




TESTING CORS SYSTEM FOR CADASTRAL SURVEYING



Nursu TUNALIOĞLU, Atınc PIRTI


ntunali@yildiz.edu.tr
atinc@yildiz.edu.tr

WORLD CADASTRE SUMMIT, Congress & Exhibition
April 20-24, 2015 ISTANBUL, TURKEY



CONTENT

- ❑ Motivation
- ❑ RTK GNSS in Cadastral Surveying
- ❑ Case Study
 - ❑ *Test Environment*
 - ❑ *Survey Methodology*
- ❑ Results
- ❑ Conclusion



MOTIVATION

- ❑ ***Importance of the definition of boundary***
- ❑ ***Managing and arranging this relationship based on laws***
- ❑ ***Requirements to enhance a sustainable and justified determination and arrangement on land properties regarding owner rights***
- ❑ ***Cadastral survey, GPS/GNSS surveying***
- ❑ ***Accurate positioning, easy to apply, less labor on site.***



RTK GNSS IN CADASTRAL SURVEYING

❑ RTK GPS

- **Satellite-based positioning systems, being usable in conjunction with GPS**
- **The phase of the signal's carrier wave**
- **Centimetre-level accuracy**
- **A reference point and rover point**



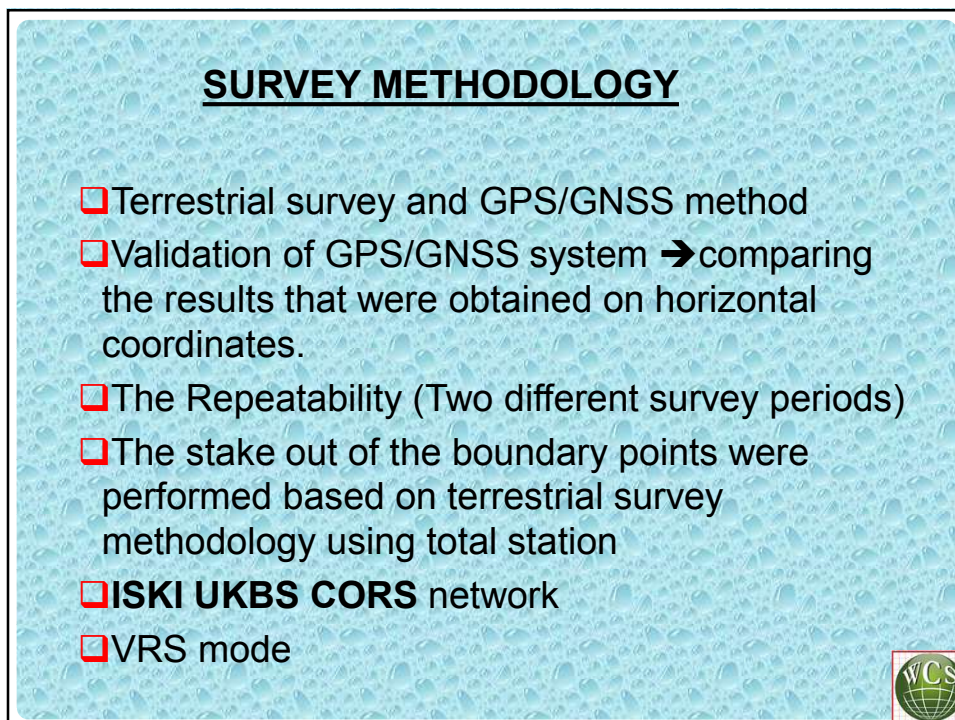
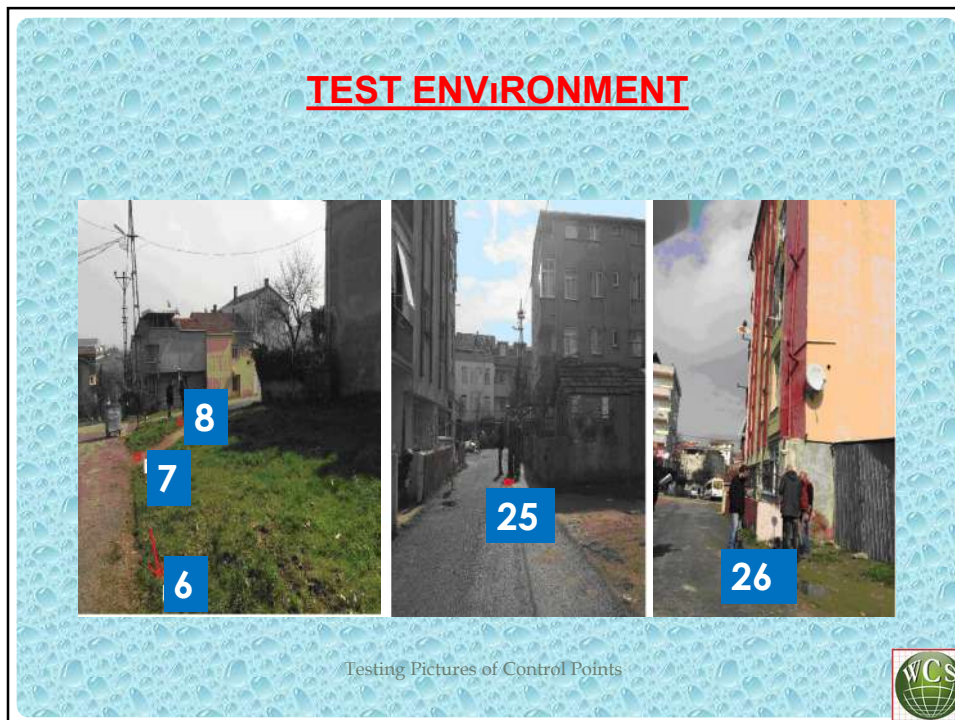
❑ The Network RTK (NRTK)

- ❖ Satellite-based positioning systems, conjunction with GNSS (**GPS, GLONASS, GALILEO, BEIDOU**)
- ❖ A Continuously Operating Reference Station (CORS) network is a network of RTK base stations that broadcast corrections, usually over an Internet connection. Accuracy is increased in a CORS network, because more than one station helps ensure correct positioning and guards against a false initialization of a single base station
- ❖ Virtual Reference Station (VRS) networks use RTK solutions to provide high-accuracy, RTK GNSS.



TEST SURVEY





TEST RESULTS HORIZONTAL ACCURACY

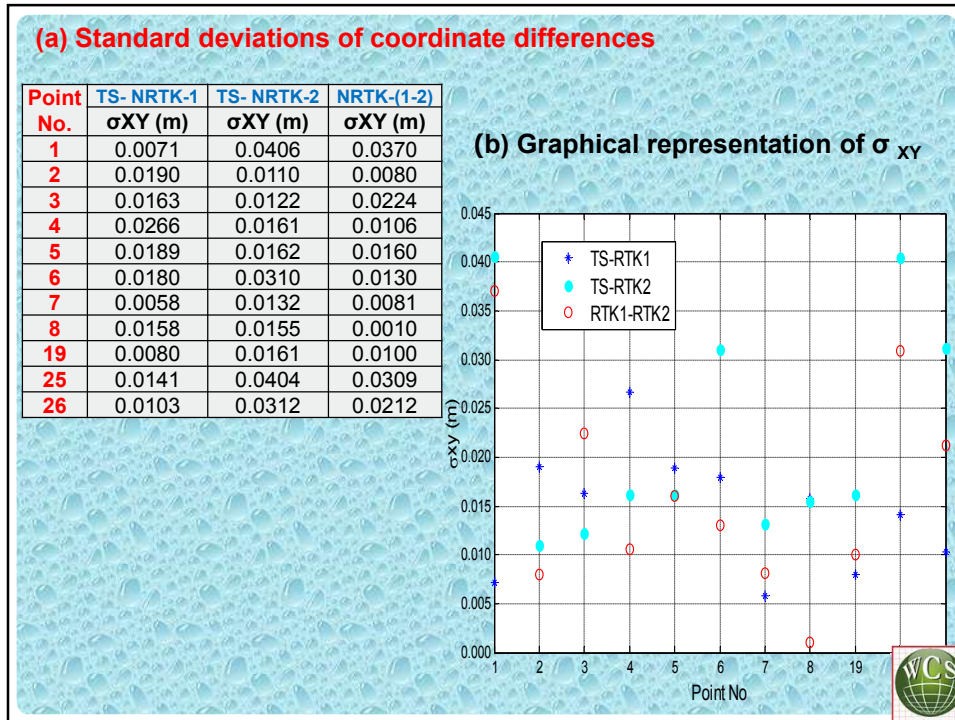
Point No.	Error (TS-NRTK-1)		Error (TS-NRTK-2)		Error (NRTK-(1-2))	
	ΔY (m)	ΔX (m)	ΔY (m)	ΔX (m)	ΔY (m)	ΔX (m)
1	0.005	-0.005	-0.007	-0.040	-0.012	-0.035
2	-0.001	-0.019	-0.001	-0.011	0.000	0.008
3	-0.012	-0.011	0.010	-0.007	0.022	0.004
4	-0.015	0.022	-0.008	0.014	0.007	-0.008
5	-0.010	-0.016	0.006	-0.015	0.016	0.001
6	0.000	0.018	0.001	0.031	0.001	0.013
7	0.003	0.005	0.002	0.013	-0.001	0.008
8	-0.015	0.005	-0.015	0.004	0.000	-0.001
19	0.008	0.000	0.014	0.008	0.006	0.008
25	-0.014	-0.002	-0.027	-0.030	-0.013	-0.028
26	0.009	0.005	0.024	0.020	0.015	0.015
690	0.007	-0.039	0.014	-0.036	0.007	0.003
691	0.109	0.006	0.105	0.011	-0.004	0.005
692	0.073	-0.066	0.052	-0.061	-0.021	0.005

Combination of Coordinate Differences between TS-RTK 1&2 period

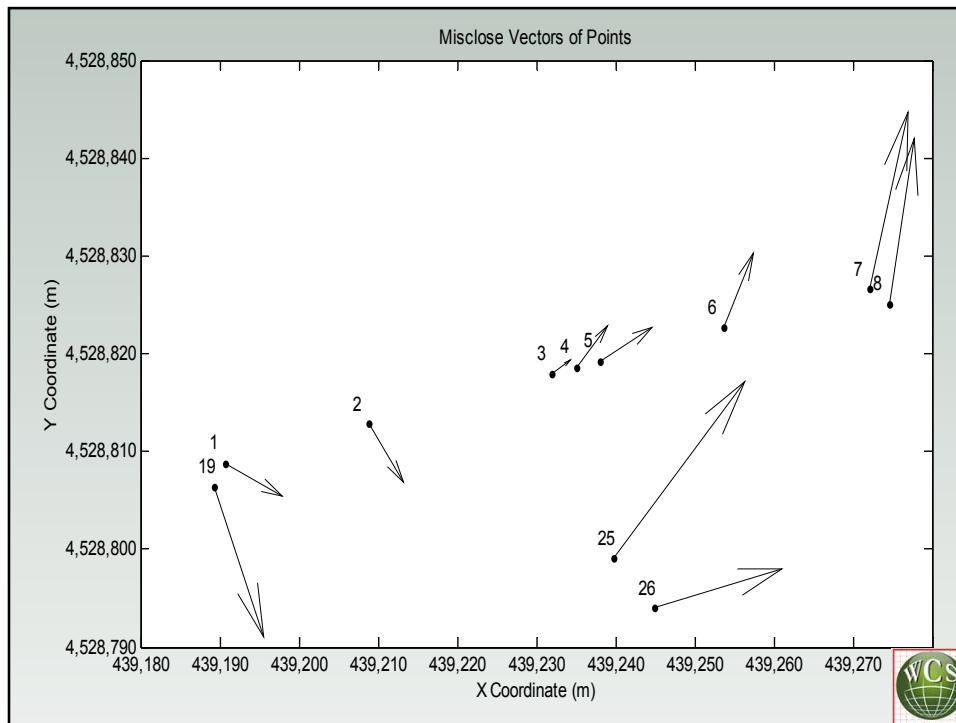


□ To ensure the reliability of the RTK GNSS surveys in cadastral applications, the standard deviations (σ) of the coordinate differences have been calculated for three calculation phases regarding namely as TS and RTK 1st period, TS and RTK 2nd period and, RTK 1st and 2nd periods (see Table). The calculations for RTK 1st and 2nd are given to represent the internal accuracy of the RTK survey methodology. During the testing application, the maximum and minimum standard deviations for three phases is reached as 4 cm and <1 cm, respectively.





Point No.	Total Station		Mean NRTK Observations		Misclose Vector (m)
	Easting (m)	Northing (m)	Easting (m)	Northing (m)	
1	439190.656	4528808.811	439190.631	4528808.823	0.028
2	439208.836	4528812.804	439208.821	4528812.825	0.026
3	439232.029	4528817.934	439232.021	4528817.929	0.009
4	439235.015	4528818.577	439235.002	4528818.562	0.020
5	439237.985	4528819.247	439237.962	4528819.236	0.026
6	439253.643	4528822.613	439253.630	4528822.586	0.031
7	439272.064	4528826.614	439272.048	4528826.551	0.065
8	439274.656	4528825.135	439274.645	4528825.076	0.061
19	439189.321	4528806.412	439189.299	4528806.466	0.058
25	439239.739	4528799.039	439239.681	4528798.976	0.086
26	439244.939	4528793.981	439244.884	4528793.968	0.057



CONCLUSION

- ❑ The use of the CORS technique for boundary surveys
- ❑ Fourteen points were selected in both normal and difficult measurement conditions
- ❑ The analyses were made in three steps
 - ❖ In the first step, the NRTK(CORS) results obtained on different periods were compared with each other
 - ❖ In the second, the total station observations have been realized on site to assign as fixed coordinates in evaluations



❖ In the last step, the CORS measurement results were compared with those of the total station

❑ The results showed differences of up to centimeters between the coordinates derived from the two survey methods in the obstructed areas. We conclude that the NRTK(CORS) technique competes well with the traditional survey methods in terms of accuracy, and it can be used in cadastral surveys even in semi residential areas

❑ Moreover, RTK and NRTK methods bring ease of use, efficiency in survey; time and budget save in field works



❑ This study conclude that the results obtained support the usability of NRTK GNSS system in cadastral survey issues

