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GENERAL

1.1. PURPOSE

In accordance with Decree No. A/720 of the Mayor of Ulaanbaatar, dated 19 June 2024, and within the framework of the preliminary feasibility study and design consultancy services for the 'New Ring Road' project, ordered by the Office of the Mayor of Ulaanbaatar, a digital topographic map at a scale of 1:500, with a height of 0.5 m, will be prepared and processed according to the pre-planned 27 km route of the Great Ring Road(New Tuul Highway-New Yarmag Bridge-Bayan Khoshuu Circle-6 Station-Dunjingarav Intersection-Tuul Highway), which is to be newly constructed in Ulaanbaatar city.

1.2. INTRODUCTION OF THE COMPANY

1.1.1. Definition

№	Indicator	Description
1	Registered Name	Bayasah Survey
2	Type of Business Entity	Limited Liability Company
3	State Registration n\Number, Company ID	9011210057, 5336384
4	Duration of Operation	Geodetic production and services - 16 years
5	Official Address of the Company	Ulaanbaatar city, Chingeltei district, 3rd khoroo, Tourist street-34, Suvd center, No. 302
6	Contact Phone Number and E-mail Address	Phone: 99032682, 99070460 info@bayasakhsurvey.mn
7	Date of Establishment	2009.10.29

Table 1.

1.1.2. Main areas of activity

- Comprehensive geodetic measurements, inspections, and monitoring of construction
- Comprehensive geodetic measurements, inspections, and monitoring of roads and railways
- Geodetic works of engineering networks
- Various scale mapping and processing
- Cadastral mapping
- Drone flights, mapping, photo processing, and recording

1.1.3. Completed and ongoing projects and programs

Table 2.

№	Partner Company Name	Project information	Completion Date
1	"MCS Property" LLC	Oyu Tolgoi underground mine critical construction project, -1344 level jaw crusher, Ore bin segment assembly measurement.	2016
		Oyu Tolgoi Underground Mine 1300 machinery welding corners all civil works, all bridge and overhead crane metalwork adjustment measurements.	2016-2017
		Oyu Tolgoi Underground Mine 5D Project, 202 level Bin11 civil works, jaw crusher, 110m belt conveyor adjustment, metal structure measurement and adjustment.	2017-2019
		The Oyu Tolgoi Underground Mine Material Transportation Project has completed geodetic network measurements for a 1,100 m long belt conveyor for transporting primary resources, laser scan measurement and processing of the main shaft, and measurement and adjustment of the suspended belt conveyor.	2019-2020
2	"Bodi International" LLC	We have been successfully providing geodetic inspection and verification consulting services for the P1/Base Structure/, P2/Fiber Optics/, P3/Construction/, and P4/Overhead Power Transmission Line/ packages of the Tavan Tolgoi-Gashuunsukhait Railway Complex Project for the 4th year.	2020-2023
3	"Bodi International" LLC	Tavan Tolgoi-Gashuusukhait successfully completed the geodetic inspection and verification consultancy	2021-2022

		services for the infrastructure of the railway project connecting the Tavan Tolgoi-Zuunbayan railway line.	
4	"Bodi International" LLC	We have been successfully providing geodetic inspection and verification consulting services for the TavanTolgoi Coal Loading Logistics Center/TNALT/ Project for the third year.	2022-2024
5	“Tsetsens Mining and Energy” LLC	We have been successfully working for the second year, providing geodetic inspection services to the client for the construction of a 300MW Power Plant, Coal Mine, Overhead Power Line, Office Building, Employee Housing, Sports Complex, Highway, and Railway Complex.	2023-2024
6	"Moncon Construction" LLC	All stages of geodetic work for the construction of groundwater wells and pipelines are being completed.	2024-2025
7	"MCS International" LLC	We provide geodetic supervision services for all stages of water transmission systems, modifications to the TPP-3 and TPP-4 TPPs, and SCADA system construction and installation projects.	2024-2025
8	“Triibtech Aufbereitungsysteme GmbH” LLC	Erdenet Plant “Circular Flow Transport TePRCology Crushing Facility” Project	2024-2025
9	"Office of the Mayor of the Capital"	Topographical map required for feasibility study of the “First Ring Road” project	2025
10	“Khan-Altai Resources” LLC	"Development project"	2025

1.1.4. Certificate of state registration of the company

Figure 1. Certificate of state registration of the company

MINISTRY OF CONSTRUCTION AND URBAN DEVELOPMENT

SPECIAL PERMIT

No: 2023/02/09/007

Pursuant to the relevant provisions of the Law of Mongolia on Geodesy and Cartography, a special permit to engage in "Geodetic Production and Services" is hereby granted to "Bayasakh Survey" LLC (Registration No. 5336384) for a period of 3 years starting from March 2, 2023.

This special permit is valid together with the certificate of registration.

MINISTER

Ts. Davaasuren

(Official Staamped & Signed)

Ulaanbaatar City

2023

Figure 2. Additional Amendments Registered to the Legal Entity's Founding Document

No.	Content of Amendment	Date	Official Signature & Seal
1	Register Tumurbaatar Dalaidash as Executive Director (appointed by decision).	2021.01.13	[Signature & Seal]
2	Issue duplicate certificate.	2021.01.13	[Signature & Seal]
3	Register change of address to: Ulaanbaatar, Sukhbaatar District, 8th Khoroo, Sodon Street 50, Apt. 17. Tel: 88768811, 99039682.	2022.11.09	[Signature & Seal]
4	Register change in shareholder composition: total 2 shareholders.	2022.11.09	[Signature & Seal]
5	Register addition of 2 business activities:		
• 4610 – Wholesale trade of agricultural raw materials and live animals.			
• 4610 – Wholesale trade of food products, beverages, and tobacco in specialized stores.	2022.11.09	*(Signed &Stamped)*	

1.1.5. License

Figure 3. License

MINISTRY OF CONSTRUCTION AND URBAN DEVELOPMENT

SPECIAL PERMIT

No: 2023/02/09/007

Pursuant to the relevant provisions of the Law of Mongolia on Geodesy and Cartography, a special permit to engage in "Geodetic Production and Services" is hereby granted to "Bagakh Sursvi" LLC (Registration No. 5336384) for a period of 3 years starting from March 2, 2023.

This special permit is valid together with the certificate of registration.

MINISTER

Ts. Davaasuren

(Signed & Stamped)

Ulaanbaatar City

2023

1.2. APPLICABLE STANDARDS, NORMS AND REGULATIONS

The following standards and regulations enforced in Mongolia were followed:

These include:

- Government Resolution of Mongolia No. 267 of 2022.
- Regulation on establishing a geodetic network of Mongolia using Global Navigation Satellite System (GNSS) technology. BNbD 11-13-22;
- Regulation on establishing a network of elevation classes III and IV of Mongolia. BNbD 11-121-19;
- Instructions for exploration and research of geodetic points and landmarks MNS:3951-20 Geodesy, cartography. General terms and definitions
- "Topographic background mapping work at scales of 1:5000, 1:2000, 1:1000, 1:500" /BD 11-06-08/
- "Designated symbols of maps at scales of 1:5000, 1:2000, 1:1000, 1:500" UGZZG
- Road and railway geodetic work. /BD 11-114-14/
- "Technical rules for safety of geodetic work" UGZZG, 1976.
- "Aerial mapping and mapping work using unmanned aerial vehicles" BD 11-125-21.
- Aerial and space mapping work BNBD 11-14-23
- MNS:6925-11:2021 Geographical information. Ortho-image spatial data indicator

EXPLANATION OF NOUNS

- **Geodetic permanent point and mark:** The basis of geodesy and cartography, the value of which is determined by three or more spatial dimensions such as position, height, and acceleration of gravity, and is fixed to a stationary object such as the earth's surface, subsoil, or buildings.
- **Geodetic network:** Depending on the measurement used to determine the value of the point, it is classified as a positional /triangulation, polygonometric/, height /I, II, III, IV class/, gravimetric, and GNSS network.
- **Positional network:** A set of points whose position is determined by GNSS measurements in the 3-dimensional equiangular ITRF and geodetic coordinate system of the world's geocenter, orthometric height by geometric leveling, and gravity value by gravimetric measurements.
- **Mongolian Elevation Reference Network:** It forms a unified elevation system throughout the territory and serves as the elevation basis for topographic mapping of all scales used in the defense, infrastructure, and scientific fields.
- **Geodetic basis:** A system of national, cartographic, and other geodetic network points and symbols for topographic mapping.
- **Global Navigation Satellite System (GNSS):** A satellite system established to determine the spatial position, direction of movement, and displacement of objects.
- **Explanation:** It includes navigation satellite systems such as the American GPS, Russian GLONASS, European GALILEO, Chinese COMPASS/Bei-Dou, Japanese QZSS, and Indian IRNSS, as well as the American WAAS, Russian SDCM, European EGNOS, Japanese MTSAT, and Indian GAGAN satellite systems established additionally to transmit their corrections.
- **Permanent Station (PS):** A set of equipment and software that continuously receives navigation satellite data and distributes three-dimensional coordinates and corrections.
- **Real Time Kinematic (RTK):** A measurement method in which a mobile station receives the correction information sent by a base station at that moment and directly determines its own coordinates.

- **Geoid:** The shape of the Earth formed by continuing to draw a surface line when the sea is calm and balanced.
- **Wall reference, mark:** A point of a national elevation network attached to a building wall, column, or concrete bridge.
- **Measurement accuracy:** A measurement indicator that shows the value that is close to the actual value of the measured quantity.
- **Alignment:** The actual value of the measured quantity or its function is determined by processing the geodetic measurement results.
- **Mean square error:** An indicator of the accuracy and quality of the measurement results.

ABBREVIATIONS

- MNG – Mongolia
- BNMAU – Mongolian People's Republic
- USA – United States of America
- PRC – People's Republic of China
- GZZG – Agency for Geodesy and Cartography
- GUGK – Main Directorate of Geodesy and Cartography (Russia)
- GZZGZZEG – General Authority for Land Administration, Geodesy, and Cartography
- BNbD – Building Norms and Regulations
- BD – Building Rules
- MNS – Mongolian National Standard
- ITRF – International Terrestrial Reference Frame
- BAS – Continuously Operating Reference Station
- UGS – National Geodetic Network
- UAV – Unmanned Aerial Vehicle
- GSD – Ground Sampling Distance
- SGO – South Geomatics Office
- UTM – Universal Transverse Mercator
- GNSS – Global Navigation Satellite System

- UB 01 – Ulaanbaatar City Continuously Operating Reference Station
- Tuv 1 – Tuv Province Continuously Operating Reference Station
- GCT – Geodetic Control Point Center
- GCH – Geodetic Control Point Form
- KhR – Wall Benchmark

2. ENGINEERING GEODESIC SURVEY

2.1. ENGINEERING GEODESY SURVEYS AND INVESTIGATION

Within the framework of the "New Circular Highway" project, an engineering geodetic survey was conducted by obtaining information on 51 point markers of the State Geodetic Positioning Network, 3 level II benchmarks and wall marks of the elevation network in Khan-Uul, Songinokhairkhan, Chingeltei, Sukhbaatar, and Bayanzurkh districts of Ulaanbaatar city from the "Geoportal" website of the spatial data infrastructure web portal of the "General Department of Land Management, Geodesy, and Cartography" of the government implementing agency.

Instructions on obtaining geodetic point marker information from the Geoportal spatial subsystem have been included.

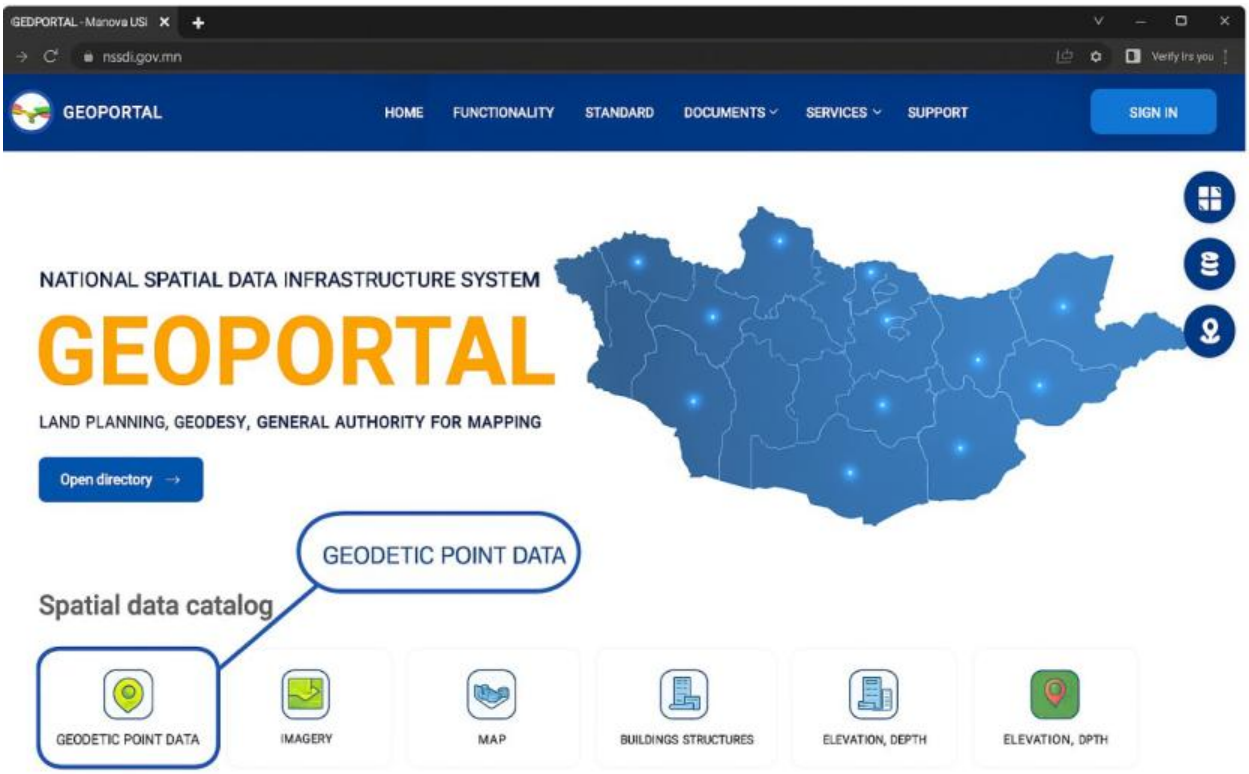


Figure 4. Access to the "Geoportal" spatial data infrastructure electronic system

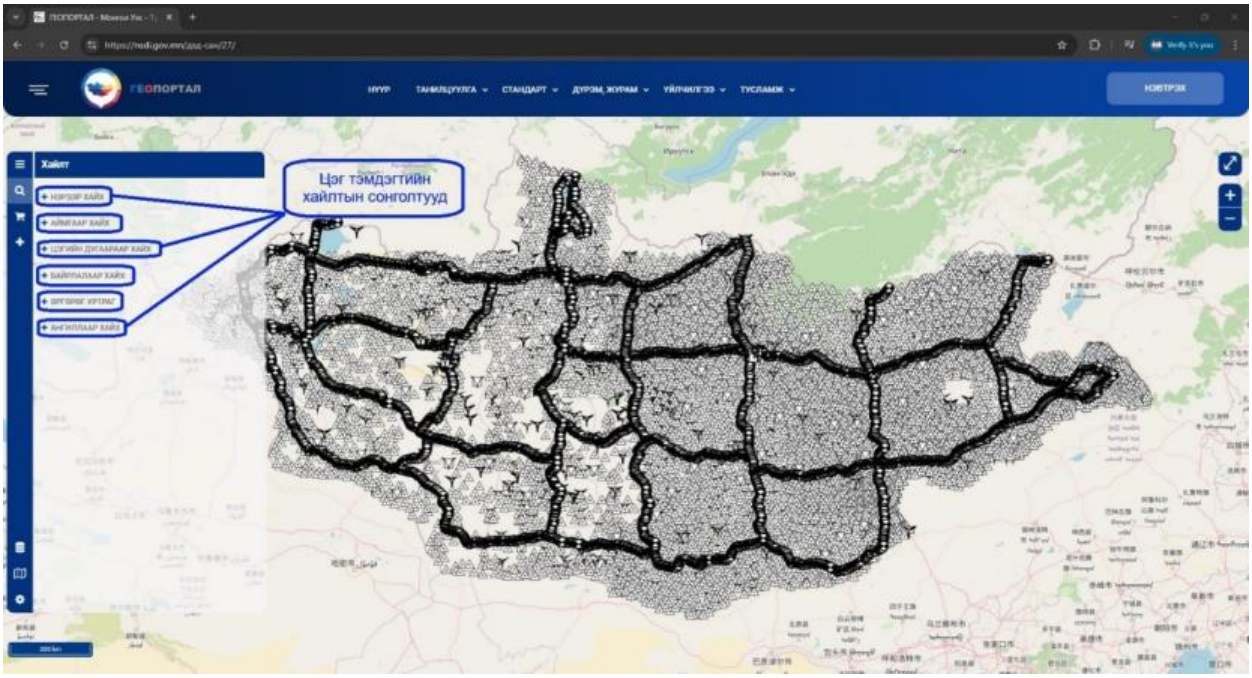


Figure 5. Geodetic network points of Mongolia

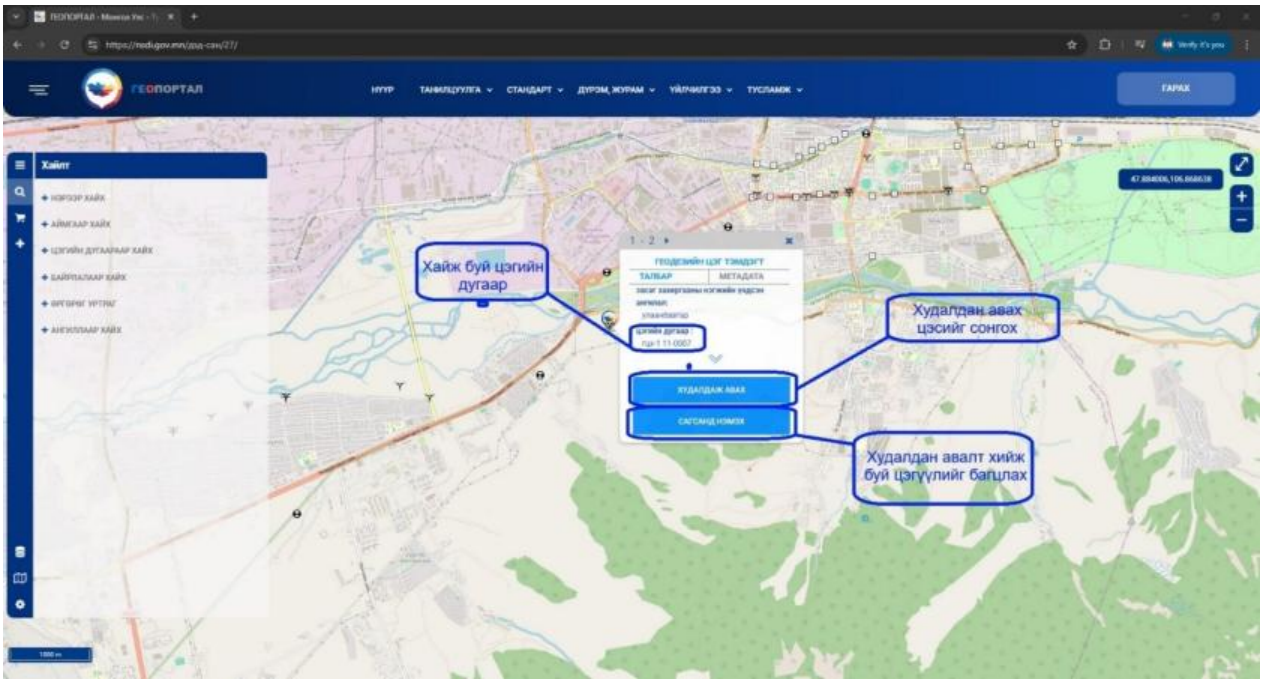
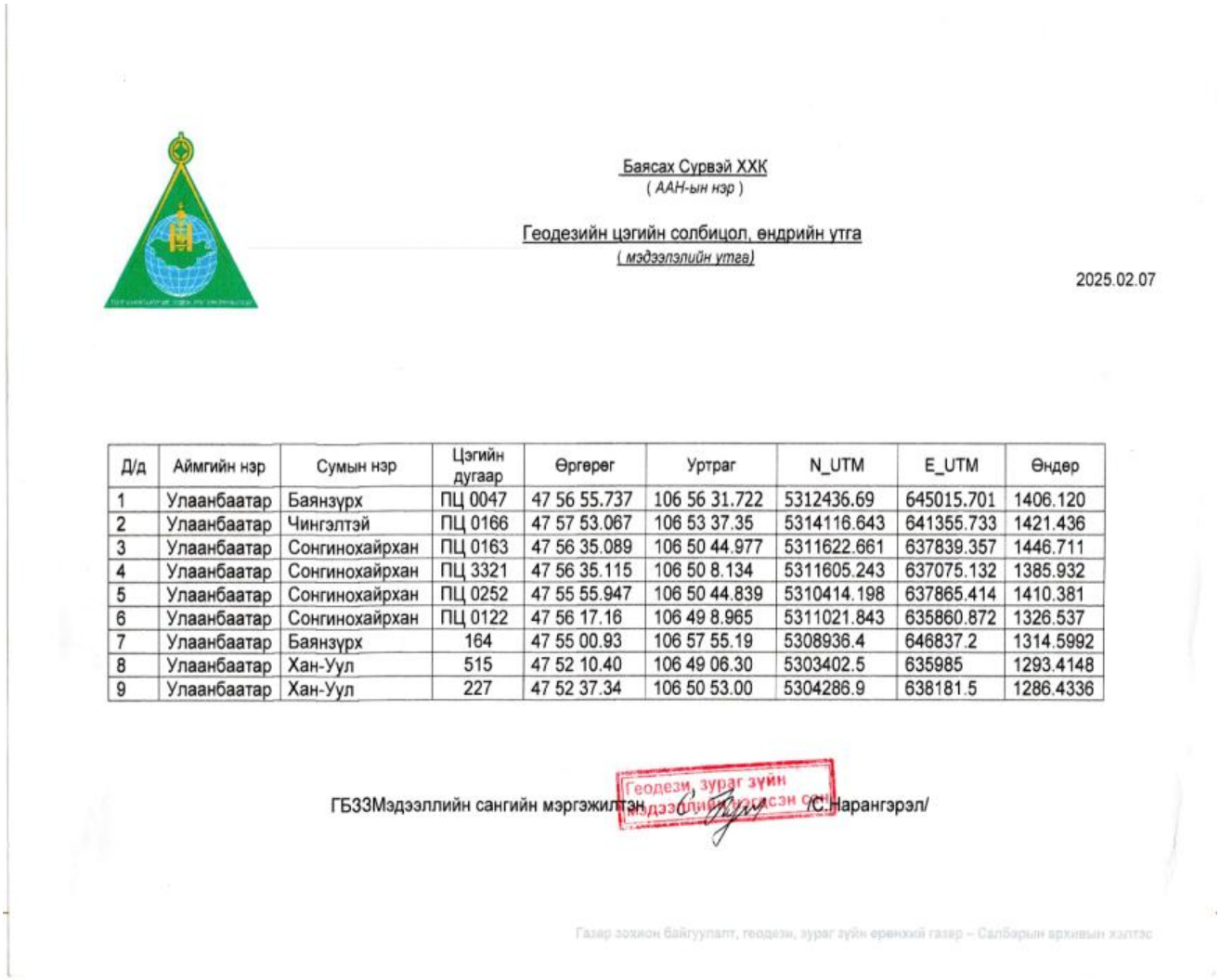


Figure 6. Find the nearest landmark in the project area

"Geospatial Portal" – The spatial data infrastructure electronic system will deliver the purchased control point and benchmark information to the registered device and email address..



Баясах Сурвэй ХХК
(ААН-ын нэр)

Геодезийн цэгийн солбицол, өндрийн утга
(мэдээлэлийн утга)

2025.02.07

Д/д	Аймгийн нэр	Сумын нэр	Цэгийн дугаар	Өргөрөг	Уртраг	N_UTM	E_UTM	Өндөр
1	Улаанбаатар	Баянзүрх	ПЦ 0047	47 56 55.737	106 56 31.722	5312436.69	645015.701	1406.120
2	Улаанбаатар	Чингэлтэй	ПЦ 0166	47 57 53.067	106 53 37.35	5314116.643	641355.733	1421.436
3	Улаанбаатар	Сонгинохайрхан	ПЦ 0163	47 56 35.089	106 50 44.977	5311622.661	637839.357	1446.711
4	Улаанбаатар	Сонгинохайрхан	ПЦ 3321	47 56 35.115	106 50 8.134	5311605.243	637075.132	1385.932
5	Улаанбаатар	Сонгинохайрхан	ПЦ 0252	47 55 55.947	106 50 44.839	5310414.198	637865.414	1410.381
6	Улаанбаатар	Сонгинохайрхан	ПЦ 0122	47 56 17.16	106 49 8.965	5311021.843	635860.872	1326.537
7	Улаанбаатар	Баянзүрх	164	47 55 00.93	106 57 55.19	5308936.4	646837.2	1314.5992
8	Улаанбаатар	Хан-Уул	515	47 52 10.40	106 49 06.30	5303402.5	635985	1293.4148
9	Улаанбаатар	Хан-Уул	227	47 52 37.34	106 50 53.00	5304286.9	638181.5	1286.4336

ГБЗЗМэдээллийн сангийн мэргэжилтэн /С.Нарангэрэл/

Геодези, зураг зүйн мэдээлэл

Газар зохион байгуулалт, геодези, зураг зүйн ерөнхий газар – Салбарын архивын хэлтэс

Figure 7.

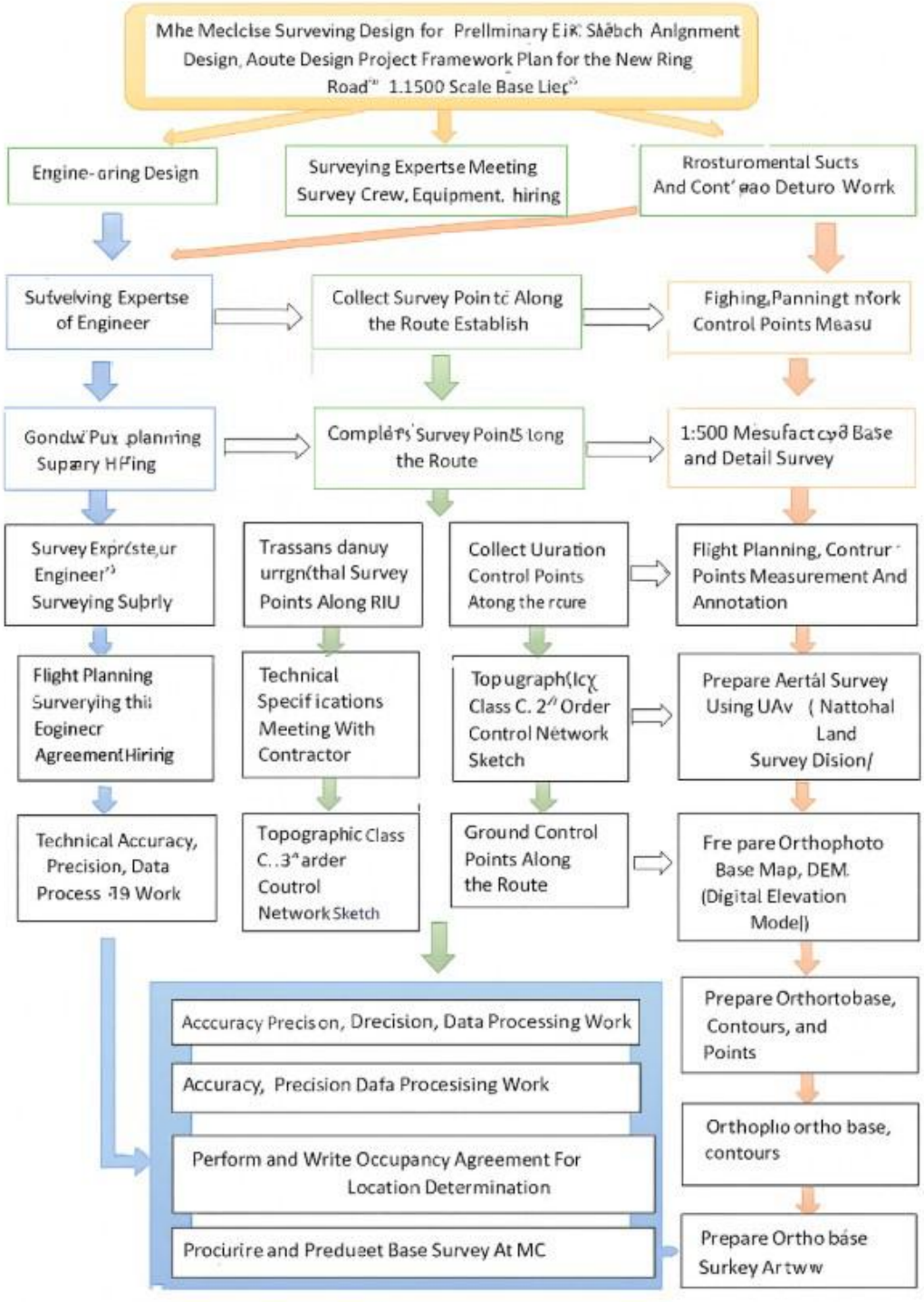


Figure 8. General planning scheme for the 1:500 scale topographic mapping work of the "First Ring Road" project

During the survey, the centers of the points found were recorded on paper. The survey work was carried out by 5 teams of 3 people each, including Geodetic Engineer-1, Geodetic TePRCician-1, and Driver-1, or a total of 15 people. The location and elevation of the points are shown in Table-1.

Table 3.

№	Point name	UTM equiangular intersection, m		Point height, m	Description
		x	y		
1	478	5304338.205	637103.147	1271.697	Undeleted points
2	MNG-0051	5308036.218	636797.796	1275.545	
3	Microraion	5309194.806	636717.296	1326.610	
4	GCP-0252	5310414.198	637865.414	1410.381	
5	GCP -0122	5311021.843	635860.872	1326.537	
6	ГЗЗГ-3321	5311605.243	637075.132	1385.932	
7	GCP -0163	5311622.661	637839.357	1446.711	
8	GCP-0230	5313686.690	635798.342	1379.453	
9	GCP-0394	5314529.361	639935.343	1580.386	
10	GCP-0463	5313241.744	640267.229	1501.184	
11	GCP-0297	5313698.427	641039.178	1527.638	
12	GCP-0166	5314116.643	641355.733	1421.436	
13	GCP-0393	5314530.967	641714.795	1480.295	
14	Chingeltei am	5314147.209	642157.520	1437.566	
15	ГУГК-8723	5313941.522	642574.311	1442.072	
16	GCP-0216	5314533.775	644153.606	1353.229	
17	GCP-0047	5312436.690	645015.701	1406.120	
18	GCP-0040	5311459.398	646735.879	1415.323	
19	GCP-0068	5306562.827	636821.783	1273.341	Deleted points

20	GCP-0414	5308647.791	636832.362	1287.590	
21	GCP-0024	5309808.893	637525.381	1363.779	
22	GCP-0016	5309938.642	636719.806	1361.756	
23	GCP-0255	5310355.356	636905.896	1379.192	
24	GCP-0337	5310872.377	637205.569	1418.131	
25	Maanit	5310948.384	637771.987	1454.476	
26	GCP-0352	5311716.762	637222.057	1395.074	
27	GCP-0437	5312565.620	638780.389	1460.052	
28	GCP-0039	5314688.069	641281.416	1511.202	
29	GCP-1120	5314392.722	642739.762	1365.705	
30	GCP-1121	5314430.126	643127.399	1354.552	
31	GCP-1122	5314657.554	643082.984	1356.795	
32	GCP-6111	5313837.432	643094.978	1350.981	
33	GCP-0461	5313908.810	643676.861	1334.212	
34	GCP-0391	5314553.103	643712.620	1339.748	
35	GCP-0018	5314531.839	644000.575	1340.631	
36	GCP-0113	5313768.319	644329.212	1343.676	
37	GCP-0145	5312970.598	644397.838	1331.411	
38	GCP-0398	5311054.147	646332.990	1414.343	
39	GCP-0174	5310892.873	647278.289	1437.665	
40	karr	5310421.367	646305.434	1420.449	
41	rels	5309709.473	646646.376	1341.655	
42	GCP-0062	5309728.104	647125.853	1338.955	
43	GCP-0575	5309760.890	647186.500	1335.238	Deleted points
44	GCP-0467	5308946.209	646140.234	1306.058	
45	GCP-0051	5308916.653	646451.674	1309.691	

46	GCP-0010	5308870.444	646912.058	1311.046	
47	GCP-0225	5308866.114	647164.874	1311.723	
48	GCP-0404	5307881.626	646638.808	1297.274	
49	GCP-0485	5307847.248	645927.043	1294.619	
50	okrug	5307883.728	647199.174	1298.266	
51	10031	5307841.085	647487.336	1298.605	

Measurements during the exploration of the point are shown in Figure 8, and the center of the point is shown in Figure 6.

Figure 9.

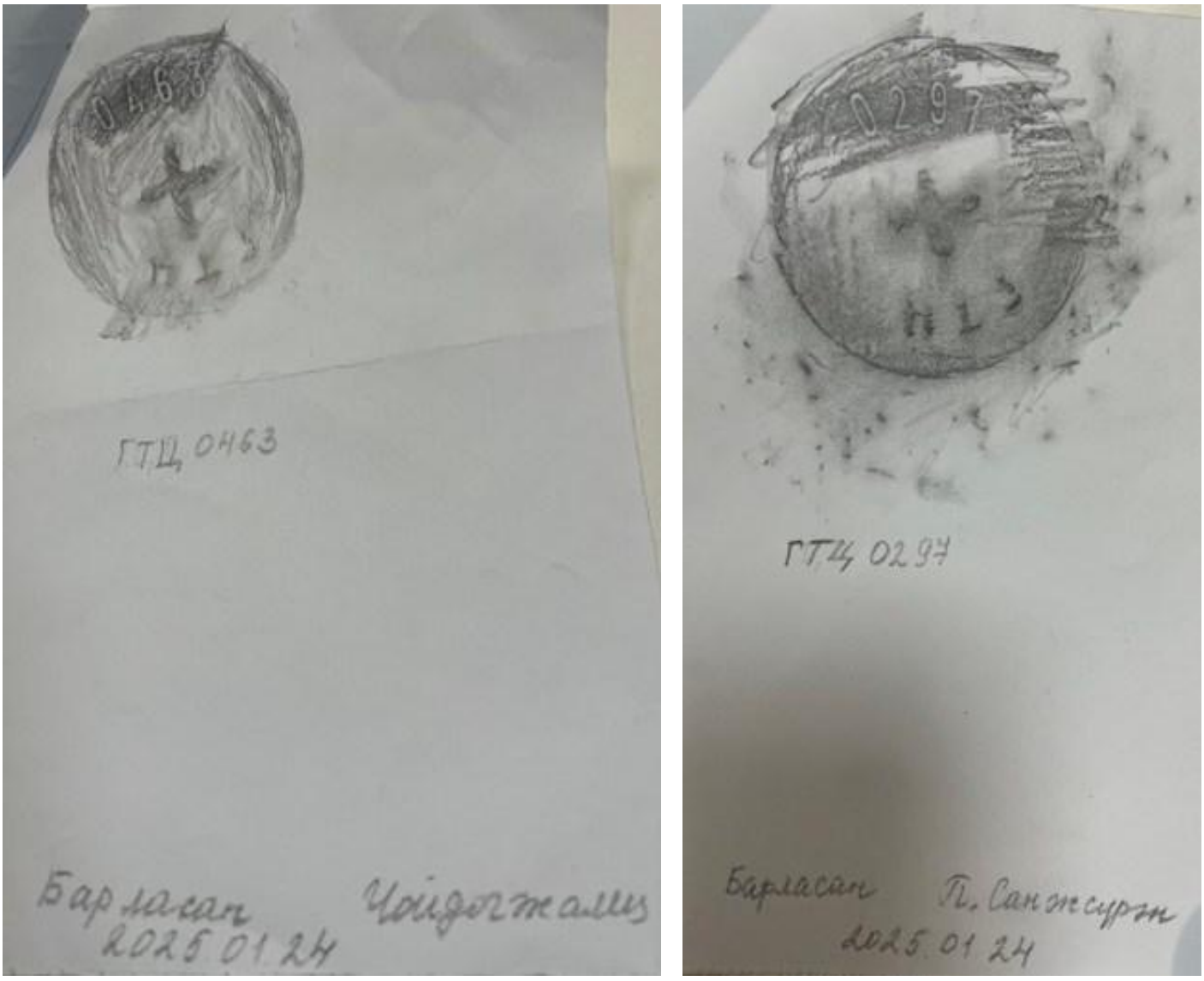


Figure 10.

As a result of the exploration and research, out of a total of 51 points, 32 points were destroyed, 1 point was lost for measurement, and 18 points were available for measurement.

A detailed record of the geodetic network points along the route was compiled.

1	**Point name:**	GCP	**2**	**Mark rapper number:**	0047
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Bayanzurkh District 27th Khoroo			
6	**Coordinates:**	47 56 55.737	106 56 31.722	5312436.69	645015.701

7. Photographs of the point:

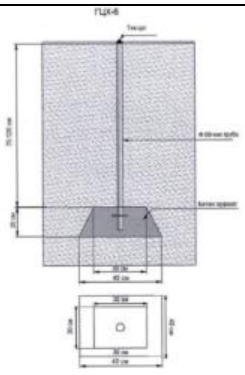
From nearby

From afar

8. Location note: In front of the hill, to the right of the mountain antenna with the network antenna, located southwest of secondary school number 127

9. Location sketch:

10. Center point shape:



11. About soil properties:

12. Date: 2025-01-24

14. Personal case manager: D. Mönkhtsetseg

15. Organization: Bayasakh Survey LLC

1	**Point name:**	GCP	**2**	**Mark rapper number:**	0394
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Chingeltei District 22nd Khoroo			
6	**Coordinates:**	47 58 7.551	106 52 29.369	5314529.362	639935.343

7. Photographs of the point:

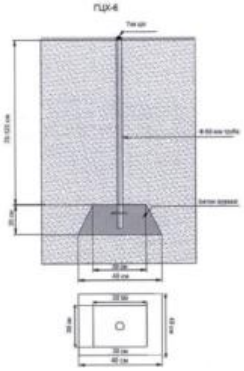
From nearby

From afar

8. Location note: 60m northwest of the Mobicom network antenna, in front of the mound

9. Location sketch:

10. Center point shape:



11. About soil properties:

12. Date: 2025-01-24

14. Personal case manager: D. Mönkhtsetseg

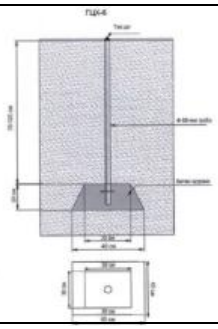
15. Organization: Bayasakh Survey LLC

1	**Point name:**	GCP	**2**	**Mark rapper number:**	0216
3	**Trapezoid number :**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Sukhbaatar District 16th District			
6	**Coordinates:**	47 58 4.324	106 55 52.712	5314533.775	644153.606

7. Photo of the point:

From nearby	**From afar**

8. Location note: 50m east of the building in Sukhbaatar 16th khoroo

9. Location sketch:	**10. Center point shape:**
	

11. About soil properties:

12. Date: 2025-01-24

14. Personal case manager: D. Mönkhtsetseg

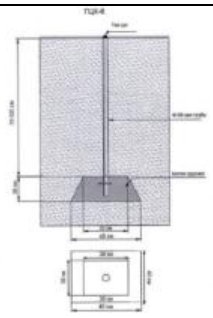
15. Organization: Bayasakh Survey LLC

1	**Point name:**	GCP	**2**	**Mark rapper number:**	0297
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Chingeltei District 22nd Khoroo			
6	**Coordinates:**	47 57 39.779	106 53 21.598	5313698.427	641039.177

7. Photo of the point:

From nearby	**From afar**

8. Location note: A mountain located 600m from the bus station in the middle of the 22nd khoroo of Chingeltei district, Ulaanbaatar.

9. Location scheme:	**10. Center point shape:**
	

11. About soil properties:

12. Date: 2025-01-24

14. Personal case manager: D. Mönkhtsetseg

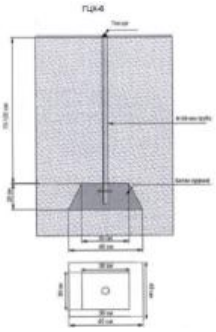
15. Organization: Bayasakh Survey LLC

1	**Point name:**	GCP	**2**	**Mark rapper number:**	0040
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Chingeltei District 31st Khoroo			
6	**Coordinates:**	47 56 22.69	106 57 53.408	5311459.398	646735.879

7. Photo of the point:

From nearby	**From afar**

8. Location note: Ulaanbaatar, Chingeltei District, Khoroo 31, Monel No. 656, courtyard

9. Location scheme:	**10. Center point shape:**
	

11. About soil properties:

12. Date: 2025-01-24

14. Personal case manager: D. Mönkhtsetseg

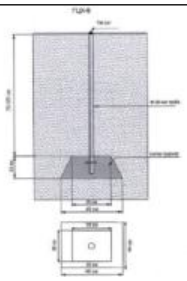
15. Organization: Bayasakh Survey LLC

1	**Point name:**	ГЦТ	**2**	**Mark rapper number:**	0163
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Songinokhairkhan District No. 8			
6	**Coordinates:**	47 56 35.089	106 50 44.977	5311622.661	637839.357

7. Photo of the point:

From nearby	**From afar**

8. Location note: 900m southeast of Gunji Nden Lake, 400m northeast of Soyombo Tolo

9. Location scheme:	**10. Center point shape:**
	

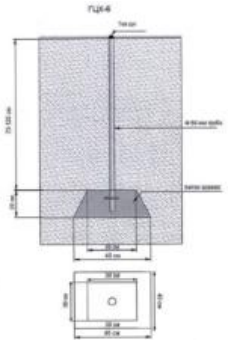
11. About soil characteristics:
12. Date: 2025-01-24
14. Personal file: M. Bukhsanaa
15. Organization: Bayasakh Survey LLC

1	**Point name:**	TR	**2**	**Mark rapper number:**	Microraion
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	Тригиуляц
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Songinokhairkhan District No. 23			
6	**Солбицол:**	47 55 17.356	106 49 48.138	5309194.806	636717.296

7. Photo of the point:

From nearby	**From afar**

8. Location note: 450m northeast of the Energy Center

9. Location scheme:	**10. Center point shape:**
	

11. About soil characteristics:
12. Date: 2025-01-24
14. Personal file: M. Bukhsanaa
15. Organization: Bayasakh Survey LLC

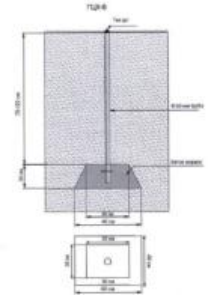
Additional note for point survey: Measurement conditions are lost

1	**Point name:**	ГЦТ	**2**	**Mark rapper number:**	0393
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Chingeltei District 15th District			
6	**Солбицол:**	47 58 6.193	106 53 55.149	5314530.967	641714.796

7. Photo of the point:

From nearby	**From afar**

8. Location note: 20m northeast of Hailast Reservoir (USUG)

9. Location scheme:	**10. Center point shape:**
	

11. About soil characteristics:
12. Date: 2025-01-24
14. Personal file: M. Bukhsanaa
15. Organization: Bayasakh Survey LLC

1	**Point name:**	ГЦТ	**2**	**Mark rapper number:**	0166
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Chingeltei District 16th District			
6	**Coordinates:**	47 57 53.067	106 53 37.35	5314116.642	641355.733

7. Photo of the point:

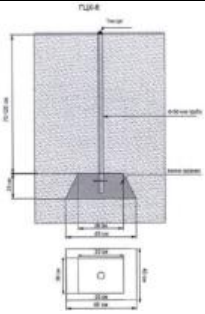
From nearby

From afar

8. Location note: 400m north of Hailast Sod Mongolian Klonk

9. Location scheme:

10. Center point shape:



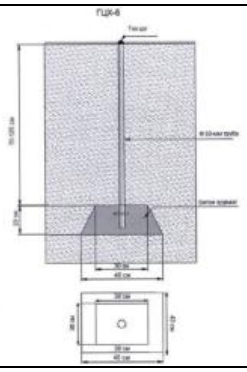
11. About soil characteristics:
12. Date: 2025-01-24
14. Personal file: M. Bukhsanaa
15. Organization: Bayasakh Survey LLC

1	**Point name:**	ГЦТ	**2**	**Mark rapper number:**	0252
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Songinokhairkhan District No. 31			
6	**Coordinates:**	47 55 5.947	106 50 44.839	5310414.199	637865.414

7. Photo of the point:

From nearby	**From afar**

8. Location note: 500m south of Soyombotoi Tolgoi, next to the network antenna

9. Location scheme:	**10. Center point shape:**
	

11. About soil characteristics:
12. Date: 2025-01-24
14. Personal file: M. Bukhsanaa
15. Organization: Bayasakh Survey LLC

1	**Point name:**	ГУГК	**2**	**Mark rapper number:**	8723
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Chingeltei District 15th District			
6	**Coordinates:**	47 57 46.425	106 54 35.878	5313941.522	642574.312

7. Photo of the point:

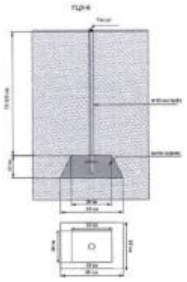
From nearby

From afar

8. Location note: Next to the 10m mound to the left of the network antenna

9. Location scheme:

10. Center point shape:



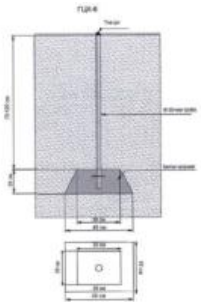
11. About soil characteristics:
12. Date: 2025-01-24
14. Personal file: M. Bukhsanaa
15. Organization: Bayasakh Survey LLC

1	**Point name:**	ГЗЗГ	**2**	**Mark rapper number:**	3321
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Songinokhairkhan District No. 8			
6	**Coordinates:**	47 56 35.115	106 50 8.134	5311605.242	637075.132

7. Photo of the point:

From nearby	**From afar**

8. Location note: Gunj Nden Lake 900m BU

9. Location scheme:	**10. Center point shape:**
	

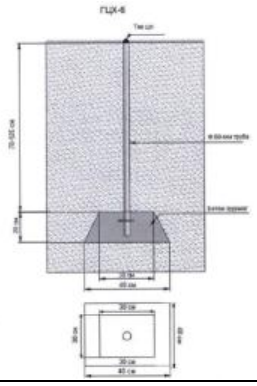
11. About soil characteristics:
12. Date: 2025-01-24
14. Personal file: M. Bukhsanaa
15. Organization: Bayasakh Survey LLC

1	**Point name:**	GCP	**2**	**Mark rapper number:**	0463
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Chingeltei District 21st Khoroo			
6	**Coordinates:**	47 57 25.606	106 52 43.855	5313241.744	640267.229

7. Photo of the point:

From nearby	**From afar**

8. Location note: A mountain located northwest of Anand Supermarket, Khoroo 21, Chingeltei District, Ulaanbaatar

9. Location scheme:	**10. Center point shape:**
	

11. About soil characteristics:
12. Date: 2025-01-24
14. Personal file: M. Bukhsanaa
15. Organization: Bayasakh Survey LLC

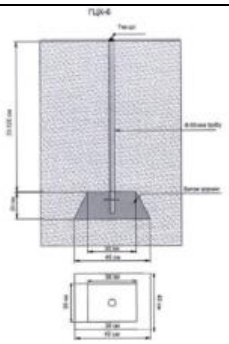
1	**Point name:**	Mongolia	**2**	**Mark rapper number:**	0051
3	**Trapezoid number:**	M-48-142	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Songinokhairkhan District 17th District			
6	**Coordinates:**	47 54 39.789	106 49 50.686	5308036.296	636797.675

7. Photo of the point:

8. Location note: On the 32nd bridge

9. Location scheme:

10. Center point shape:



11. About soil properties:

12. Date: 2025-01-24

14. Personal case manager: M. Bukhsanaa

15. Organization: Bayasakh Survey LLC

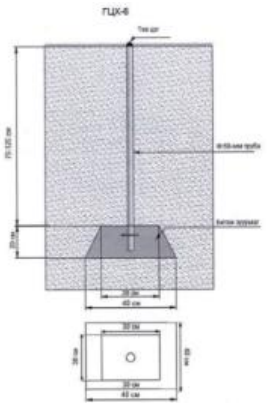
1	**Point name:**	Chingeltei	**2**	**Mark rapper number:**	Ам
3	**Trapezoid number:**	L-48-10	**4**	**Network type:**	GNSS
5	**Location: (aimag, soum, district, khoroo)**	Ulaanbaatar Chingeltei District 15th District			
6	**Coordinates:**	47 57 53.417	106 54 16.033	5314147.209	642157.52

7. Photo of the point:

8. Location note: On top of the mountain in the courtyard of number 0280

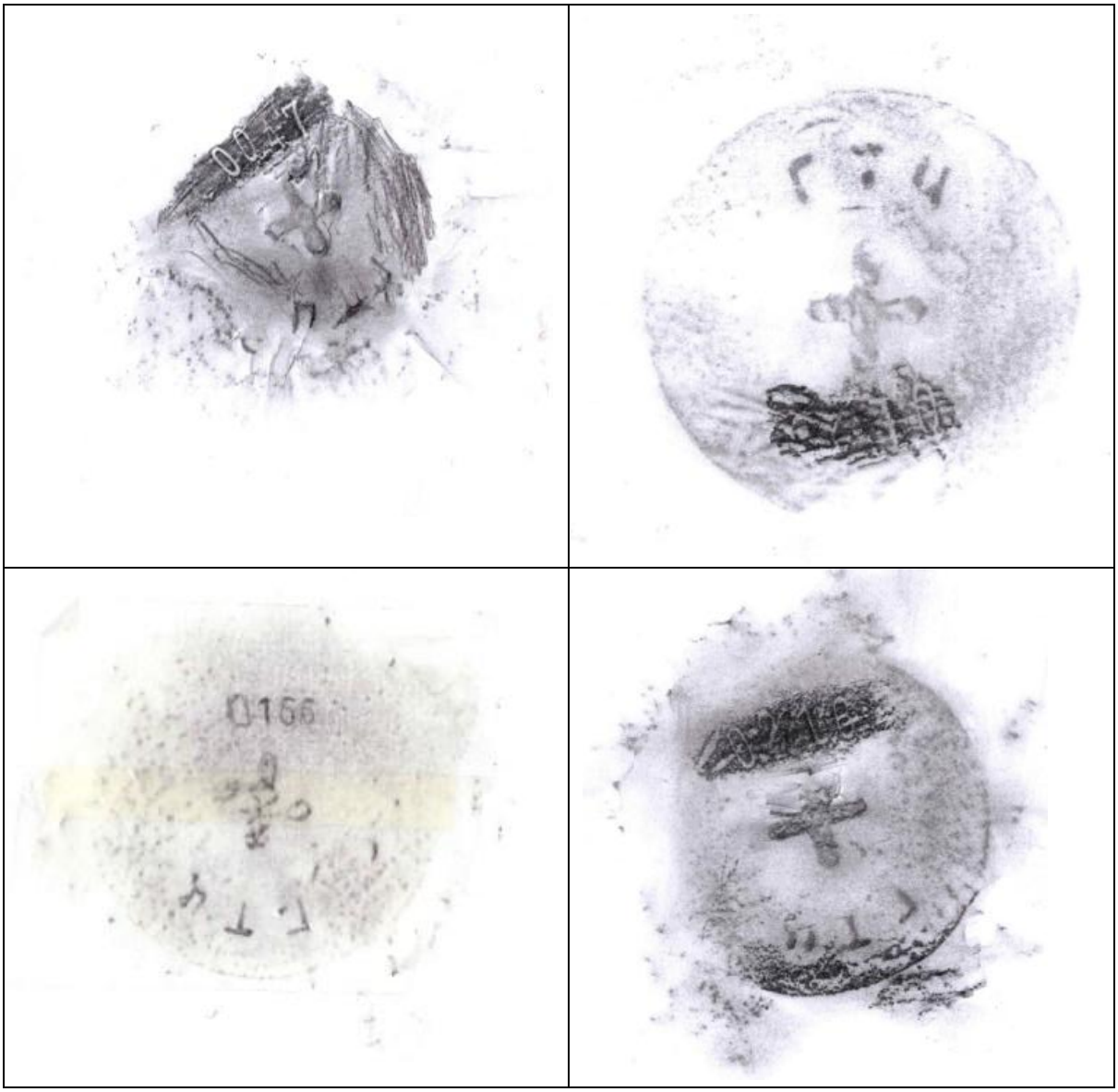
9. Location scheme:

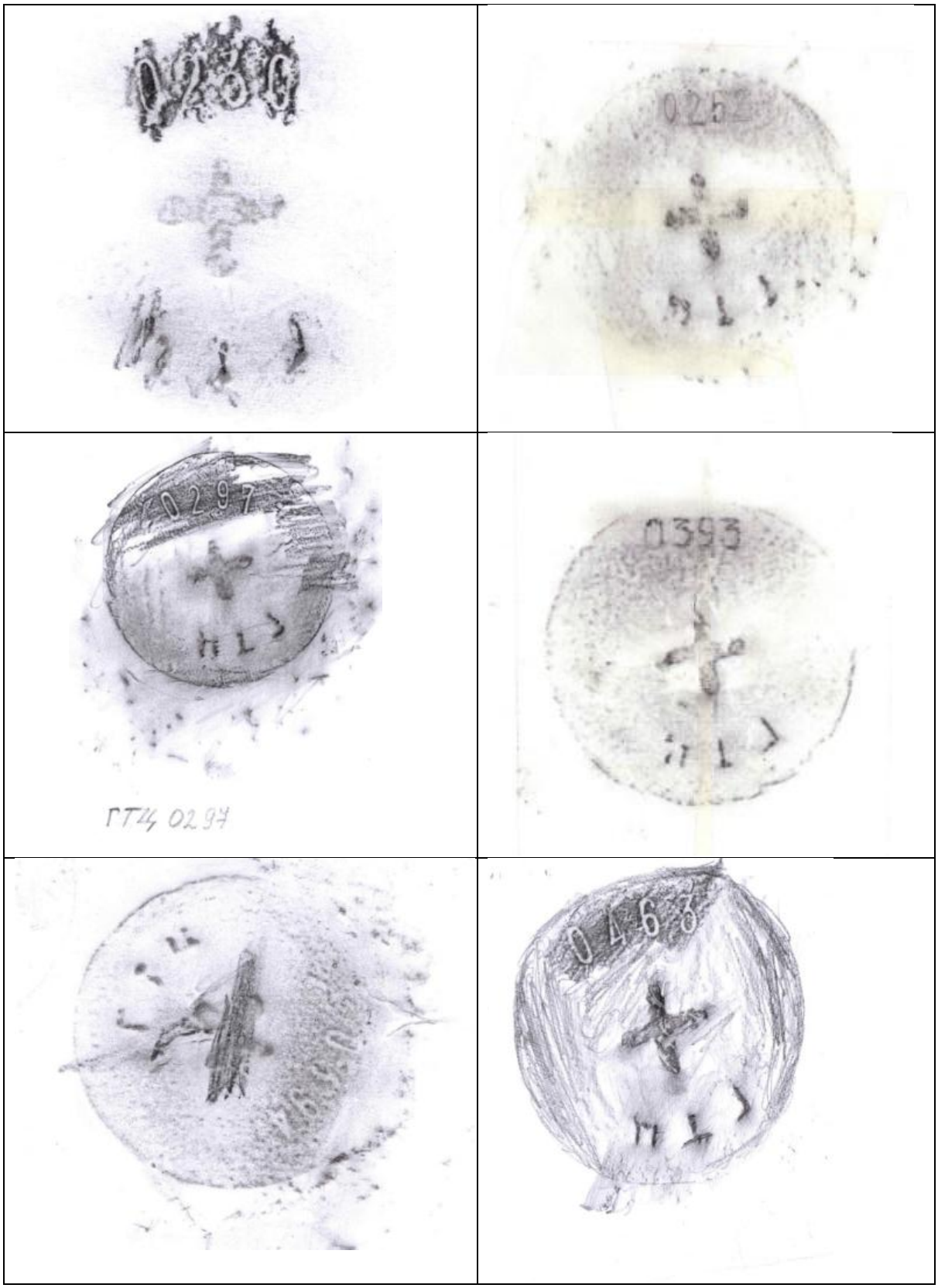
10. Center point shape:

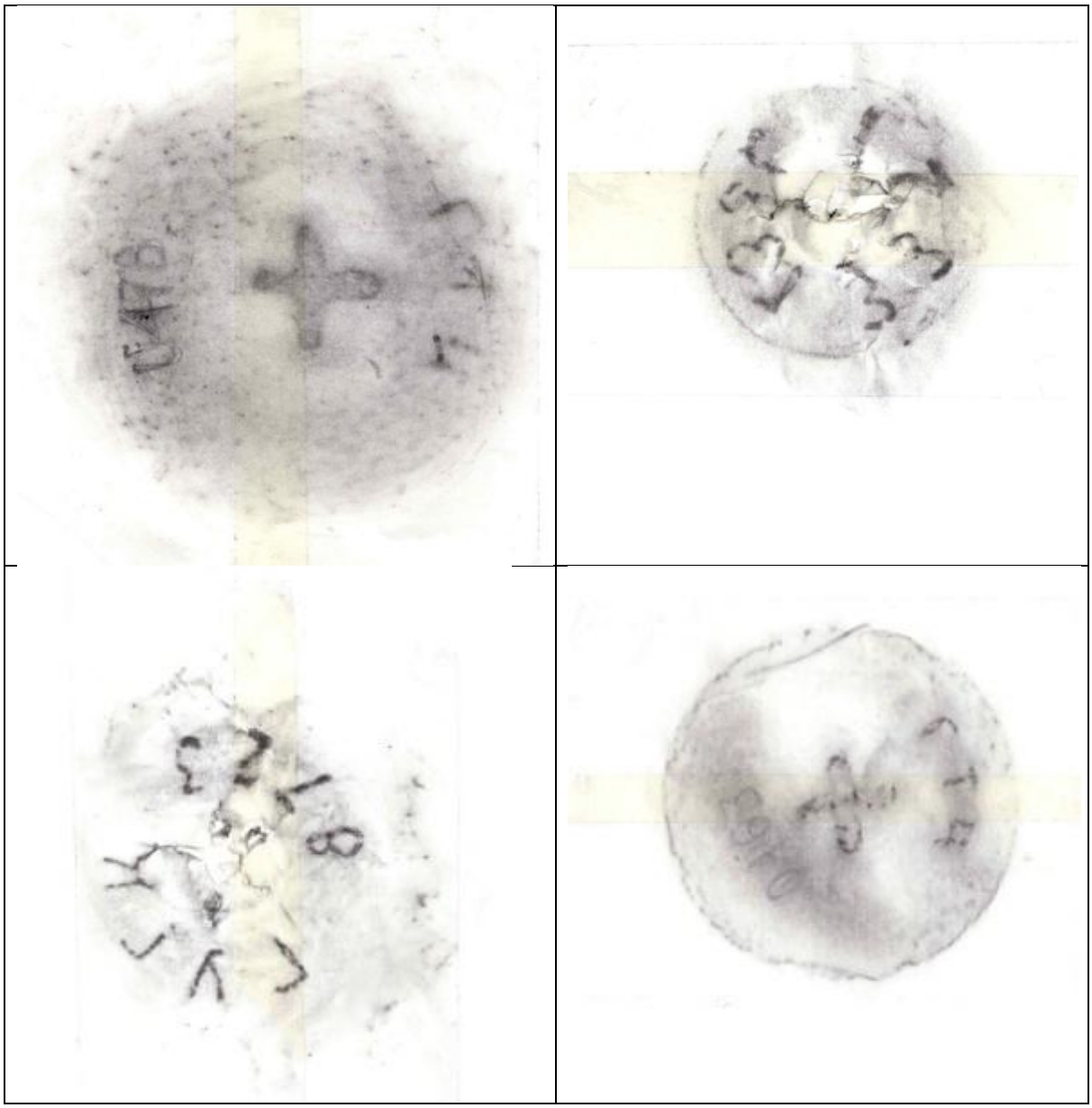


11. About soil characteristics:
12. Date: 2025-01-2414.
13.Personal file: M. Bukhsanaa
14. Organization: Bayasakh Survey LLC

The situation where the number of the point center was determined by conducting a survey:




0252
0297
0393
0463



2.2. ESTABLISHING AND PROCESSING THE BASIS FOR LARGE-SCALE TOPOGRAPHY USING SATELLITE TECHNOLOGY

About the establishment of a location network:

Coordinate system. Geodetic surveying and mapping work carried out within the territory of Mongolia is carried out using the International Geodetic Coordinate System (ITRF2020) with the date of January 1, 2008, the Baltic Sea system for the elevation grid, and the "UTM" system for the global transverse mercator for the topography.

Dots. Within the framework of the "New Ring Road" project, 11 new center points with the mapping basis numbers "GTC-11", "GTC-12", "GTC-13", "GTC-14", "GTC-15", "GTC-16", "GTC-17", "GTC-18", "GTC-19", "GTC-20", "GTC-76" were installed along the planned route, and 2 network points for cadastral mapping of UB city, or GTC 0478 and "BNMAU-0051", were used to establish a support network along the route with a total of 13 points.

The newly installed point markers were prepared and installed in the ground in such a way that they were high, easy to find, safe, not close to satellite data blocks, did not interfere with road traffic, were able to store geodetic digital data for a long time, and had good durability. The 6-point GCC is intended for the construction and operation of engineering structures such as mapping networks, roads and railways. The point was prepared by welding the center on a stainless steel pipe with a cross section of 60 mm and a length of 100 mm. The earthwork for installing the point was carried out using a simple mechanical drill, digging a hole 1.5 m below the ground, and after placing a 20 cm thick layer of sand protected from moisture at the bottom of the hole and compacting it, the point was installed in the hole, anchored to prevent movement, and concrete was poured. A 10 X 40 X 40 cm wooden formwork was made for the concrete base of the lower cast part of the point, and the concrete was prepared and poured according to the ingredients specified in BD 11-104-19. In order to prevent damage or loss of conditions for finding the point, long-term storage, and measurement, concrete was poured on the outside and a protective trench was dug. Figures 10 and 11 are shown.

Figure 11. Preparation of formwork and concrete for the foundation of the point:

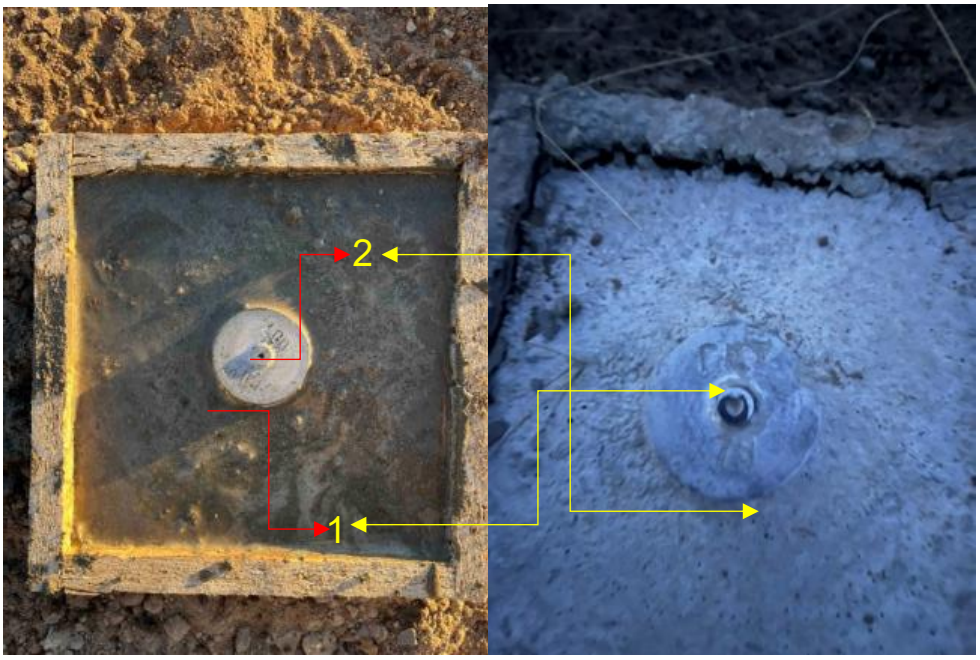


Figure 12. The point is installed in the ground and protected from the outside. /1-point type, inscription GCC, 2 – center number, 007, 012/

Measurements. The mapping network was established by geodetic spatial structures with an average separation of 2-3 km between mapping bases, a mean square error of the mutual position between points of 3 cm, and a relative error of the length of the side of not less than 1:20000. The location of the mapping network and the districts to which it belongs are shown on the digital elevation model in Figure 12, and the switching diagram is shown in Figure 13, respectively.

The measurement of the 3rd level network of the mapping class C was carried out by 7 GNSS receivers of the 2nd, 3rd, and 4th models of the American TRIMBLE R8 brand in 2 shifts / sessions / measurements.

The number of satellite geodetic measurements is calculated using the following formula:

$$N=(S-O)/(R-O) =(13-1)/(7-1)=12/6=2$$

here: N- number of shifts,

O- Number of points,

R- Number of measuring instruments,

O- The number of overlapping points in a single measurement cycle.

The satellite coded signal used for the measurement was received on the 2-wavelength L1/L2/L5 channels, and the metrological verification of the instrument showed that the integral term of the formula for expressing the mean square error was no more than 5 mm in absolute value, and the evaluation of the phase center of the receiver antenna was verified by IGS (International GNSS Service).

Before the start of the static measurement, the GNSS instrument was centered and aligned with an accuracy of 1 mm on the mapping grid point using its optical centering device.

The following settings have been made in the instrument control block. These include:

- Minimum angle of inclination of the satellite to the plane of its position - 10 degrees;

- Number of satellites to be observed simultaneously in the measurement work – 4
- Interval of receiving satellite signals - 30 seconds
- Permissible value of PDOP (geometric indicator) - 4

Location of mapping reference points established along the "first ring road" route

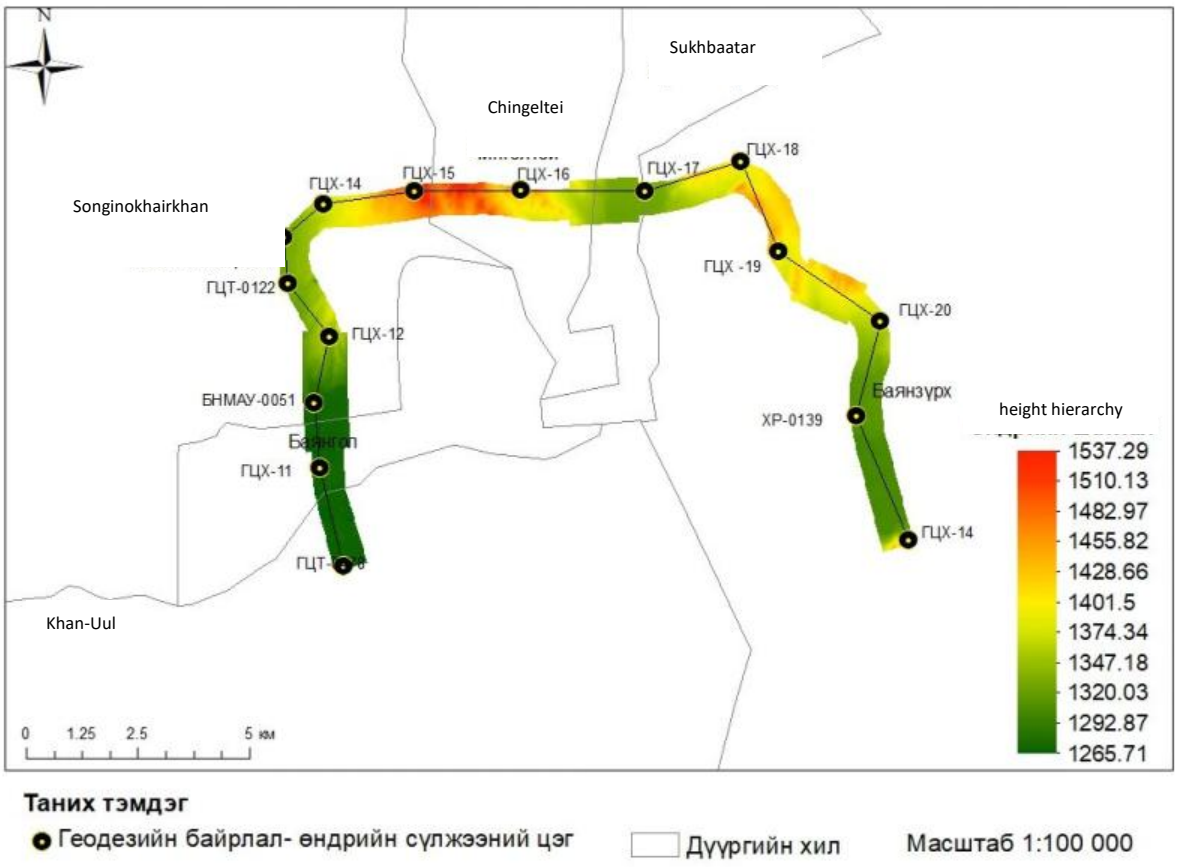


Figure 13. The representation of the mapping network on a digital terrain model.

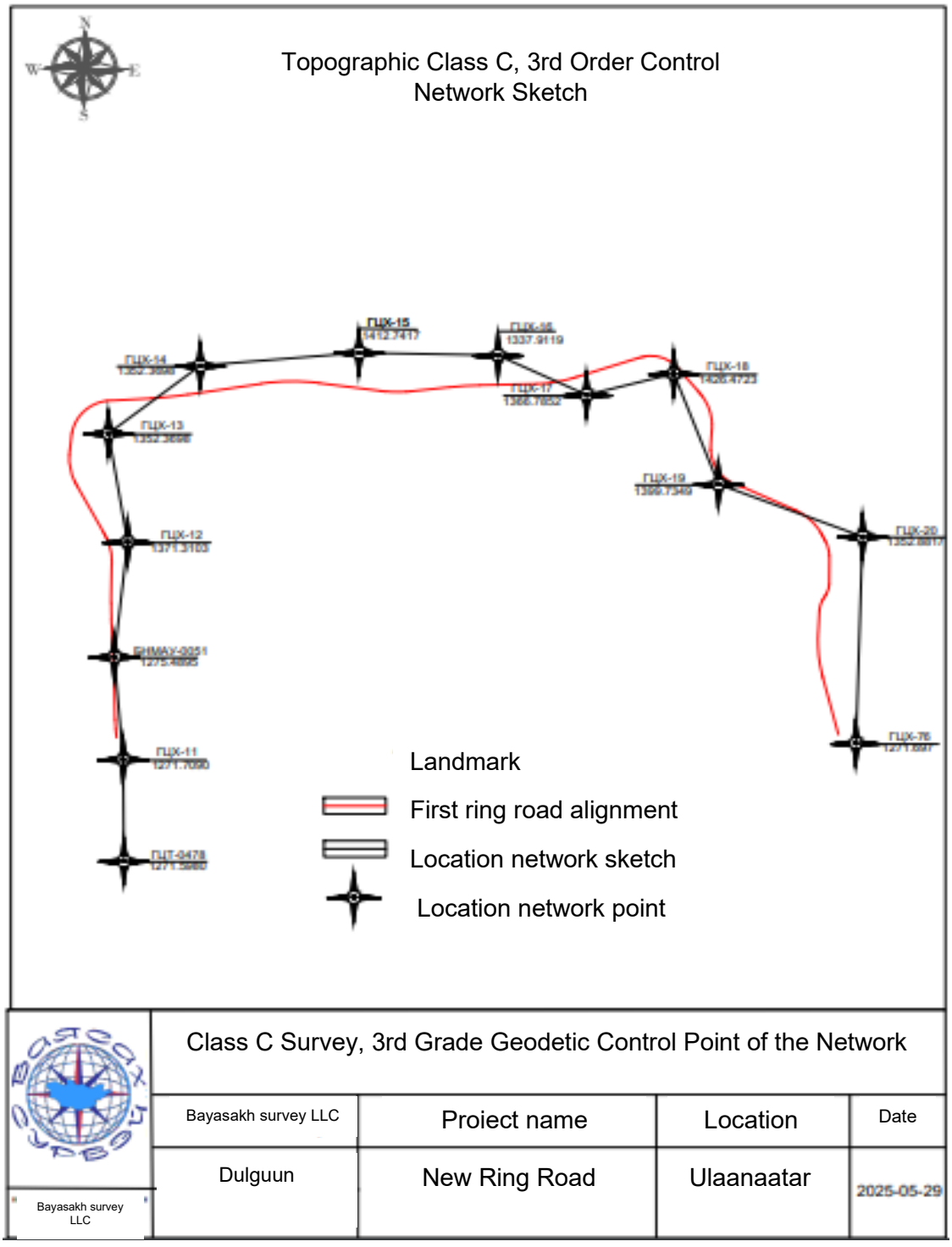


Figure 14. Mapping network diagram

Before the start of the measurement, a "Satellite Geodetic Measurement Journal" was kept at each point. A sample measurement journal is shown in Table-6.

The following parameters are shown in the satellite (GPS/Glonass) geodetic network measurement journal. These include:

- Point name: GCC. Center number -011;
- Province/District Name: – Ulaanbaatar, Songino-khairkan District;
- Trapezoid number relevant to the measuremt: M-48-10
- Measurement start and end time;
- Equipment brand and model: Trimble R8
- Antenna and control unit number;
- Weather conditions;
- Antenna height measurement details, etc..

Table 4.

Receiver type 2 wave	Repeat 1		Repeat 2	
	started	finished	started	finished
Date	2025.05.29	2025.05.29		
Measurement time	12:17	15:17		
Antenna height, in cm	130.6	130.6		
Antenna number	5318436450			
Control unit number				
Air temperature, C	14℃			
Air pressure, hPa	863	863		
Air humidity, %	21	21		
Definition of the conversion element			Additional information during measurement	

In accordance with the instructions to use as many receivers of the same type as possible in geodetic measurements to be performed in one shift, 7 TRIMBLE R8 GNSS

instruments were used at 7 points numbered GCT0478-GCT015. The first round of measurements was conducted in static mode, at a time with low satellite influence, and the duration of measurements at one point was calculated using the formula 1 hour + 20 minutes per kilometer, and continued for 3 hours continuously at each point. After the completion of the first round of measurements, the second round of measurements was conducted at each of 7 points numbered GCT015-GCT076 for 3 hours continuously.

After the completion of the measurement work, a quality check of the measurement data was performed on each measurement.

Measurement data quality check. The quality of GNSS static measurement data at the network points was checked using TEQC software. For the quality check, the multipath error of 0.7m for the L1 wave and 0.7m for the L2 wave met the requirements. When checking the quality of the measurement data of a total of 13 points installed along the route, the multipath error of the L1 wave MP1 was 0.58m at most, and the L2 wave MP2 was 0.61m, which met the quality requirements. The quality of the measurements was 73-94%, of which the lowest was 73% at the GTZ 0051 point. The point is located on the median strip of the heavily trafficked highway north of the "Kharkhorin" market, which affected the quality of the satellite measurements. The quality check parameters are shown in Table-4.

Table 5.

Point number	%	MP1	MP2
019	94%	0.54	0.59
013	87%	0.40	0.41
076	76%	0.38	0.28
0478	90%	0.29	0.27
020	88%	0.30	0.29
018	87%	0.48	0.42
011	76%	0.35	0.34
014	87%	0.41	0.34
0051	73%	0.58	0.61

016	88%	0.47	0.51
017	87%	0.48	0.49
015	87%	0.47	0.49

Balanced thinking. The reference network established along the route was created using GAMIT/GLOBK/ software developed by the Massachusetts Institute of TePRCology based on data from the International GNSS Service (IGS), ULAB, IRKT, BJFS, XIAN, LHAZ, URUM, and TSKB stations, as well as data from the UB 01 fixed station of the Permanent Mission of the Republic of Mongolia. Figure-14 shows.

Figure 15. Location of the International GNSS Authority base station

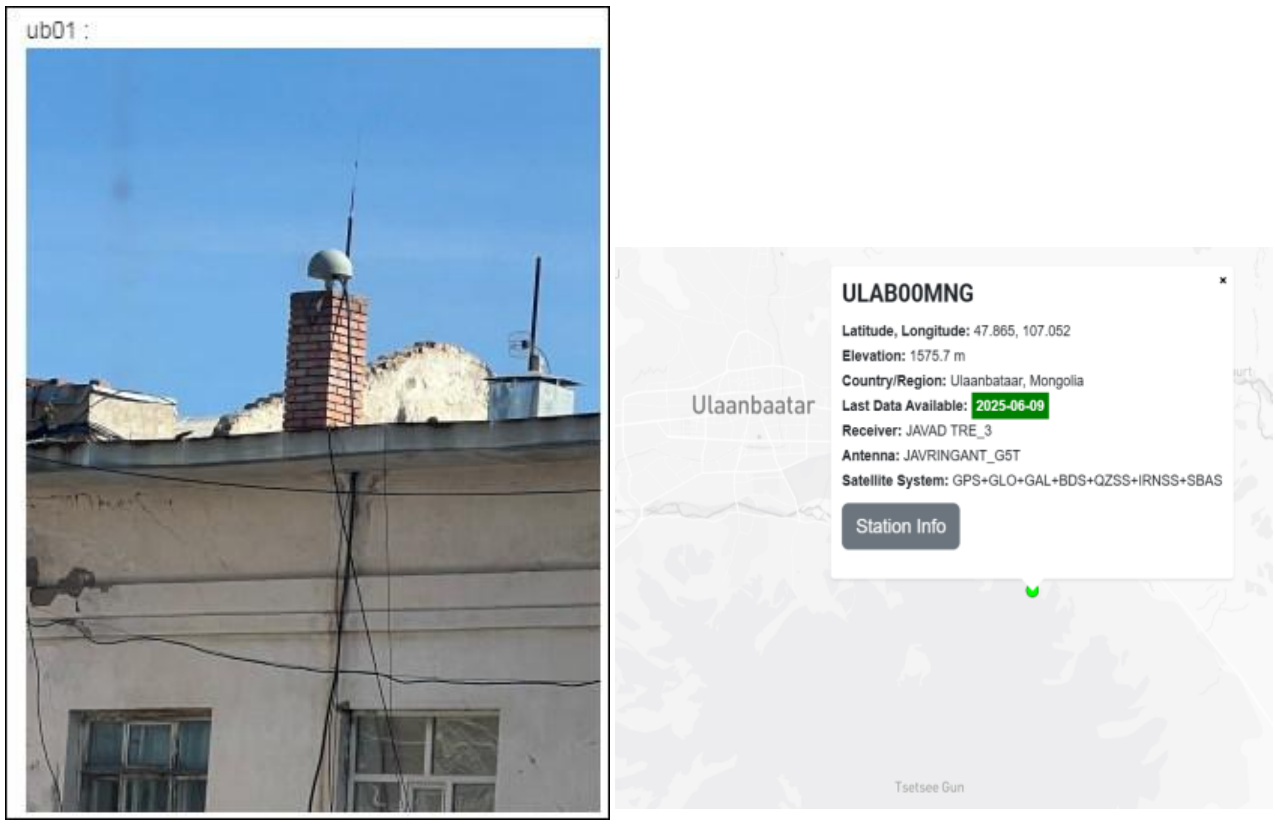


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Figure 16. Permanently operational fixed station UB 01 photo, ULAB information

The antenna phase center evaluation was downloaded from https://igs.org/wg/antenna/. The antenna data download address is shown in Figure-16, and the data file template is shown in Figure-17.

Figure 17.

IGS INTERNATIONAL GNSS SERVICE

NETWORK PRODUCTS DATA DOCUMENTS PARTICIPATE ABOUT CONTACT US

ANTEX (igs20.atx.gz)	Antenna calibrations- absolute IGS phase center corrections for satellite and receiver antennas; to be used with the ITRF2020 terrestrial reference frame.
ANTEX Format Description (antext14.txt)	ANTEX: The Antenna Exchange Format, Version 1.4
Naming Convention (rcvr_ant.tab)	IGS naming conventions for GNSS equipment (receivers, antennas, radomes, satellite antennas); only valid names to be used in IGS site logs, RINEX headers, SINEX files, etc.
Reference points and Dimensions (antenna.gra)	antenna reference point (ARP) definition, north reference point (NRP) definition, physical antenna dimensions

Figure 18. Antenna file

https://files.igs.org/pub/station/general/rcvr_ant.tab?_gl=1*1cu0myy*_ga*MTM2OD

	BDS B1/B2/B3 integrated rec/ant Maxwell 7
TRIMBLE R780-2	GPS L1/L2/L5 GLO L1/L2/L3 GAL E1/E5ab/E6
	BDS B1/B2/B3 integrated rec/ant dual Maxwell 7
TRIMBLE R8	L1/L2+L2C integrated receiver/antenna w/ Maxwell-5
TRIMBLE R8 GNSS	L1/L2+L2C/L5 GLO L1/L2 integrated receiver/antenna
	with Maxwell-5 + SBAS
TRIMBLE R8 GNSS3	L1/L2+L2C/L5 GLO L1/L2 integrated receiver/antenna
	with Maxwell-6 + SBAS
TRIMBLE R8-4	L1/L2+L2C/L5 GLO L1/L2/L3 SBAS L1/L5 GAL E1/E5A/E5B
	BDS B1/B2/B3 w/Maxwell-6 integrated receiver/antenna
TRIMBLE R8S	L1/L2+L2C/L5 GLO L1/L2/L3 SBAS L1/L5 GAL E1/E5a/E5b
	BDS B1/B2 w/Maxwell-6 integrated receiver/antenna
	(scalable: track types dependent on purchase options)

TRMR8_GNSS
TRMR8_GNSS3
TRMR8-4

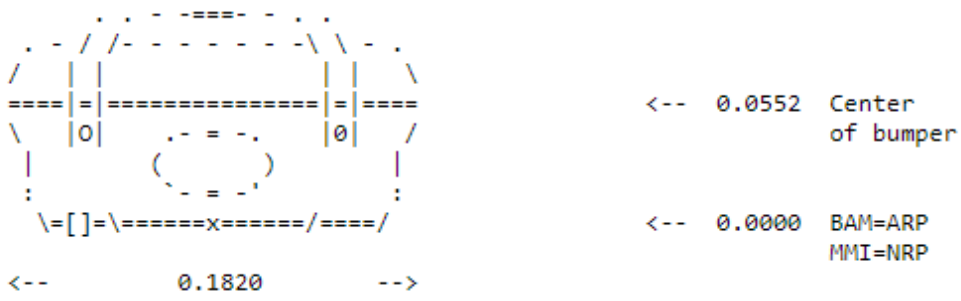


Figure 19. Antenna model and nomenclature

The results of the balanced analysis are shown in Table-5.

Table 6.

№	Point number	Coordinates	
		x	y
1	ГЦТ0478	5304338.205	637103.147
2	ГЦХ012	5310198.256	637067.945
3	ГЦХ013	5312369.003	636532.190
4	ГЦХ014	5312968.512	638907.668
5	ГЦХ015	5313013.638	640762.403
6	ГЦХ016	5313038.56	643002.603
7	ГЦХ017	5312961.975	645188.458
8	ГЦХ018	5312926.873	646567.883
9	ГЦХ019	5311252.859	647718.204
10	ГЦХ020	5311198.586	647996.157
11	ГЦТ0076	5306694.580	649400.949

ESTABLISHMENT OF ELEVATION CONTROL FOR LARGE-SCALE TOPOGRAPHIC MAPPING WITH CLASS III LEVELING AND ADJUSTMENT CALCULATION

The elevation support network established along the route was established on the principle of thickening the elevation network of the State of Mongolia. The elevation basis was established by a single leveling switch, based on the wall marks of the upper class or elevation class II polygons 30 and 38, Xr-0139, Xp-515, with 13 points in the leveling class III, so that the position and elevation network points overlap.

(Note: The height of the position network points is transferred to the leveling class III.)

The values of the wall marks of the II class of the state elevation network Xr-0139, Xp-515 are shown in Table-6.

Table 7.

№	Point name	UTM equiangular intersection, m		Point height, N, m	Description
		x	y		
1	Xp-515	530405.225	635985.704	1293.4148	Class II point
2	Xp-0139	5308624.100	648916.000	1313.4548	Class III point

The leveling was carried out by establishing an open switch with 13 reference points based on the height class II wall marks Hr 515 and Hr 0139, and the total length of the switch was calculated to be 33.25 km in the forward and reverse directions, with a total length of 66.5 km. The leveling measurement was carried out in the forward direction based on the Hr 515 mark installed on the wall of School No. 41 located in the 11th khoroo of Khan-Uul district, along the planned route, the newly established reference points and the newly installed and UB city cadastral mapping network points along the route were leveled, and the end of the route was connected to the Hr 0139 wall mark installed on the front wall of the "Auto Repair" LLC building. The reverse direction measurement was

carried out from the Hr 0139 wall mark to the Hr 515 mark. The reference points are shown in Figure-19 and Figure-20, respectively.

Figure 20. Hr 515 wall stamp mounted on the wall of School No. 41

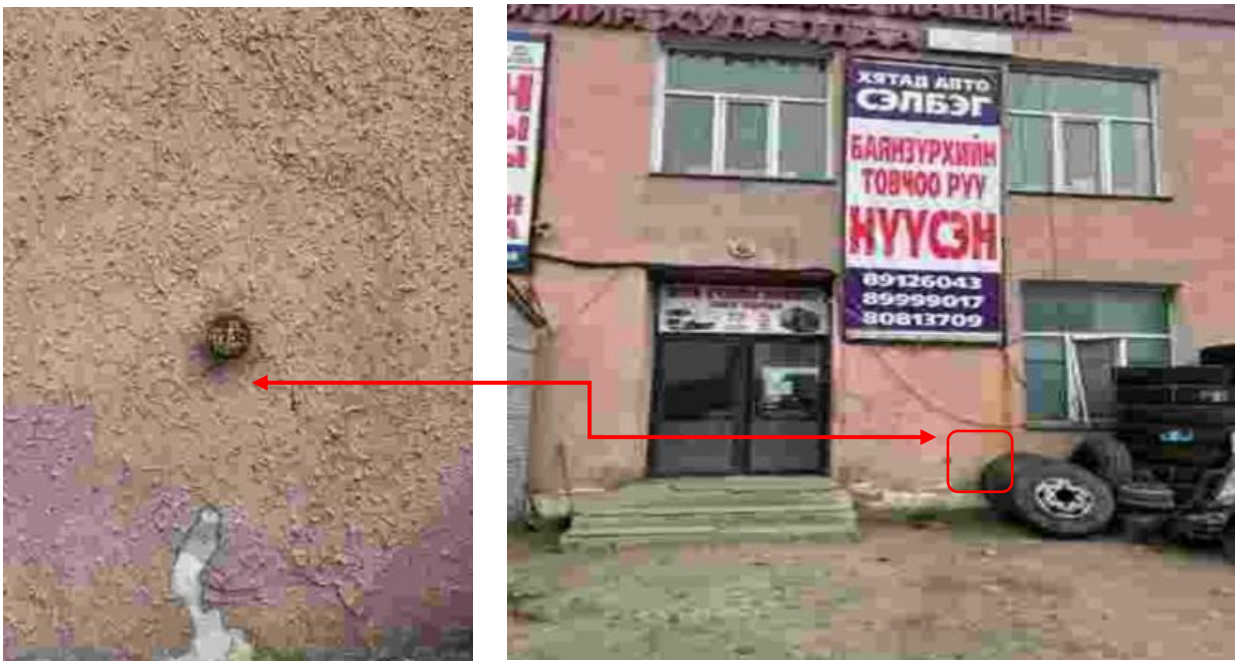


Figure 21. The wall stamp Xp 0139 installed on the front wall of the "Auto Repair" LLC building

Due to the large number of stops per 1 km, the mountainous terrain, the large number of valleys, and the short time for measurement, the construction of the elevation network along the planned route was completed by a total of 5 teams consisting of 1 Geodetic Engineer-1, 1 Geodetic Engineer-1, and 4 Geodetic TePRCicians in the Field Team 1, in accordance with the III level of work specification.

The measurement work of the III class of leveling was carried out in the direct and reverse directions with a level that determines the elevation with an error of no less than 3 mm in 1 km of the switch. The following requirements were followed in establishing the III class of leveling open switch. These include:

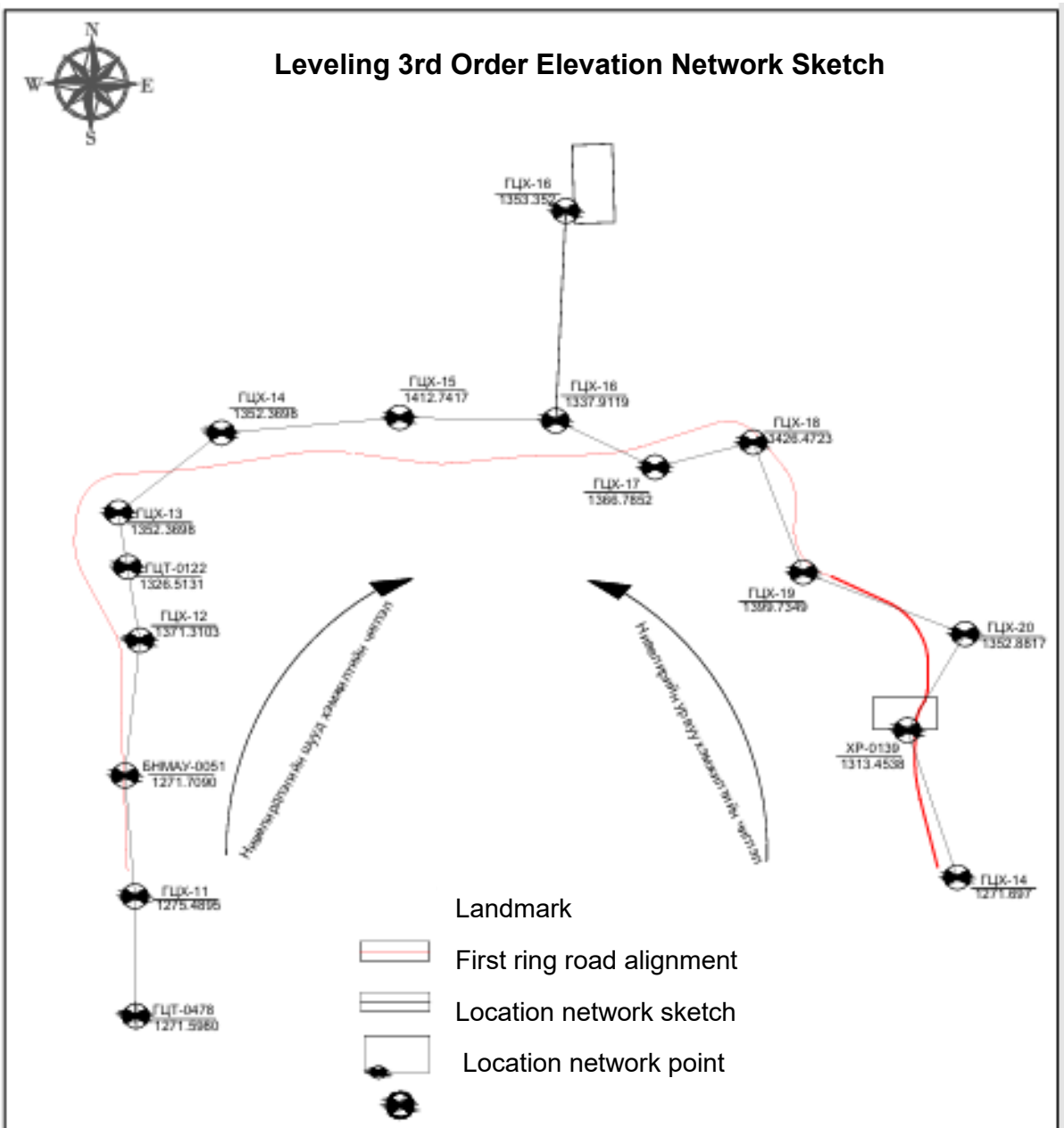
- The length of the leveling line (distance from the tool to the rake) should not exceed 100m;
- The line difference at the stop should not exceed 2m, and the accumulation of line differences should not exceed 10m;
- The height of the viewing axis should not be less than 0.3m above the ground;
- The rake should be placed on a shoe or on a stake. It should be leveled with a circular leveler.

The following tests were performed during the fieldwork:

- Wheel alignment checks are performed daily before starting work.
- Tangent (i) errors are checked and identified daily before starting work. If the measurement exceeds the permissible error, control measurements are performed and checked.

The elevation network diagram is shown in Figure-21, and the measurement process is shown in Figure-22.

Leveling 3rd Order Elevation Network Sketch



"БАЯСАХ СУРВЭЙ" ХХК

Leveling 3rd Order Elevation Network Sketch			
"Bagakh Sursvi" LLC Geodetic Engineer	Project Name	Location	Date
T. Daltgon	"New Ring Road"	"Ulaanbaatar City"	2025-04-20

Figure 22.

Figure 23.

Before calculating the leveling of the III class of leveling networks, it was checked whether the leveling errors in the polygons were within a certain permissible range. The error was calculated as the difference between the sum of the elevations of the direct and reverse leveling, respectively. In the III class of leveling, this difference is no more than 3 mm. After completing this check, the leveling work was calculated as leveling.

The permissible measurement error was calculated using the following formula:

$$\text{зов}f = \pm 10 \text{ мм}\sqrt{L}, \text{км}$$

The accuracy of the pair of measurements was estimated using Bessel's formula, which is:

$$m = \sqrt{\frac{[d^2]}{n-1}}$$

The field measurement log is shown in Table-10, the results of the alignment from Xr-515 to Xr-0139 are shown in Table-11, and the accuracy assessment is shown in Table-7.

Table 8.

Leveling Grade III Journal					
Measurement: ГЦТ-0478-aac XP-0139			**Measurements were taken. T.Dulgun**		
Measurement started:2025-04.20			**Measurement completed: 2025-04.30**		
Appearance:			**Weather:**		
Journal kept:			**D.Saranchimeg**		
Parking number	**Viewpoint number**	**Distance, m**	**Count from Reikn, m**		**Measured elevation, m**
			back	**front**	
1	ГЦТ-0478	44.493	1.1599		
	x1	44.485		1.3204	-0.1605
		0.01			
2	x1	45.221	1.3804		
	x2	45.284		1.0975	0.2829
		-0.06			
3	x2	39.464	1.8750		
	x3	39.210		1.3178	0.5572
		0.25			
4	x3	33.400	1.9923		
	x4	33.738		0.5807	1.4116
		-0.34			
5	x4	8.677	2.3927		
	x5	8.149		0.8628	1.5299
		0.53			
6	x5	34.374	1.0727		
	x6	35.499		2.0899	-1.0172
		-1.13			
7	x6	44.713	0.6581		
	x7	44.214		1.7170	-1.0589
		0.50			
8	x7	28.927	1.4025		
	x8	28.827		1.2540	0.1485
		0.10			
9	x8	26.335	1.5025		
	x9	26.320		1.1630	0.3395
		0.02			
10	x9	27.919	1.9385		
	x10	27.527		0.7075	1.2310
		0.39			

Table 9.

Geometric leveling class III leveling calculation table								
№	**point number**	**Distance, m**	**elevation, m**				**corrected elevation, m**	**Point height, m**
			direct, m	**reverse,m**	**average,m**	**repair,m**		
	ГЦТ-0478							**1271.598**
1		23.687	0.109	-0.111	0.11	0.001	0.111	
	ГЦХ-0011							1271.709
2		19.691	3.779	-3.78	3.779	0.001	3.781	
	ГЦТ-0051							1275.490
3		26.164	95.833	-95.806	95.819	0.001	95.821	
	ГЦХ-0012							1371.310
4		18.372	-44.791	44.806	-44.798	0.001	-44.797	
	ГЦТ-0122							1326.513
5		20.693	25.858	-25.852	25.855	0.001	25.857	
	ГЦХ-0013							1352.370
6		31.775	162.357	-162.357	162.357	0.001	162.358	
	ГЦХ-0014							1514.728
7		38.974	-101.997	101.978	-101.987	0.001	-101.986	
	ГЦХ-0015							1412.742
8		30.881	-74.823	74.84	-74.831	0.001	-74.83	
	ГЦХ-0016							1337.912
9		25.218	28.857	-28.887	28.872	0.001	28.873	
	ГЦХ-0017							1366.785
10		20.274	59.693	-59.679	59.686	0.001	59.687	
	ГЦХ-0018							1426.472
11		26.252	-26.741	26.736	-26.739	0.001	-26.737	
	ГЦХ-0019							1399.735
12		34.631	-46.862	46.847	-46.854	0.001	-46.853	
	ГЦХ-0020							1352.882
13		15.91	-39.433	39.426	-39.429	0.001	-39.428	
	RP0139							**1313.454**
∑		**33.252**	**41.839**	**-41.84**	**41.839**	**0.017**	**41.856**	
theoretical elevation, m			**41.8558**					
measurement error			-0.0165					
permissible error, mm			57.6647					
repair, m			0.0013					

Table of the accuracy assessment of geometric leveling class III

№	Direct (m)	Reverse (m)	Difference d (m)	Difference d(mm)	d^2(mm)
1	0.1087	-0.1108	-0.002	-2.1	4.41
2	3.7786	-3.7799	-0.001	-1.3	1.69
3	95.8062	-95.8062	0.000	0	0
4	-44.7911	44.8057	0.015	14.6	213.16
5	25.8584	-25.8524	0.006	6	36
6	162.357	-162.3566	0.000	0	0
7	-101.9968	101.9778	-0.019	-19	361
8	-74.8225	74.8395	0.017	17	289
9	28.8876	-28.8866	0.001	1	1
s10	59.6925	-59.6793	0.013	13.2	174.24
11	-26.7413	26.7362	-0.005	-5.1	26.01
12	-46.8619	46.8469	-0.015	-15	225
13	-39.4326	39.4258	-0.007	-6.8	46.24
∑	**41.8424**	**-41.83993**	**0.00250**	**2.5**	**1377.75**
m		10.2947	mm		
m_x		5.147348	mm		

энд: m-mean square error of measurement,

m_x- mean square error of unit measurement,

d- difference between two measurements

The results of the Class III leveling show that the permissible displacement error is 57.7 mm, the measurement error is 16.5 mm, and the mean square measurement error is 10.3 mm, thus meeting the requirements of the BD 11-121-19 rule.

3. 1:500 SCALE SITE MAPPING WORK

3.1. ESTABLISHING AND MARKING IDENTIFICATION POINTS ON THE GROUND ACCORDING TO THE INITIAL VERSION OF THE PRE-PLANNED ROUTE ALIGNMENT

The work of creating and processing digital topographic maps with a scale of 1:1000 and a height of 0.5 m was carried out by aerial mapping on a total area of 1080 hectares, of which 20 hectares were designated as ravines. The aerial mapping work was carried out for 9 days from February 6, 2025 to February 14, 2025, or an average of 80 hectares per day. This work was carried out in accordance with the "Topographic Background Mapping Work at Scales of 1:500, 1:1000, 1:2000, 1:5000" (BD 11-106-08) and other relevant instructions in Mongolia, and in accordance with the ITRF 2020 coordinate system and the Baltic Sea elevation system.

Aerial mapping was carried out using a GPS along a 200-by-200-meter strip on both sides of the planned road axis, or along a 600-meter wide strip in areas with watersheds and catchment areas with 400-meter gullies.

The flight and mapping work was carried out according to the tePRCological scheme. The tePRCological scheme is shown in Figure-24.

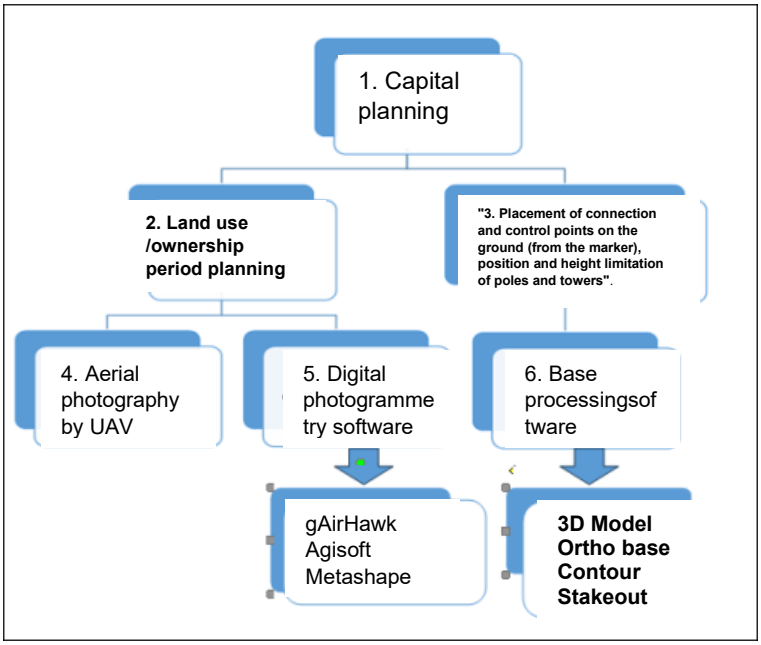


Figure 24.

In order to connect the aerial image to the geodetic grid and elevation system, 170 ground grid and elevation points were identified in the aerial image. The parameters for aerial imaging were selected as follows. These include:

- The value of GSD depends on the scale of the topographic map and its resolution, so for 1:100-1:1000 scale maps, the value of 0.01≤GSD≤0.05 (m) or GSD= 3 cm was chosen.
- Flight height. The main parameters of the digital camera DJIL1 used for the measurements are shown in Table 5, and the flight height is shown in Table 6.

  The flight altitude was calculated using the following formula:

  H=10*GSD*f/Pxl (1)

  Here: H- flight altitude, m

  GSD- The distance between the centers of two parallel pixels in an aerial image, expressed as a distance on the ground, in cm

  f – focal length, m

  Pxl- actual camera pixel size, μm

Table 10. Digital Camera DJI 1 – Main Specifications

Camera name	Focal length, mm	Camera pixels
DJI IL1 digital camera	8.8mm/24mm (equivalent)	19.96 mega pixels
DJI L1 lidar	--	--

The tePRCical and equipment specifications of the unmanned aerial vehicle are shown as follows:

Brand: DJI

Design: Zemnuse P1,L1

Equipment specifications

Sensor size - 1inch

Pixel-20MP

Image size: 5472*3078 (16:9); 4864*3648 (4:3); 5472*3648 (3:2)

Ambient temperature during flight (maximum)- -20^0 ooc $+50^0$C

Image format:JPEG

Measurement accuracy: (RMS 1o)^2 - 100м-т 3см

Accessories:

- *Zemnuse P1*

- *Zemnuse L1*

Figure 25. Digital camera and lidar specifications:

Table 11. Flight altitude depending on camera GSD, m

№	Focal length, mm	Sensor size, mm	Image size, pixels	GSD, sm	The following overlap %	Cross-overlap %	Flight altitude, m
1	8.8	13.2x8.8	5472x3648	3	70	60	109

- The connection and control points were marked on the ground in the following sizes. These are: 15-20 cm circles with an inner frame - R=2xGSD=6cm, and an outer frame - R=4xGSD=12cm, painted with red paint in accordance with the instructions to choose a color that stands out from the surface of the area to be mapped. The distance between the connection and control identification points of the aerial photo is planned to be 250-350 m since the flight is linear. In accordance with the provisions of the construction normative documents for performing aerial and space mapping work, the provisions that the ground identification points should be planned at least in the corners and center of the area covered by the aerial photo were followed.
- The position of the position-height connection and control points was measured with an accuracy of 0.01 m and height of 0.02 m before the flight, based on the data of the permanent stationary UB 01 station of the Main Network of the Mongolian Autonomous Region, using the 2018 geoid model of Ulaanbaatar city "mongeoid-ub2018.grd". The measurements were made with a real-time "control" mode of GNSS for a period of 30 seconds. The identification points established on the ground and the measurements on them are shown in Figure-22, and the location of the identification points on the aerial photo is shown in Figure-26.

Figure 26. Identification points established on the ground and measurements on them:

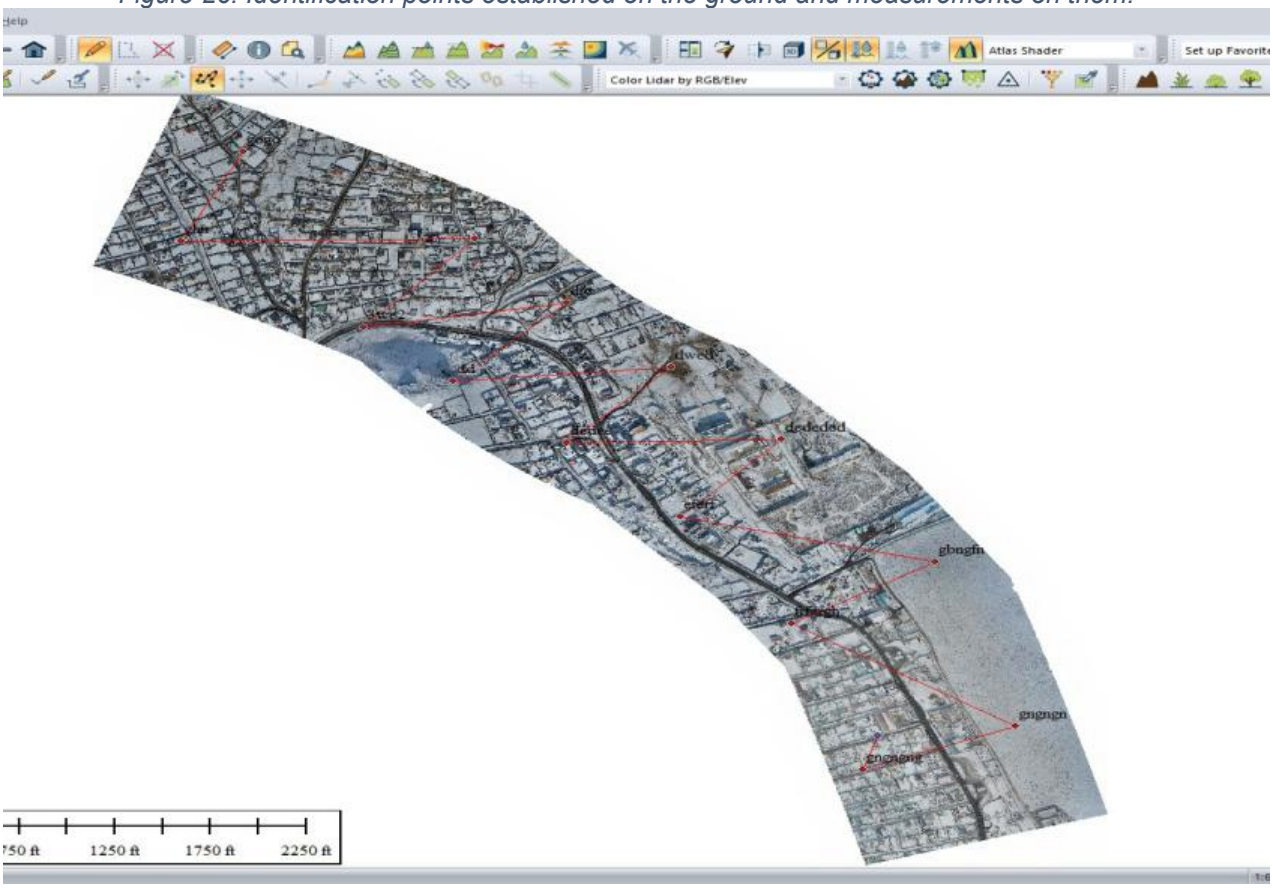


Figure 27. Location of identification points on aerial photographs:

3.2. AERIAL PHOTOGRAPHY ALONG THE ROUTE

The geodetic network points of the area designated for aerial mapping were surveyed using the static method, and a geodetic network of Class C, 3rd order, consisting of 7 points was planned and measured to serve as the basis for the mapping.

The overlaps at the edges of the two areas or the confluence were planned to be 50-100 m and the flight was planned. The flight time for aerial survey was selected between 11:00 and 16:00, when the sun was at its peak and there was little shadow. The flight and survey work planning was carried out using the DataPilot 5.0 APP program, and the photos during the flight are shown in Figure-27 and Figure-28, respectively. The parameters such as flight height 100 m, longitudinal overlap 80%, and transverse overlap 70% were selected in the program.

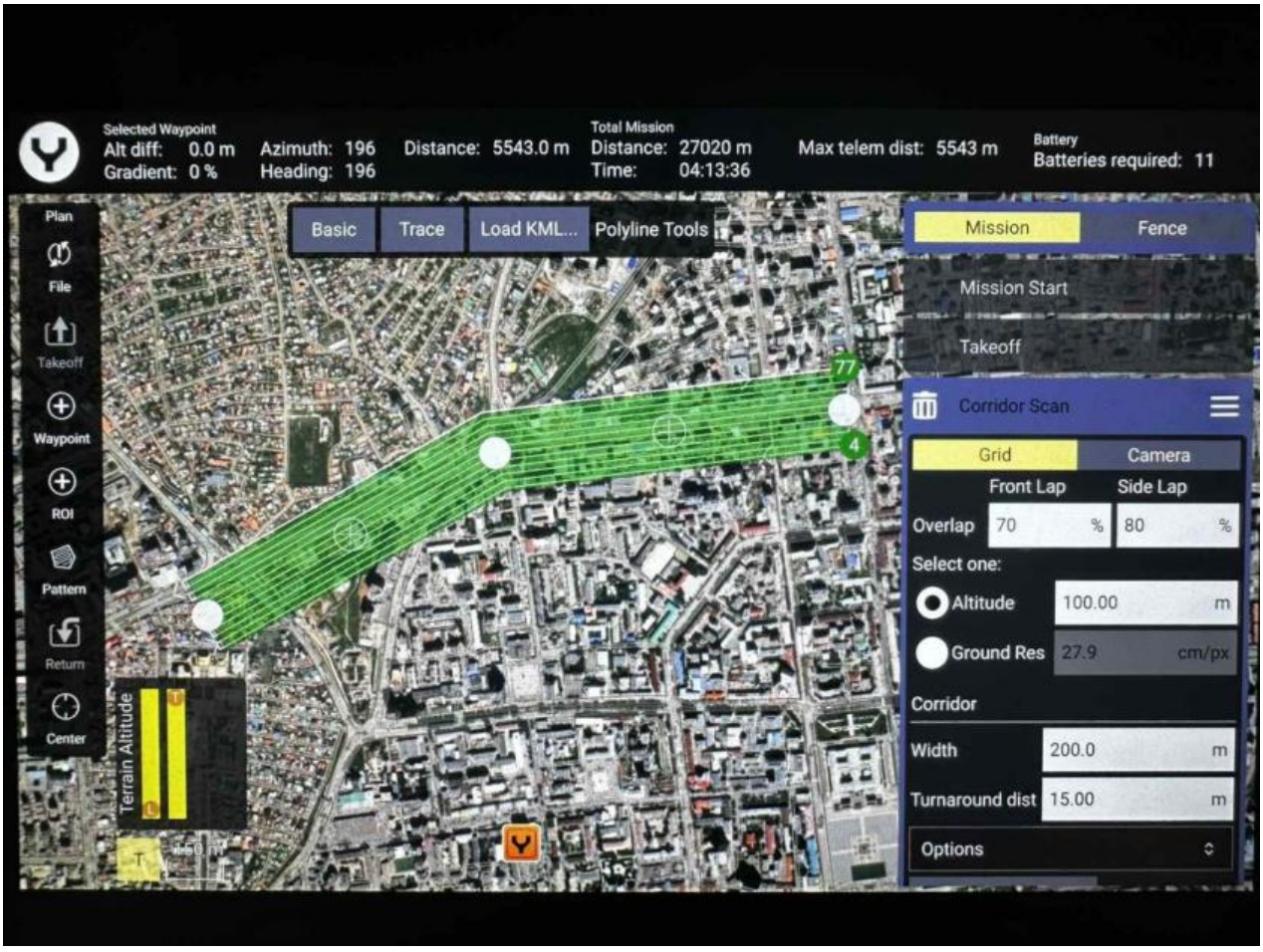


Figure 28. Flight path map:

The tracks are parallel to each other and, depending on the shape of the survey area, run in a west-east or north-south direction. The tracks are planned and flown to extend beyond the boundaries of the survey area by at least 10 m beyond the baseline for one complete survey.

Figure 29. Flight and mapping work:

GNSS static measurements were performed to determine the outer direction elements of the image and the intersection of the image center.

Aerial mapping along the highway route was performed in separate tracks and parallel track groups covering the straight part of the road route. Each track group was imaged on the principle that each track group overlapped with the adjacent track group, and the overlap size was not less than 85 of the area of each of the outermost images of the adjacent track groups.

The parameters of the aerial mapping project are shown as follows. They include:

- Normal display capability of digital aerial imagery –
- Flight altitude – 100 m
- Forward and side overlap – 70%, 80%
- Average aircraft speed – 10 m/s
- Since LiDAR is used: average density of laser return points, pulse and scanning frequency, field of view – 316.80, 70.40
- Spectral characteristics of aerial imagery
- GNSS receiver measurement method and maximum permissible distance from base station – Static method; for topographic base (orthophoto) maps at scales 1:500, 1:1000, 1:2000, 1:5000 – 30 km

The weather forecast for the aerial survey flight was obtained from the websites of the Meteorological and Environmental Analysis Department https://weather.gov.mn/ and https://www.windy.com/.

Before the flight, an aerial survey passport was kept that met the standards and regulations. The consolidated record of aerial survey flights is shown in Table-15, and the report sheet for each flight is shown in Table-16-42.

Figure 30. Integrated flight record of aerial photography:

№	Date	Area size in hectares	GSD /см/	Flight altitude	Model of the NTT	Location	Flight type
1	06/02/2025	40	3	100	DJI MATRICE-350	Bayanzurkh District Hospital	Linear
2	06/02/2025	40	3	100	DJI MATRICE-350	BZD 22nd district Monel	Linear
3	06/02/2025	40	3	100	DJI MATRICE-350	Prison Unit 407	Linear
4	07/02/2025	40	3	100	DJI MATRICE-350	Dari ekh etses	Linear
5	07/02/2025	40	3	100	DJI MATRICE-350	Belkh Selkh	Linear

						river	
6	07/02/2025	40	3	100	DJI MATRICE-350	7 buudal	Linear
7	08/02/2025	40	3	100	DJI MATRICE-350	Chingeltei am	Linear
8	08/02/2025	40	3	100	DJI MATRICE-350	Khailaast	Linear
9	08/02/2025	40	3	100	DJI MATRICE-350	Chingeltei district 17th khoroo	Linear
10	09/02/2025	40	3	100	DJI MATRICE-350	Chingeltei District General Service Office	Linear
11	09/02/2025	40	3	100	DJI MATRICE-350	Khailaast	Linear
12	09/02/2025	40	3	100	DJI MATRICE-350	SHD 28th khoroo 286th Tsetserleg	Linear
13	10/02/2025	40	3	100	DJI MATRICE-350	HD 10th District Jishig erdem School	Linear
14	10/02/2025	40	3	100	DJI MATRICE-350	Zuun salaa	Linear
15	10/02/2025	40	3	100	DJI MATRICE-350	SHD 9th district	Linear
16	11/02/2025	40	3	100	DJI MATRICE-350	300m from Nomin Supermarket	Linear
17	11/02/2025	40	3	100	DJI MATRICE-350	Bayankhoshuu toirog	Linear
18	11/02/2025	40	3	100	DJI MATRICE-350	250 meters north of School No. 67	Linear
19	12/02/2025	40	3	100	DJI MATRICE-350	School No.67	Linear
20	12/02/2025	40	3	100	DJI MATRICE-350	500m north of Hilchin town	Linear
21	12/02/2025	40	3	100	DJI MATRICE-350	300 meters south of the border town of SHD 7th khoroo	Linear
22	13/02/2025	40	3	100	DJI MATRICE-350	500m from the	Linear

						wall material	
23	13/02/2025	40	3	100	DJI MATRICE-350	SHD 39th district	Linear
24	13/02/2025	40	3	100	DJI MATRICE-350	Kindergarten No. 284	Linear
25	14/02/2025	40	3	100	DJI MATRICE-350	1st khoroolol	Linear
26	14/02/2025	40	3	100	DJI MATRICE-350	Kharkhorin market apartment 32th	Linear
27	14/02/2025	40	3	100	DJI MATRICE-350	Yarmag new bridge	Linear

Flight report sheet: *Table 12.*

Object name: Bayanzurkh District Hospital
Date:2025.02.06

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	1
Weather conditions	Time agaap -15 C Wind speed 8 m / s Wind direction - northwest				
Geographical situation	Mountainous areas + Urban areas + Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 10:00 Ended: 11:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS		If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS		Number of images: 502

Table 13.

Object name: Prison Unit 407
Date:2025.02.06

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	2
Weather conditions	weather-12 C Wind speed 8 m / s Wind direction - northwest				
Geographical situation	Mountainous areas + Urban areas + Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ga				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started:13:00 Ended:13:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 14.

Object name: Dari ekh gants khudag
Date:2025.02.06

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	3
Weather conditions	weather-15 C Wind speed 8 m / s Wind direction - northwest				
Geographical situation	Mountainous areas + Urban areas + Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ga				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started: 14:40 Ended: 15:41	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 15.

Object name: Belkh Selkh river
Date:2025.02.07

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	4
Weather conditions	weather-12 C Wind speed 8 m / s Wind direction - northwest				
Geographical situation	Mountainous areas + Urban areas + Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started:10:00 Ended:10:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 16.

Object name: Chingeltei am
Date:2025.02.07

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	5
Weather conditions	weather-15 C Wind speed 8 m / s Wind direction - northwest				
Geographical situation	Mountainous areas Urban areas Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started:10:00 Ended:10:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502		

Table 17.

Object name: Khailaast
Date:2025.02.07

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	6
Weather conditions	weather -15 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 14:10 Ended: 14:50	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS		If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS		Number of images: 502

Table 18.

Object name: 7 Buudal
Date:2025.02.08

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	7
Weather conditions	weather -12 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started: 09:50 Ended: 10:30	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 19.

Object name: swimming pool
Date:2025.02.08

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	8
Weather conditions	weather 13 C Wind speed 8 m/s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started: 11:00 Ended: 11:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 20.

Object name: Chingeltei district
Date:2025.02.08

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	9
Weather conditions	weather 15 C Wind speed 8 m/s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 14:00 Ended: 14:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS		If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS		Number of images: 502

Table 21.

Object name: Songinokhairkhan district 10th khoroo
Date:2025.02.09

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	10
Weather conditions	Weather- 10 C Wind speed 7 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 10:00 Ended: 10:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS		If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502	

Table 22.

Object name: Songinokhairkhan district 10th khoroo
Date:2025.02.09

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	11
Weather conditions	Weather 12 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 10:00 Ended: 10:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS		If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502	

Table 23.

Object name: Songinokhairkhan district 9th khoroo
Date:2025.02.09

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	12
Weather conditions	Weather 15 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 14:30 Ended: 15:10	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS		If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS		Number of images: 502

Table 24.

Object name: Bayankhoshuu round
Date:2025.02.10

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	13
Weather conditions	Weather 11 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started: 14:30 Ended: 15:10	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 25.

Object name: Songinokhairkhan district 9th khoroo
Date:2025.02.10

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	14
Weather conditions	Weather 10 C Wind speed 6 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Нислэг хугацаа Эхлэсэн: 11:40 Дууссан: 12:20	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502		

Table 26.

Object: Songinokhairkhan district 9th khoroo
Date:2025.02.10

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	15
Weather conditions	Weather 10 C Wind speed 6 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Нислэг хугацаа Эхлэсэн: 14:00 Дууссан: 14:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502		

Table 27.

Object name: Songinokhairkhan 7th khoroo
Date:2025.02.11

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	16
Weather conditions	Weather 11 C Wind speed 7 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 10:00 Ended: 10:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS		If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502	

Table 28.

Object name: Songinokhairkhan district 7th khoroo Khilchin town
Date:2025.02.11

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	17
Weather conditions	Weather 10 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 12:00 Ended: 12:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS		If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS		Number of images: 502

Table 29.

Object name: Songinokhairkhan district 17th khoroo
Date:2025.02.11

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	18
Weather conditions	Weather 11 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 14:00 Ended: 14:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS		If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS		Number of images: 502

Table 30.

Object name: Songinokhairkhan district 39th khoroo
Date:2025.02.12

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	19
Weather conditions	Weather 9 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 10:20 Ended: 11:00	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502		

Table 31.

Object name: Songinokhairkhan district 39th khoroo
Date:2025.02.12

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	20
Weather conditions	Weather 9 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 12:00 Ended: 12:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS		If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS		Number of images: 502

Table 32.

Object name: Songinokhairkhan district 39th khoroo
Date:2025.02.12

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	21
Weather conditions	Weather 8 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started: 14:00 Ended: 14:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 33.

Object name: Kindergarten No. 284 of the Songinokhairkhan district
Date:2025.02.13

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	22
Weather conditions	Weather 8 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started: 10:00 Ended: 10:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 34.

Object name: Songinokhairkhan district 18th khoroo
Date:2025.02.13

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	23
Weather conditions	Weather 9 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started: 11:00 Ended: 11:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 35.

Object: Songinokhairkhan 18th khoroo
Date:2025.02.13

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	24
Weather conditions	Weather 9 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started: 13:00 Ended: 13:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 36.

Object name: Songinokhairkhan 18th khoroo
Date:2025.02.14

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	25
Weather conditions	Weather 10 C Wind speed 7 m / s Wind direction northwest				
Geographical situation	Mountainous areas___ Urban areas_____Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started: 10:00 Ended: 10:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 37.

Object name: Songinokhairkhan 8th khoroo
Date:2025.02.14

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	26
Weather conditions	weather -9 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas Urban areas Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					

Flight time Started: 11:00 Ended: 11:40	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502

Table 38.

Object new: Yarmag new bridge
Date:2025.02.14

HHT serial number	DJI MATRICE-350	Test		Flight range	
Photo camera model	DJIL1 digital camera, aerial laser scanner DJIL1	Pilot and operator name	Bukhsanaa	Flight number	27
Weather conditions	weather -9 C Wind speed 8 m / s Wind direction northwest				
Geographical situation	Mountainous areas + Urban areas + Other				
Flight performance	GSD size 3 cm, Flight range km, Flight area size 40 Ha				
The following overlap	80	Crossover	70	Flight altitude	100
Unmanned Aerial Vehicle (UAV) testing and calibration					
Check device settings		Check the number of artificial followers		Check IMU/Compass settings	
Section to be filled out after the flight is completed					
If HHT with additional equipment, measure the height of the base station antenna					
Flight time Started: 14:20 Ended: 15:00	If the HHT has a GPS/GNSS option for the PPK base station: Download flight data from the HHT's GPS	If the PPK is a HHT with GPS/GNSS configuration from a base station: Download data from the base station or GPS	Number of images: 502		

3.3. CREATING AND EDITING DIGITAL ELEVATION AND SURFACE MODELS

According to the guideline stating that the photogrammetric network adjustment shall use ground control points as reference points, ensuring that the mapping of linear objects along a single flight path is carried out with permissible accuracy based on the coordinates of the aerial photo centers measured by the onboard GNSS receiver, and that surface mapping is performed with the camera's own calibration at an average error not exceeding 0.25 m, the adjustment calculation was carried out using these points.

Using GairHawk 5.0 software, the raw data from the Unmanned Aerial Vehicle (UAV) images were processed to determine the center of the aerial image. Using DJI Terra software, points were automatically detected from the overlapping aerial images, spatial coordinates of the land surface points were determined using photogrammetric direct intersection, and a digital surface elevation model was constructed.

Orthophoto images were processed using Agisoft Metashape Professional.

This included the following steps:

- Importing aerial images into Metashape
- Checking and configuring the imported aerial images in Metashape
- Aligning the aerial images
- Generating point clouds
- Creating digital terrain models
- Creating orthophotos

The processing process is shown in Figures 31, 32, and 33.

Figure 31. Inserting images into Metashape

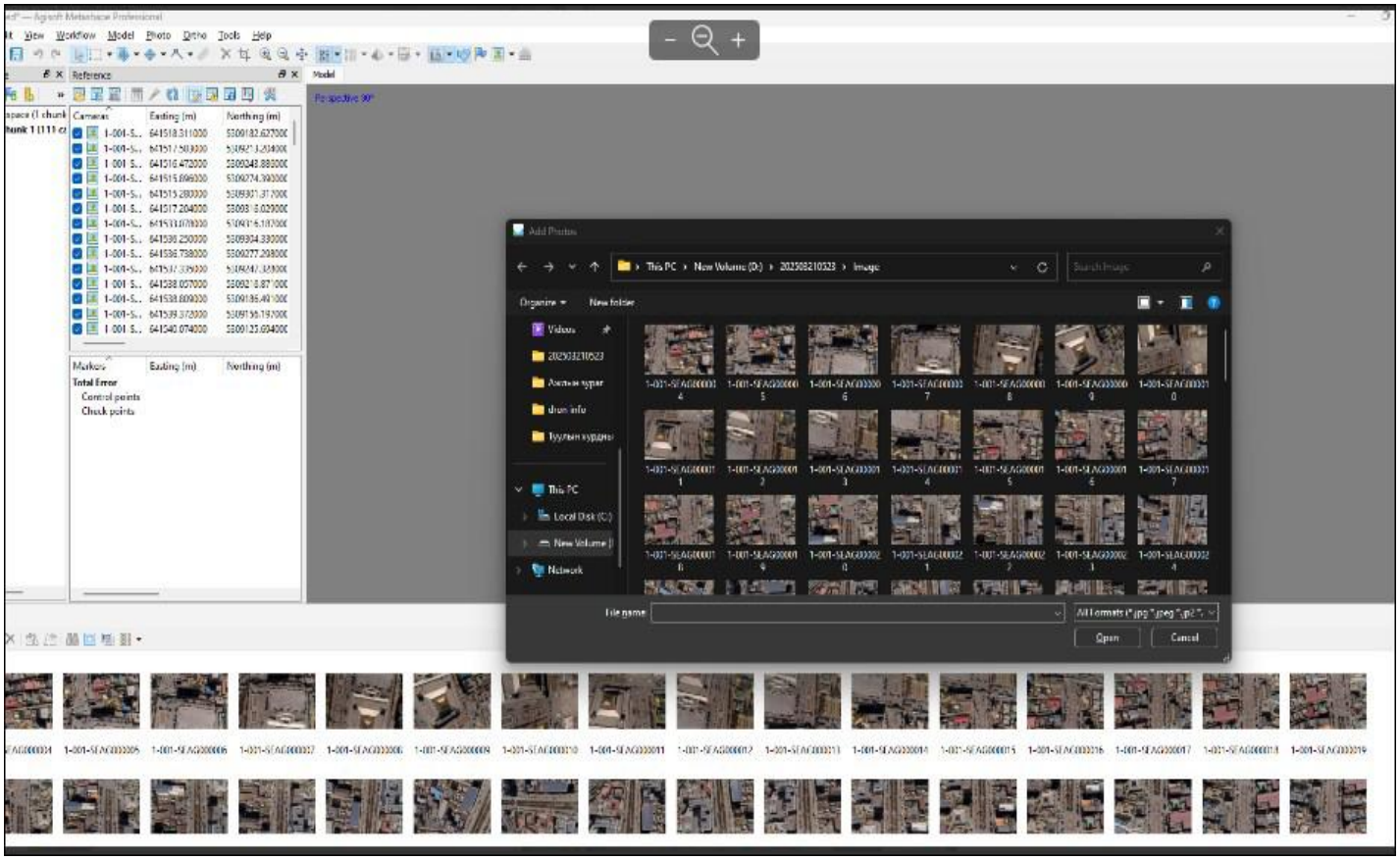


Figure 32. Connecting to GCP endpoints

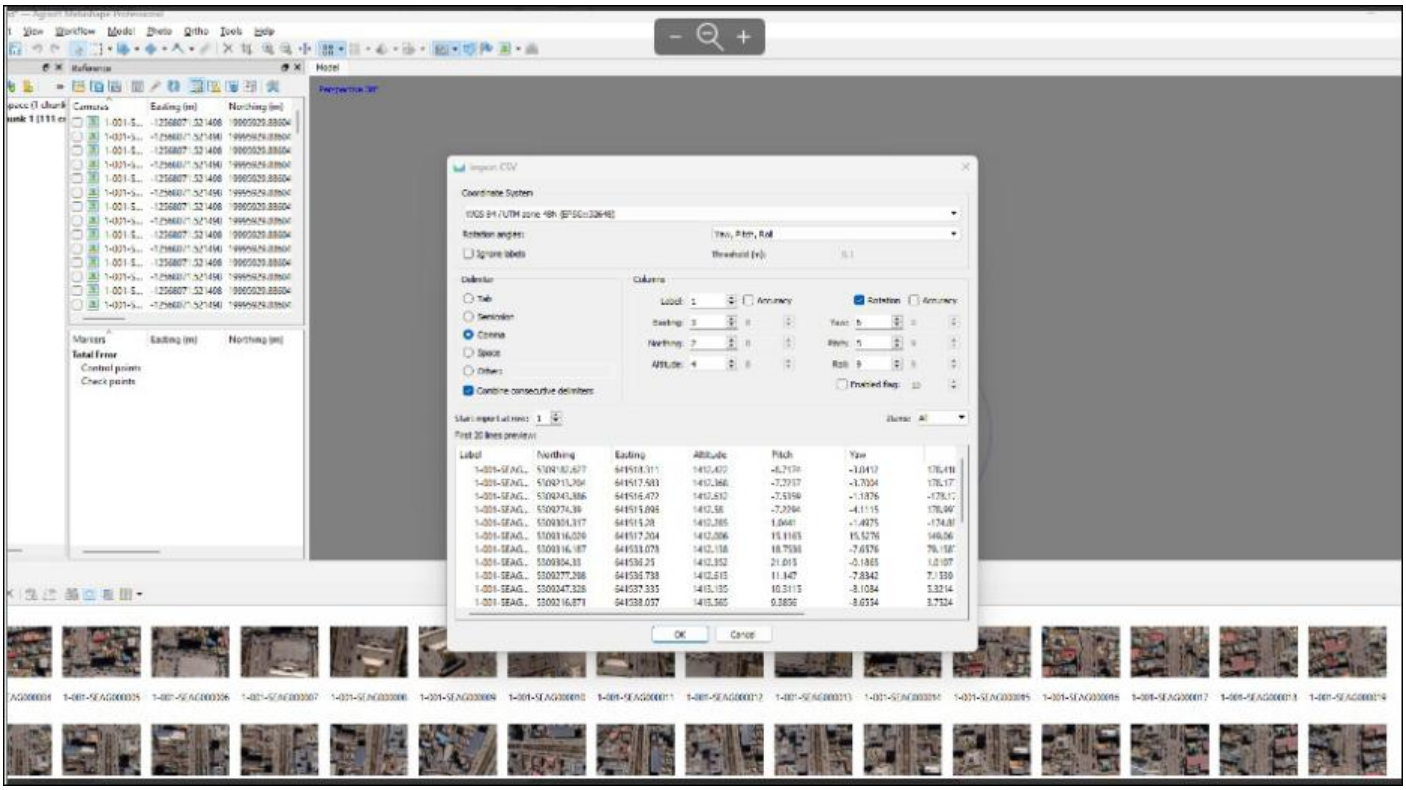
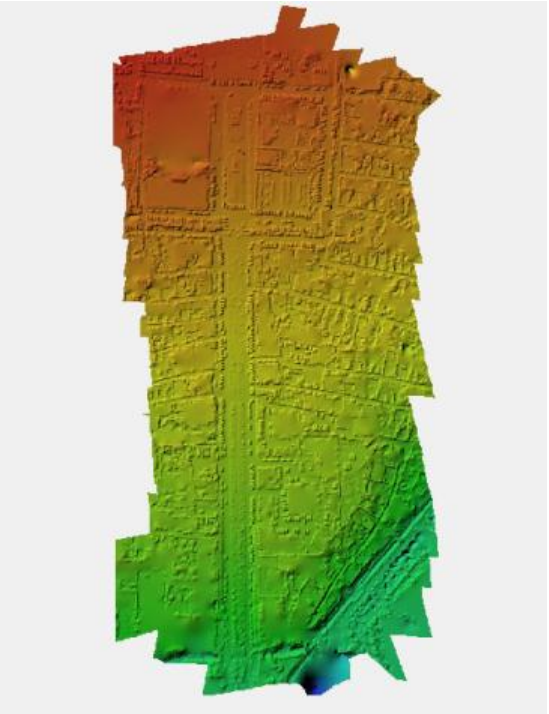


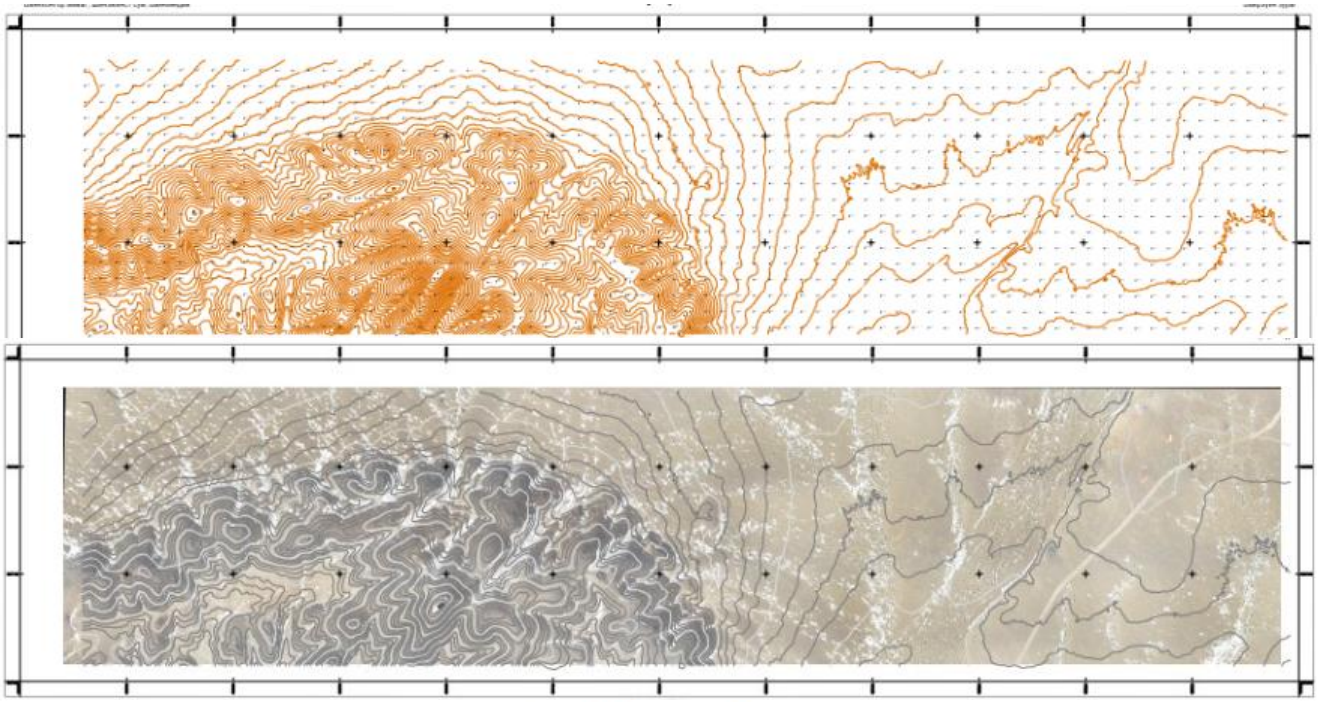
Figure 33. Digital Surface Model and Orthophoto



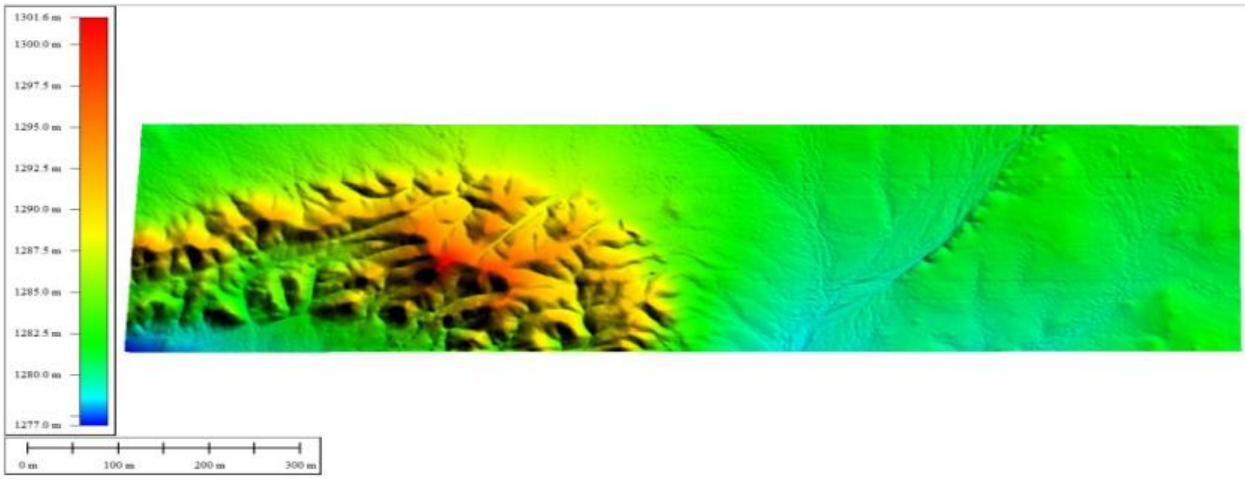
Completed tasks:

- Topographic map
- Orthophoto
- Digital Elevation Model (DEM)
- Post-processing Point Cloud
- Orthophoto and Lidar measurements, 2-wave GNSS instrument measurement comparison accuracy report

Figure 34.



Digital Elevation Model



3.4. ORTHOPHOTO EDITING AND CREATION OF ORTHOPHOTO MOSAIC IMAGES

From each aerial image, a cut line was roughly constructed to pass through the middle of the overlapping parts of the single orthophotos, and the center sections cut along this line were combined to create a composite orthophoto. The cut line was selected along the edges of artificial objects whose edges were as clearly visible as possible on the orthophoto, between natural objects occupying a homogeneous area, or along linear objects. The sharp linear contours were intersected at an angle of approximately 90 degrees with the cut line, and high objects were not crossed.

When creating a composite orthophoto, the average difference between the contour lines meeting on both sides of the cut line did not exceed 0.5 mm of the topographic and background scale in flat and hilly areas, and 0.7 mm in mountainous areas. The creation of a composite orthophoto is shown in Figure-33, and the editing of moving objects and diffuse objects using software is shown in Figure-34.

Figure 35. Create an orthophotogram

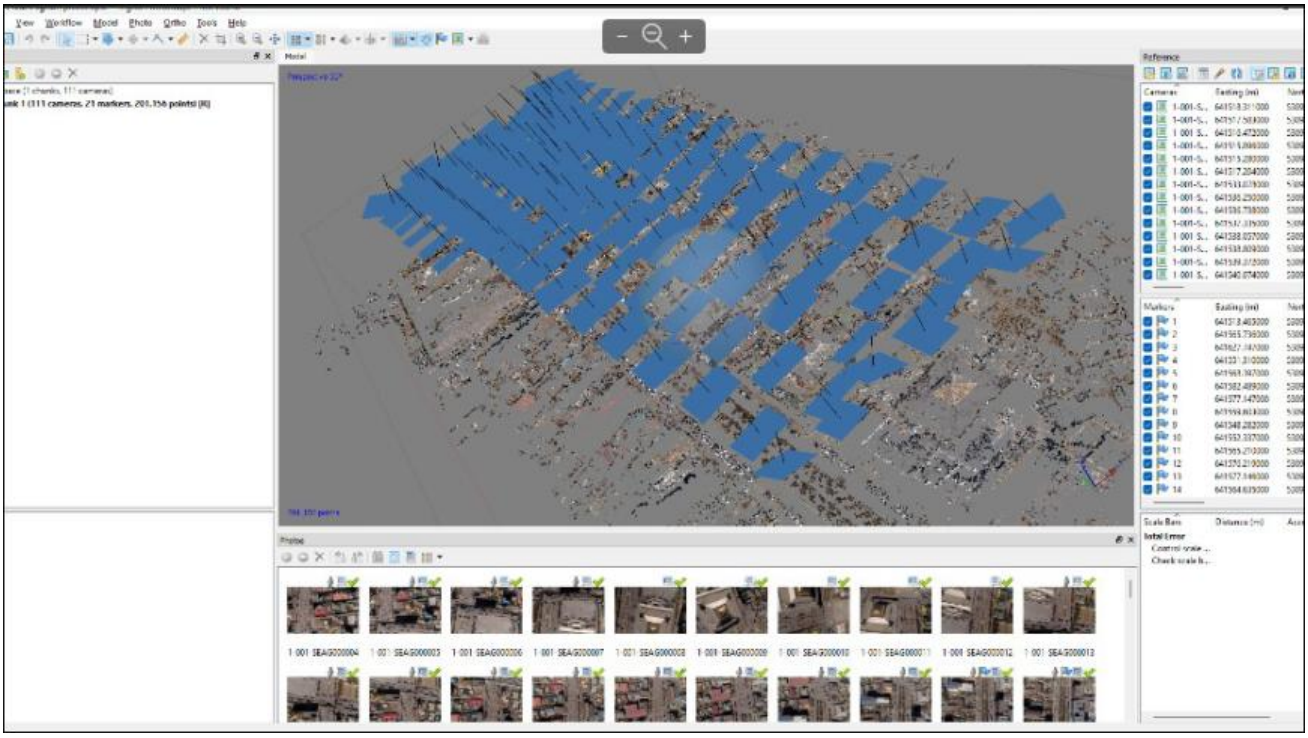
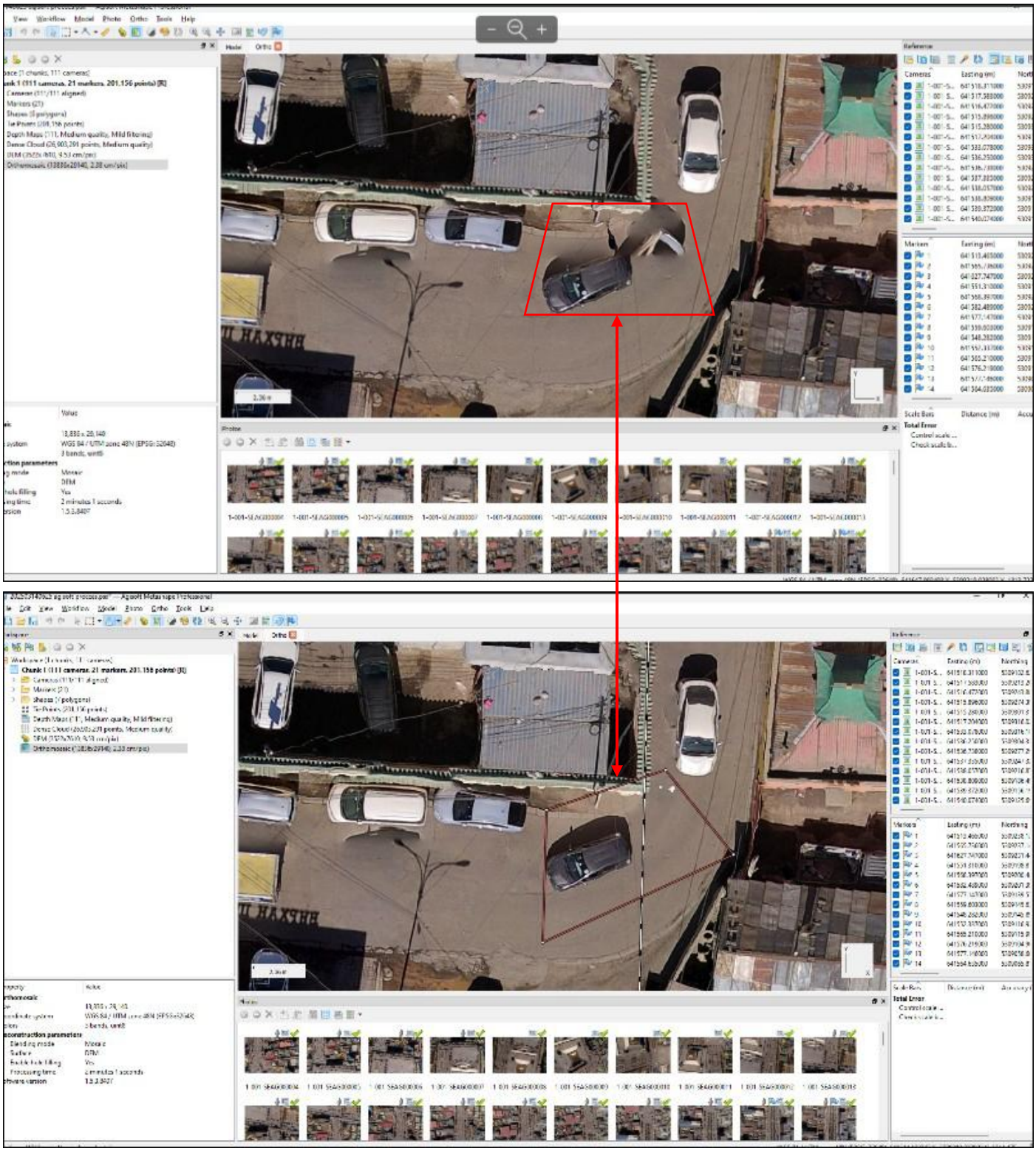


Figure 36. Orthophoto editing status



3.5. CONDUCTING LARGE-SCALE TOPOGRAPHY

According to the results of the digital topographic mapping measurements, the objects and elements to be mapped were entered into the AutoCad Civil program and drawn separately in different layers for each specified category. The height of each picket taken for the purpose of mapping buildings and their elements was recorded with an accuracy of 0.01 m.

The mapped buildings were depicted with appropriate identification symbols and placed on the topographic background map. The buildings were mapped with their foundations, and each of their corners and edges was mapped to the actual size. The entrances, porches, vestibules, sheds, stairs, and manholes of the buildings were mapped, separated from the building foundations, and drawn with identification symbols.

In the topographic background map, the buildings were classified as residential, public (government, school, kindergarten, hospital, police, association, cinema, hotel, industry, service, etc.) and by building material (reinforced concrete, brick, stone, wood mixture), and as one-story or more.

Residential buildings are classified by material as 5TBS- (prefabricated reinforced concrete, 5-story apartment), TS- (single-story brick apartment, Su - straw building, X- mixed material, the ground floor is brick and stone, etc.), public buildings are classified by material, number of floors, and purpose, and buildings under construction and collapsed and damaged buildings are entered by their foundation, and "build" and "restore" are written. (For example: 5T. Star Hotel), (T.emn) (6TB. APU JSC), etc.

Wooden houses are classified as "M" if they have one floor, and "MS" if they have more than 2 floors, and the name of the area and garden is written.

The building entrance, stairs, entrance, concreted or asphalted area, canopied balcony, entrance to the underground part, etc., are mapped and distinguished by appropriate identification marks.

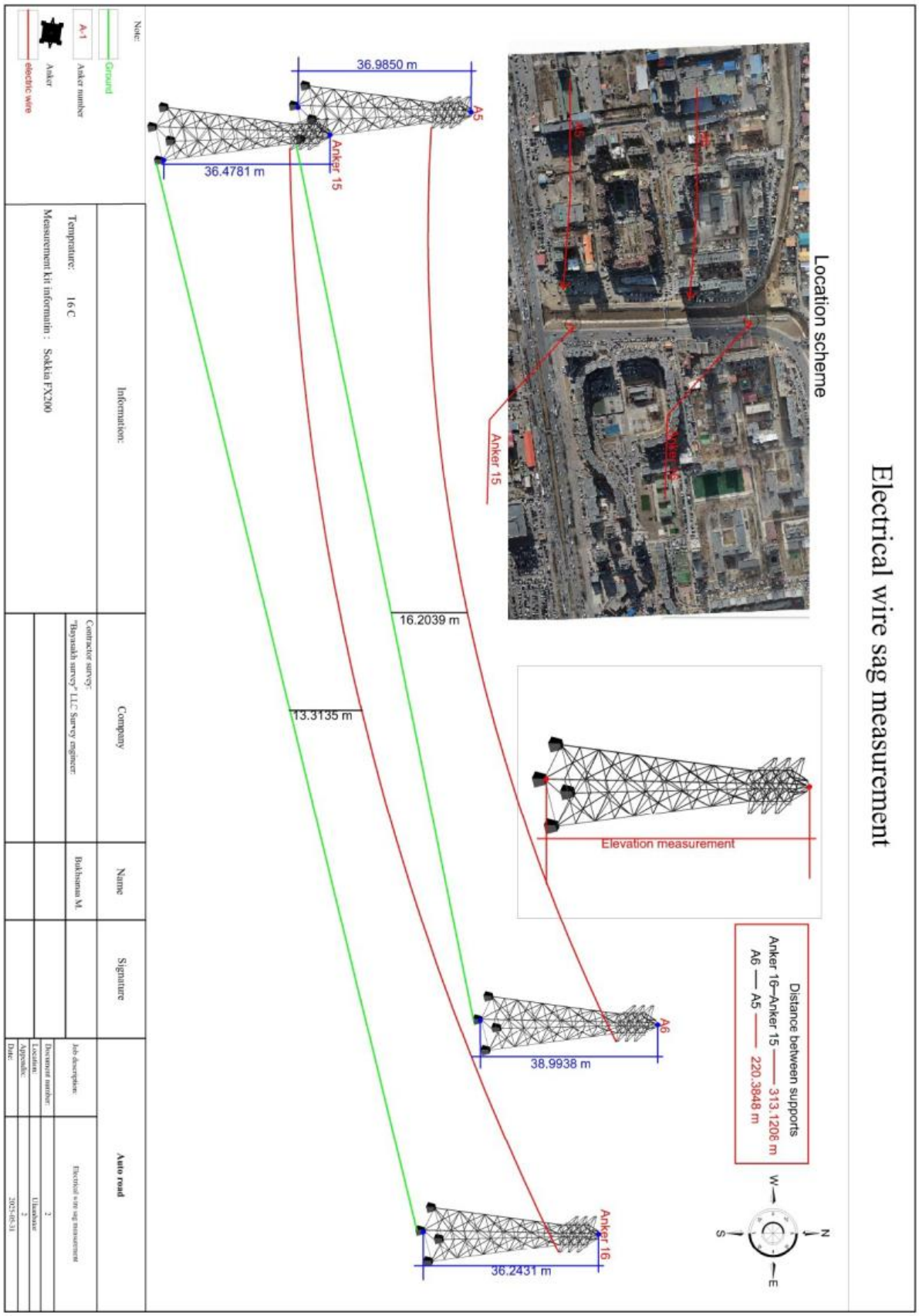
The top and bottom boundaries of reinforced and unsupported embankments (dams) are mapped and their heights are recorded. Piled earth, stockpiled coal, sand,

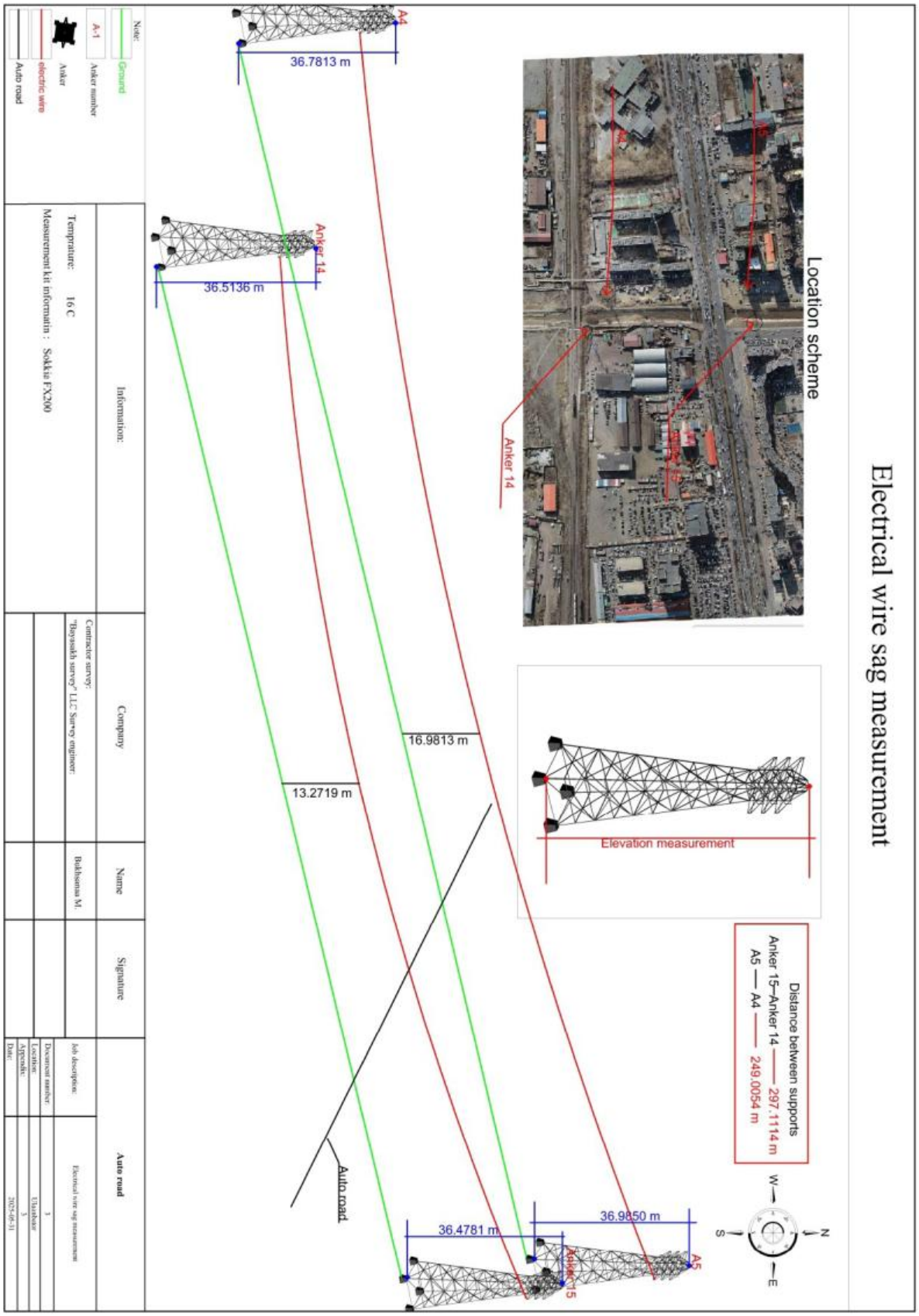
gravel, sawdust, soil, weeds, excess waste materials, excavated and leveled land are mapped and named by their area. The heights of the piles and leveled land are recorded. Where necessary, the contours are outlined with dashed lines.

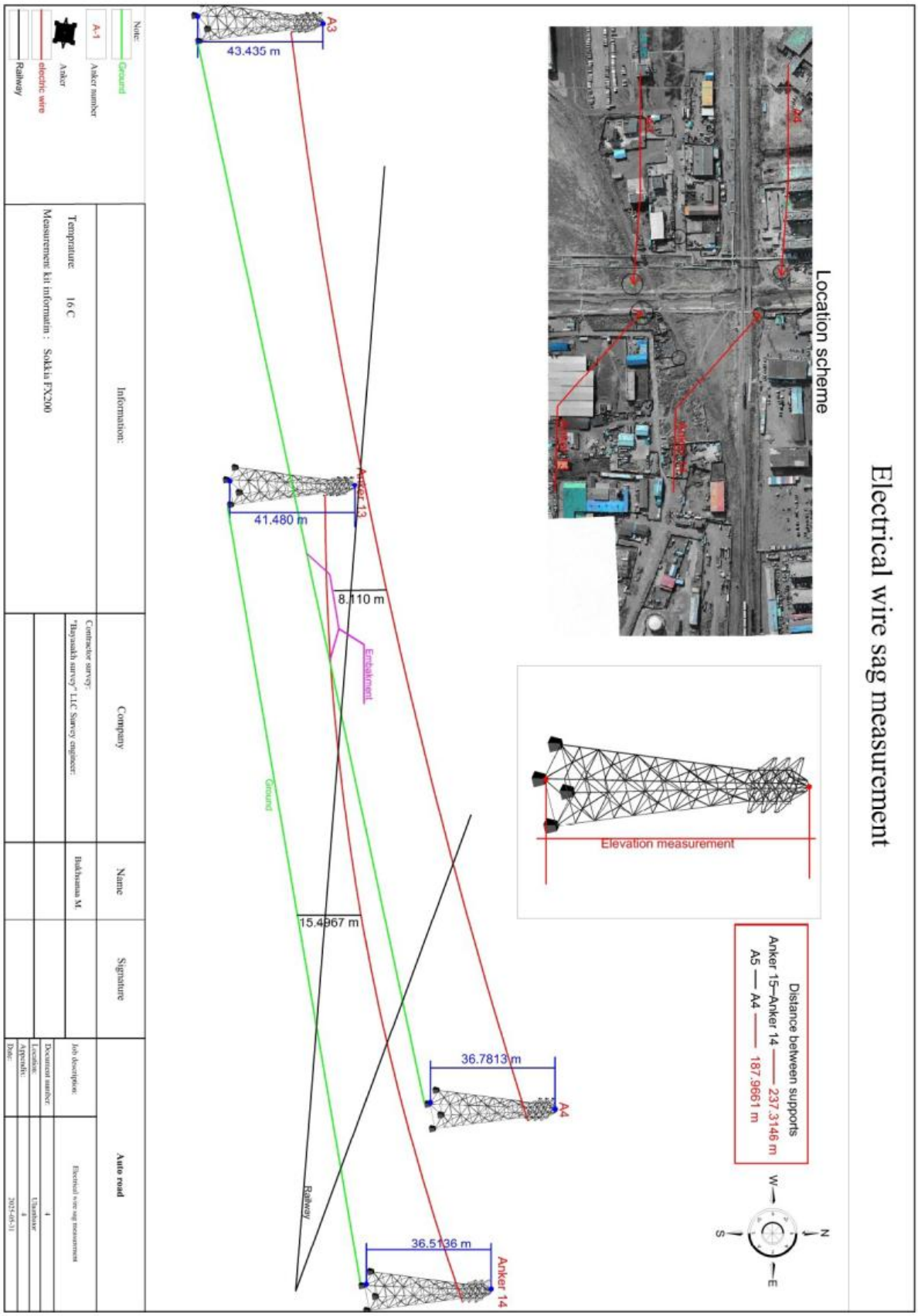
Elements of the above-ground and underground engineering network were taken from the .dwg file provided by "AUDI" LLC and inserted into the topographic background map.

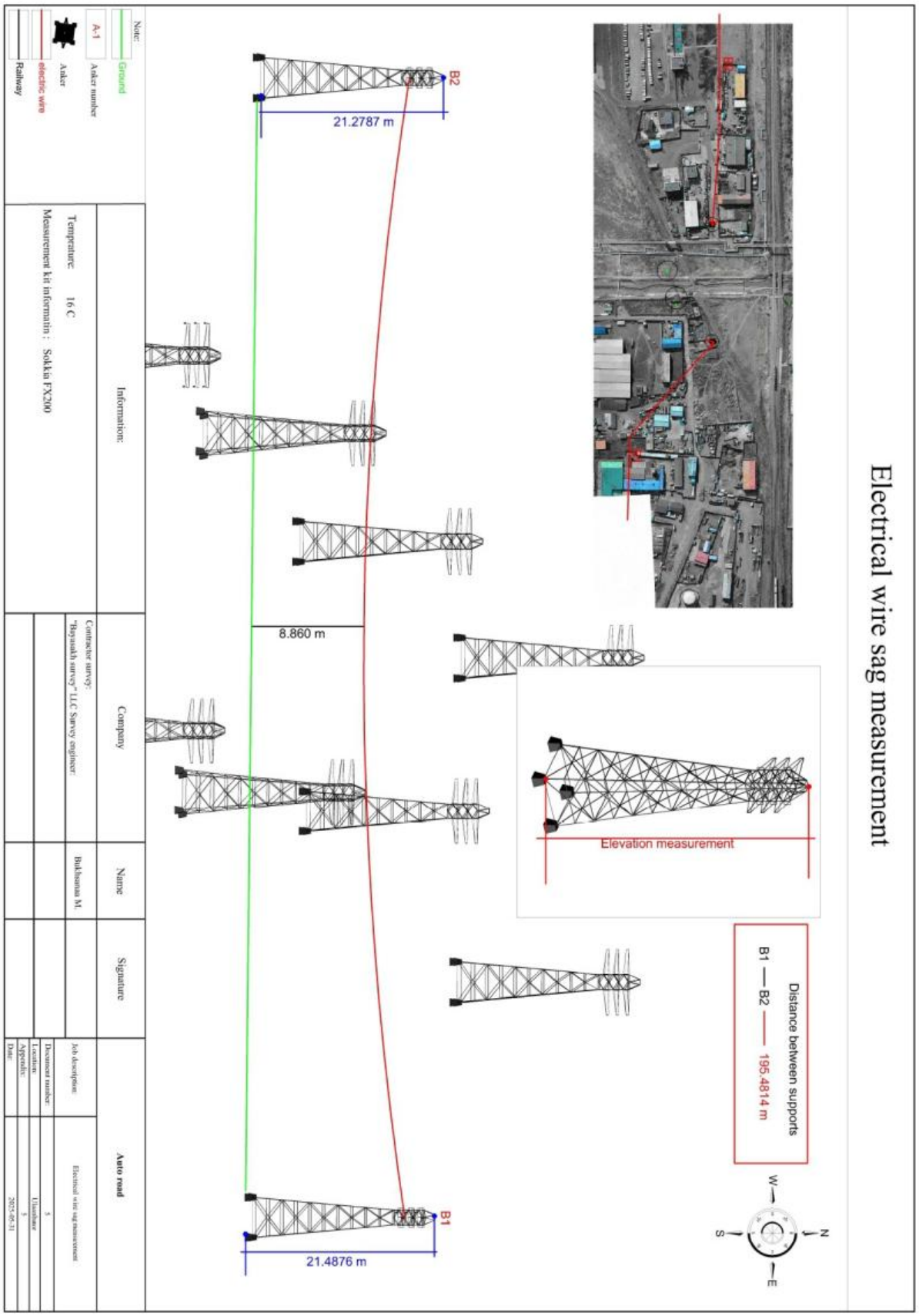
The electrical substation, transformer protection fence, and buildings were mapped to scale, and identification arrows were placed outside these.

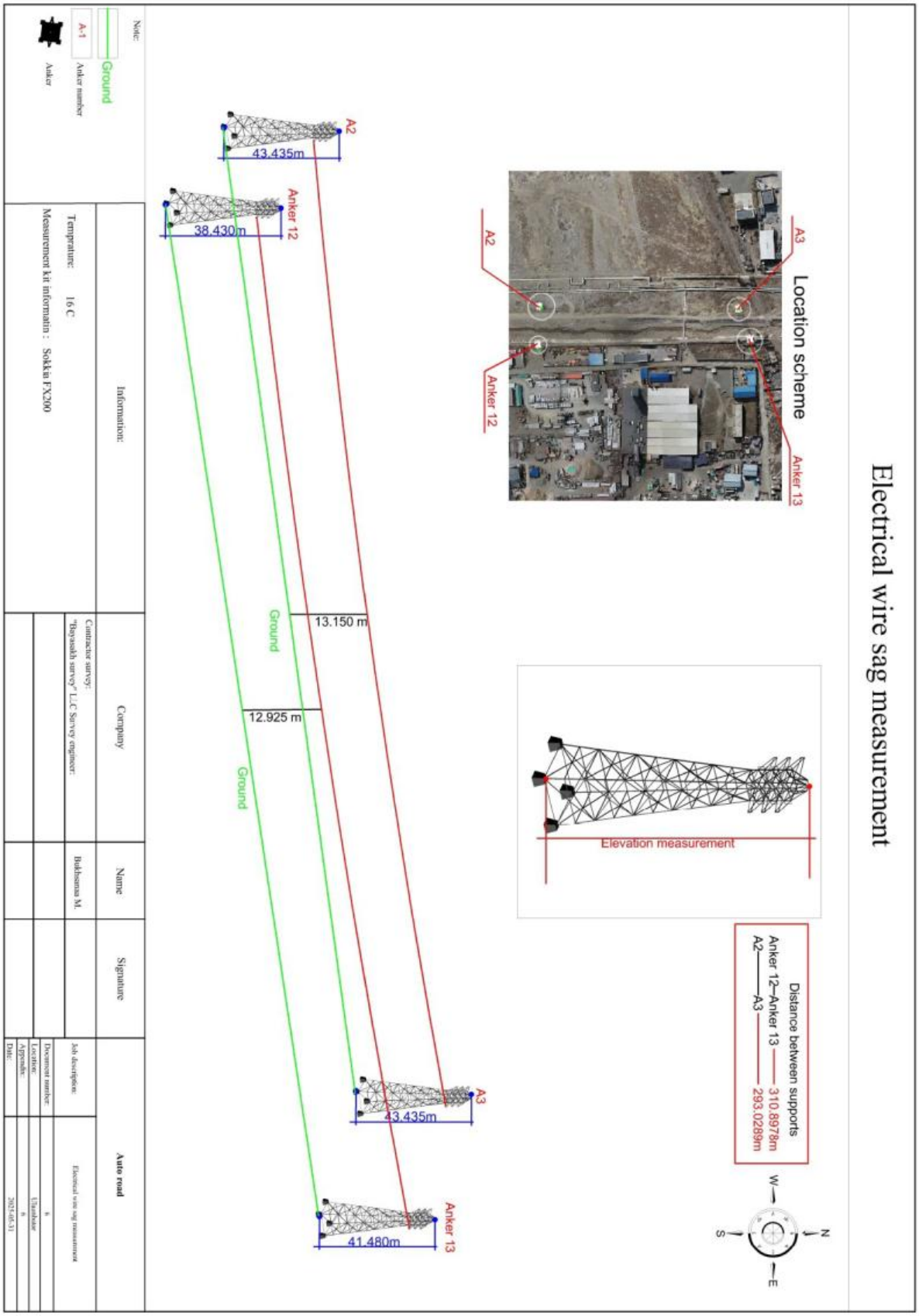
Figure 37. Additionally, the results of the measurement of the sag of the CDS cable are attached in the form of pictures.

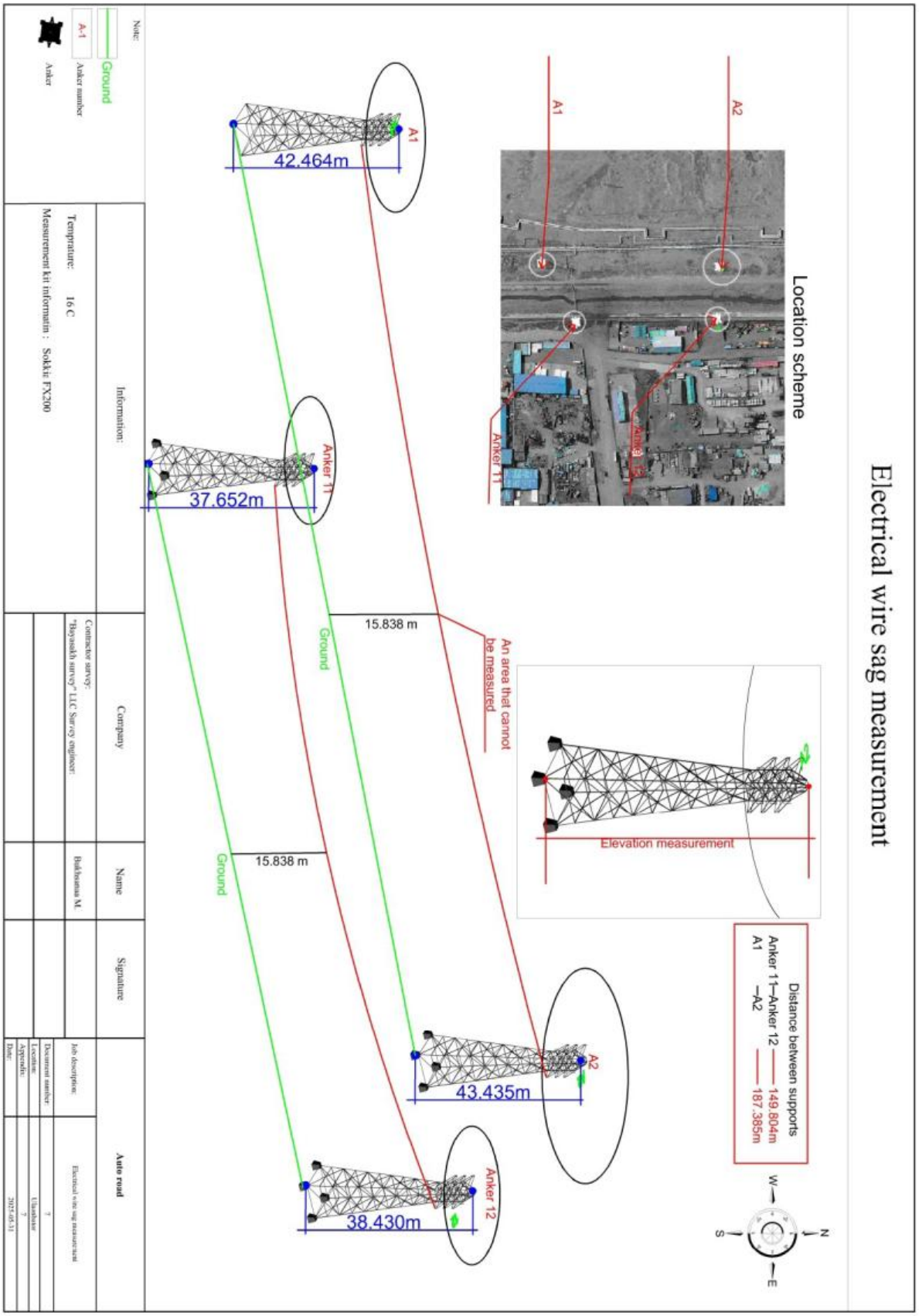

Electrical wire sag measurement
Location scheme
Anker 15
Anker 16
36.9850 m
36.4781 m
16.2039 m
13.3135 m
38.9938 m
36.2431 m
Elevation measurement
Distance between supports
Anker 16–Anker 15 —— 313.1206 m
A6 — A5 —— 220.3848 m
W
N
S
E
Note:
Ground
A-1
Anker number
Anker
electric wire
Information:
Temprature: 16 C
Measurement kit information : Sokkia FX200
Company
Contractor survey:
"Bayasakh survey" LLC Survey engineer
Name
Bakhsuran M.
Signature
Auto road
Job description:
Electrical wire sag measurement
Document number:
Location:
Ulaanbaatar
Appendix:
2
Date:
2023-05-31

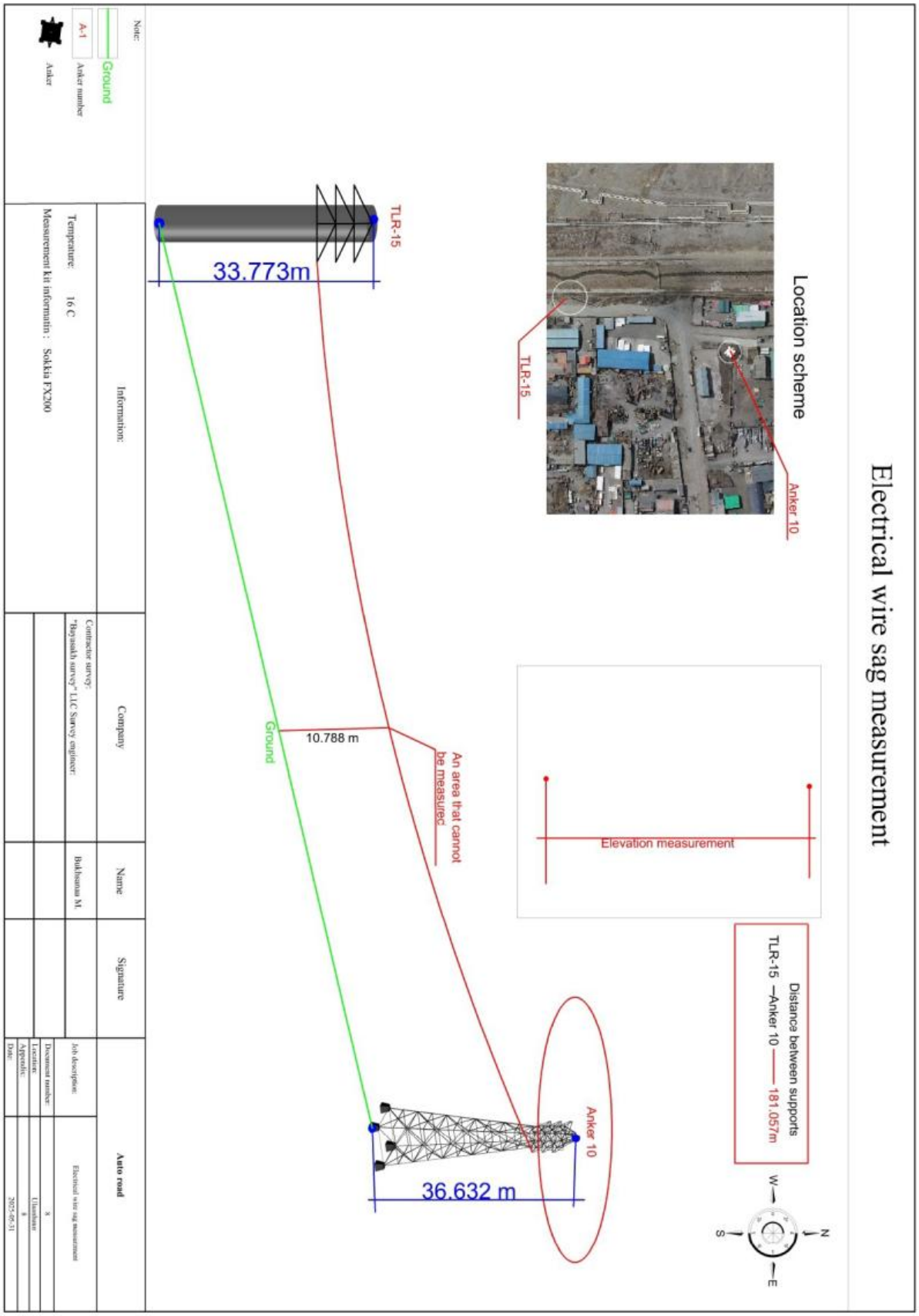

Electrical wire sag measurement
Location scheme
Anker 14
Elevation measurement
Distance between supports
Anker 15–Anker 14 —— 297.1114 m
A5 — A4 —— 249.0054 m
A4
36.7813 m
Anker 14
36.5136 m
16.9813 m
13.2719 m
Auto road
36.4781 m
36.9850 m
A5
Anker 15
Note:
Ground
A-1
Anker number
Anker
electric wire
Auto road
Information:
Company
Name
Signature
Job description:
Electrical wire sag measurement
Document number:
1
Location:
Uzunbase
Appendix:
3
Date:
2025-08-31
Temprature: 16 C
Measurement kit information : Sokkia FX200
Contractor survey:
"Bayasakh survey" LLC Survey engineer:
Bakhsenaa M.
W
N
S
E

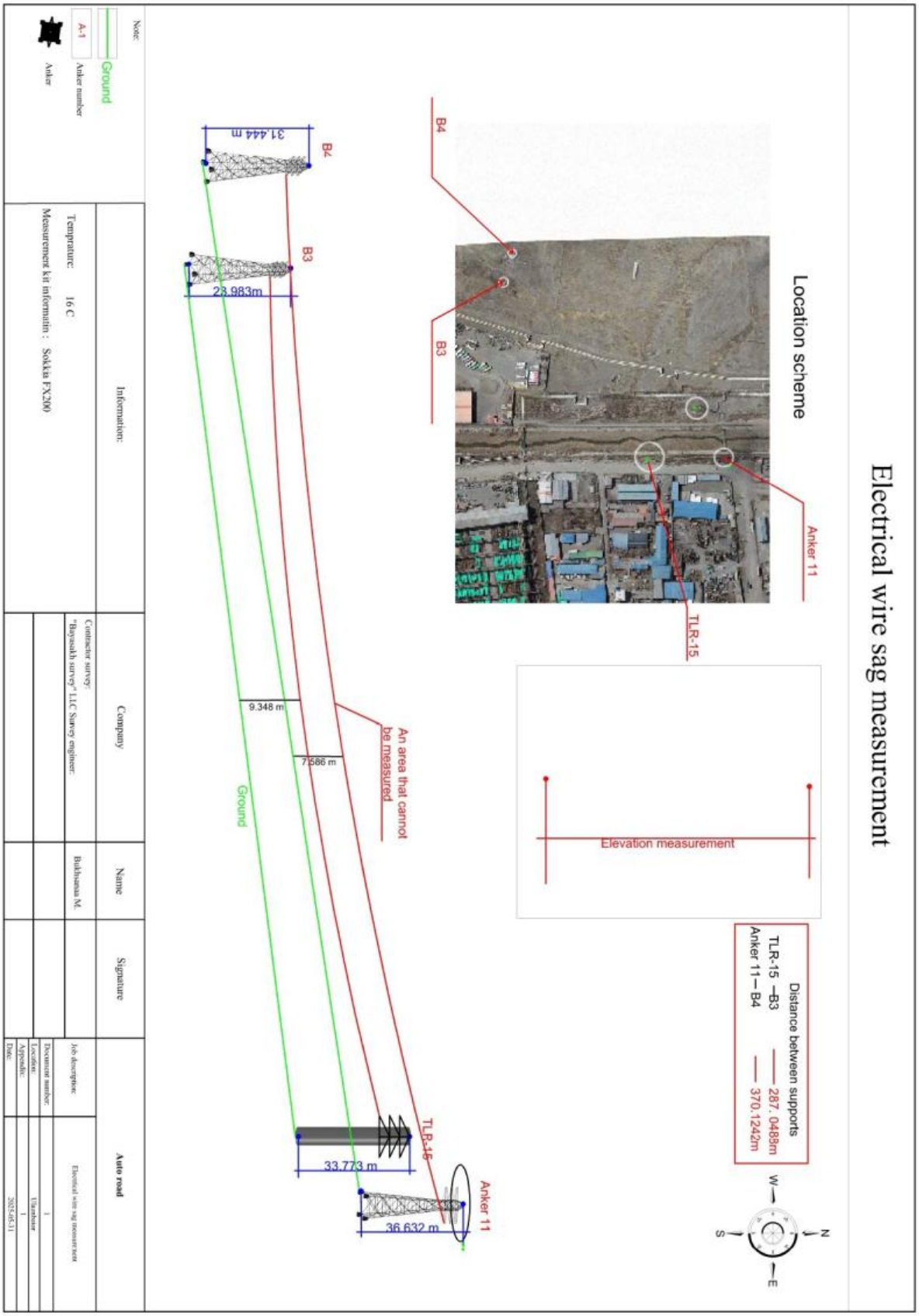

Electrical wire sag measurement
Location scheme
A3
43.435 m
Anker 13
41.480 m
8.110 m
Embankment
Ground
15.4967 m
36.7813 m
A4
Railway
36.5136 m
Anker 14
Elevation measurement
Distance between supports
Anker 15–Anker 14 —— 237.3146 m
A5 —— A4 —— 187.9661 m
W
N
S
E
Note:
Ground
A-1
Anker number
Anker
electric wire
Railway
Information:
Temprature 16 C
Measurement kit information : Sokkia FX200
Company
Contractor survey:
"Bayasakh survey" LLC Survey engineer:
Name
Bukhsuren M.
Signature
Job description:
Electrical wire sag measurement
Auto road
Document number:
1
Location:
Ulaanbaatar
Appendix:
8
Date:
2025-05-31


Electrical wire sag measurement
Note:
Ground
A-1
Anker number
Anker
electric wire
Railway
B2
21.2787 m
8.860 m
B1
21.4876 m
Elevation measurement
Distance between supports
B1 — B2 —— 195.4814 m
W
N
S
E
Information:
Temperature: 16 C
Measurement kit information : Sokkia FX200
Company
Contractor survey:
"Bayanakh survey" LLC Survey engineer:
Name
Bukhsuren M
Signature
Auto road
Job description:
Electrical wire sag measurement
Document number:
1
Location:
Ulaanbaatar
Appendix:
1
Date:
2025-05-31


Electrical wire sag measurement
Location scheme
A2
A3
Anker 12
Anker 13
Elevation measurement
Distance between supports
Anker 12—Anker 13 310.8978m
A2—A3 293.0289m
43.435m
38.430m
13.150 m
12.925 m
41.480m
Ground
Note:
Ground
A-1
Anker number
Anker
Information:
Temprature: 16 C
Measurement kit informatin : Sokkia FX200
Company
Contractor survey:
"Bayasakh survey" LLC Survey engineer:
Name
Bukhsanaa M.
Signature
Auto road
Job description:
Electrical wire sag measurement
Document number:
Location:
Ulaanbaatar
Appendix:
Date:
2025-05-31


Electrical wire sag measurement
Location scheme
A1
A2
Anker 11
Anker 12
42.464m
37.652m
43.435m
38.430m
15.838 m
15.838 m
Ground
Ground
Ground
An area that cannot be measured
Elevation measurement
Distance between supports
Anker 11–Anker 12 — 149.804m
A1 —A2 — 187.385m
W
N
S
E
Note:
Ground
A-1
Anker number
Anker
Information:
Temprature: 16 C
Measurement kit information : Sokkia FX200
Company
Contractor survey:
"Bayanakh survey" LLC Survey engineer:
Name
Bukhsuuna M.
Signature
Job description:
Document number:
Location:
Appendix:
Date:
Auto road
Electrical wire sag measurement
Ulaanbaatar
2027-05-31


Electrical wire sag measurement
Location scheme
TLR-15
Anker 10
TLR-15
33.773m
Ground
10.788 m
An area that cannot be measured
Anker 10
36.632 m
Elevation measurement
Distance between supports
TLR-15 —Anker 10 —— 181.057m
W
N
S
E
Note:
Ground
A-1
Anker number
Anker
Information:
Temperature: 16 C
Measurement kit information : Sokkia FX200
Company
Contractor survey:
"Buyanakh survey" LLC Survey engineer:
Name
Bukhsuren M.
Signature
Job description:
Electrical wire sag measurement
Document number:
x
Location:
Ulaanbaatar
Appendix:
x
Date:
2025-05-31
Asto road


Electrical wire sag measurement
Location scheme
Anker 11
TLR-15
B4
B3
31.444 m
23.983m
9.348 m
7.586 m
An area that cannot be measured
Ground
33.773 m
36.632 m
Elevation measurement
Distance between supports
TLR-15 —B3 287. 0488m
Anker 11—B4 370.1242m
W
S
N
E
Note:
Ground
A-1
Anker number
Anker
Information:
Temprature: 16 C
Measurement kit informatin : Sokkia FX200
Company
Contractor survey:
"Bayasakh survey" LLC Survey engineer:
Name
Bukhsanaa M.
Signature
Auto road
Job description:
Document number:
Location:
Appendix:
Date:
Electrical wire sag measurement
1
Ulaanbaatar
1
2025-05-31

Electrical wire sag measurement
Note:
Ground
A-1
Anker number
Anker
electric wire
Railway
Information:
Company
Name
Signature
Temprature: 16 C
Measurement kit information : Sokkia FX200
Contractor survey:
"Bayanakh survey" LLC Survey engineer:
Bakhsuren M.
Auto road
Job description:
Electrical wire sag measurement
Document number:
Location:
Appendix:
Ulaanbaatar
Date:
2021-03-31
W
N
S
E

4. LIST OF EQUIPMENTS, VERIFICATION

4.1. LIST OF EQUIPMENTS USED FOR MEASUREMENT

Table 39.

№	Country of manufacture	Firm	Indicator	Photo	Quantity
1	USA	Trimble R8 GNSS	**Code differential GPS positioning**[2] Horizontal ..... ±0.25 m + 1 ppm RMS Vertical ..... ±0.50 m + 1 ppm RMS WAAS differential positioning accuracy[3] ..... Typically <5 m 3DRMS **Static and FastStatic GPS surveying**[2] Horizontal ..... ±5 mm + 0.5 ppm RMS Vertical ..... ±5 mm + 1 ppm RMS **Kinematic surveying**[2] Horizontal ..... ±10 mm + 1 ppm RMS Vertical ..... ±20 mm + 1 ppm RMS Initialization time ..... Single/Multi-base minimum 10 sec + 0.5 times baseline length in km, up to 30 km Initialization reliability[4] ..... Typically >99.9%		1
2	PRC	South G4 GNSS	**Precisión en Posicionamiento** DGNSS (Diferencial con códigos)..... Horizontal: 0.25 m + 1 ppm RMS Vertical: 0.50 m + 1 ppm RMS Estático (fase) con..... Horizontal: 2.5 mm + 0.1 ppm RMS observaciones largas Vertical: 3 mm + 0.4 ppm RMS Estático..... Horizontal: 2.5 mm + 0.5 ppm RMS Vertical: 3.5 mm + 0.5 ppm RMS Estático (rápido)..... Horizontal: 2.5 mm + 0.5 ppm RMS Vertical: 5 mm + 0.5 ppm RMS PPK..... Horizontal: 3 mm + 1 ppm RMS Vertical: 5 mm + 1 ppm RMS Cinemático en Tiempo Real..... Horizontal: 8 mm + 1 ppm RMS (RTK UHF) Vertical: 15 mm + 1 ppm RMS RTK(NTRIP)..... Horizontal: 8 mm + 0.5 ppm RMS Vertical: 15 mm + 0.5 ppm RMS Tiempo inicialización RTK..... 2 ~ 8s Posicionamiento SBAS..... Típicamente < 5m 3DRMS		3
3	PRC	South INN07 GNSS	**Positioning Precision** Code differential GNSS positioning.... Horizontal: 0.25 m + 1 ppm RMS Vertical: 0.50 m + 1 ppm RMS GNSS static..... Horizontal: 2.5 mm + 0.5 ppm RMS Vertical: 5 mm + 0.5 ppm RMS Real-time kinematic..... Horizontal: 8 mm + 1 ppm RMS (Baseline<30km) Vertical: 15 mm + 1 ppm RMS SLink (RTX)[2]..... Horizontal: 4-10 cm Vertical: 8-20 cm RTK XTRa (xFill)[3]..... Horizontal: 5 + 10 mm/min RMS Vertical: 5 + 20 mm/min RMS SBAS positioning..... Typically<5m 3DRMS RTK initialization time..... 2~8s IMU tilt angle..... 0°~60°		2

<table>
<tr>
<td>4</td>
<td>PRC</td>
<td>South G2

GNSS</td>
<td>Positioning Precision
Code differential GNSS..... Horizontal: 0.25 m + 1 ppm RMS
Vertical: 0.50 m + 1 ppm RMS
Static(long observations).....Horizontal: 2.5 mm + 0.1 ppm RMS
Vertical: 3 mm + 0.4 ppm RMS
Static.....Horizontal: 2.5 mm + 0.5 ppm RMS
Vertical: 3.5 mm + 0.5 ppm RMS
Rapid static.....Horizontal: 2.5 mm + 0.5 ppm RMS
Vertical: 5 mm + 0.5 ppm RMS
PPK.....Horizontal: 3 mm + 1 ppm RMS
Vertical: 5 mm + 1 ppm RMS
RTK(UHF).....Horizontal: 8 mm + 1 ppm RMS
Vertical: 15 mm + 1 ppm RMS
RTK(NTRIP).....Horizontal: 8 mm + 0.5 ppm RMS
Vertical: 15 mm + 0.5 ppm RMS
RTK initialization time.....2 ~ 8s</td>
<td> </td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>PRC</td>
<td>South DL level</td>
<td>
<table>
<tr><th colspan="2">Item</th><th>DL-2003A</th><th>DL-2007</th><th>DL-202</th></tr>
<tr><td rowspan="2">Height Accuracy (standard deviation for 1km double run leveling)</td><td>Digital Reading</td><td>0.3mm</td><td>0.7mm</td><td>1.5mm</td></tr>
<tr><td>Optical Reading</td><td></td><td>2.0mm</td><td></td></tr>
<tr><td>Distance Accuracy</td><td>Digital Reading</td><td colspan="3">D≤10m:10mm; D>10m:D*0.001</td></tr>
<tr><td>Distance Range</td><td>Digital Reading</td><td colspan="3">1.8m~110m</td></tr>
<tr><td rowspan="2">Minimum Display</td><td>HD</td><td>0.01mm/0.1mm/1mm</td><td>1mm/0.1mm</td><td>0.1mm/1mm</td></tr>
<tr><td>Distance</td><td></td><td>0.1/1cm</td><td></td></tr>
<tr><td>Measuring Time</td><td></td><td colspan="3">Within 3s in normal condition</td></tr>
<tr><td rowspan="5">Telescope</td><td>Magnification</td><td colspan="3">32X</td></tr>
<tr><td>Resolving Power</td><td colspan="3">3"</td></tr>
<tr><td>Field of View</td><td colspan="3">1°30'</td></tr>
<tr><td>Multiple Constant</td><td colspan="3">100</td></tr>
<tr><td>Additive Constant</td><td colspan="3">0</td></tr>
</table>
</td>
<td> </td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>PRC</td>
<td>DJI matrice 350 drone</td>
<td>Maximum flight altitude – 7000 m
Maximum flight time – 55 min
Maximum flight speed in windy conditions – 12 m/s
Operating temperature range – -20°C to +50°C
Maximum payload during flight – 2.7 kg</td>
<td> </td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>PRC</td>
<td>Yneec H850 drone</td>
<td>Maximum flight altitude – 7000 m
Maximum flight time – 55 min
Maximum flight speed in windy conditions – 12 m/s
Operating temperature range – -20°C to +50°C
Maximum payload during flight – 2.7 kg</td>
<td> </td>
<td>1</td>
</tr>
</table>

4.2. VERIFICATION OF EQUIPMENTS

Figure 38. SOUTH INNO 7 instrument certification certificate:

Government Implementing Agency
General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031525

Bayasakh Survey LLC
(Name of organization)

Instrument name: South INN07
Serial number: SG70AC133368786EGD
Specification: ±2.5 mm + 0.5 ppm horizontal, ±5.0 mm + 0.5 ppm vertical
Description: Dual-frequency GNSS receiver

Valid until 24 January 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: ***(Signed)***

"Accredited Metrology Laboratory" ***(Stamped)***

Date of issue: 25 January 2024

: *Figure 39. SOUTH INNO 7 instrument verification certificate*

Government Implementing Agency
General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031524

Bayasakh Survey LLC
(Name of organization)

Instrument name: South INN07
Serial number: SG70AC133368788EGD
Specification: ±2.5 mm + 0.5 ppm horizontal, ±5.0 mm + 0.5 ppm vertical
Description: Dual-frequency GNSS receiver

Valid until 24 January 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: *(Signed)*

"Accredited Metrology Laboratory" *(Stamped)*

Date of issue: 25 January 2024

Figure 40. SOUTH GALAXY G2 instrument certification certificate

Government Implementing Agency
General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031529

Bayasakh Survey LLC
(Name of organization)

Instrument name: South Galaxy G2
Serial number: SG50B6148512748EKA
Specification: ±2.5 mm + 0.5 ppm horizontal, ±5.0 mm + 0.5 ppm vertical
Description: Dual-frequency GNSS receiver

Valid until 24 January 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: ***(Signed)***

"Accredited Metrology Laboratory" ***(Stamped)***

Date of issue: 25 January 2024

: *Figure 41. SOUTH G4 instrument certification certificate*

Government Implementing Agency
General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031530

Bayasakh Survey LLC
(Name of organization)

Instrument name: South G4
Serial number: S914E3152100338PKA
Specification: ±2.5 mm + 0.5 ppm horizontal, ±3.5 mm + 0.5 ppm vertical
Description: Dual-frequency GNSS receiver

Valid until 24 January 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: ***(Signed)***

"Accredited Metrology Laboratory" ***(Stamped)***

Date of issue: 25 January 2024

Figure 42. SOUTH G4 instrument certification certificate

Government Implementing Agency
General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031531

Bayasakh Survey LLC
(Name of organization)

Instrument name: South G4
Serial number: S914E7152101338PKA
Specification: ±2.5 mm + 0.5 ppm horizontal, ±3.5 mm + 0.5 ppm vertical
Description: Dual-frequency GNSS receiver

Valid until 24 January 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: ***(Signed)***

"Accredited Metrology Laboratory" ***(Stamped)***

Date of issue: 25 January 2024

: *Figure 43.SOUTH G4 instrument certification certificate*

Government Implementing Agency
General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031532

Bayasakh Survey LLC
(Name of organization)

Instrument name: South G4
Serial number: S914E7152101370PKA
Specification: ±2.5 mm + 0.5 ppm horizontal, ±3.5 mm + 0.5 ppm vertical
Description: Dual-frequency GNSS receiver

Valid until 24 January 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: *(Signed)*

"Accredited Metrology Laboratory" *(Stamped)*

Date of issue: 25 January 2024

Figure 44. Trimble R8 instrument certification certificate

Government Implementing Agency
General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031536

Bayasakh Survey LLC
(Name of organization)

Instrument name: Trimble R8
Serial number: 4808145745
Specification: ±5.0 mm + 0.5 ppm horizontal, ±5.0 mm + 1.0 ppm vertical
Description: Dual-frequency GNSS receiver

Valid until 24 January 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: *(Signed)*

"Accredited Metrology Laboratory" *(Stamped)*

Date of issue: 25 January 2024

: *Figure 45. SOUTH DL-202 instrument certification certificate*

Government Implementing Agency
General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031510

Bayasakh Survey LLC
(Name of organization)

Instrument name: South DL-202
Serial number: 017282
Specification: 1.5 mm
Description: Digital level

Valid until 21 January 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: ***(Signed)***

"Accredited Metrology Laboratory" ***(Stamped)***

Date of issue: 21 January 2025

: *Figure 46. SOUTH DL-207 instrument certification certificate*

Government Implementing Agency
General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031512

Bayasakh Survey LLC
(Name of organization)

Instrument name: South DL 207
Serial number: 015785
Specification: 0.7 mm
Description: Digital level

Valid until 21 January 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: ***(Signed)***

"Accredited Metrology Laboratory" ***(Stamped)***

Date of issue: 21 January 2025

: *Figure 47. SOUTH DL-2007 instrument certification certificate*

Government Implementing Agency
General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031640

Bayasakh Survey LLC
(Name of organization)

Instrument name: South DL-2007
Serial number: 021333
Specification: 0.7 mm
Description: Digital level

Valid until 18 February 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: ***(Signed)***

"Accredited Metrology Laboratory" ***(Stamped)***

Date of issue: 18 February 2025

: *Figure 48. SOUTH DL-2007 instrument certification certificate*

Government Implementing Agency
General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031637

Bayasakh Survey LLC
(Name of organization)

Instrument name: South DL-2007
Serial number: 020953
Specification: 0.7 mm
Description: Digital level

Valid until 18 February 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: ***(Signed)***

"Accredited Metrology Laboratory" ***(Stamped)***

Date of issue: 18 February 2025

Figure 49. SOUTH DL-2007 instrument certification certificate

Government Implementing Agency

General Authority for Land Administration, Geodesy and Cartography

Geodetic Metrology Laboratory

Certificate No. 0031639

Bayasakh Survey LLC
(Name of organization)

Instrument name: South DL-2007
Serial number: 021263
Specification: 0.7 mm
Description: Digital level

Valid until 18 February 2026 for production use.

Laboratory: Metrology Laboratory
Head of Laboratory: ***(Signed)***

"Accredited Metrology Laboratory" ***(Stamped)***

Date of issue: 18 February 2025

5. INFORMATION ON SOFTWARE USED FOR PROCESSING

Table 40.

№	Country of manufacture	Program name	Version	Picture
1	PRC	DJI Terra	V 4.4.6	
2	USA	Autocad	2026	
3	USA	Civil 3D	2025	
4	PRC	South Geomatics office	version 2.30.250310	

5	USA	Global mapper	18	GlobalMapper PL
6	RF	Agisoft metashape professional	version 1.5.3build 8407	Agisoft Metashape
7	PRC	GairHawk	5.0	Geosun gAirHawk® Version 5.0 One-key point cloud pre-processing software Integrated with Shuttle trajectory processing inside

Figure 50. The actual process of Lidar and aerial imagery measurement:

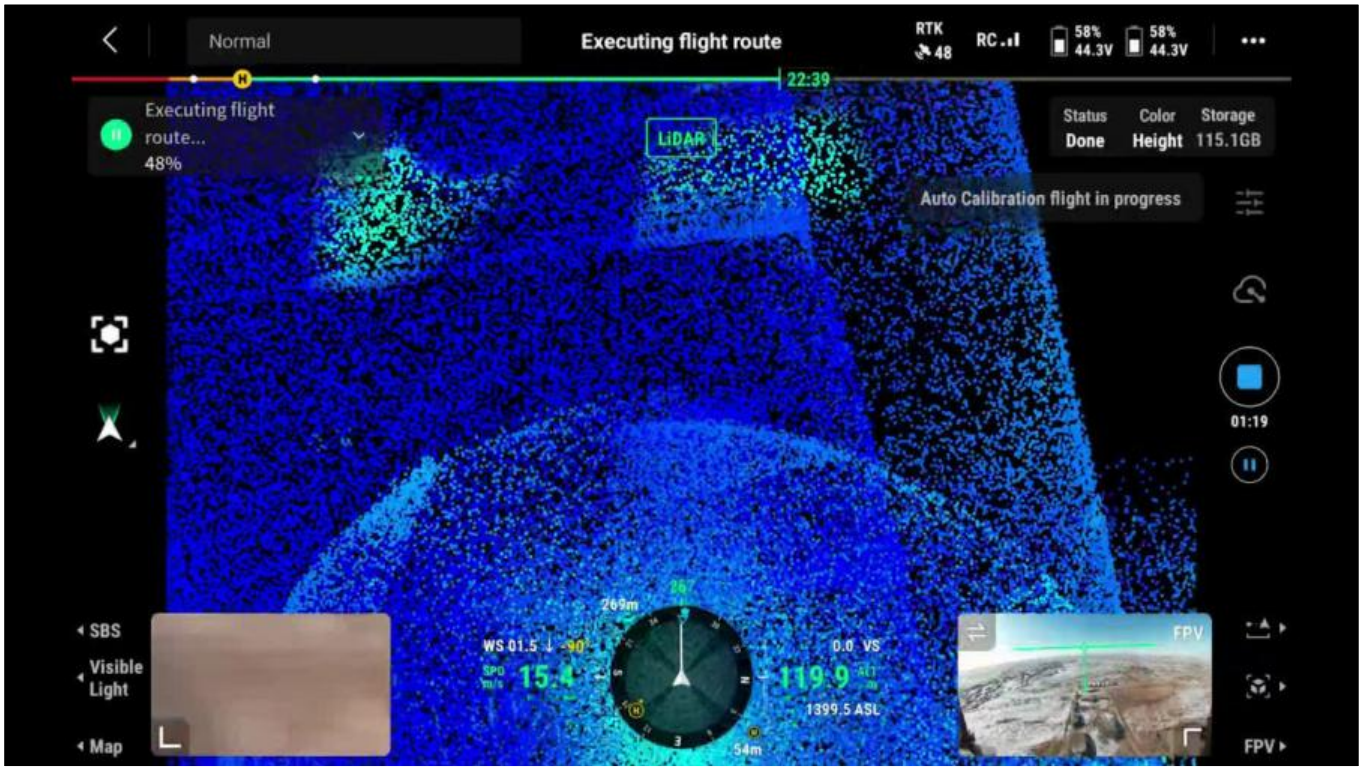


Figure 51. DJI TERRA software development process:

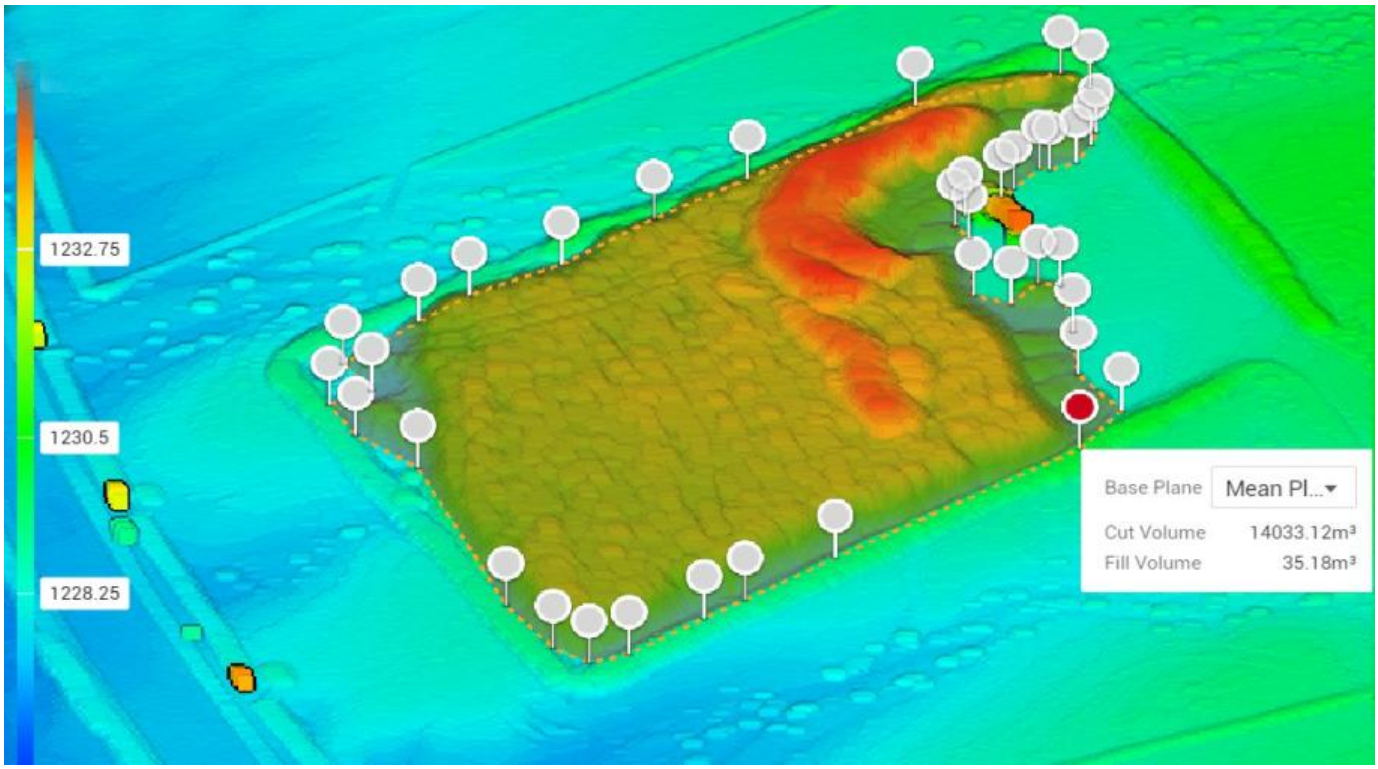


Figure 52. The development process of the "South geomatics office" program:

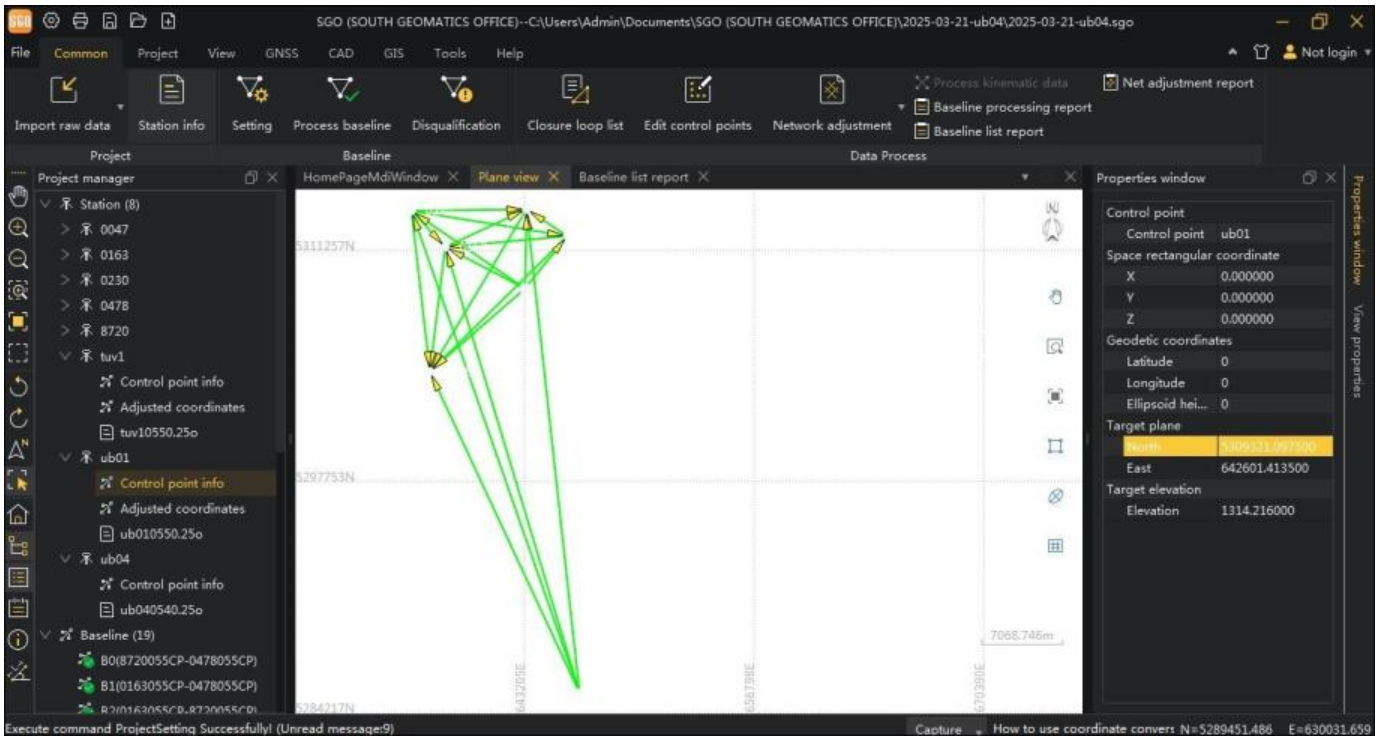


Figure 53. "Global Mapper"-18:

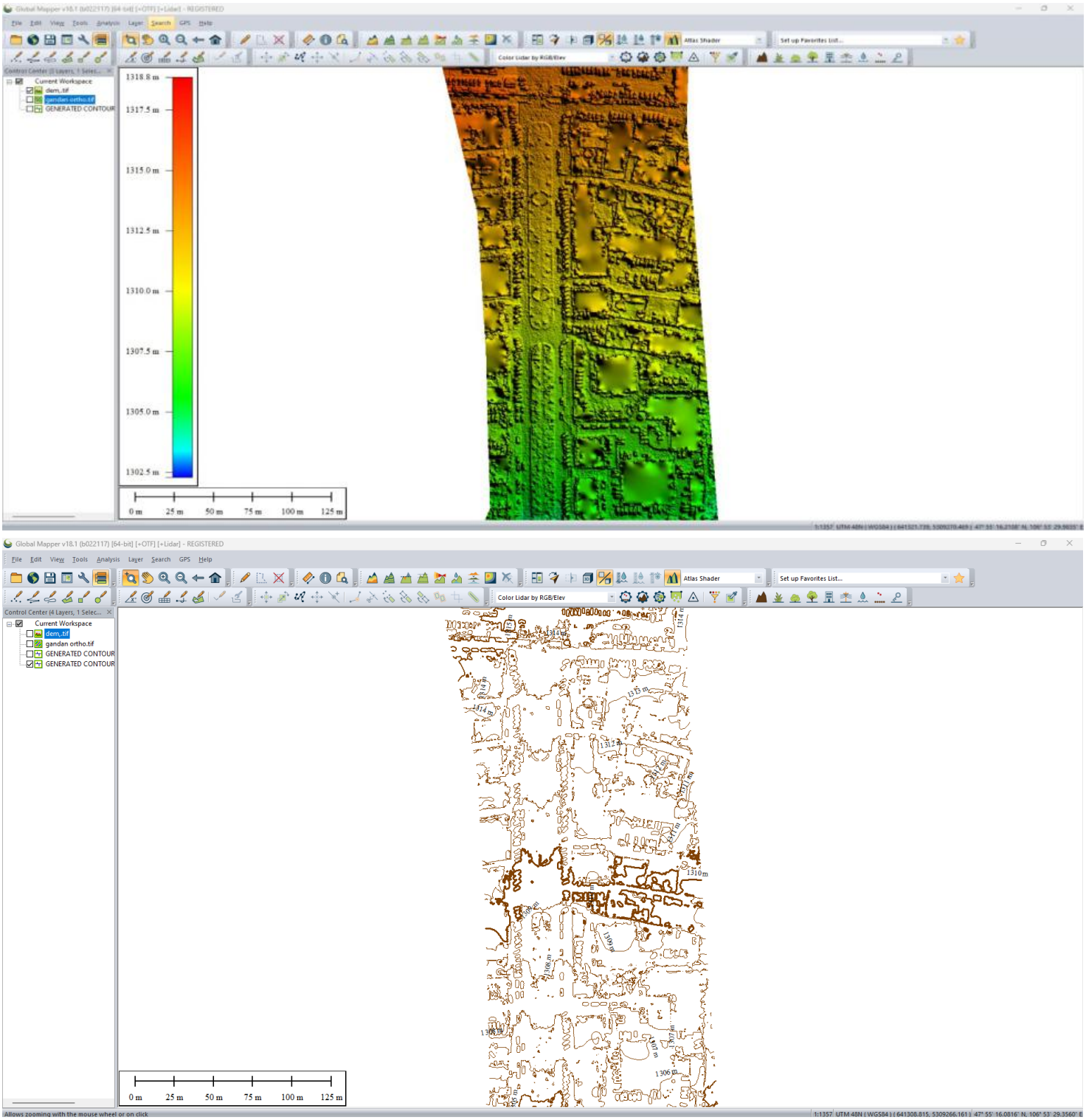


Figure 54. "Agisoft Mateshape" software processing process:

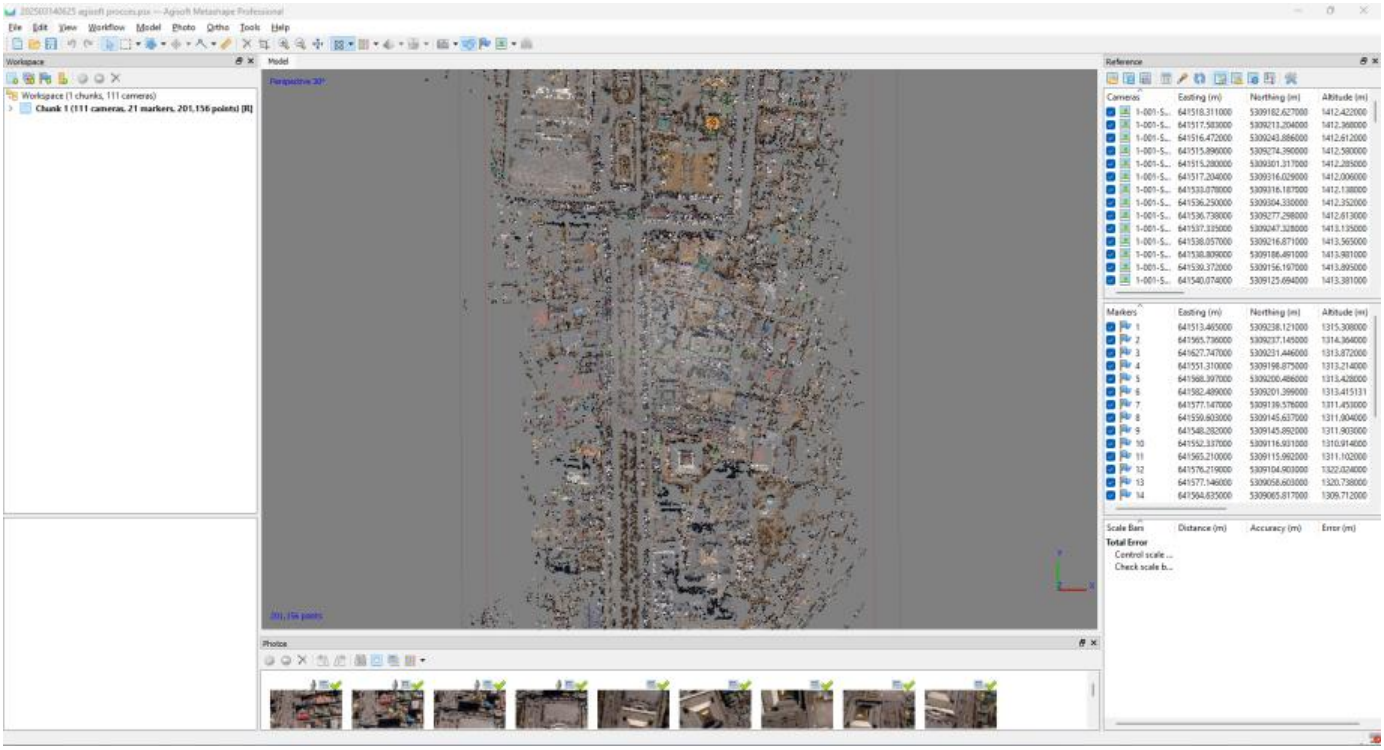


Figure 55. Agisoft Mateshape" program processing process: ("DEM-Digital elevation model")

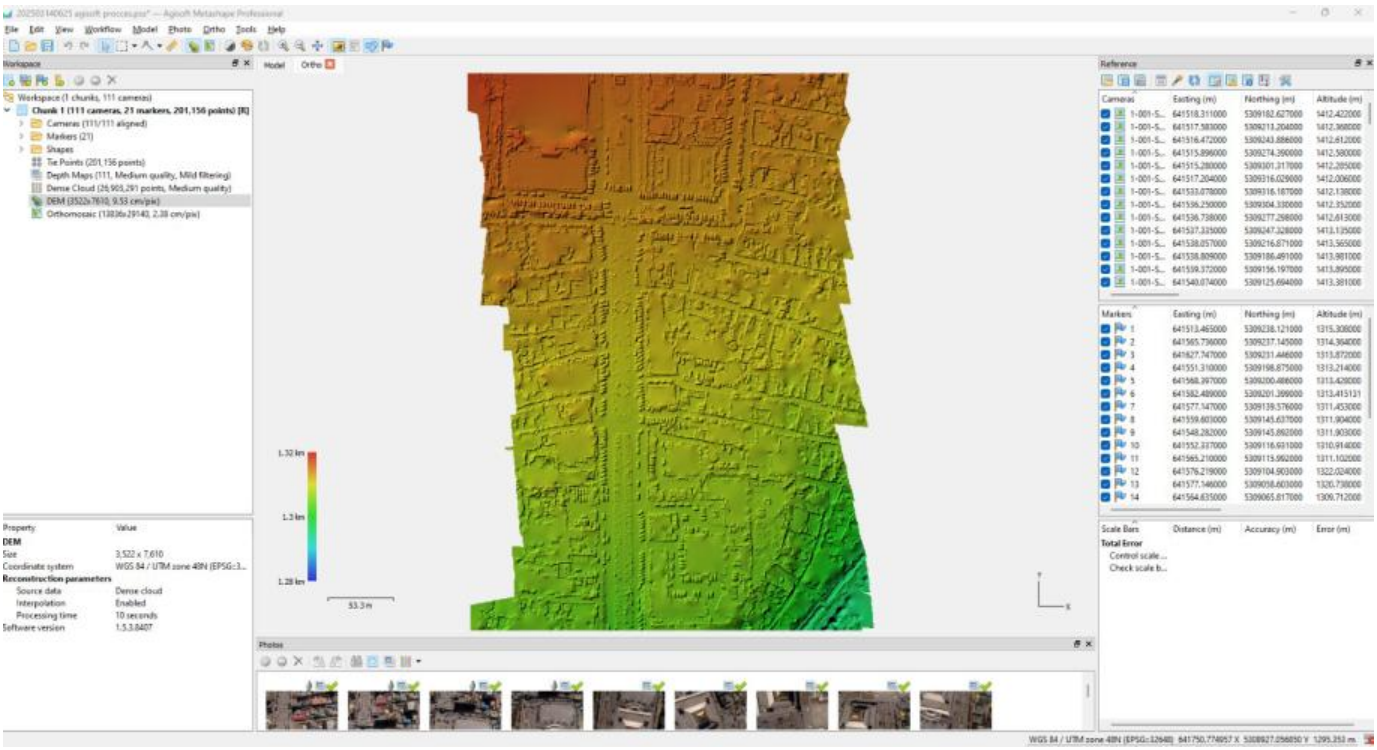


Figure 56. "Agisoft Mateshape" software processing process:

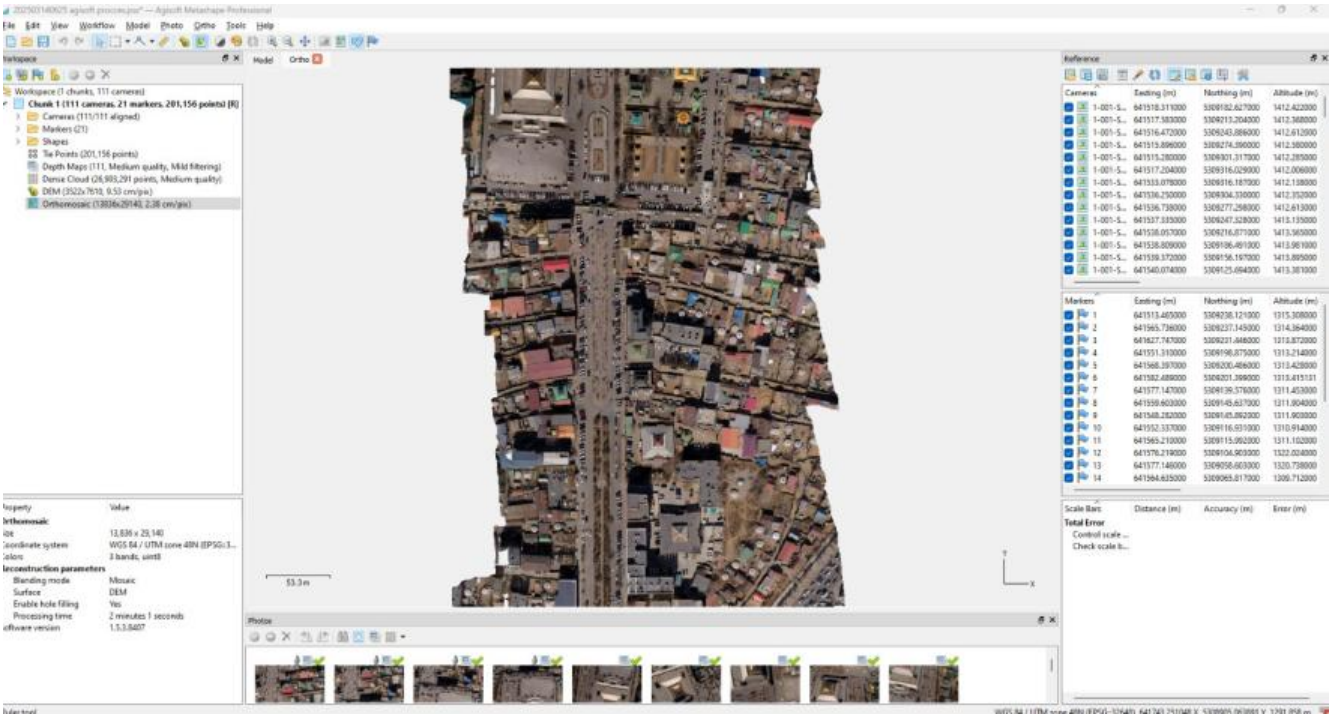
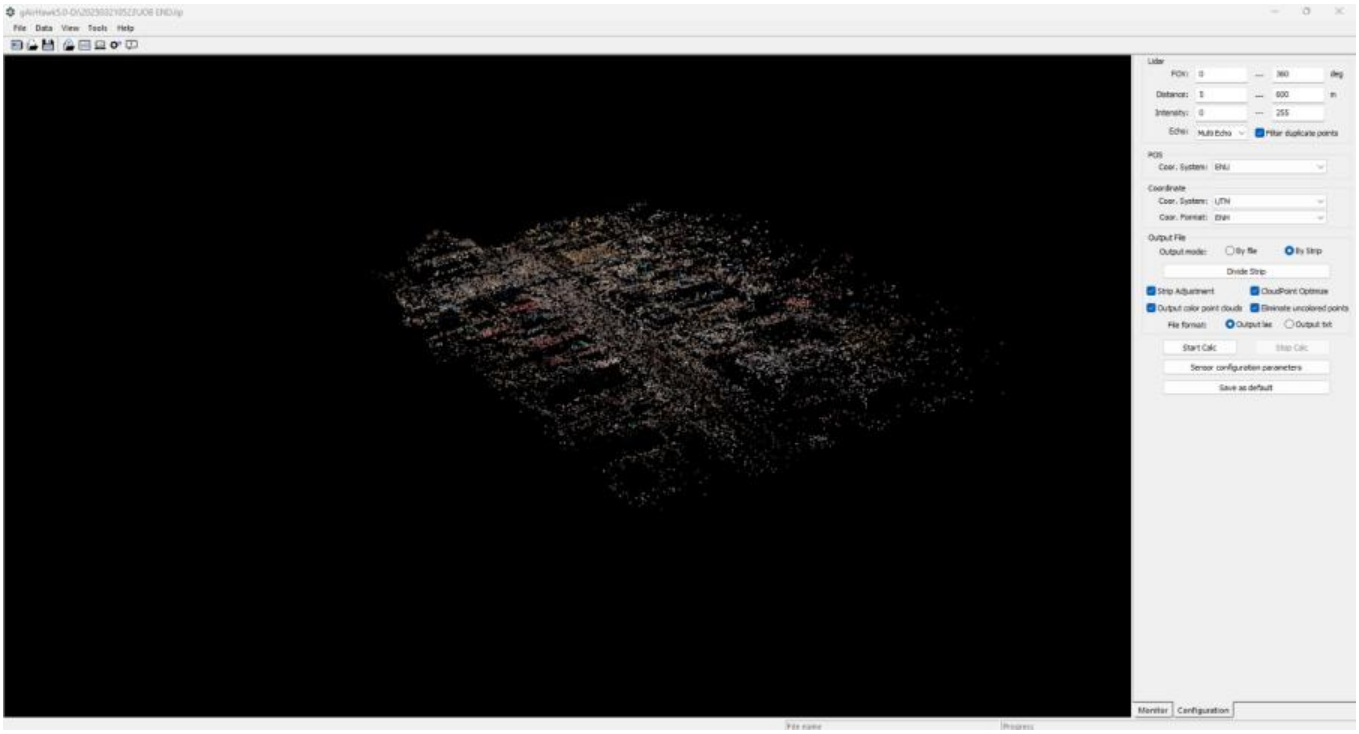


Figure 57. "Geosun" GairHawk 5.0 software development process: ("Cloud point")



6. INFORMATION ON ENGINEERING AND TECHNICAL STAFF

6.1. LIST OF ENGINEERING AND TECHNICAL STAFF

Table 41.

№	Last Name	First Name	Age	Gender	Position
1	Dalaibaatar	Tumennast	33	Male	Executive Director
2	Sukhbaatar	Lkhagvajav	33	Male	Project Manager
3	Battogtokh	Myanganbayar	33	Male	Operations Manager
4	Jamiyan	Altantsetseg	60	Female	Consulting Engineer
5	Bumbatseren	Bolormaa	59	Female	Professional Engineer
6	Dalaibaatar	Sergelenbaatar	28	Male	Professional Engineer
7	Mashbat	Bukhsanaa	24	Male	Chief Geodetic Engineer
8	Gankhuyag	Erdene	30	Male	Geodetic Engineer
9	Tserenbadam	Tumennast	27	Male	Geodetic Engineer
10	Altangerel	Otgonbaatar	26	Male	Geodetic Engineer
11	Gansukh	Otgonbayar	33	Male	Geodetic Engineer
12	Purevsuren	Sanjsuren	24	Male	Geodetic Engineer
13	Osorjav	Baasanbat	23	Male	Geodetic Engineer
14	Dondov	Munkhtsetseg	23	Femal	Geodetic Engineer
15	Dashnyam	Saranchimeg	29	Female	Document Control Officer
16	Sampildorj	Saruul	22	Female	Document Control Officer
17	Tumen-Ulzii	Choidogjamts	22	Male	Geodetic Technician
18	Tuyanaa	Bayanmunkh	25	Male	Geodetic Technician
19	Bazarragchaa	Tuvshintugs	23	Male	Geodetic Technician
20	Basbish	Temuujin	22	Male	Geodetic Technician
21	Enkhbayar	Temuujin	23	Male	Geodetic Technician
22	Zorigoo	Khishigjargak	19	Male	Geodetic Technician
23	Altankhundaga	Altankhishig	21	Male	Geodetic Technician
24	Chuluunbaatar	Olzbayar	33	Male	Driver
25	Chinzorig	Ayush	34	Male	Driver
26	Megzem	Battogtokh	51	Male	Driver
27	Dendee	Amartur	51	Male	Driver
28	Baatarkhuu	Chinbat	50	Male	Driver

6.2. PROFESSIONAL DIPLOMAS AND CERTIFICATES

: *Figure 58. Executive Director D. Tumennast's Geodetic Engineering Diploma*

MONGOLIA
Mongolian University of Science and TePRCology

BACHELOR'S DIPLOMA
No. D 201332608

Citizen of Mongolia Tumennast Dalaibaatar
has graduated in 2013 from the School of Mining Engineering
specializing in Geodesy
(major code /D524800/)

Based on the decision of the Graduation Committee dated June 17, 2013, and by order of the President of the Mongolian University of Science and TePRCology dated June 20, 2013,
is hereby conferred the academic degree of

Bachelor of Geodesy

Diploma Registration No.: BD 53848

(Signatures)

L. Odokhuu – Head of the University Council of the Mongolian University of Science and TePRCology *(Signed)*

T. Batbayar – Vice President, Mongolian University of Science and TePRCology, Professor, Doctor *(Signed)*

J. Narantsogt – Chair of the Graduation Committee, Professor, Doctor *(Signed)*

L. Purev – Dean of the School of Mining Engineering, Professor, Doctor *(Signed)*

Figure 59. Chief Engineer M. Bukhsanaa's Geodetic Engineering Diploma

MONGOLIA
National TePRCical University

BACHELOR'S DIPLOMA
No. D202102885

Citizen of Mongolia Bukhanaa Mashbat
graduated in 2021 from the National TePRCical University
specializing in Geodesy
(major code /D 053201/)

Based on the decision of the Graduation Committee dated January 15, 2021,
and by order of the President dated February 1, 2021,
is hereby conferred the academic degree of

Bachelor of Geodetic Engineering

Diploma Registration No.: BD 04284

(Signatures)

J. Altantsogt – Dean of the School of Geodesy and Mining, Doctor, Professor *(Signed)*

O. Yanjinkham – Chair of the Graduation Committee *(Signed)*

A. Azjargal – Head of Academic Affairs *(Signed)*

Figure 60. Manager B. Myanganbayar's Geodetic Engineering Diploma

MONGOLIA
NATIONAL UNIVERSITY OF TEPRCOLOGY
BACHELOR'S DIPLOMA
No. D202204029

Citizen of Mongolia Batgotokh Myanganbayar
studied at the National University of TePRCology in 2022,
majoring in Geodesy (specialization code: D 053201), and graduated.

Based on the decision of the Graduation Committee on June 28, 2022,
and the order issued on June 29, 2022,
the degree of Bachelor of Geodesy Engineering is hereby awarded.

Registration No.: 04867

(Signatures and stamps)

S. Togtokh, Director of the School of Geology and Mining, Ph.D. *(Signed)*

N. Batzaya, Chair of the Graduation Committee *(Signed)*

O. Yanjinlkham, Head of the Academic Affairs Office *(Signed)*

Figure 61. Geodetic Engineer D. Sergelenbaatar's Geodetic Professional Diploma

MONGOLIA
MONGOLIAN UNIVERSITY OF SCIENCE AND TEPRCOLOGY
BACHELOR'S DIPLOMA
No. D201728774

Citizen of Mongolia Dalai-Baatar Sergelenbaatar
studied at the School of Geology and Mining in 2017,
majoring in Geodesy (specialization code: D524800), and graduated.

Based on the decision of the Graduation Committee on June 20, 2017,
and the order issued by the President of the Mongolian University of Science and TePRCology on June 21, 2017,
the degree of Bachelor of Geodesy is hereby awarded.

Registration No.: 66804

(Signatures and stamps)

N. Begz, Academic, Chair of the Board of Directors of the Mongolian University of Science and TePRCology *(Signed)*

B. Ochirbat, Professor, Ph.D., President of the Mongolian University of Science and TePRCology *(Signed)*

S. Enkhjargal, Professor, Ph.D., Chair of the Graduation Committee *(Signed)*

B. Chinzorig, Associate Professor, Ph.D., Dean of the School of Geology and Mining *(Signed)*

Figure 62. Geodetic Engineer O. Baasanbat's Professional Diploma in Geodesy

MONGOLIA
MONGOLIAN UNIVERSITY OF SCIENCE AND TEPRCOLOGY
BACHELOR'S DIPLOMA
No. D202226066

Citizen of Mongolia Osorjavyn Baasanjav
studied at the School of Geology and Mining in 2022,
majoring in Geodesy (program code: D053201), and graduated.

Based on the decision of the Graduation Committee on June 17, 2022,
and the order issued by the President of the Mongolian University of Science and TePRCology on June 21, 2022,
the degree of Bachelor of Geodesy is hereby awarded.

Registration No.: 80724

(Signatures and stamps)

D. Battogtokh, Associate Professor, Ph.D., Chair of the Board of Directors *(Signed)*

T. Namnan, Professor, Ph.D., President of the Mongolian University of Science and TePRCology *(Signed)*

N. Ganzorig, Chair of the Graduation Committee *(Signed)*

K. Khavalsbolot, Associate Professor, Ph.D., Dean of the School of Geology and Mining *(Signed)*

Figure 63. Geodetic Engineer G. Otgonbayar's Geodetic Professional Diploma

MONGOLIA
NATIONAL UNIVERSITY OF TEPRCOLOGY

BACHELOR'S DIPLOMA
No: D202204030

Citizen of Mongolia Otgonbayar Gansukh
In 2022, having completed studies at the National University of TePRCology
in the specialty of Geodesy
(code D 053201),

And having satisfied the decision of the Graduation Committee dated June 28, 2022,
by order of the rector dated June 29, 2022,

is hereby conferred the degree of

Bachelor of Geodetic Engineering.

BD: 04868

(Signatures)
Dean of the School of Geodesy and Mining:
Doctor, Ph.D. D. Enkhjargal *(Signed)*

Chairman of the Graduation Committee: N. Batzaya *(Signed)*

Head of the Academic Affairs Office: O. Yanjinkham *(Signed)*

Figure 64. Geodesy Professional Diploma of Senior Geodetic Engineer G. Otgonbaatar

MONGOLIA
MONGOLIAN UNIVERSITY OF SCIENCE AND TEPRCOLOGY

PROFESSIONAL DIPLOMA
No: C202000891

Citizen of Mongolia Altangerel's Otgonbaatar
In 2020, having completed studies at the School of Geodesy and Mining,
in the specialty of Geodesy,

and having satisfied the decision of the Graduation Committee dated January 20, 2020,
by order of the rector of the Mongolian University of Science and TePRCology dated January 23, 2020,

is hereby conferred the Professional Diploma.

GPA: 1.52
Total Credits: 91

(Signatures)

Head of the Supervisory Council: Professor, Doctor D. Baatar ***(Signed)***

Chairman of the Graduation Committee: Academician Kh. Janchivgarav ***(Signed)***

Dean of the School of Geodesy and Mining: Professor, Doctor L. Purev ***(Signed)***

: *Figure 65. Geodetic Engineer D. Sanjsuren's Geodetic Professional Diploma*

MONGOLIA
MONGOLIAN UNIVERSITY OF SCIENCE AND TEPRCOLOGY

BACHELOR'S DIPLOMA
No: D202226056

Citizen of Mongolia Sanjmyagmar Pürevseren
In 2022, having completed studies at the School of Geology and Mining, in the specialty of Geodesy (program D053201),

and having satisfied the decision of the Graduation Committee dated June 17, 2022,
by order of the Rector of the Mongolian University of Science and TePRCology dated June 21, 2022,

is hereby conferred the degree of

Bachelor of Geodesy.

BD: 80714

(Signatures)

Head of the Supervisory Board: Assoc. Professor, Doctor D. Battogtokh *(Signed)*

Rector of the Mongolian University of Science and TePRCology: Professor, Doctor T. Mankhan *(Signed)*

Chairman of the Graduation Committee: Assoc. Professor, Doctor N. Ganzorig *(Signed)*

Dean of the School of Geology and Mining: Assoc. Professor, Doctor K. Khavalbold *(Signed)*

Figure 66. Geodetic Engineer D. Mönkhtsetseg's Geodetic Professional Diploma

MONGOLIA
MONGOLIAN UNIVERSITY OF SCIENCE AND TEPRCOLOGY

BACHELOR'S DIPLOMA
No: D202316392

Citizen of Mongolia Mönkhjigj Dondov
In 2023, having completed studies at the School of Geology and Mining, in the specialty of Geodesy (program D053201),

and having satisfied the decision of the Graduation Committee dated June 12, 2023,
by order of the Rector of the Mongolian University of Science and TePRCology dated June 15, 2023,

is hereby conferred the degree of

Bachelor of Geodetic Engineering.

BD: 83119

(Signatures)

Head of the Supervisory Board: Assoc. Professor, Doctor D. Battogtokh ***(Signed)***

Rector of the Mongolian University of Science and TePRCology: Professor, Doctor T. Mankhan ***(Signed)***

Chairman of the Graduation Committee: Professor, Doctor Kh. Erdenekhuu ***(Signed)***

Dean of the School of Geology and Mining: Assoc. Professor, Doctor K. Khavalbold ***(Signed)***

Figure 67. Geodetic Engineer G. Erdene's Geodetic Professional Diploma

MONGOLIA
NATIONAL UNIVERSITY OF TEPRCOLOGY

BACHELOR'S DIPLOMA
No: D201702444

Citizen of Mongolia **Erdene Gankhuyag**
In 2017, having completed studies at the **National University of TePRCology**,
in the specialty of **Geodesy**
(code D053201),

and having satisfied the decision of the Graduation Committee dated February 15, 2017,
by order of the rector dated February 16, 2017,

is hereby conferred the degree of

Bachelor of Geodetic Engineering.

BD: 01176

(Signatures)

Dean of the School: **N. Gantumur** *(Signed)*

Chairman of the Graduation Committee: Doctor, Professor **B. Battsagaan** *(Signed)*

Head of the Academic Affairs Office: **G. Erdenejargal** *(Signed)*

Figure 68. Diploma of Geodetic Consulting Engineer J. Altantsetseg:

CERTIFICATE

Consulting Engineer

Awarded to Altangerel Jamiyangin

Certificate No.: ЗИ–16–1108

By Order No. A/173 of December 16, 2022, of the State Secretary of the Ministry of Construction and Urban Development, the Consulting Engineer qualification, originally granted in 2016, is hereby renewed and certified in the field of Geodetic measurement and mapping, based on a qualification review.

Valid until December 16, 2027.

Ulaanbaatar, December 16, 2022

(Signed & Stamped)
S. Mankhsaikhan
State Secretary of the Ministry of Construction and Urban Development

69. Diploma of B. Bolormaa, a certified Figure geodetic engineer:

DIPLOMA
DVO No. 010699

This diploma is awarded to Bolormaa Balbaazeryn stating that she entered the Novosibirsk Institute of Engineers of Geodesy, Aerial Photography, and Cartography in 1983 and in 1989 completed the full course of the said Institute, specializing in Applied Geodesy.

By the decision of the State Examination Commission dated June 1, 1989, Bolormaa Balbaazeryn is awarded the qualification of Engineer in Geodesy.

Chairman of the State Examination Commission: *(Signed)*
Rector: *(Signed)*
City of Novosibirsk – June 1, 1989

Registration No.: 05

Printed by the Moscow Printing Plant Goznak, 1987

(Signed & Stamped)

Хүснэгт 1

Leveling Grade III Journal					
Measurement: ГЦТ-0478-аас XP-0139			Measurements taken. T.Dulguun		
Measurement started:2025-04.20			Measurement completed.: 2025-04.30		
Appearance :			Weather:		
Journal kept:			D.Saranchimeg		
Parking number	Viewpoint number	Distance, m	Count from Reikn, m		Measured elevation, m
			back	front	
1	ГЦТ-0478	44.493	1.1599		
	x1	44.485		1.3204	-0.1605
		0.01			
2	x1	45.221	1.3804		
	x2	45.284		1.0975	0.2829
		-0.06			
3	x2	39.464	1.8750		
	x3	39.210		1.3178	0.5572
		0.25			
4	x3	33.400	1.9923		
	x4	33.738		0.5807	1.4116
		-0.34			
5	x4	8.677	2.3927		
	x5	8.149		0.8628	1.5299
		0.53			
6	x5	34.374	1.0727		
	x6	35.499		2.0899	-1.0172
		-1.13			
7	x6	44.713	0.6581		
	x7	44.214		1.7170	-1.0589
		0.50			
8	x7	28.927	1.4025		
	x8	28.827		1.2540	0.1485
		0.10			
9	x8	26.335	1.5025		
	x9	26.320		1.1630	0.3395
		0.02			
10	x9	27.919	1.9385		

	x10	27.527		0.7075	1.2310
		0.39			
11	x10	26.161	2.2279		
	x11	26.697		0.6339	1.5940
		-0.54			
12	x11	70.393	1.5082		
	x12	69.057		0.3929	1.1153
		1.34			
13	x12	59.620	2.1527		
	x13	60.084		0.6501	1.5026
		-0.46			
14	x13	55.807	2.0873		
	x14	54.316		0.6756	1.4117
		1.49			
15	x14	69.439	1.7977		
	x15	69.605		1.3996	0.4781
		-0.17			
16	x15	72.444	0.8221		
	x16	71.228		2.3417	-1.5196
		1.22			
17	x16	43.571	0.4177		
	x17	42.090		1.5909	-1.1732
		1.48			
18	x17	47.022	0.5136		
	x18	46.784		2.3439	-1.8303
		0.24			
19	x18	58.665	0.3400		
	x19	58.468		2.3869	-2.0469
		0.20			
20	x19	62.378	0.9153		
	x20	63.700		1.4778	-0.5625
		-1.32			
21	x20	72.127	1.2294		
	x21	71.953		1.5595	-0.3301
		0.17			
22	x21	54.377	1.1969		
	x22	54.534		1.5340	-0.3371
		-0.16			
23	x22	48.500	1.0417		

	x23	48.389		1.4613	-0.4196
		0.11			
24	x23	58.010	1.1919		
	x24	59.471		1.5031	-0.3112
		-1.46			
25	x24	41.698	1.1425		
	x25	40.784		1.4393	-0.2968
		0.91			
26	x25	10.591	0.8589		
	ГЦХ-011	9.379		1.2886	-0.4297
		1.21			
27	ГЦХ-011	36.077	1.7030		
	x1	36.134		1.7470	-0.0440
		-0.06			
28	x1	39.400	1.5431		
	x2	38.687		1.0575	0.4856
		0.71			
29	x2	26.043	2.3128		
	x3	26.368		0.7017	1.6111
		-0.32			
30	x3	81.299	1.6761		
	x4	80.814		1.9066	-0.2305
		0.49			
31	x4	41.146	1.3971		
	x5	40.584		1.6828	-0.2857
		0.56			
32	x5	49.047	1.5886		
	x6	50.070		1.3188	0.2698
		-1.02			
33	x6	56.908	1.2853		
	x7	56.512		1.6511	-0.3658
		0.40			
34	x7	57.390	1.6806		
	x8	56.338		1.6881	-0.0075
		1.05			
35	x8	56.280	1.1416		
	x9	56.304		1.2522	-0.1106
		-0.02			
36	x9	68.622	1.2407		

	x10	69.703		1.7271	-0.4864
		-1.08			
37	x10	42.099	0.7370		
	x11	42.029		1.5554	-0.8184
		0.07			
38	x11	73.994	1.2393		
	x12	73.811		1.1178	0.1215
		0.18			
39	x12	65.981	1.4389		
	x13	65.625		1.7952	-0.3563
		0.36			
40	x13	25.926	2.4869		
	x14	26.097		0.7948	1.6921
		-0.17			
41	x14	44.158	1.4135		
	x15	45.760		1.0795	0.3340
		-1.60			
42	x15	55.984	1.2915		
	x16	55.113		1.5765	-0.2850
		0.87			
43	x16	21.528	2.0752		
	x17	21.86		1.1537	0.9215
		-0.33			
44	x17	22.903	1.0903		
	x18	22.632		1.5284	-0.4381
		0.27			
45	x18	66.65	1.5005		
	x19	66.587		1.3183	0.1822
		0.06			
46	x19	19.002	1.9663		
	x20	19.691		1.0082	0.9581
		-0.69			
47	x20	14.675	1.7685		
	x21	14.915		1.4275	0.3410
		-0.24			
48	x21	19.455	1.4949		
	БНМАУ 0051	20.299		1.2049	0.2900
		-0.84			

49	БНМАУ 0051	33.786	1.1898		
	x1	33.641		1.9951	-0.8053
		0.15			
50	x1	62.061	0.8882		
	x2	62.729		2.0953	-1.2071
		-0.67			
51	x2	58.103	0.8285		
	x3	59.662		1.5442	-0.7157
		-1.56			
52	x3	70.896	1.8266		
	x4	70.798		0.4566	1.3700
		0.10			
53	x4	47.641	2.9267		
	x5	47.609		2.5621	0.3646
		0.03			
54	x5	11.559	2.1641		
	x6	11.349		0.5946	1.5695
		0.21			
55	x6	18.698	2.3001		
	x7	18.631		0.6055	1.6946
		0.07			
56	x7	14.881	2.2360		
	x8	14.316		0.3861	1.8499
		0.57			
57	x8	13.479	2.5544		
	x9	12.828		0.4142	2.1402
		0.65			
58	x9	16.510	3.2059		
	x10	15.442		0.3158	2.8901
		1.07			
59	x10	19.519	3.3852		
	x11	18.076		0.3316	3.0536
		1.44			
60	x11	14.377	2.0596		
	x12	14.407		0.6734	1.3862
		-0.03			
61	x12	20.478	1.934		
	x13	20.398		0.9183	1.0157

		0.08			
62	x13	16.405	2.3376		
	x14	17.376		0.8895	1.4481
		-0.97			
63	x14	42.892	2.8728		
	x15	42.314		0.3261	2.5467
		0.58			
64	x15	20.776	2.8237		
	x16	20.899		0.6834	2.1403
		-0.12			
65	x16	26.800	2.6761		
	x17	26.872		0.9286	1.7475
		-0.07			
66	x17	22.137	2.5348		
	x18	21.962		0.5507	1.9841
		0.18			
67	x18	27.579	3.0442		
	x19	27.751		0.6646	2.3796
		-0.17			
68	x19	24.198	2.5397		
	x20	24.694		0.6135	1.9262
		-0.50			
69	x20	27.062	3.1511		
	x21	26.969		0.3097	2.8414
		0.09			
70	x21	18.849	2.4645		
	x22	19.134		0.6261	1.8384
		-0.29			
71	x22	20.864	2.8674		
	x23	19.911		1.287	1.5804
		0.95			
72	x23	19.915	3.1004		
	x24	20.823		0.4121	2.6883
		-0.91			
73	x24	14.001	1.5191		
	x25	15.636		0.5555	0.9636
		-1.64			
74	x25	12.842	1.7266		
	x26	13.230		0.7671	0.9595

		-0.39			
75	x26	21.313	1.8639		
	x27	22.004		1.193	0.6709
		-0.69			
76	x27	15.574	2.1391		
	x28	15.721		0.4698	1.6693
		-0.15			
77	x28	31.459	2.3745		
	x29	30.829		0.4526	1.9219
		0.63			
78	x29	33.081	2.6821		
	x30	32.119		0.7364	1.9457
		0.96			
79	x30	27.761	2.2529		
	x31	28.427		0.7194	1.5335
		-0.67			
80	x31	24.15	2.1619		
	x32	24.626		0.4619	1.7000
		-0.48			
81	x32	34.750	2.1824		
	x33	35.254		0.5743	1.6081
		-0.50			
82	x33	21.311	2.1188		
	x34	21.943		0.9533	1.1655
		-0.63			
83	x34	24.603	0.6506		
	x35	23.097		1.8068	-1.1562
		1.51			
84	x35	13.393	0.9294		
	x36	11.61		0.3253	0.6041
		1.78			
85	x36	22.650	3.2629		
	x37	21.811		0.4220	2.8409
		0.84			
86	x37	27.561	2.7786		
	x38	27.565		0.3765	2.4021
87	x38	15.320	1.2545		
	x39	14.320		0.7671	0.4874

88	x39	16.974	1.3769		
	x40	16.602		0.6732	0.7037
		0.37			
89	x40	10.126	2.5106		
	x41	11.081		1.2067	1.3039
		-0.96			
90	x41	9.967	2.6170		
	x42	9.916		0.4824	2.1346
		0.05			
91	x42	15.137	3.1398		
	x43	14.624		0.4102	2.7296
		0.51			
92	x43	11.63	2.5220		
	x44	11.988		0.6794	1.8426
		-0.36			
93	x44	12.441	2.7706		
	x45	12.325		0.3274	2.4432
		0.12			
94	x45	9.658	2.3771		
	x46	9.932		0.8195	1.5576
		-0.27			
95	x46	9.323	2.4578		
	x47	9.666		0.6998	1.7580
		-0.34			
96	x47	10.206	2.5250		
	x48	10.168		0.9831	1.5419
		0.04			
97	x48	11.239	2.515		
	x49	10.675		0.3946	2.1204
		0.56			
98	x49	9.572	2.5566		
	x50	9.348		0.6428	1.9138
		0.22			
99	x50	11.249	2.9924		
	x51	10.858		0.4353	2.5571
		0.39			
100	x51	9.373	2.6979		
	x52	9.684		0.7528	1.9451

		-0.31			
101	x52	9.786	2.8772		
	x53	9.086		0.4452	2.4320
		0.70			
102	x53	8.620	2.4421		
	x54	9.009		0.4212	2.0209
		-0.39			
103	x54	12.735	1.8401		
	x55	13.157		0.3159	1.5242
		-0.42			
104	x55	15.741	2.4501		
	x56	14.892		0.3378	2.1123
		0.85			
105	x56	15.782	2.7418		
	x57	15.402		0.8736	1.8682
		0.38			
106	x57	16.555	2.2498		
	x58	16.166		0.5789	1.6709
		0.39			
107	x58	17.459	2.6614		
	x59	17.823		0.7639	1.8975
		-0.36			
108	x59	33.236	1.8168		
	x60	33.694		0.8430	0.9738
		-0.46			
109	x60	21.973	0.9702		
	x61	21.625		1.4449	-0.4747
		0.35			
110	x61	15.522	1.3690		
	ГЦХ-012	14.871		1.1565	0.2125
		0.65			
111	ГЦХ-012	13.204	1.0900		
	x1	13.184		2.4777	-1.3877
112	x1	6.177	0.7612		
	x2	6.087		2.2277	-1.4665
113	x2	7.247	0.5924		
	x3	7.845		2.6371	-2.0447

114	x3	6.308	0.6227		
	x4	6.744		2.3269	-1.7042
115	x4	10.752	0.6113		
	x5	10.820		2.5747	-1.9634
116	x5	6.551	0.7973		
	x6	7.014		2.4277	-1.6304
117	x6	7.775	0.6362		
	x7	7.430		2.6472	-2.0110
118	x7	19.773	1.4964		
	x8	19.72		1.3540	0.1424
119	x8	7.917	2.5625		
	x9	7.564		0.5402	2.0223
120	x9	7.837	2.484		
	x10	7.882		1.1424	1.3416
121	x10	12.976	2.9669		
	x11	12.825		0.8475	2.1194
122	x11	9.242	2.6215		
	x12	9.11		0.7332	1.8883
123	x12	13.112	3.2266		
	x13	13.621		0.6689	2.5577
124	x13	14.243	3.0200		
	x14	13.738		0.4416	2.5784
125	x14	10.275	3.2820		
	x15	10.487		0.5176	2.7644
126	x15	11.976	3.4903		
	x16	11.891		0.9280	2.5623

127	x16	8.159	2.6548		
	x17	8.113		0.5316	2.1232
128	x17	24.187	0.9152		
	x18	24.465		3.7146	-2.7994
129	x18	8.877	0.4626		
	x19	8.339		2.5221	-2.0595
130	x19	8.603	0.6058		
	x20	8.551		2.3560	-1.7502
131	x20	11.563	0.3254		
	x21	11.549		3.276	-2.9506
132	x21	9.862	0.3557		
	x22	9.886		2.6155	-2.2598
133	x22	11.268	0.3692		
	x23	11.161		3.1576	-2.7884
134	x23	10.717	0.4708		
	x24	10.655		2.6546	-2.1838
135	x24	12.625	0.3039		
	x25	12.335		3.0001	-2.6962
136	x25	10.621	0.5891		
	x26	10.027		2.6496	-2.0605
137	x26	9.218	0.6502		
	x27	9.289		2.6969	-2.0467
138	x27	7.786	0.7360		
	x28	8.151		2.4607	-1.7247
139	x28	8.158	0.4963		
	x29	8.659		2.4894	-1.9931

140	x29	12.333	0.5422		
	x30	12.775		2.2242	-1.6820
141	x30	14.158	1.2499		
	x31	14.725		1.1758	0.0741
142	x31	15.692	2.2116		
	x32	15.948		1.1332	1.0784
143	x32	18.538	1.9259		
	x33	18.047		1.2441	0.6818
144	x33	25.833	1.3055		
	x34	25.252		2.3789	-1.0734
145	x34	12.471	0.5822		
	x35	12.294		2.2252	-1.6430
146	x35	7.118	0.7008		
	x36	6.132		2.0072	-1.3064
147	x36	8.299	0.5625		
	x37	8.111		2.0920	-1.5295
148	x37	8.318	0.9513		
	x38	8.782		2.7770	-1.8257
149	x38	7.006	0.8434		
	x39	7.380		2.5668	-1.7234
150	x39	8.846	0.5830		
	x40	9.001		2.9427	-2.3597
151	x40	9.755	0.5443		
	x41	9.260		2.8056	-2.2613
152	x41	8.232	0.8630		
	x42	8.485		2.5180	-1.6550

153	x42	8.264	0.7009		
	x43	8.733		2.174	-1.4731
154	x43	9.773	0.5773		
	x44	9.256		2.2524	-1.6751
155	x44	15.599	0.3478		
	x45	15.531		2.7250	-2.3772
156	x45	20.020	0.5791		
	x46	20.194		3.3559	-2.7768
157	x46	11.621	0.3182		
	x47	11.496		2.5368	-2.2186
158	x47	10.968	0.5841		
	x48	11.146		2.0843	-1.5002
159	x48	27.347	0.4048		
	x49	27.718		1.8286	-1.4238
160	x49	36.096	1.3952		
	x50	36.163		1.6341	-0.2389
161	x50	36.199	1.1263		
	x51	36.201		1.7902	-0.6639
162	x51	49.043	0.7123		
	x52	49.043		1.4918	-0.7795
163	x52	10.660	1.0225		
	x53	1.144		1.6003	-0.5778
164	x53	51.439	3.0832		
	x54	51.638		0.7050	2.3782
165	x54	61.715	1.9224		
	x55	60.916		0.6774	1.2450

166	x55	70.926	2.0328		
	x56	70.354		0.7233	1.3095
167	x56	22.800	1.4557		
	x57	22.735		1.1855	0.2702
168	x57	17.791	1.2433		
	ГЦТ-0122	17.76		0.8865	0.3568
		1837.23			
169	ГЦТ-0122	40.343	0.6945		
	x1	40.569		2.3777	-1.6832
		-0.23			
170	x1	48.809	0.8976		
	x2	48.739		2.7253	-1.8277
		0.07			
171	x2	43.411	0.5696		
	x3	43.269		2.1497	-1.5801
		0.14			
172	x3	48.675	0.6389		
	x4	48.41		2.6306	-1.9917
		0.27			
173	x4	20.669	1.3284		
	ХЦ-1	21.466		1.4092	-0.0808
		-0.80			
174	ХЦ-1	46.742	1.0664		
	x6	46.657		1.4503	-0.3839
		0.09			
175	x6	39.675	1.4219		
	x7	39.305		1.1702	0.2517
		0.37			
176	x7	42.721	1.9298		
	x8	42.023		1.0344	0.8954
		0.70			
177	x8	49.149	2.2297		
	x9	49.482		0.548	1.6817
		-0.33			
178	x9	33.348	2.089		
	x10	32.886		0.813	1.2760

		0.46			
179	x10	25.151	1.9799		
	x11	25.466		0.8640	1.1159
		-0.32			
180	x11	23.499	2.8508		
	x12	23.358		0.3853	2.4655
		0.14			
181	x12	15.713	2.4909		
	x13	16.184		0.4392	2.0517
		-0.47			
182	x13	15.118	2.4954		
	x14	14.987		0.5777	1.9177
		0.13			
183	x14	37.348	2.4250		
	x15	36.841		0.7412	1.6838
		0.51			
184	x15	47.194	1.3281		
	x16	47.263		1.1907	0.1374
		-0.07			
185	x16	37.577	2.191		
	x17	37.765		0.4058	1.7852
		-0.19			
186	x17	42.223	3.0745		
	x18	42.935		0.3254	2.7491
		-0.71			
187	x18	28.285	2.6135		
	x19	27.990		0.4863	2.1272
		0.30			
188	x19	18.651	1.9684		
	ХЦ-2	17.501		1.0795	0.8889
		1.15			
189	ХЦ-2	39.227	2.0367		
	x21	39.641		1.3275	0.7092
		-0.41			
190	x21	43.627	1.4606		
	x22	43.994		1.1603	0.3003
		-0.37			
191	x22	45.036	1.7428		
	x23	45.153		1.1929	0.5499

		-0.12			
192	x23	38.146	1.9398		
	x24	37.6		0.9739	0.9659
		0.55			
193	x24	48.674	1.996		
	x25	49.089		0.7458	1.2502
		-0.41			
194	x25	20.301	1.9897		
	x26	20.369		0.6848	1.3049
		-0.07			
195	x26	26.344	2.4356		
	x27	27.009		0.4602	1.9754
		-0.66			
196	x27	36.724	2.8704		
	x28	36.262		0.3162	2.5542
		0.46			
197	x28	23.382	2.3755		
	x29	23.187		0.4165	1.9590
		0.20			
198	x29	8.885	1.8197		
	ГЦХ-013	9.284		1.0101	0.8096
		-0.40			
199	гцх 0013	14.490	1.6539		
	x1	14.119		1.2199	0.4340
200	x1	34.321	2.4462		
	x2	34.127		0.4947	1.9515
201	x2	21.247	1.7923		
	x3	22.464		0.5882	1.2041
202	x3	29.239	2.2477		
	x4	30.559		0.3084	1.9393
203	x4	12.287	2.0723		
	x5	12.692		1.0437	1.0286
204	x5	15.147	2.4303		
	x6	15.349		0.5741	1.8562

205	x6	14.518	2.5466		
	x7	14.630		0.7049	1.8417
206	x7	12.365	2.6700		
	x8	12.301		0.5751	2.0949
207	x8	7.587	1.9551		
	x9	8.280		0.6948	1.2603
208	x9	12.362	2.9578		
	x10	11.894		1.0339	1.9239
209	x10	14.022	2.5399		
	x11	14.289		0.7421	1.7978
210	x11	24.539	2.6967		
	x12	23.490		0.4162	2.2805
211	x12	15.962	2.6577		
	x13	14.583		0.7842	1.8735
212	x13	15.389	2.2923		
	x14	15.886		0.5923	1.7000
213	x14	15.929	2.4230		
	x15	15.193		0.4987	1.9243
214	x15	16.889	2.1908		
	x16	16.345		0.7513	1.4395
215	x16	17.524	2.5816		
	x17	16.901		0.2844	2.2972
216	x17	15.709	2.3679		
	x18	15.555		0.4977	1.8702
217	x18	13.039	2.2986		
	x19	12.684		0.8861	1.4125

218	x19	14.684	2.3437		
	x20	15.148		0.8252	1.5185
219	x20	17.469	2.4578		
	x21	16.039		0.4544	2.0034
220	x21	11.300	2.3408		
	x22	11.302		0.6517	1.6891
221	x22	9.710	2.4663		
	x23	10.026		0.6534	1.8129
222	x23	9.172	2.4283		
	x24	10.085		0.6095	1.8188
223	x24	10.595	2.4620		
	x25	9.986		0.5310	1.9310
224	x25	8.272	2.2027		
	x26	8.027		0.9544	1.2483
225	x26	14.333	2.6805		
	x27	13.622		0.9743	1.7062
226	x27	20.293	1.6478		
	x28	21.245		2.0591	-0.4113
227	x28	27.817	1.4281		
	x29	27.354		0.7750	0.6531
228	x29	27.552	3.0098		
	x30	28.240		0.2065	2.8033
229	x30	32.802	3.1375		
	x31	31.077		2.1674	0.9701
230	x31	41.175	1.6101		
	x32	41.059		0.8602	0.7499

231	x32	17.691	2.1918		
	x33	17.440		0.3517	1.8401
232	x33	16.205	2.4954		
	x34	16.868		0.5152	1.9802
233	x34	15.015	1.8443		
	x35	16.036		1.1341	0.7102
234	x35	20.421	2.2834		
	x36	19.004		0.5500	1.7334
235	x36	12.227	2.0415		
	x37	12.048		0.8821	1.1594
236	x37	14.326	2.3321		
	x38	14.122		0.5898	1.7423
237	x38	13.357	2.4671		
	x39	13.606		0.3622	2.1049
238	x39	8.995	2.3732		
	x40	8.942		0.7609	1.6123
239	x40	9.437	2.4932		
	x41	9.756		0.5078	1.9854
240	x41	16.714	2.6410		
	x42	15.675		0.2871	2.3539
241	x42	16.712	2.5817		
	x43	17.015		0.5630	2.0187
242	x43	18.757	2.5515		
	x44	19.790		0.2856	2.2659
243	x44	22.193	2.7229		
	x45	21.999		0.3740	2.3489

244	x45	23.063	1.7049		
	x46	23.487		1.9999	-0.2950
245	x46	16.860	1.0066		
	x47	16.812		1.6803	-0.6737
246	x47	23.531	1.5297		
	x48	23.225		0.5413	0.9884
247	x48	15.829	2.3632		
	x49	16.481		0.4050	1.9582
248	x49	20.549	2.7274		
	x50	20.452		0.3018	2.4256
249	x50	17.552	2.4012		
	x51	17.881		0.7388	1.6624
250	x51	20.305	2.6021		
	x52	21.073		0.6669	1.9352
251	x52	22.488	2.8847		
	x53	22.454		0.5454	2.3393
252	x53	18.531	2.2901		
	x54	19.237		0.9200	1.3701
253	x54	16.294	2.6421		
	x55	15.729		0.3707	2.2714
254	x55	6.666	3.5869		
	x56	6.920		0.6733	2.9136
255	x56	49.335	2.4869		
	x57	49.254		0.6719	1.8150
256	x57	31.089	1.8116		
	x58	31.156		1.6054	0.2062

257	x58	28.358	1.4264		
	x59	28.503		1.8657	-0.4393
258	x59	47.265	0.6740		
	x60	48.981		2.4225	-1.7485
259	x60	38.301	1.4323		
	x61	38.435		0.6723	0.7600
260	x61	23.789	2.2500		
	x62	23.640		0.5967	1.6533
261	x62	22.326	2.2980		
	x63	22.330		0.5105	1.7875
262	x63	16.394	2.1605		
	x64	16.299		0.8785	1.2820
263	x64	26.311	3.0090		
	x65	25.389		0.3439	2.6651
264	x65	26.416	2.9056		
	x66	24.949		0.3627	2.5429
265	x66	18.805	2.0135		
	x67	18.099		0.5252	1.4883
266	x67	9.005	2.0257		
	TSEG1	8.432		0.8755	1.1502
267	TSEG1	8.799	1.6080		
	x52	9.616		0.8594	0.7486
268	x52	11.884	2.5947		
	x53	11.034		0.5657	2.0290
269	x53	12.697	2.2431		
	x54	12.416		0.9337	1.3094

270	x54	15.457	2.8977		
	x55	16.042		1.2224	1.6753
271	x55	14.181	2.7816		
	x56	14.115		1.0028	1.7788
272	x56	6.689	2.0822		
	x57	7.048		0.6581	1.4241
273	x57	7.737	2.4517		
	x58	7.052		0.6329	1.8188
274	x58	10.829	2.3104		
	x59	10.362		0.4107	1.8997
275	x59	8.177	2.4467		
	x60	8.403		1.3876	1.0591
276	x60	10.279	2.8270		
	x61	9.091		1.5347	1.2923
277	x61	11.147	3.2280		
	x62	11.553		0.7811	2.4469
278	x62	11.107	3.2426		
	x63	10.420		1.0995	2.1431
279	x63	8.785	3.1212		
	x64	8.782		0.9643	2.1569
280	x64	9.346	2.9276		
	x65	9.462		0.9024	2.0252
281	x65	10.313	2.9248		
	x66	10.224		0.8066	2.1182
282	x66	5.538	2.4291		

	x67	6.654		0.8243	1.6048
283	x67	8.364	3.0906		
	x52	7.801		1.2362	1.8544
284	x52	8.084	3.0248		
	x53	9.044		0.3389	2.6859
285	x53	12.565	3.6135		
	x54	12.538		0.7492	2.8643
286	x54	9.102	2.6563		
	x55	10.758		0.6424	2.0139
287	x55	11.128	3.6181		
	x56	11.953		0.6764	2.9417
288	x56	8.438	3.0384		
	x57	9.599		1.0572	1.9812
289	x57	4.646	2.1863		
	x58	4.751		0.5793	1.6070
290	x58	4.78	2.1693		
	x59	6.17		0.4174	1.7519
291	x59	4.78	2.0192		
	x60	5.89		1.4166	0.6026
292	x60	4.39	2.1709		
	x61	5.32		0.6700	1.5009
293	x61	10.13	2.6261		
	x62	8.70		0.3506	2.2755
294	x62	9.31	2.1745		
	x63	9.19		0.5114	1.6631
295	x63	7.39	2.8245		

	x64	7.47		0.7245	2.1000
296	x64	8.83	2.9963		
	x65	7.51		0.4483	2.5480
297	x65	4.57	2.3060		
	ГЦХ-014	4.11		0.4273	1.8787
298	ГЦХ-014	10.342	3.4837		
	x67	11.307		1.1702	2.3135
		-0.97			
299	x67	9.258	3.3596		
	x57	9.080		0.9281	2.4315
		0.18			
300	x57	8.172	3.1664		
	x58	8.130		1.2966	1.8698
		0.04			
301	x58	8.032	3.1015		
	x59	7.871		1.0119	2.0896
		0.16			
302	x59	11.005	3.1181		
	x60	11.580		0.2878	2.8303
		-0.57			
303	x60	12.756	2.7295		
	x61	14.099		0.8278	1.9017
		-1.34			
304	x61	14.156	2.6109		
	x67	12.206		1.9938	0.6171
		1.95			
305	x67	8.563	2.6822		
	x57	8.720		0.7918	1.8904
		-0.16			
306	x57	12.145	2.5268		
	x58	12.137		0.9495	1.5773
		0.01			
307	x58	24.075	2.7865		
	x59	24.592		2.0886	0.6979
		-0.52			
308	x59	6.150	0.9305		

	x60	7.926		2.9359	-2.0054
		-1.78			
309	x60	18.843	1.1139		
	x61	19.032		3.0174	-1.9035
		-0.19			
310	x59	13.922	1.3397		
	x60	13.333		3.5677	-2.2280
		0.59			
311	x60	19.541	1.1237		
	x14	22.301		3.4517	-2.3280
		-2.76			
312	x14	17.235	1.1351		
	x15	17.653		1.7223	-0.5872
		-0.42			
313	x15	21.354	0.7968		
	x16	19.463		2.0181	-1.2213
		1.89			
314	x16	18.020	2.4378		
	x17	18.173		0.4996	1.9382
		-0.15			
315	x17	12.002	1.4537		
	x18	10.072		0.4523	1.0014
		1.93			
316	x18	9.177	2.2595		
	x19	8.426		0.6130	1.6465
		0.75			
317	x19	9.442	2.4534		
	x20	9.219		0.4052	2.0482
		0.22			
318	x20	11.709	2.7112		
	x21	10.298		0.5800	2.1312
		1.41			
319	x21	11.816	2.5392		
	x22	11.496		0.7286	1.8106
		0.32			
320	x22	12.165	2.4575		
	x23	12.145		0.8573	1.6002
		0.02			
321	x23	22.572	3.2753		

	x24	22.240		1.3510	1.9243
		0.33			
322	x24	31.758	2.4910		
	x25	32.211		1.4070	1.0840
		-0.45			
323	x25	36.461	1.0026		
	x1	36.584		1.8112	-0.8086
		-0.12			
324	x1	35.788	0.3154		
	x2	35.174		2.5103	-2.1949
		0.61			
325	x2	9.057	0.5091		
	x3	9.098		2.0487	-1.5396
		-0.04			
326	x3	16.921	1.5750		
	x4	16.409		0.9432	0.6318
		0.51			
327	x4	28.569	1.8595		
	ХЦ-1	28.926		1.0886	0.7709
		-0.36			
328	ХЦ-1	19.966	1.4863		
	x6	17.487		1.1312	0.3551
		2.48			
329	x6	43.172	1.9734		
	x7	43.655		0.8621	1.1113
		-0.48			
330	x7	43.669	1.7876		
	x8	42.950		0.9659	0.8217
		0.72			
331	x8	44.069	2.0201		
	x9	46.313		0.7686	1.2515
		-2.24			
332	x9	27.104	1.9683		
	x10	27.625		0.6363	1.3320
		-0.52			
333	x10	18.312	2.1636		
	x11	18.509		0.4571	1.7065
		-0.20			
334	x11	12.496	2.0811		

	x12	10.566		0.7006	1.3805
		1.93			
335	x12	12.566	2.6618		
	x13	13.184		0.4749	2.1869
		-0.62			
336	x13	9.812	2.4852		
	x14	10.906		0.5055	1.9797
		-1.09			
337	x14	10.673	2.1850		
	x15	10.289		0.8362	1.3488
		0.38			
338	x15	34.469	2.7251		
	x16	34.189		2.9819	-0.2568
		0.28			
339	x16	9.833	0.5753		
	x17	10.107		2.5142	-1.9389
		-0.27			
340	x17	9.408	0.6176		
	x18	11.524		2.9029	-2.2853
		-2.12			
341	x18	7.324	0.5810		
	x19	8.986		2.5860	-2.0050
		-1.66			
342	x19	8.110	0.4081		
	ХЦ-2	8.857		2.5679	-2.1598
		-0.75			
343	ХЦ-2	6.535	0.5068		
	x21	6.863		2.1857	-1.6789
		-0.33			
344	x21	7.021	0.5127		
	x22	7.261		2.2434	-1.7307
		-0.24			
345	x22	7.951	0.4953		
	x23	7.460		2.2554	-1.7601
		0.49			
346	x23	7.190	0.5808		
	x24	7.461		2.2914	-1.7106
347	x24	8.206	0.4384		

	x25	7.898		2.2725	-1.8341
348	x25	6.913	0.5926		
	x26	7.945		2.2976	-1.7050
349	x26	6.196	0.7285		
	x27	6.625		2.1435	-1.4150
350	x27	7.953	0.5244		
	x28	9.797		1.7079	-1.1835
		-1.84			
351	x28	13.309	0.3159		
	x29	12.303		1.9910	-1.6751
		1.01			
352	x29	12.613	0.4846		
	x25	11.883		2.0178	-1.5332
		0.73			
353	x25	12.792	0.3944		
	x14	12.813		2.3408	-1.9464
		-0.02			
354	x14	7.372	0.4267		
	x15	7.041		2.1125	-1.6858
		0.33			
355	x15	8.027	0.3155		
	x1	7.843		2.3946	-2.0791
		0.18			
356	x1	8.408	0.3684		
	x2	7.767		2.3033	-1.9349
		0.64			
357	x2	7.302	0.5801		
	x3	7.837		2.2391	-1.6590
		-0.54			
358	x3	7.561	0.7223		
	x4	7.484		1.9971	-1.2748
		0.08			
359	x4	11.619	0.4948		
	ХЦ-1	11.005		2.2183	-1.7235
		0.61			
360	ХЦ-1	15.740	0.4133		

	x6	16.672		2.8789	-2.4656
		-0.93			
361	x6	18.048	0.3937		
	x7	17.693		2.5847	-2.1910
		0.35			
362	x7	13.036	0.5646		
	x8	12.671		2.5494	-1.9848
		0.37			
363	x8	9.395	0.6393		
	x9	10.190		2.4563	-1.8170
		-0.80			
364	x9	12.532	0.4606		
	x10	14.500		2.6560	-2.1954
		-1.97			
365	x10	11.513	0.7107		
	x11	11.677		2.3843	-1.6736
		-0.16			
366	x11	24.366	0.4272		
	x12	26.337		1.2021	-0.7749
		-1.97			
367	x12	50.955	2.0770		
	x13	51.650		0.8859	1.1911
		-0.70			
368	x13	41.605	1.9796		
	x14	40.895		0.4484	1.5312
		0.71			
369	x14	15.945	0.5433		
	x15	17.662		3.1483	-2.6050
		-1.72			
370	x15	9.860	0.8916		
	x16	8.097		2.4659	-1.5743
		1.76			
371	x16	8.207	0.4561		
	x17	9.285		2.5640	-2.1079
		-1.08			
372	x17	8.529	0.2662		
	x18	9.813		2.7195	-2.4533
		-1.28			
373	x18	13.291	0.5578		

	x19	14.270		3.5850	-3.0272
		-0.98			
374	x19	8.811	0.3654		
	ХЦ-2	9.364		2.6435	-2.2781
		-0.55			
375	ХЦ-2	11.582	0.5961		
	x21	9.616		2.3302	-1.7341
		1.97			
376	x21	11.688	0.6542		
	x22	11.276		2.6851	-2.0309
		0.41			
377	x22	8.569	0.5853		
	x23	9.760		1.9481	-1.3628
		-1.19			
378	x23	12.825	0.4697		
	x24	11.953		2.4845	-2.0148
		0.87			
379	x24	12.388	0.6673		
	x25	12.448		2.2078	-1.5405
		-0.06			
380	x25	13.397	0.6005		
	x26	12.637		2.3979	-1.7974
		0.76			
381	x26	18.398	0.5073		
	x27	16.008		2.8864	-2.3791
		2.39			
382	x27	13.691	0.8702		
	x28	13.694		2.1937	-1.3235
		0.00			
383	x28	16.143	0.4867		
	x29	16.495		2.8524	-2.3657
		-0.35			
384	x29	14.416	0.3200		
	x14	13.873		2.7442	-2.4242
		0.54			
385	x14	14.396	0.3912		
	x15	13.393		2.7271	-2.3359
		1.00			
386	x15	12.598	0.5767		

	x16	13.547		2.3564	-1.7797
		-0.95			
387	x16	14.802	0.7927		
	x17	16.050		2.4942	-1.7015
		-1.25			
388	x17	13.707	0.7635		
	x18	14.078		2.3089	-1.5454
		-0.37			
389	x18	14.097	0.7906		
	x19	13.173		2.3011	-1.5105
		0.92			
390	x19	18.672	0.6020		
	ХЦ-2	17.396		2.1076	-1.5056
		1.28			
391	ХЦ-2	19.232	0.2791		
	x21	19.494		2.5830	-2.3039
		-0.26			
392	x21	16.454	0.5794		
	x22	16.065		2.4447	-1.8653
		0.39			
393	x22	18.606	0.3166		
	x23	19.325		2.6083	-2.2917
		-0.72			
394	x23	20.540	0.5182		
	x24	20.790		1.8180	-1.2998
		-0.25			
395	x24	28.359	0.8122		
	x25	26.498		2.1740	-1.3618
		1.86			
396	x25	15.951	0.6808		
	x26	16.381		2.4855	-1.8047
		-0.43			
397	x26	14.290	0.2982		
	x27	16.409		2.5673	-2.2691
		-2.12			
398	x27	14.907	0.5478		
	x28	13.727		2.1870	-1.6392
		1.18			
399	x28	12.622	0.9029		

	x29	12.998		1.8631	-0.9602
		-0.38			
400	x29	46.263	0.5217		
	x17	47.275		3.0807	-2.5590
		-1.01			
401	x17	23.725	0.3297		
	x18	22.425		2.8352	-2.5055
		1.30			
402	x18	16.324	0.5684		
	x19	18.493		2.6885	-2.1201
		-2.17			
403	x19	14.088	0.3644		
	ХЦ-2	14.175		2.4406	-2.0762
		-0.09			
404	ХЦ-2	15.707	0.5639		
	x21	16.625		2.3280	-1.7641
		-0.92			
405	x21	16.763	0.5188		
	x22	18.404		2.3872	-1.8684
		-1.64			
406	x22	21.635	0.3207		
	x23	21.934		2.5171	-2.1964
		-0.30			
407	x23	17.048	0.7035		
	x24	18.076		2.2888	-1.5853
		-1.03			
408	x24	22.613	0.4312		
	x25	21.877		2.4017	-1.9705
		0.74			
409	x25	21.963	0.4620		
	x26	21.792		2.3215	-1.8595
		0.17			
410	x26	21.785	0.4621		
	x27	20.118		2.1624	-1.7003
411	x27	16.993	0.7309		
	x28	18.138		2.1720	-1.4411
		-1.15			
412	x28	22.926	0.4851		

	x29	21.215		2.2592	-1.7741
		1.71			
413	x29	26.706	0.4047		
	x32	26.783		2.4482	-2.0435
		-0.08			
414	x32	27.089	0.4902		
	x33	26.999		2.8163	-2.3261
		0.09			
415	x33	25.289	0.5332		
	x34	23.219		1.0311	-0.4979
		2.07			
416	x35	8.807	2.0485		
	ГЦХ-015	8.146	.	0.4726	1.5759
		0.66			
417	гцх 015	15.549	0.7815		
	x1	14.526		2.2413	-1.4598
418	x1	15.249	1.4238		
	x2	15.074		1.7393	-0.3155
419	x2	20.784	0.3138		
	x3	20.312		2.6641	-2.3503
420	x3	18.509	0.5995		
	x4	18.765		2.1689	-1.5694
421	x4	23.175	0.5692		
	x5	22.073		2.4907	-1.9215
422	x5	15.690	0.8052		
	x6	16.326		2.0282	-1.2230
423	x6	15.469	0.9868		
	rp1	16.019		2.2041	-1.2173
424	rp1	16.490	0.8646		
	x8	17.808		1.9561	-1.0915
425	x8	20.930	0.4373		

	x9	20.643		2.3197	-1.8824
426	x9	30.890	0.5141		
	x10	29.436		2.4125	-1.8984
427	x10	23.898	0.7880		
	x11	22.198		2.0141	-1.2261
428	x11	8.189	1.1743		
	x12	8.341		1.8422	-0.6679
429	x12	12.536	1.3599		
	x13	11.214		2.3785	-1.0186
430	x13	7.039	1.6975		
	x14	6.673		0.5327	1.1648
431	x14	8.319	2.5404		
	x15	7.397		0.7001	1.8403
432	x15	7.610	2.6260		
	x16	7.800		0.5045	2.1215
433	x16	6.335	2.7710		
	x17	7.835		0.3988	2.3722
434	x17	8.797	2.7305		
	x18	7.023		1.0296	1.7009
435	x18	9.212	2.3480		
	x19	8.685		0.6764	1.6716
436	x19	8.920	2.4401		
	x20	9.100		0.3678	2.0723
437	x20	16.625	2.3134		
	x21	16.442		1.0609	1.2525
438	x21	13.932	2.3551		

	x22	12.080		0.6524	1.7027
439	x22	11.764	2.3599		
	x23	11.114		0.8266	1.5333
440	x23	7.900	2.3704		
	x24	7.829		0.5269	1.8435
441	x24	7.236	2.1550		
	x25	7.863		0.4420	1.7130
442	x25	11.514	2.4449		
	x26	10.703		1.4199	1.0250
443	x26	11.716	0.8317		
	x27	11.977		2.7051	-1.8734
444	x27	10.888	0.8007		
	x28	11.074		2.3766	-1.5759
445	x28	21.609	1.2373		
	x29	20.195		1.1414	0.0959
446	x29	10.541	1.3663		
	x30	10.735		2.4922	-1.1259
447	x30	7.169	0.6532		
	x31	8.943		2.5296	-1.8764
448	x31	16.471	0.5952		
	x32	16.835		1.5519	-0.9567
449	x32	11.416	1.7793		
	x33	12.147		0.7235	1.0558
450	x33	10.985	2.1556		
	x34	11.615		0.5509	1.6047
451	x34	6.766	1.9649		

	x35	7.290		0.5476	1.4173
452	x35	7.778	2.3439		
	x36	7.860		0.3200	2.0239
453	x36	7.652	2.4568		
	x37	8.927		0.2192	2.2376
454	x37	9.093	2.8576		
	x38	9.369		0.9039	1.9537
455	x38	9.957	2.5469		
	x39	8.102		0.4983	2.0486
456	x39	9.015	2.5993		
	rp3	12.207		1.7769	0.8224
457	rp3	8.470	0.5099		
	x41	8.947		3.5328	-3.0229
458	x41	10.339	0.3134		
	x42	8.313		3.0156	-2.7022
459	x42	8.193	0.6895		
	x43	8.629		2.8303	-2.1408
460	x43	8.195	0.6178		
	x44	7.362		2.4034	-1.7856
461	x44	8.763	0.3656		
	x45	10.943		2.2951	-1.9295
462	x45	7.597	0.6501		
	x46	7.250		1.9592	-1.3091
463	x46	10.110	0.7881		
	x47	9.383		1.7055	-0.9174
464	x47	24.550	1.1707		

	x48	25.235		0.9975	0.1732
465	x48	8.225	2.0963		
	x49	7.821		0.5398	1.5565
466	x49	8.855	2.5634		
	x50	8.316		0.6075	1.9559
467	x50	7.904	2.5038		
	x51	7.367		0.6040	1.8998
468	x51	6.543	2.4828		
	x52	7.458		0.5071	1.9757
469	x52	6.409	2.5216		
	x53	7.422		0.9822	1.5394
470	x53	7.737	2.5731		
	x54	7.943		0.9396	1.6335
471	x54	7.831	2.7073		
	x55	6.829		0.7010	2.0063
472	x55	6.039	2.3378		
	x56	5.929		0.9422	1.3956
473	x56	6.203	2.7470		
	x57	5.507		0.5543	2.1927
474	x57	12.839	3.3644		
	x58	12.063		0.2658	3.0986
475	x58	6.962	1.0832		
	x59	6.990		1.7851	-0.7019
476	x59	4.136	0.9229		
	x60	6.655		2.5636	-1.6407
477	x60	15.654	0.3031		

	x61	15.514		3.4898	-3.1867
478	x61	6.604	0.8005		
	x62	8.271		2.1641	-1.3636
479	x62	9.262	0.6841		
	x63	9.098		2.0604	-1.3763
480	x63	13.220	0.1747		
	x64	12.489		2.4443	-2.2696
481	x64	13.075	0.8057		
	x65	12.113		2.4748	-1.6691
482	x65	13.519	0.7998		
	x66	12.484		3.5368	-2.7370
483	x66	8.701	0.7307		
	x67	8.506		2.3438	-1.6131
484	x67	8.693	0.6914		
	x68	8.301		2.2912	-1.5998
485	X68	7.943	0.9982		
	X69	8.513		2.1975	-1.1993
486	x69	8.559	0.8944		
	x2	8.117		2.0094	-1.1150
487	x2	9.445	0.6666		
	x3	8.107		1.9818	-1.3152
488	x3	9.292	0.6119		
	x4	8.610		1.8586	-1.2467
489	x4	10.089	0.5834		
	x5	9.535		2.2391	-1.6557
490	x5	9.053	0.8930		

	x6	8.865		2.1199	-1.2269
491	x6	10.486	0.7144		
	x7	9.778		2.1003	-1.3859
492	x7	10.183	0.7143		
	x8	10.344		2.1372	-1.4229
493	x8	10.372	0.7743		
	x9	9.826		2.1818	-1.4075
494	x9	9.605	0.7981		
	x10	8.915		1.9563	-1.1582
495	x10	11.778	0.2576		
	x11	10.515		2.1856	-1.9280
496	x11	9.323	0.5698		
	x12	8.591		2.0042	-1.4344
497	x12	10.766	0.2437		
	x13	9.932		2.6069	-2.3632
498	x13	9.128	0.5234		
	x2	8.916		2.1944	-1.6710
499	x2	8.411	0.5716		
	x3	7.995		1.9511	-1.3795
500	x3	9.035	0.5156		
	x4	8.238		1.8606	-1.3450
501	x4	10.441	0.2857		
	x5	10.843		2.5323	-2.2466
502	x5	9.703	0.4024		
	x6	9.174		2.2042	-1.8018
503	x6	9.227	0.7211		

	x7	9.620		2.0995	-1.3784
504	x7	11.052	0.4794		
	x8	9.887		2.1010	-1.6216
505	x8	9.148	0.6993		
	x9	8.832		1.9568	-1.2575
506	x9	8.824	0.7433		
	x10	8.590		1.9521	-1.2088
507	x10	10.218	0.6104		
	x11	10.415		2.2094	-1.5990
508	x11	10.962	0.6320		
	x3	10.096		2.0889	-1.4569
509	x3	12.783	0.7041		
	x4	12.141		2.0999	-1.3958
510	x4	12.272	0.7844		
	x5	11.610		1.9328	-1.1484
511	x5	11.393	0.8936		
	x6	11.128		1.8044	-0.9108
512	x6	11.518	0.9522		
	x7	9.113		1.6210	-0.6688
513	x7	25.236	0.7640		
	x8	24.651		2.9880	-2.2240
514	x8	25.621	1.0604		
	x9	24.729		1.7547	-0.6943
515	x9	27.205	1.2388		
	x10	26.532		1.0361	0.2027
516	x10	48.696	1.2896		

	x11	50.622		1.7071	-0.4175
517	x11	35.093	0.7073		
	x9	34.562		2.4510	-1.7437
518	x9	26.167	1.2453		
	x10	25.130		1.2116	0.0337
519	x10	34.146	1.7304		
	x11	34.635		1.1703	0.5601
520	x11	31.950	1.2746		
	x3	31.834		3.1205	-1.8459
521	x3	11.810	0.6317		
	x4	10.838		2.1882	-1.5565
522	x4	10.348	0.8177		
	x5	9.049		2.1802	-1.3625
523	x5	9.998	0.7173		
	x6	9.409		2.2015	-1.4842
524	x6	12.814	0.5728		
	x7	12.217		2.1346	-1.5618
525	x7	16.648	0.2736		
	x8	15.460		2.3677	-2.0941
526	x8	19.392	0.6408		
	x9	18.882		2.1948	-1.5540
527	x9	26.867	0.6207		
	x10	26.005		2.8623	-2.2416
528	x10	23.335	0.3443		
	x11	24.487		3.1954	-2.8511
529	x11	16.651	0.3845		

	x12	18.492		3.0788	-2.6943
530	x12	13.601	0.5251		
	x13	12.913		2.5037	-1.9786
531	x13	13.220	0.3814		
	x14	13.769		2.5990	-2.2176
532	x14	12.876	0.7146		
	x15	11.536		1.9249	-1.2103
533	x15	13.985	0.6432		
	x16	12.270		2.1420	-1.4988
534	x16	13.153	0.6858		
	RP12	13.393		2.0992	-1.4134
535	RP12'	29.401	1.0037		
	ГЦХ-0016	29.263		1.5151	-0.5114
536	ГЦХ-0016	9.322	0.7703		
	x1	8.314		3.6078	-2.8375
537	x1	20.88	0.3253		
	x2	21.1		2.1005	-1.7752
538	x2	19.865	0.4721		
	x3	19.659		2.8103	-2.3382
539	x3	22.77	0.4096		
	x4	22.78		1.8207	-1.4111
540	x4	28.420	0.3253		
	x5	27.260		1.9491	-1.6238
541	x5	41.25	0.9684		
	x6	40.09		1.3662	-0.3978
542	x6	9.997	1.4148		

	x7	10.565		1.8368	-0.4220
543	x7	61.3	0.835		
	x8	59.66		1.9212	-1.0862
544	x8	55.110	1.4864		
	x9	54.260		1.6537	-0.1673
545	x9	57.19	1.4119		
	x10	55.19		1.8552	-0.4433
546	x10	57.510	1.4502		
	x11	56.310		1.4945	-0.0443
547	x11	43.03	1.3457		
	x12	43.21		1.5549	-0.2092
548	x12	37.040	2.7503		
	x13	36.990		2.9740	-0.2237
549	x13	35.31	1.3983		
	x14	35.14		0.5765	0.8218
550	x14	44.250	1.4971		
	x15	42.510		1.3696	0.1275
551	x15	42.78	1.1344		
	x16	40.82		1.6871	-0.5527
552	x16	47.190	1.5053		
	x17	46.460		1.3821	0.1232
553	x17	41.16	1.9255		
	x18	41.66		1.4986	0.4269
554	x18	60.240	1.7243		
	x19	58.270		0.9383	0.7860
555	x19	36.72	1.6772		

	x20	35.22		0.9559	0.7213
556	x20	25.15	4.2497		
	Ц-1	24.66		0.7777	3.4720
557	Ц-1	12.089	1.6651		
	x21	11.895		0.6675	0.9976
558	x21	9.073	2.1318		
	x22	10.653		0.4034	1.7284
559	x22	10.594	3.0900		
	x23	11.032		0.7535	2.3365
560	x23	15.552	3.0823		
	x24	13.968		0.413	2.6693
561	x24	24.75	2.5389		
	x25	24.35		0.85	1.6889
562	x25	14.132	1.9985		
	x26	14.301		0.5990	1.3995
563	x26	20.140	2.8673		
	x27	19.900		0.7714	2.0959
564	x27	40.120	3.0800		
	x28	40.830		0.4216	2.6584
565	x28	62.1	2.9733		
	x29	59.23		0.307	2.6663
566	x29	19.236	1.9731		
	x30	19.986		1.4682	0.5049
567	x30	26.280	2.2254		
	x31	25.600		0.9727	1.2527
568	x31	24.38	2.2809		

	x32	25.06		0.8043	1.4766
569	x32	25.050	1.8968		
	x33	24.620		1.0702	0.8266
570	x33	18.844	2.2186		
	x34	20.1		0.7464	1.4722
571	x34	39.89	3.2802		
	x35	39.38		0.3646	2.9156
572	x35	33.930	2.7438		
	x36	32.030		0.6420	2.1018
573	x36	20.35	2.156		
	x37	21.04		0.5126	1.6434
574	x37	21.72	2.0145		
	Ц-2	21.46		0.6158	1.3987
575	Ц-2	16.704	2.3932		
	x38	15.682		0.5813	1.8119
576	x38	19.041	2.9733		
	ГЦХ-17	20.1		0.7076	2.2657
577	ГЦХ-17	41.560	3.6478		
	x1	52.960		0.5615	3.0863
578	x1	52.96	3.2171		
	x2	50.45		1.011	2.2061
579	x2	61.520	2.7330		
	x3	60.580		1.3739	1.3591
580	x3	35.78	2.835		
	x4	35.34		1.9936	0.8414
581	x4	14.011	0.5323		

	x5	15.515		3.0625	-2.5302
582	x5	10.81	0.672		
	x6	11.256		2.7364	-2.0644
583	x6	8.578	0.7885		
	x7	10.512		2.8432	-2.0547
584	x7	28.69	1.7856		
	x8	28.51		0.7593	1.0263
585	x8	33.880	2.4272		
	x9	33.300		0.3981	2.0291
586	x9	48.34	3.1642		
	x10	48.57		0.5521	2.6121
587	x10	40.380	1.9046		
	x цэг	40.560		0.6490	1.2556
588	x цэг	43.63	2.4013		
	x11	42.69		0.502	1.8993
589	x11	51.110	2.6367		
	x12	52.370		0.3050	2.3317
590	x12	55.76	2.8374		
	x13	52.72		0.3223	2.5151
591	x13	47.130	2.5656		
	x14	44.940		0.4510	2.1146
592	x14	47.08	2.5812		
	x15	47.25		0.466	2.1152
593	x15	48.120	2.6720		
	x16	47.090		0.4412	2.2308
594	x16	45.94	3.1505		

	x17	46.24		0.4428	2.7077
595	x17	10.413	2.7607		
	x18	11.180		0.8727	1.8880
596	x18	11.906	2.203		
	x19	12.494		0.7886	1.4144
597	x19	13.807	2.3385		
	x20	14.495		0.6232	1.7153
598	x20	11.680	2.2083		
	x21	12.867		0.6712	1.5371
599	x21	14.263	2.3218		
	x22	13.992		0.6191	1.7027
600	x22	12.265	2.2674		
	x23	14.152		0.6702	1.5972
601	x23	10.97	3.2105		
	x24	10.006		0.5067	2.7038
602	x24	19.533	3.2946		
	x25	17.474		0.4147	2.8799
603	x25	5.038	1.9804		
	x26	5.661		0.8862	1.0942
604	x26	8.945	3.6059		
	x27	9.338		0.8413	2.7646
605	x27	15.448	3.2660		
	x28	15.402		0.7459	2.5201
606	x28	10.915	2.5757		
	x29	9.47		0.3205	2.2552
607	x29	12.12	2.8221		

	x30	12.86		0.5376	2.2845
608	x30	20.340	3.4302		
	x31	18.478		0.7011	2.7291
609	x31	20.11	3.7923		
	x32	18.549		0.3328	3.4595
610	x32	26.710	4.0586		
	x33	23.940		0.5503	3.5083
611	x33	17.689	3.8457		
	x34	19.163		0.6657	3.1800
612	x34	16.132	2.1006		
	x35	16.546		0.5970	1.5036
613	x35	25.920	2.2373		
	x36	22.420		3.3738	-1.1365
614	x36	15.428	0.4283		
	ГЦХ-18	13.105		4.0179	-3.5896
615	ГЦХ-18	24.400	0.5079		
	x1	24.130		3.5258	-3.0179
616	x1	13.56	0.4649		
	x2	14.434		2.9153	-2.4504
617	x2	9.227	0.5067		
	x3	8.944		3.2735	-2.7668
618	x3	8.165	0.5473		
	x4	8.68		3.4779	-2.9306
619	x4	36.500	1.2248		
	x5	37.490		1.7361	-0.5113
620	x5	39.78	1.0533		

	x6	38.64		2.1024	-1.0491
621	x6	41.970	1.0075		
	x7	43.810		1.8321	-0.8246
622	x7	33.39	1.534		
	x8	3570		1.0684	0.4656
623	x8	32.030	1.8685		
	x9	34.760		1.0861	0.7824
624	x9	64.93	1.473		
	x10	66.37		2.578	-1.1050
625	x10	53.290	0.3225		
	x 11	52.580		2.7451	-2.4226
626	x11	49.31	0.3875		
	x12	49.98		2.6869	-2.2994
627	x12	44.760	0.4749		
	x13	46.430		2.4689	-1.9940
628	x13	40.77	1.9409		
	x14	39.54		1.106	0.8349
629	x14	24.470	1.8936		
	x15	26.500		0.6888	1.2048
630	x15	16.48	2.0853		
	x16	16.986		1.0062	1.0791
631	x16	15.116	2.2576		
	x17	16.218		0.7603	1.4973
632	x17	19.831	2.3108		
	x18	19.181		0.4946	1.8162
633	x18	14.640	2.3501		

	x19	14.846		0.6432	1.7069
634	x19	20.67	3.027		
	x20	19.228		0.362	2.6650
635	x20	21.15	2.7595		
	x21	21.21		0.3476	2.4119
636	x21	37.820	3.2588		
	x22	36.460		1.7781	1.4807
637	x22	17.381	0.6365		
	x23	17.98		1.9406	-1.3041
638	x23	8.575	1.2346		
	x24	9.231		1.6256	-0.3910
639	x24	24.37	0.5403		
	x25	23.37		2.3469	-1.8066
640	x25	32.26	0.3		
	x26	30.81		2.5942	-2.2942
641	x26	30.020	0.4290		
	x27	30.850		2.6458	-2.2168
642	x27	28.530	0.5153		
	x28	27.770		2.4845	-1.9692
643	x28	31.350	0.6590		
	x29	29.080		2.7693	-2.1103
644	x29	34.02	0.4866		
	x30	35.39		2.2207	-1.7341
645	x30	41.38	1.3583		
	x31	39.91		1.4631	-0.1048
646	x30	61.940	1.5938		

	x31	60.950		1.3879	0.2059
647	x31	50.29	1.6969		
	x32	48.19		1.62	0.0769
648	x32	27.840	0.5169		
	x33	28.480		3.5268	-3.0099
649	x33	20.57	0.4744		
	x34	20.51		2.1869	-1.7125
650	x34	32.9	1.8339		
	x35	31.44		1.0766	0.7573
651	x35	45.710	2.4187		
	x36	43.020		0.9898	1.4289
652	x36	40.25	1.681		
	x37	41.74		1.7601	-0.0791
653	x37	14.539	0.7358		
	x38	13.721		3.0153	-2.2795
654	x38	8.84	0.4849		
	x39	9.317		2.7688	-2.2839
655	x39	11.092	0.7214		
	x40	11.610		3.0481	-2.3267
656	x40	12.939	0.9765		
	x41	12.916		3.0694	-2.0929
657	x41	45.410	1.6552		
	x42	44.480		0.7968	0.8584
658	x42	30.83	3.7622		
	ГЦХ-019	29.04		0.6884	3.0738
659	ГЦХ-19	15.332	0.7323		-2.2211

	x1	16.272		2.9534	
660	x1	10.478	0.4181		
	x2	10.833		2.5302	-2.1121
661	x2	11.073	0.4336		
	x3	11.759		2.5418	-2.1082
662	x3	11.671	0.3535		
	x4	11.647		2.5715	-2.2180
663	x4	10.220	0.3228		
	x5	9.836		2.7453	-2.4225
664	x5	8.59	0.3511		
	T-1	10.999		2.8882	-2.5371
665	T-1	17.660	1.6307		
	X6	17.826		2.3160	-0.6853
666	X6	30.42	0.7458		
	X7	30.04		2.9659	-2.2201
667	X7	30.190	0.5712		
	X8	29.540		2.2443	-1.6731
668	X8	17.055	1.1207		
	X9	18.746		2.2492	-1.1285
669	X9	15.399	0.4792		
	X10	17.837		3.0072	-2.5280
670	X10	21.83	0.8386		
	X11	21.13		2.1334	-1.2948
671	X11	35.060	0.5098		
	X12	33.080		2.3983	-1.8885
672	X12	41.9	0.7229		

	X13	42.3		2.4956	-1.7727
673	X13	41.660	0.6216		
	X14	40.870		1.8592	-1.2376
674	X14	39.72	0.7164		
	X15	38.7		4.1122	-3.3958
675	X15	15.495	0.4622		
	X16	17.494		2.5188	-2.0566
676	X16	20.38	0.6121		
	X17	19.792		2.703	-2.0909
677	X17	19.241	0.3552		
	X18	20.790		2.7350	-2.3798
678	X18	29.24	0.5798		
	X19	30.42		2.2265	-1.6467
679	X19	23.58	0.8481		
	X20	24.41		2.4038	-1.5557
680	X20	16.710	0.3696		
	X21	19.238		2.3256	-1.9560
681	X21	26.42	0.7981		
	X22	28.5		2.3604	-1.5623
682	X22	25.620	3.0604		
	X23	27.600		0.9735	2.0869
683	X23	27.24	1.6413		
	X24	25.97		1.5688	0.0725
684	X24	30.35	3.2531		
	T-2	32.1		1.4003	1.8528
685	T-2	24.260	1.1280		

	X25	26.170		2.7317	-1.6037
686	X25	22.930	0.7276		
	X26	21.270		1.3440	-0.6164
687	X26	35.680	1.2931		
	X27	34.050		3.1216	-1.8285
688	X27	20.68	0.5725		
	X28	19.914		2.1295	-1.5570
689	X28	23.9	0.6044		
	X29	22.31		2.4019	-1.7975
690	X29	25.590	0.4839		
	X30	24.660		2.5598	-2.0759
691	X30	27.83	0.5301		
	X31	27.48		2.4927	-1.9626
692	X31	21.580	0.3117		
	X32	21.360		2.7235	-2.4118
693	X32	16.62	0.3879		
	X33	16.021		2.4022	-2.0143
694	X33	19.83	0.4046		
	X34	19.187		2.2313	-1.8267
695	X34	18.820	0.7634		
	T-3	19.635		1.5847	-0.8213
696	T-3	24.75	2.0257		
	X35	25.56		1.0346	0.9911
697	X35	22.46	2.0823		
	T-4	20.29		1.1582	0.9241
698	T-4	39.33	2.4503		

	X36	38.23		0.6017	1.8486
699	X36	38.550	2.4987		
	X37	37.340		0.8987	1.6000
700	X37	44.55	2.1296		
	X38	43.17		1.2437	0.8859
701	X38	16.730	0.8769		
	X39	16.774		2.2804	-1.4035
702	X39	23.08	0.3173		
	X40	22.76		2.7417	-2.4244
703	X40	22.71	0.7772		
	T-5	23.04		2.1902	-1.4130
704	T-5	13.654	1.2156		
	X41	13.126		1.0589	0.1567
705	X41	47.64	2.3553		
	X42	45.53		0.9716	1.3837
706	X42	44.170	1.6991		
	X43	44.410		1.4008	0.2983
707	X43	52.56	1.6391		
	X44	50.34		1.4757	0.1634
708	X44	64.83	1.5531		
	T-6	62.91		1.1939	0.3592
709	T-6	60.480	2.2505		
	X45	58.670		0.7426	1.5079
710	X45	31.450	1.7754		
	X46	31.220		1.0643	0.7111
711	X46	26.710	1.4758		

	X47	28.340		2.8514	-1.3756
712	X47	5.637	0.6607		
	X48	7.08		1.8074	-1.1467
713	X48	29.77	0.3199		
	X49	27.33		2.5345	-2.2146
714	X49	21.340	0.6701		
	X50	20.640		2.1164	-1.4463
715	X50	32.44	0.7663		
	X51	31		2.2855	-1.5192
716	X51	27.710	0.8834		
	T-7	26.200		1.7975	-0.9141
717	T-7	14.438	2.1446		
	x1	14.653		0.8784	1.2662
718	x1	25.63	3.2715		
	x2	24.6		0.7185	2.5530
719	x2	49.38	3.5251		
	x3	51.75		0.7453	2.7798
720	x3	55.52	2.5443		
	x4	52.63		0.4425	2.1018
721	x4	30.53	3.793		
	x5	29.77		0.6734	3.1196
722	x5	18.721	4.1234		
	ГЦХ-20	20.93		0.5834	3.5400
723	ГЦХ-20	17.448	0.362		
	x1	17.734		3.6383	-3.2763
724	x1	22.22	0.3404		

	x2	21.94		2.966	-2.6256
725	x2	31	0.4482		
	x3	31.88		2.8808	-2.4326
726	x3	62.35	1.4312		
	x4	61.99		2.5453	-1.1141
727	x4	22.51	0.585		
	x5	22.91		3.2693	-2.6843
728	x5	19.809	0.759		
	x6	20.05		2.8672	-2.1082
729	x6	13.096	1.006		
	T7	13.964		2.1288	-1.1228
730	T-7	45.1	1.3469		
	X52	43.32		2.1322	-0.7853
731	X52	38.65	0.5915		
	X53	38.57		2.8558	-2.2643
732	X53	21.730	0.3986		
	X54	21.560		2.8827	-2.4841
733	X54	22.25	0.5594		
	X55	22.19		2.3773	-1.8179
734	X55	28.62	0.7612		
	X56	28.12		2.4788	-1.7176
735	X56	21.1	0.7794		
	X57	21.77		2.6102	-1.8308
736	X57	27.160	0.3627		
	X58	27.180		3.0345	-2.6718
737	X59	18.223	0.4241		

	X60	19.351		2.6382	-2.2141
738	X60	18.658	0.8461		
	X61	18.500		2.0418	-1.1957
739	X61	31.19	0.3195		
	X62	30.32		3.0761	-2.7566
740	X62	22.83	0.6387		
	X63	20		2.6753	-2.0366
741	X63	44.770	1.0127		
	X64	42.790		1.6818	-0.6691
742	X64	58.24	1.2792		
	X65	57.32		1.5685	-0.2893
743	X65	63.800	1.3935		-0.3725
	X66	61.150		1.7660	
744	X66	50.26	1.3036		
	T-8	49.39		1.9603	-0.6567
745	T-8	40.59	0.9714		
	X67	41.53		1.9565	-0.9851
746	X67	45.020	1.0254		
	X68	44.700		1.4924	-0.4670
747	X68	13.7780	1.4916		
	XP-0139	12.3830		0.3458	1.1458
748	XP-0139	21.28	0.3333		
	x1	22.52		1.3535	-1.0202
749	x1	33.24	1.5340		
	x2	33.26		1.8559	-0.3219
750	x2	12.62	1.2765		

	x3	13.78		1.4111	-0.1346
751	x3	59.73	0.9455		
	x4	60.30		1.6582	-0.7127
752	x4	50.08	1.5265		
	x5	48.25		1.5008	0.0257
753	x5	64.84	1.3069		
	x6	65.67		1.4522	-0.1453
754	x6	66.4300	1.8290		
	x7	64.7200		0.7506	1.0784
755	x7	43.9400	1.8280		
	x8	44.8700		1.3974	0.4306
756	x8	48.2500	1.4478		
	x9	48.5600		1.8799	-0.4321
757	x9	54.4800	0.9199		
	x10	51.8400		1.8951	-0.9752
758	x10	62.6600	1.0431		
	x11	66.0100		2.2393	-1.1962
759	тур-1x11	21.9800	1.3288		
	x12	21.2800		0.9709	0.3579
760	x12	59.4900	1.1796		
	x13	59.0700		1.1834	-0.0038
761	x13	64.2600	0.9892		
	x14	62.9300		1.1790	-0.1898
762	x14	46.7300	1.7243		
	x15	46.2500		1.3204	0.4039
763	x15	59.6700	2.1006		

	x16	57.0300		1.1661	0.9345
764	x16	27.0200	0.6873		
	x17	27.5500		2.8288	-2.1415
765	x17	37.9600	0.9454		
	x18	37.6000		1.6358	-0.6904
766	x18	38..54	1.0539		
	x19	40.7000		2.9016	-1.8477
767	x19	17.6450	0.5295		
	x20	19.7370		2.0387	-1.5092
768	x20	48.6500	0.9781		
	x21	49.4800		1.5998	-0.6217
769	x21	49.4600	1.3347		
	x22	48.3000		1.4593	-0.1246
770	x22	30.6500	3.5459		
	x23	30.9000		0.8738	2.6721
771	x23	61.2200	0.9161		
	x24	62.4300		2.0456	-1.1295
772	x24	58.5800	1.1905		
	x25	59.7300		2.0500	-0.8595
773	x25	20.4500	1.1060		
	x26	18.8220		1.3452	-0.2392
774	x26	8.0010	1.4521		
	T-1	7.4910		2.2370	-0.7849
775	T-1	44.2000	1.2632		
	x29	42.9200		3.0146	-1.7514
776	x29	34.7900	2.2678		

	x30	34.6200		1.5092	0.7586
777	x30	50.6500	3.2596		
	x31	48.1200		1.7709	1.4887
778	x31	19.2200	1.5662		
	ГЦХ-076	16.413		1.5911	-0.0249
779	Гцх-076	66.6200	1.3612		
	x1	65.0700		2.7151	-1.3539
780	x1	54.7100	1.2178		
	x2	52.920		0.7931	0.4247
781	x2	25.830	1.3020		
	T1	24.540		0.8421	0.4599
782	T1	29.280	2.0946		
	x3	30.540		1.0812	1.0134
783	x3	55.360	1.9697		
	x4	53.810		1.1989	0.7708
784	x4	54.890	2.2501		
	T4	53.810		0.9243	1.3258
785	T4	41.280	0.8244		
	x5	42.280		3.6099	-2.7855
786	x5	57.720	1.5790		
	x6	55.630		1.3757	0.2033
787	x6	45.960	1.6279		
	x7	43.980		0.8254	0.8025
788	x7	44.020	3.7037		
	x8	43.490		0.7910	2.9127
789	x8	53.640	1.8369		

	x9	50.830		0.4015	1.4354
790	x9	37.630	2.9094		
	x10	26.610		1.5150	1.3944
791	x10	44.990	1.2712		
	x11	43.970		2.0317	-0.7605
792	x11	69.630	1.3635		
	x12	69.030		1.6390	-0.2755
793	x12	63.850	1.6397		
	x13	63.450		1.4971	0.1426
794	x13	42.890	1.4882		
	x14	44.730		1.6832	-0.1950
795	x14	11.775	1.4611		
	Typ1	10.505		1.6702	-0.2091
796	Typ1	59.070	2.1485		
	x15	59.340		1.0833	1.0652
797	x15	62.500	2.0317		
	x16	61.400		0.9379	1.0938
798	x16	68.680	1.9220		
	x17	68.440		1.7342	0.1878
799	x17	47.940	0.8849		
	x18	46.540		1.5584	-0.6735
800	x18	64.460	0.9020		
	x19	65.990		1.5801	-0.6781
801	x19	56.370	1.7481		
	x20	55.270		1.5425	0.2056
802	x20	64.100	1.5010		

	x21	63.770		1.2223	0.2787
803	x21	53.300	2.1170		
	x22	53.830		1.2942	0.8228
804	x22	38.080	1.6256		
	XP-0139	35.120		0.5213	1.1043