitive axis of the sensor. Differences in rotation introduce systematic error declared in the calibration sheet. The value of 0.5° introduces a negligible error that doesn't require any data correction
Total accuracy	± 4.00 mm x 30 m	It is the system accuracy attainable during the measurements in field. It is expressed as lateral deviation over a length of 30 m of casing, correctly installed (vertical deviation within 3°)

TECHNICAL SPECIFICATIONS

INCLINOMETER PROBES	Model OS242SV3000	Model OS241SH3000
Applications	(sub)vertical casings	horizontal casing
Sensor	Force balance servo-accelerometer	
Measuring range	±30°(± 15°, ±90°optional)	±30°(±15°optional)
Sensitive axis	one or two	one
Electric output signal	± 5 V at full scale	± 1 V at full scale
Excitation voltage	from ±12.5 to ±15 V DC	+ 5 to 15 V DC
Non-linearity + hysteresis	0.02% FS (for ±90°probe: 0.06% FS)	0.02% FS
Repeatability	0.01%FS (for ±90°probe: 0.02% FS)	0.01%FS
Temp. operating range	from -20°C to+70°C	from -20°C to+70°C
Temp. compensated range	from 0°C to+50°C	from 0°C to+50°C
Material	stainless steel	stainless steel
Diameter	28 mm	42 mm
Length (without connector)	750 mm	790 mm
Wheel carriage	pair of wheels mounted on long-life sealed ball bearings	
Wheel diameter	32 mm	32 mm
Distance between wheel axis	500 mm (metric), 2 feet (English)	
Weight	2.0 kg	4.0 kg



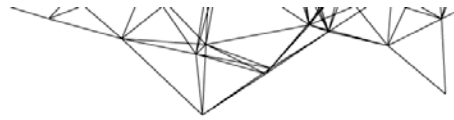
CE electromagnetic compatibility according to EN 61326-1 and EN 61326-A1 directives for EMC emission and immunity

INCLINOMETER CABLE (PRODUCT CODE OWE306KE000)



Inclinometer cable is used to position the probe in the casing. It has 6 electrical leads – 18 AWG - conducting power and signal. The external yellow polyurethane jacket with copper crimped depth marks resists abrasions and chemicals. A stainless steel shield moulded within the external jacket reduces cable twisting and a stainless steel core wire controls stretching. An internal binder sheath eliminates slipping of the single conductors relative to the external cable jacket. Cable is supplied in specified lengths graduated every 500 mm (metric) and every 2 feet (English), wrapped on a portable cable reel with the connector of probe attached at factory. Probe connector is stainless steel made watertight up to 20 bar.

Cable lengths	30,50,60,100,150,200 m 100',200',300',400',500' (English)
Graduation	500 mm (metric), 2-foot (English)
Layout	6 conductors 18 AWG
Depth tactile marks	every 500 mm (2 feet English)
Stress member	steel core, diam. 2.5 mm
Max strength	500 kg
Outer jacket	yellow colour polyurethane
Overall diameter	nominal 12 mm



ARCHIMEDE READOUT

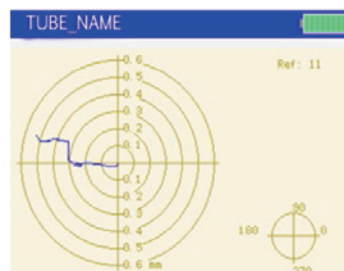
ARCHIMEDE is a rugged, portable readout designed for inclinometer applications. It features a large, daylight-readable display that can display inclinometer graphs. Other features include a rugged, water resistant case and a convenient hand-switch for one-man surveys. The Archimedes connects by cable for reliable field operations. SISGEO's SMART Manager Suite for Windows, included with the readout, is used to manage the Archimede and provides a way to update its firmware and software.

TECHNICAL SPECIFICATIONS

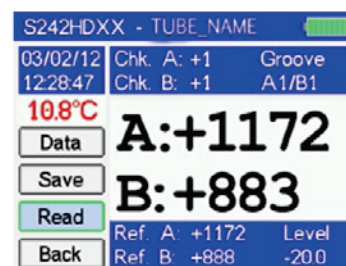
	OCDL300INCL	CE
A/D converter	2 x 24 bit, with autocalibration	
Storage memory	2 GB	
Resolution	100 μ V with FS \pm 5 V 100 μ V with FS \pm 12 V	
Accuracy	0.01 % FS	
Input impedance	>10 M Ω for voltage <2.5 V	
LCD color graphic display	5.7" (320 x 240 pixel), sunlight reliable	
Communication with pc/notebook	USB 2.0, 1.0 Mbit / sec	
Communication with digital probe	RS485 modbus	
Temperature operating range	-20°C +60 °C	
Case	Crushproof ABS, IP67	
Dimensions and weight	200 x 280 x 75mm (LxWxH), 2 kg	
Probe power supply	24 V for digital MEMS probes \pm 2.5 V for spiral probe	
Battery	12V - 4.5 Ah, Ni-MH	
Operating time	approx. 8 hours	



SURVEY AND PLOT



Archimede can display high-resolution plots when the survey is finished.

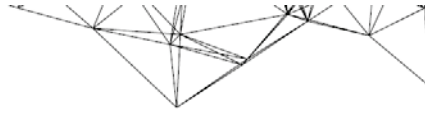


At each reading interval, Archimede displays depth, A and B readings, and checksums. Reference (zero) readings and temperature are also displayed.

INCLINOMETER CABLES



Back bag cable 0S2SB600000

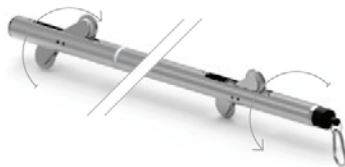


S200D

Inclinometer cables are used to control the depth of the probe and transmit readings from the probe to the readout. The HD (Heavy Duty) and Light cables are supplied on reels and include a factory-attached connector for the probe. The back bag cable is supplied without reel and has factory-attached connectors at both ends. Probe-end connectors are watertight to 20 bar.

	HD CABLE 0S2RC600000	LIGHT CABLE 0S2RD600000	BACK BAG CABLE 0S2SB600000
	It has a stainless steel core wire to control stretching and a stainless steel torsion braid to prevent twisting. Yellow cable jacket has copper depth marks. Available with both simple reel or slip-ring reel (0S2RCS000000).	Light cable has a Kevlar stress member for strength. For digital sensors only. Orange cable jacket has aluminum depth marks. Supplied on reel.	It is the same as light cable, but has connectors attached at both ends. Orange cable has aluminum depth marks. Supplied with back bag, without reel.
Cable lengths	30,50,60,100,150,200 m	30,50,60,100,150,200 m	30,50,70,100 m
Conductors	6x0.50 mm ²	2x0.50 + 2x0.22 mm ²	2x0.50 + 2x0.22 mm ²
Depth tactile marks	copper, every 500 mm	aluminum, every 500 mm	aluminum, every 500 mm
Stress member	steel core	kevlar fiber	kevlar fiber
Max strength	500 kg	300 kg	300 kg
Outer jacket	yellow, polyurethane	orange, polyurethane	orange, polyurethane
Cable diameter	10.4 mm	5.7 mm	5.7 mm
Weight (cable+marks)	0,150 kg/m	0,072 kg/m	0,072 kg/m
Total weight with 50 m cable	12 kg with reel	4.50 kg with reel	3.80 kg no reel

SPIRAL PROBE



Spiral probe: twisting on the probe axis for measuring the inclinometer casing torsion

The Spiral probe is used to measure twist in installed inclinometer casing (tubes). The measurements can be used for correcting readings taken from twisted casing. SISGEO recommends that spiral surveys be taken at the same time as the initial inclinometer readings. The spiral probe is compatible with the Archimede readout and HD inclinometer cable. It is not compatible with light cable or no-reel cable.

KLION software is required to process spiral data and apply corrections to inclinometer readings.

	0S30PR12000
Type of sensor	rotary contactless potentiometer (magneto-resistive)
Measuring range	±5 degrees over the wheel base (1 meter)
Resolution	± 0.01°
Accuracy	< 0.5% FS
Output signal	± 200 mV at FS
Power supply	± 2.5 V DC
Connector	watertight, 6 pins compatible with heavy-duty cable
Body diameter	28 mm
Length	1250 mm (without connector)
Gauge length (distance between wheels)	1000 mm

Sito di misura e relativi dati

SITO: COLLESTRADA VOC. S. MARTA

NOTE RELATIVE ALLA CAMPAGNA DI MISURA

tubo	data di misura	note
S17In	14/04/2022	nessuna nota
S17In	28/04/2022	nessuna nota
S17In	27/05/2022	nessuna nota

Tubi rilevati e riportati nel presente rapporto

Identificativo tubo
Incl. S17

Data misura di zero
14/04/2022

TUBO : S17 In

Località: Collestrada Voc. s. Marta

Coordinata X (GB) : 2.298.618

Coordinata Y (GB) : 4.770.057

Quota testa tubo [m slm] : 234,00

Altezza pozzetto da testa tubo [m] : +0.00

Altezza pozzetto da p.c. [m] : +0.00

Profondità progetto [m] : 34,5

Profondità prima misura [m] : 34,5

Azimut guida 1-3 (°) : 10

Data misura spiralometrica [gg/mm/aa] : 14/04/2022

Data misura di zero [gg/mm/aa] : 14/04/2022

Sonda misura di zero : S160073

Sonda spiralometrica : S30PR120

Tubo inclinometrico	n°	Date misure di esercizio
S17In	1	28/04/2022
	2	27/05/2022

TUBO INCLINOMETRICO S17In letture di campagna

lettura es. n° 2

quota (m slm)	prof. (m)	Letture guide Tubo S17 In							
		A1	B1	A2	B2	A3	B3	A4	B4
347,24	0,00								
346,74	0,50	-83	33	42	79	84	-27	-40	-67
346,24	1,00	-124	16	15	123	129	-6	-14	-114
345,74	1,50	-203	4	11	197	202	-4	-6	-198
345,24	2,00	-236	-38	-27	225	233	40	33	-214
344,74	2,50	-250	-64	-61	258	253	67	65	-244
344,24	3,00	-290	-99	-90	294	287	98	95	-282
343,74	3,50	-304	-103	-98	314	309	104	104	-299
343,24	4,00	-306	-63	-57	315	310	62	62	-302
342,74	4,50	-314	-7	0	321	318	4	6	-307
342,24	5,00	-273	-22	-17	286	275	23	23	-273
341,74	5,50	-270	-15	-9	280	271	12	12	-265
341,24	6,00	-308	3	8	320	311	-5	-3	-302
340,74	6,50	-336	-2	5	344	338	0	-4	-331
340,24	7,00	-337	0	4	348	339	-2	0	-330
339,74	7,50	-314	-3	3	324	315	-2	1	-308
339,24	8,00	-303	-103	-117	293	305	122	120	-296
338,74	8,50	-280	-125	-130	284	286	140	131	-282
338,24	9,00	-265	-94	-98	265	270	106	101	-265
337,74	9,50	-280	-59	-63	284	282	72	68	-281
337,24	10,00	-248	-48	-54	250	253	63	55	-251
336,74	10,50	-237	-41	-59	241	245	62	58	-242
336,24	11,00	-219	-72	-78	226	214	82	82	-218
335,74	11,50	-241	-44	-54	248	254	63	58	-253
335,24	12,00	-311	-58	-54	309	310	67	54	-303
334,74	12,50	-372	-75	-73	374	377	87	77	-381
334,24	13,00	-446	-103	-106	436	445	114	107	-447
333,74	13,50	-477	-106	-114	471	481	121	113	-482
333,24	14,00	-263	-231	-220	285	266	230	222	-273
332,74	14,50	-200	-202	-195	211	202	197	199	-197
332,24	15,00	-206	-156	-153	211	205	154	153	-201
331,74	15,50	-226	-108	-89	231	223	92	96	-216
331,24	16,00	-251	-55	-47	255	251	49	49	-241
330,74	16,50	-276	-53	-46	286	279	50	49	-271
330,24	17,00	-326	-185	-177	336	328	182	181	-322
329,74	17,50	-333	-215	-209	345	336	215	213	-338
329,24	18,00	-356	-196	-188	366	359	193	190	-354
328,74	18,50	-359	-189	-182	371	364	184	186	-360
328,24	19,00	-350	-186	-180	359	350	186	182	-345
327,74	19,50	-322	-176	-171	331	323	177	177	-315
327,24	20,00	-377	-157	-172	366	380	171	176	-365
326,74	20,50	-386	-141	-143	387	392	153	145	-389
326,24	21,00	-365	-145	-152	372	368	161	152	-368
325,74	21,50	-346	-130	-131	342	346	142	136	-345
325,24	22,00	-331	-99	-102	328	334	112	106	-328
324,74	22,50	-311	-66	-80	319	324	87	83	-319
324,24	23,00	-278	-151	-165	299	281	156	170	-283
323,74	23,50	-287	-172	-175	292	290	177	179	-281
323,24	24,00	-301	-132	-130	300	300	133	130	-294
322,74	24,50	-333	-160	-156	340	336	159	162	-327
322,24	25,00	-293	-149	-150	305	299	150	153	-287
321,74	25,50	-309	-179	-177	312	311	179	183	-301
321,24	26,00	-282	-117	-113	272	285	139	115	-271
320,74	26,50	-289	-86	-89	287	292	98	92	-288
320,24	27,00	-318	-114	-119	317	321	130	118	-317
319,74	27,50	-353	-147	-153	352	355	163	155	-354
319,24	28,00	-379	-168	-174	378	384	185	176	-381

318,74	28,50	-392	-164	-171	394	399	181	171	-394
318,24	29,00	-366	-186	-207	383	368	203	212	-387
317,74	29,50	-363	-153	-159	368	366	168	168	-369
317,24	30,00	-342	-154	-164	344	348	170	166	-349
316,74	30,50	-330	-141	-147	333	332	155	154	-339
316,24	31,00	-305	-113	-118	306	307	124	120	-310
315,74	31,50	-261	-56	-64	262	262	72	67	-268
315,24	32,00	-245	-155	-143	270	251	154	146	-253
314,74	32,50	-315	-149	-143	323	316	146	147	-309
314,24	33,00	-386	-90	-87	395	388	93	91	-391
313,74	33,50	-389	-116	-120	396	391	117	127	-387
313,24	34,00	-299	-155	-154	306	304	163	154	-298
312,74	34,50	-221	-159	-151	232	227	154	156	-223
S17		xGB = 2.298.618 y=4.770.057		Az G1 350 (10)		Quota 234,00 m			
		lettura due del 27/05/2022		altezza pozzetto 0 cm		TD 34,5 m			

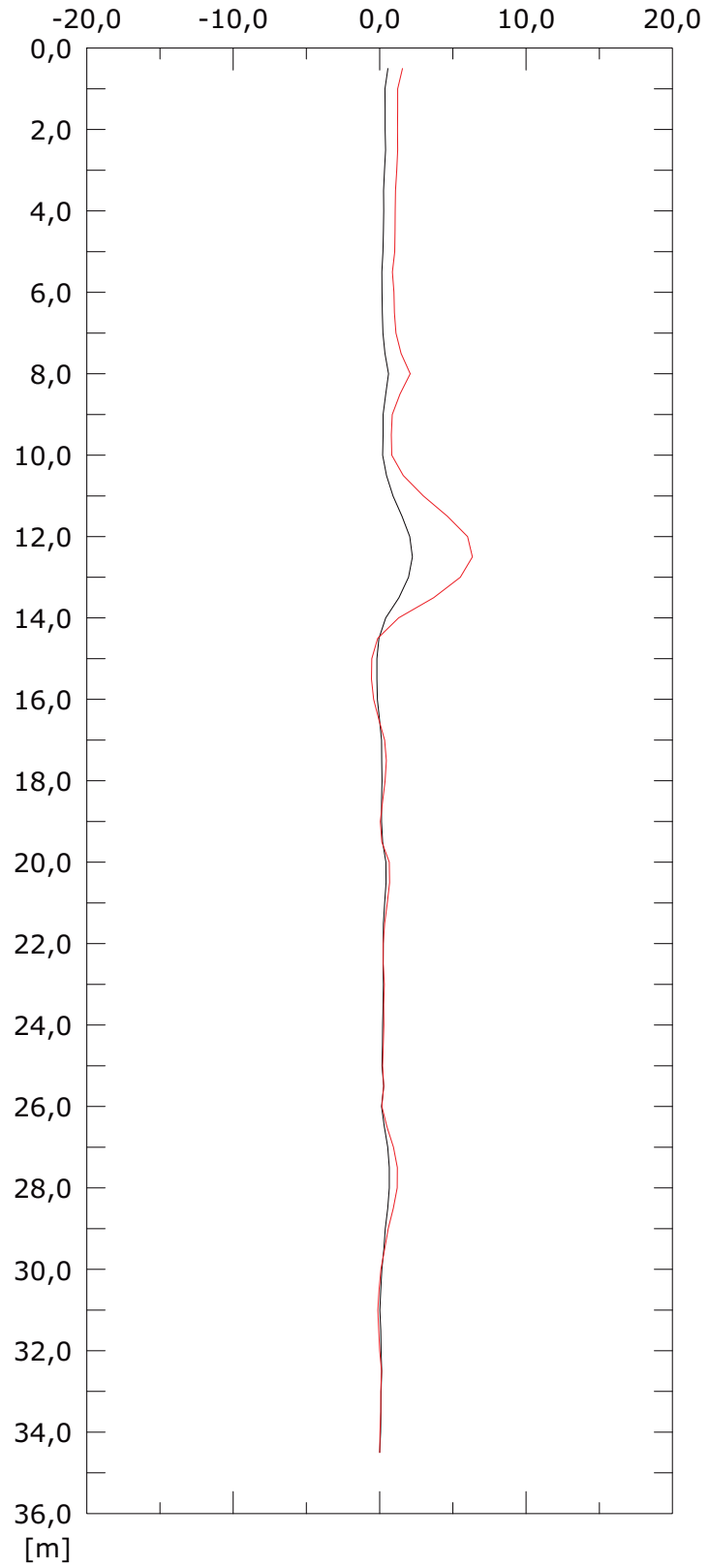
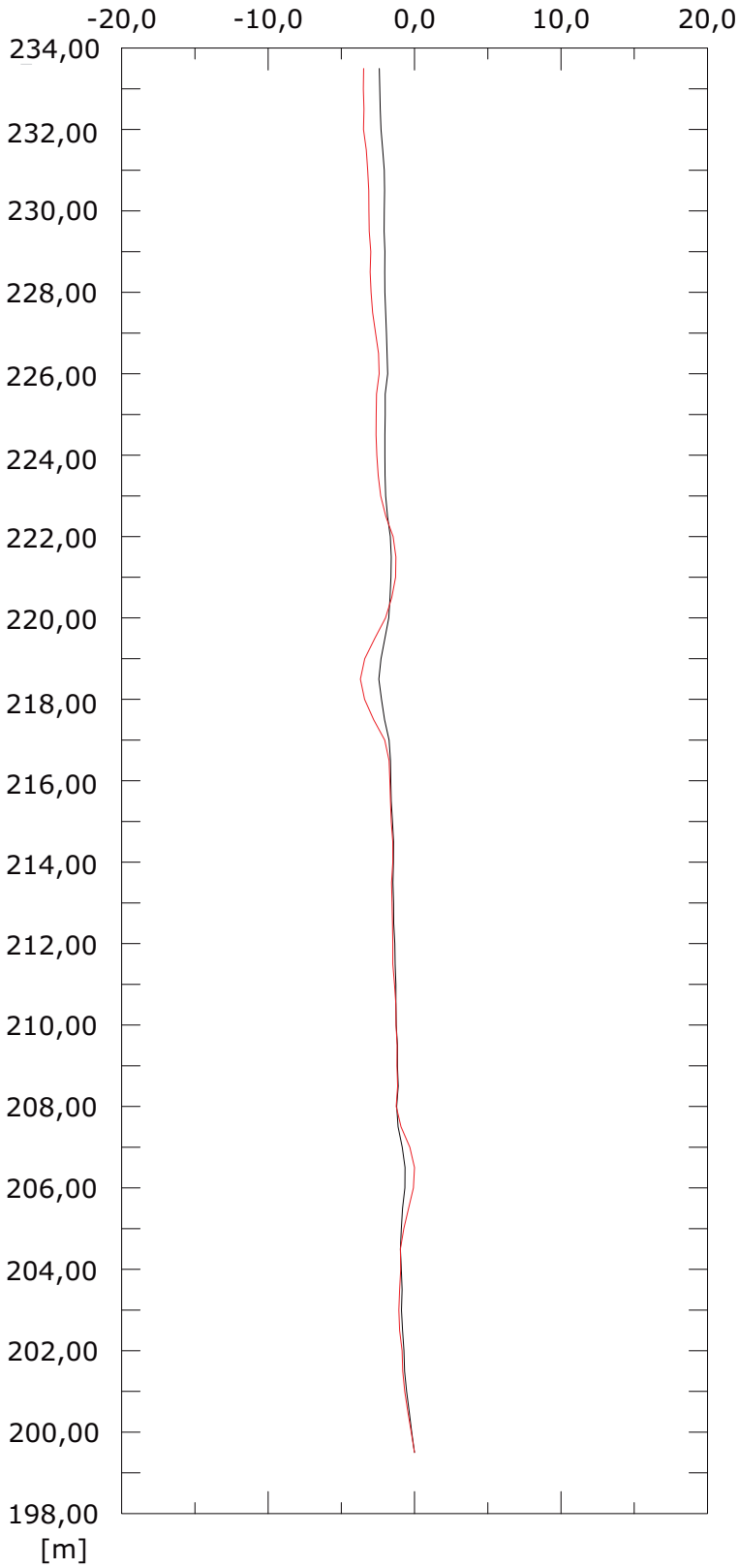
TUBO INCLINOMETRICO S17In **elaborati grafici e numerici**

Elaborazione differenziale integrale dal basso

Riferimento 000:14/04/2022

Spost. EST [mm]

Spost. NORD [mm]



001:28/04/2022

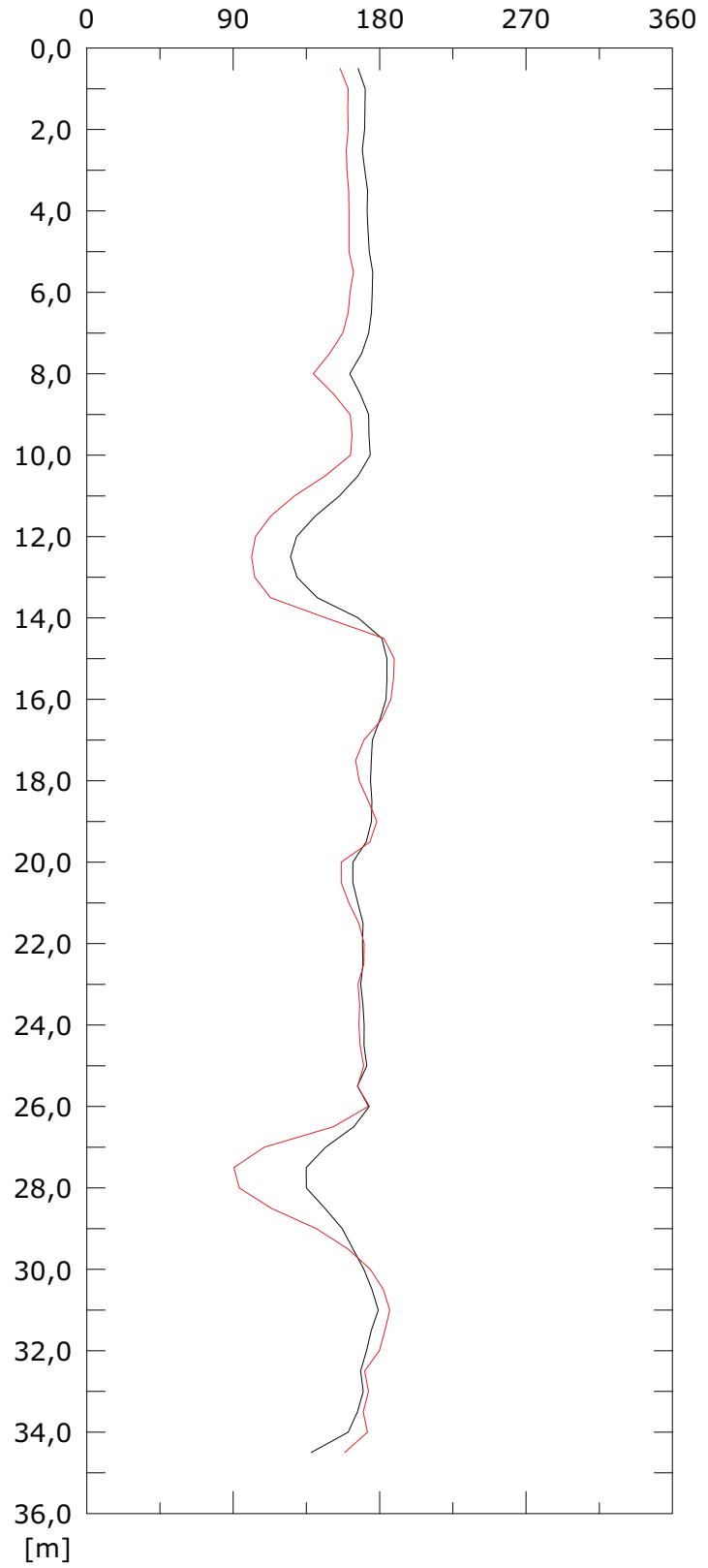
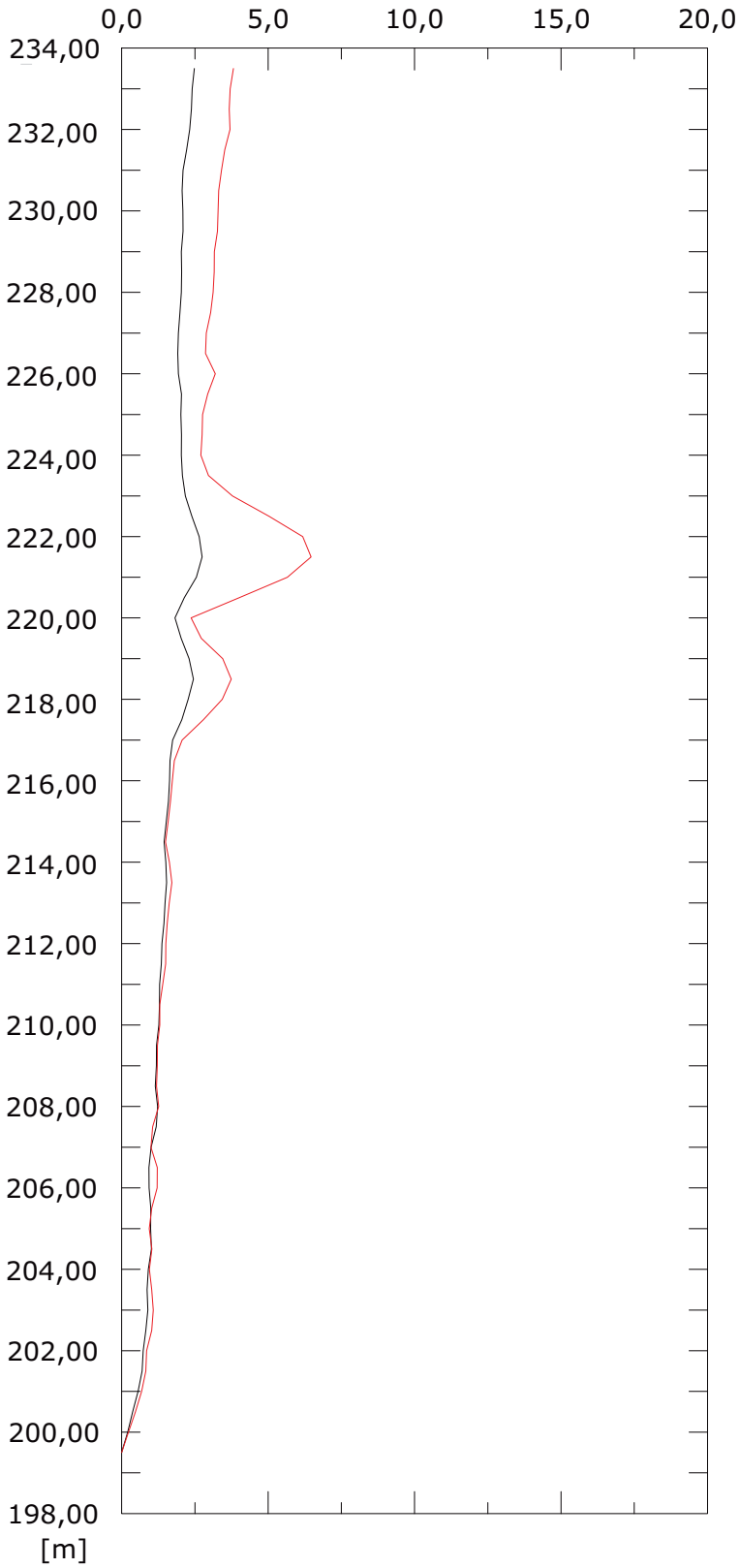
002:27/05/2022

Elaborazione differenziale integrale dal basso

Riferimento 000:14/04/2022

Risultante spost. [mm]

Angolo [gradi]



001:28/04/2022

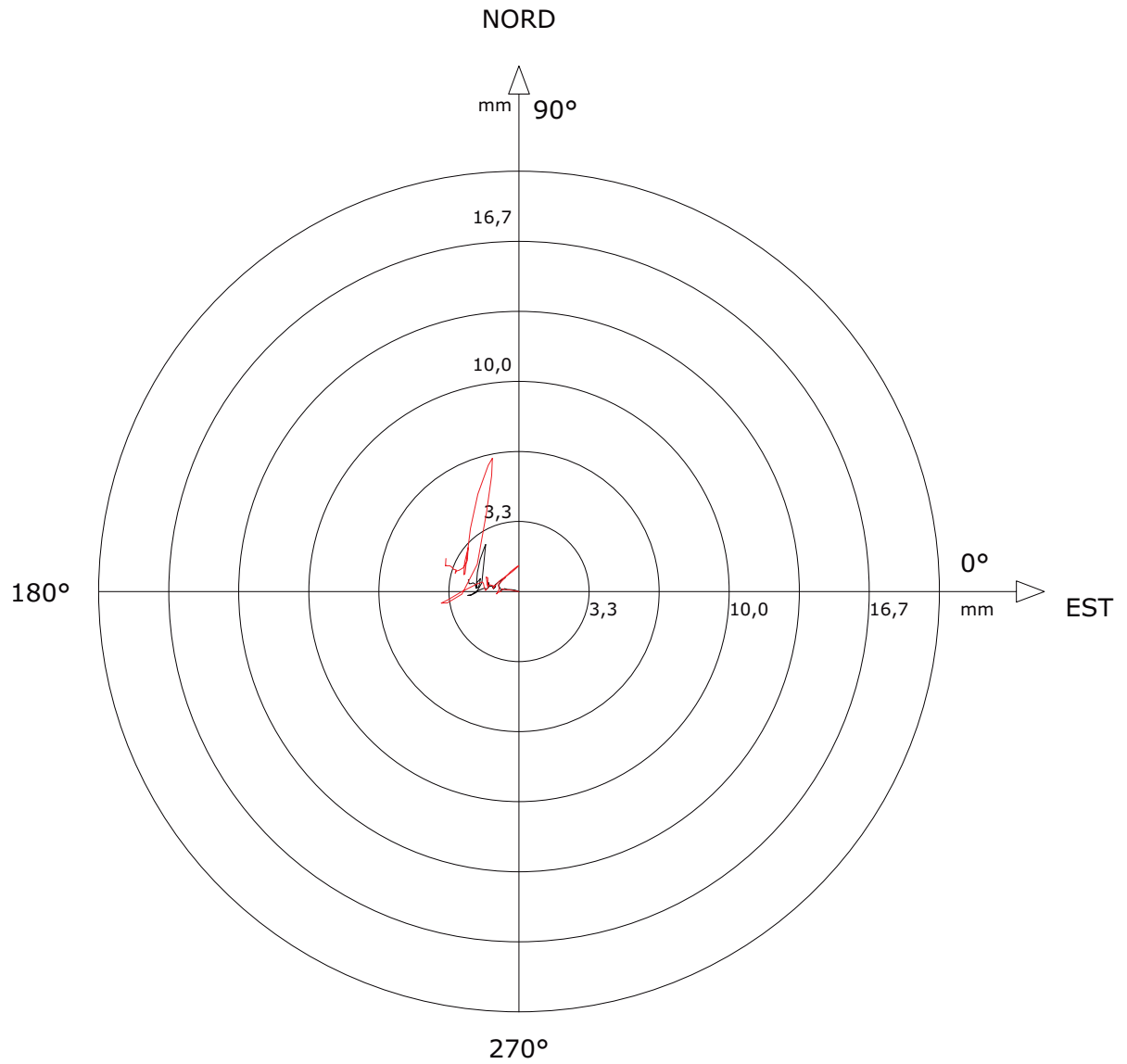
002:27/05/2022

Sito: COLLESTRADA Tubo: S17in

Elaborazione differenziale integrale dal basso

Riferimento 000:14/04/2022

Diagramma polare della deviazione



001:28/04/2022

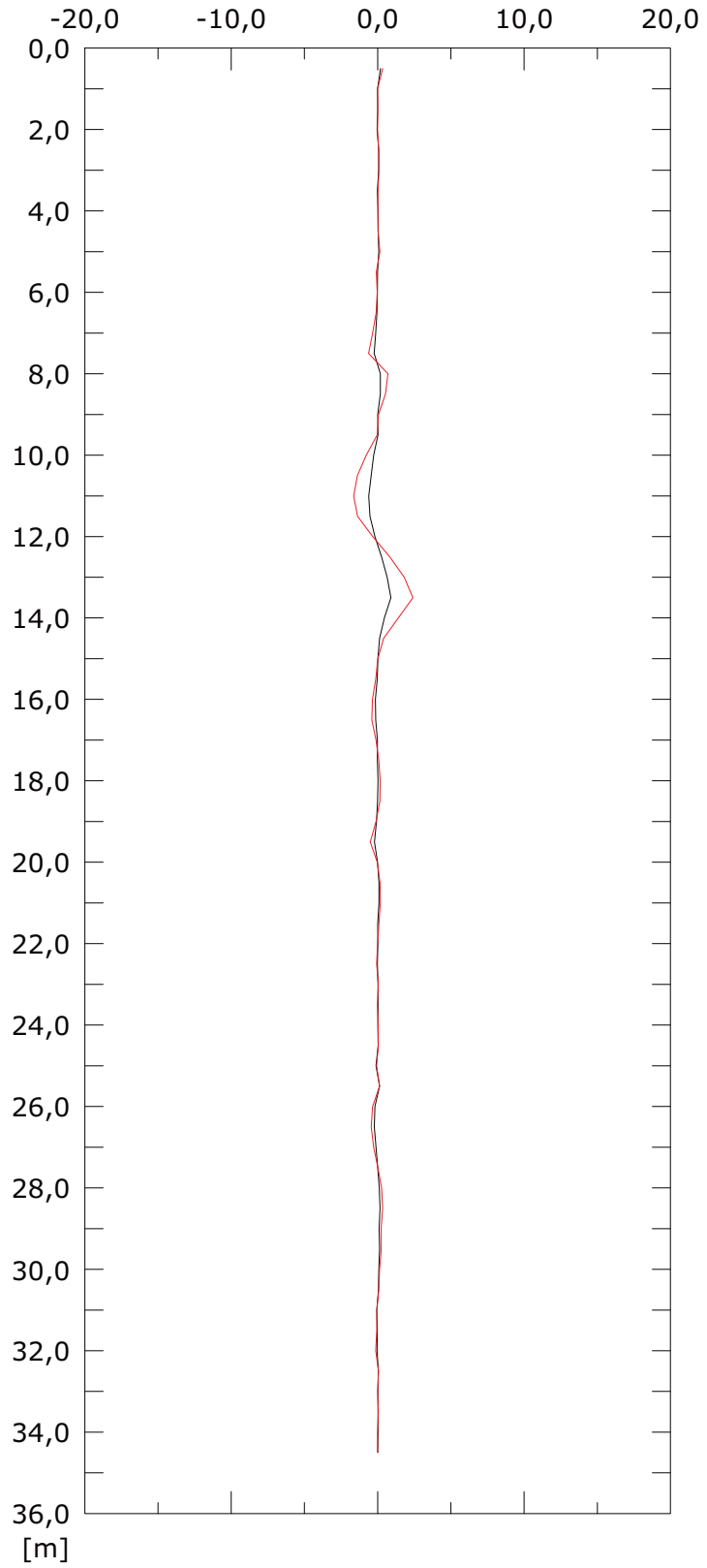
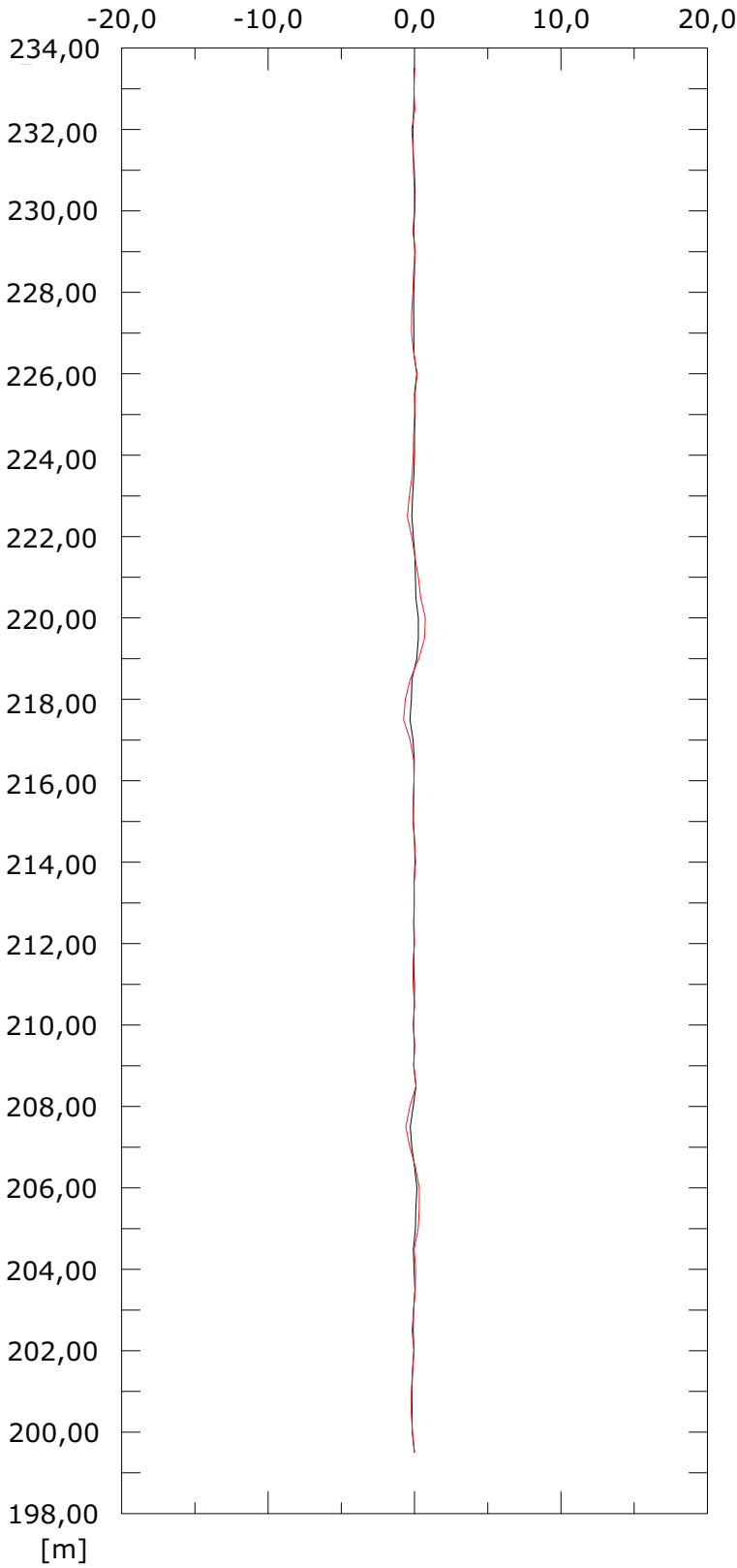
002:27/05/2022

Elaborazione differenziale locale dal basso

Riferimento 000:14/04/2022

Spost. EST [mm]

Spost. NORD [mm]



001:28/04/2022

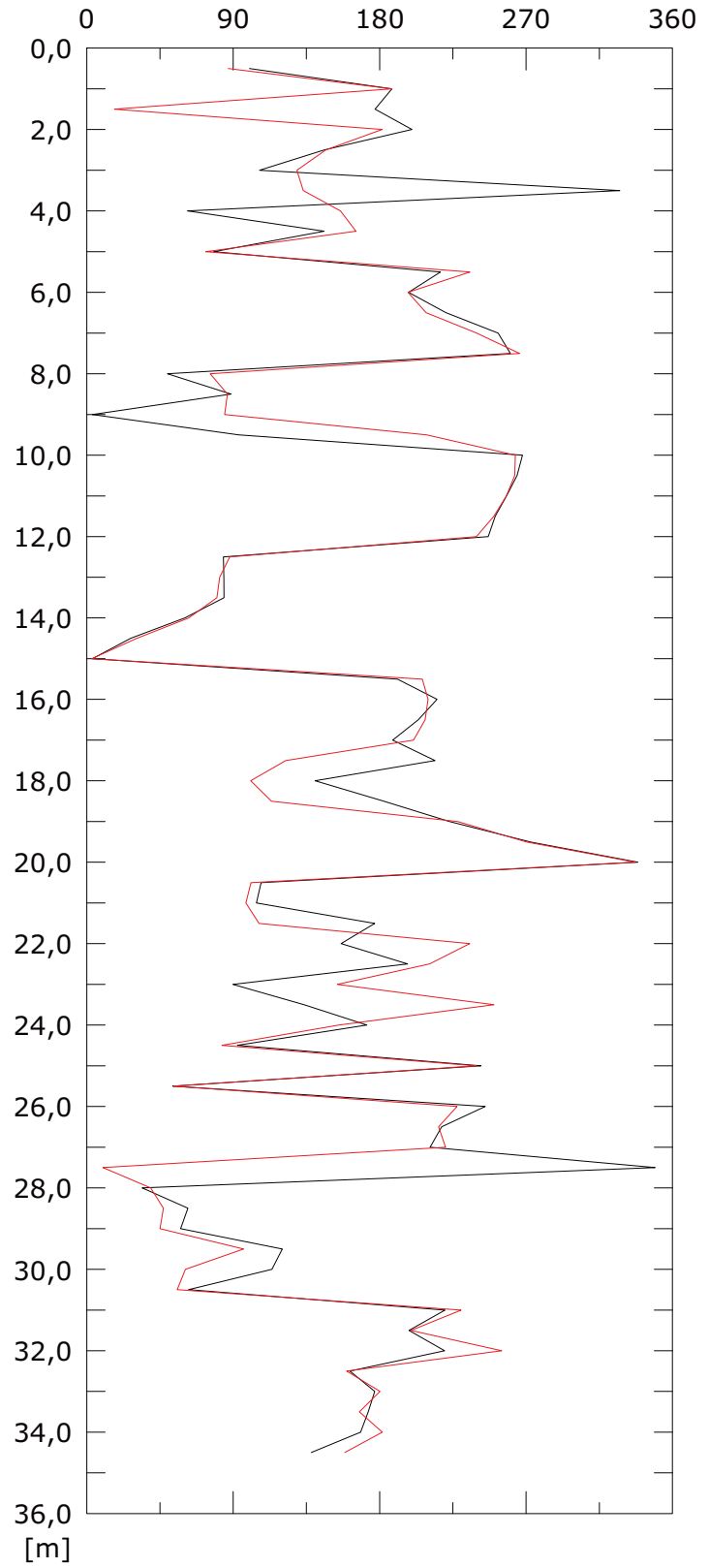
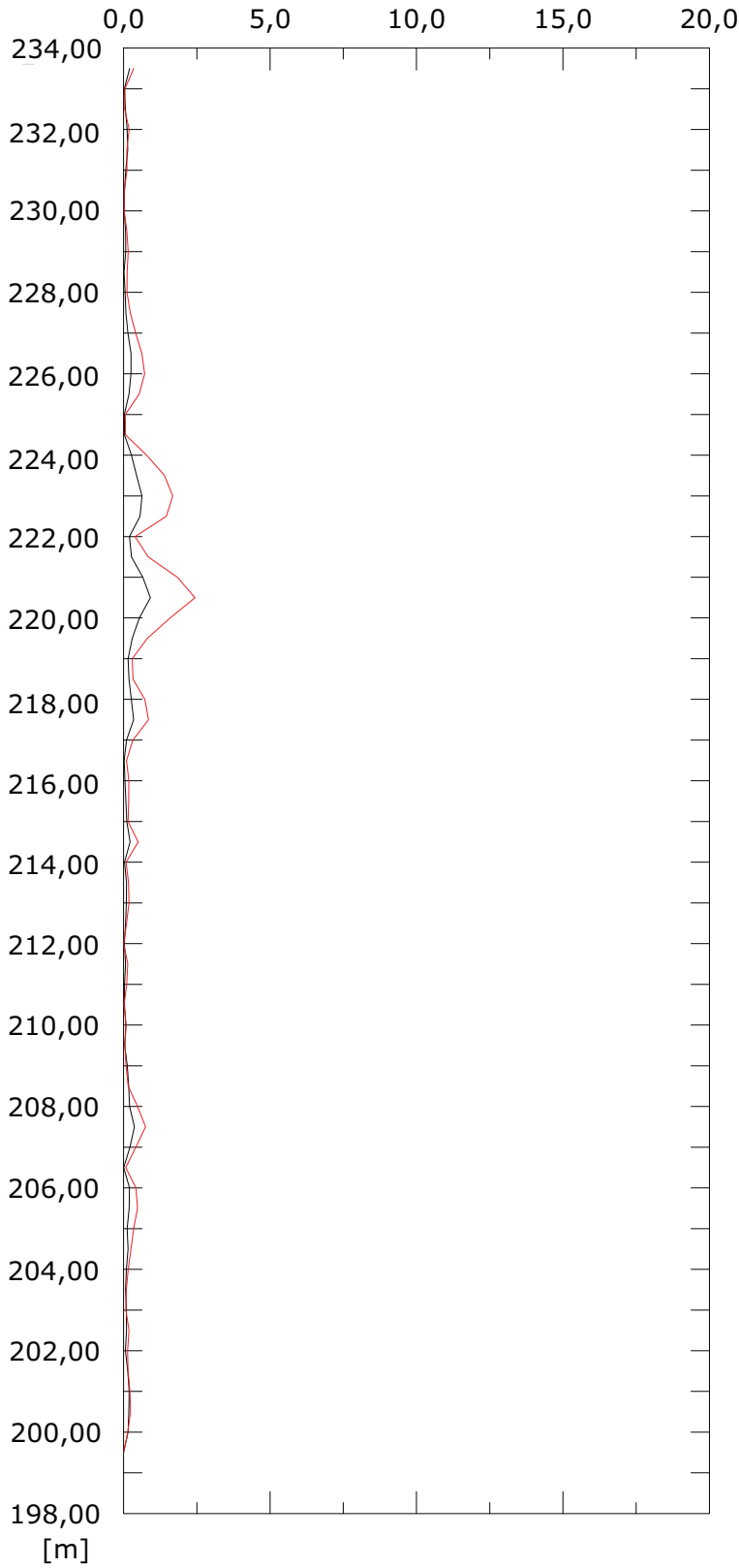
002:27/05/2022

Elaborazione differenziale locale dal basso

Riferimento 000:14/04/2022

Risultante spost. [mm]

Angolo [gradi]



001:28/04/2022

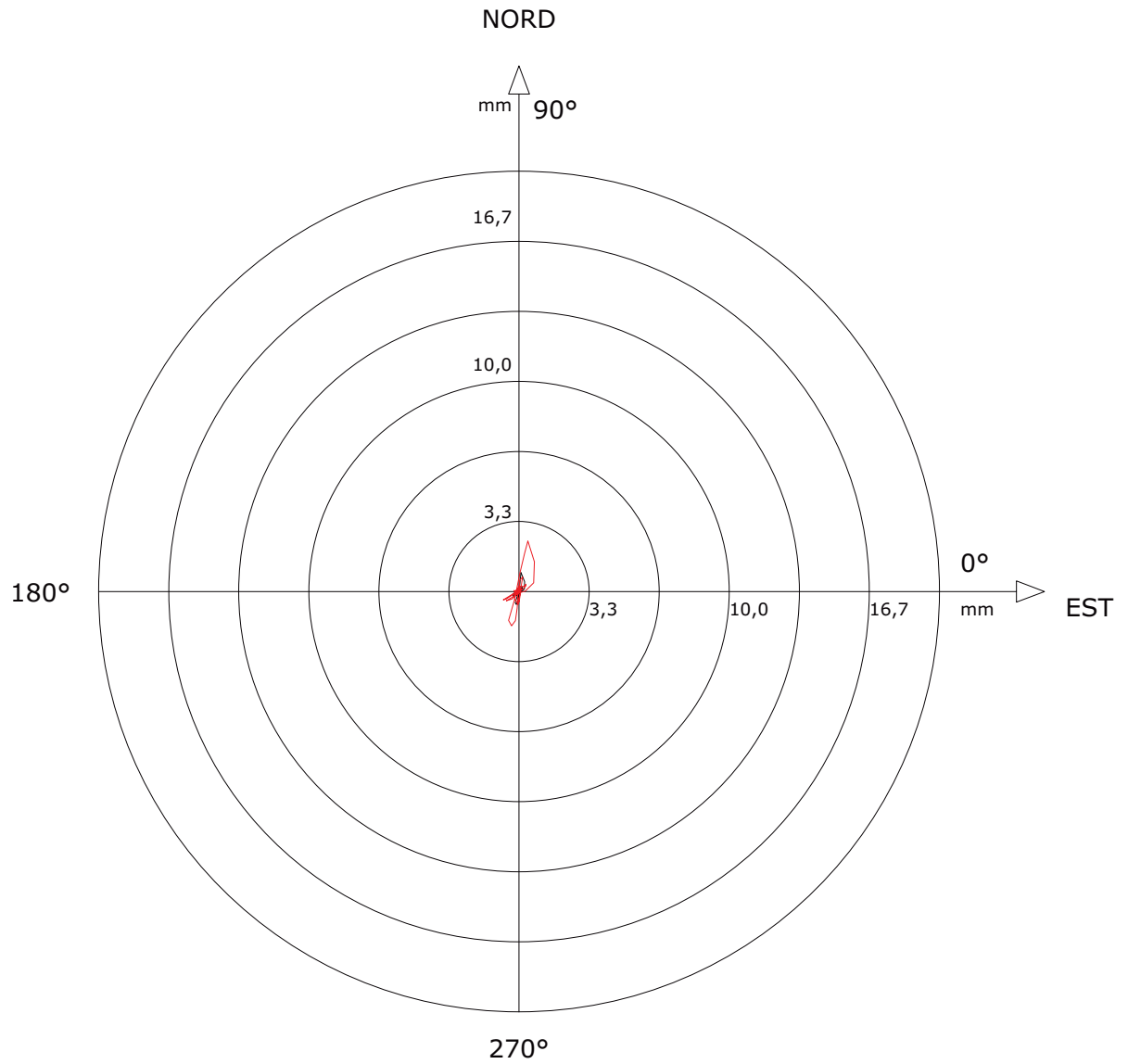
002:27/05/2022

Sito: COLLESTRADA Tubo: S17in

Elaborazione differenziale locale dal basso

Riferimento 000:14/04/2022

Diagramma polare della deviazione



— 001:28/04/2022

— 002:27/05/2022

Sito : COLLESTRAD

Tubo inclin. : S17in

N.ro Misura : 002

Data Misura : 27/05/2022

Località : Collestrada

Scostamenti dalla misura N. 000 - Elaborazione dal basso

Metri	Scost.locali Dir. EST [mm]	Scost.locali Dir. NORD [mm]	Scost.integr. Dir. EST [mm]	Scost.integr. Dir. NORD [mm]	Val.integr. Risultante [mm]	Val.integr. Azimut [gradi]
0,5	0,02	0,34	-3,48	1,57	3,82	155,73
1,0	-0,04	-0,01	-3,50	1,23	3,71	160,67
1,5	0,03	0,01	-3,46	1,23	3,67	160,38
2,0	-0,19	-0,01	-3,49	1,22	3,69	160,67
2,5	-0,09	0,06	-3,30	1,23	3,52	159,57
3,0	-0,07	0,09	-3,20	1,17	3,41	159,97
3,5	-0,02	0,02	-3,13	1,08	3,31	160,99
4,0	-0,02	0,01	-3,11	1,06	3,29	161,21
4,5	-0,10	0,03	-3,09	1,05	3,27	161,24
5,0	0,05	0,15	-2,99	1,02	3,16	161,10
5,5	-0,07	-0,10	-3,04	0,87	3,16	163,92
6,0	-0,11	-0,03	-2,97	0,97	3,12	161,87
6,5	-0,20	-0,11	-2,86	1,01	3,03	160,65
7,0	-0,21	-0,35	-2,66	1,11	2,89	157,34
7,5	-0,04	-0,62	-2,46	1,47	2,86	149,21
8,0	0,18	0,70	-2,41	2,09	3,19	139,18
8,5	0,03	0,53	-2,59	1,39	2,94	151,79
9,0	0,01	0,06	-2,62	0,86	2,76	161,89
9,5	-0,06	-0,03	-2,63	0,80	2,75	163,05
10,0	-0,09	-0,78	-2,57	0,83	2,70	162,09
10,5	-0,17	-1,38	-2,48	1,62	2,96	146,95
11,0	-0,35	-1,64	-2,31	3,00	3,79	127,65
11,5	-0,50	-1,37	-1,96	4,63	5,03	112,94
12,0	-0,20	-0,34	-1,47	6,00	6,18	103,72
12,5	0,03	0,83	-1,27	6,34	6,46	101,30
13,0	0,26	1,81	-1,30	5,51	5,66	103,26
13,5	0,42	2,40	-1,56	3,69	4,01	112,93
14,0	0,73	1,41	-1,99	1,29	2,37	147,03

Sito : COLLESTRAD

Tubo inclin. : S17in

N.ro Misura : 002

Data Misura : 27/05/2022

Località : Collestrada

Scostamenti dalla misura N. 000 - Elaborazione dal basso

Metri	Scost.locali Dir. EST [mm]	Scost.locali Dir. NORD [mm]	Scost.integr. Dir. EST [mm]	Scost.integr. Dir. NORD [mm]	Val.integr. Risultante [mm]	Val.integr. Azimut [gradi]
14,5	0,69	0,41	-2,71	-0,13	2,72	182,67
15,0	0,29	0,02	-3,40	-0,54	3,45	188,96
15,5	-0,29	-0,14	-3,70	-0,55	3,74	188,50
16,0	-0,63	-0,36	-3,41	-0,41	3,44	186,88
16,5	-0,75	-0,40	-2,79	-0,05	2,79	181,08
17,0	-0,30	-0,11	-2,04	0,35	2,07	170,35
17,5	-0,05	0,09	-1,74	0,46	1,80	165,23
18,0	-0,03	0,17	-1,69	0,37	1,73	167,51
18,5	-0,07	0,16	-1,65	0,20	1,67	173,02
19,0	-0,10	-0,11	-1,59	0,05	1,59	178,30
19,5	0,00	-0,50	-1,49	0,16	1,50	174,01
20,0	0,08	-0,03	-1,49	0,65	1,63	156,38
20,5	-0,03	0,16	-1,57	0,68	1,71	156,42
21,0	-0,02	0,18	-1,54	0,52	1,62	161,21
21,5	-0,03	0,09	-1,51	0,34	1,55	167,24
22,0	0,00	0,00	-1,49	0,25	1,51	170,50
22,5	-0,12	-0,07	-1,48	0,25	1,50	170,38
23,0	-0,09	0,05	-1,36	0,32	1,40	166,72
23,5	0,00	-0,01	-1,27	0,28	1,30	167,73
24,0	-0,07	0,03	-1,27	0,29	1,30	167,21
24,5	0,01	0,05	-1,19	0,25	1,22	168,02
25,0	-0,04	-0,07	-1,20	0,21	1,22	170,25
25,5	0,09	0,12	-1,16	0,28	1,19	166,50
26,0	-0,32	-0,35	-1,25	0,15	1,26	173,02
26,5	-0,60	-0,44	-0,93	0,50	1,06	151,53
27,0	-0,32	-0,27	-0,33	0,94	1,00	109,05
27,5	0,07	0,01	-0,01	1,22	1,22	90,43
28,0	0,33	0,27	-0,08	1,20	1,21	93,68

Sito : COLLESTRAD

Tubo inclin. : S17in

N.ro Misura : 002

Data Misura : 27/05/2022

Località : Collestrada

Scostamenti dalla misura N. 000 - Elaborazione dal basso

Metri	Scost.locali	Scost.locali	Scost.integr.	Scost.integr.	Val.integr.	Val.integr.
	Dir. EST [mm]	Dir. NORD [mm]	Dir. EST [mm]	Dir. NORD [mm]	Risultante [mm]	Azimut [gradi]
28,5	0,32	0,35	-0,40	0,94	1,02	113,34
29,0	0,24	0,24	-0,73	0,59	0,94	141,12
29,5	-0,03	0,25	-0,97	0,34	1,03	160,54
30,0	0,08	0,14	-0,94	0,09	0,95	174,32
30,5	0,05	0,07	-1,02	-0,04	1,02	182,36
31,0	-0,05	-0,06	-1,07	-0,12	1,08	186,23
31,5	-0,17	-0,06	-1,02	-0,06	1,03	183,26
32,0	-0,03	-0,13	-0,85	0,00	0,85	179,83
32,5	-0,14	0,05	-0,81	0,13	0,83	170,81
33,0	-0,22	0,00	-0,67	0,08	0,68	173,22
33,5	-0,23	0,05	-0,46	0,08	0,47	169,97
34,0	-0,14	0,00	-0,23	0,03	0,23	172,47
34,5	0,00	0,00	0,00	0,00	0,00	0,00

Sito : COLLESTRAD

Tubo inclin. : S17in

N.ro Misura : 002

Data Misura : 27/05/2022

Località : Collestrada

Scostamenti dalla misura N. 000 - Dati statistici

	Scost.locali Dir. EST [mm]	Scost.locali Dir. NORD [mm]	Scost.integr. Dir. EST [mm]	Scost.integr. Dir. NORD [mm]	Val.integr. Risultante [mm]	Val.integr. Azimut [gradi]
Min	-0,75	-1,64	-3,70	-0,55	0,09	90,43
Max	0,73	2,40	-0,01	6,34	6,46	188,96
Media	-0,05	0,02	-1,86	0,95	2,32	157,35
V. Q. M.	0,06	0,32	4,49	2,79	7,28	25312,80
Varianza	0,06	0,32	1,02	1,88	1,89	24751,97
Dev. Std.	0,24	0,57	1,01	1,37	1,37	157,33