

Preliminary project of the height system reconstruction in the Republic of Croatia

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STATE GEODETIC ADMINISTRATION

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HEIGHT SYSTEMS IN CROATIA



HVRS1875

I. Leveling of high
accuracy (I. NVT)
1945 - 1963

HVRS71

II. Leveling of high
accuracy (II. NVT)
1970 - 1973

HEIGHT SYSTEM HVRS1875

- 1878 -1908 - Austrian Precise Levelling (APN)
- normal orthometric height system
- mean sea level – tide gauge Trieste
- 1 year observation (1875)
- 1945 -1963 - I. Levelling of High Accuracy
- new lines and benchmark stabilization
- heights taken from the APN
- numerous deficiencies: origin point, different instruments and procedures, long period of time



HEIGHT SYSTEM HVRS71



- 1970 -1973 – former Yugoslavia
- II. levelling of high accuracy
- normal orthometric height system
- mean sea level – five tide gauges
- 18.6 years long observations (epoch – 1971.5)
- measurements - unified and clearly specified scientific and technical criteria
- partial gravity measurements
- I. and II. NVT level lines differ
- systematic data processing and adjustment has been done 20 years after measurements
- official reference height system - HVRS71 (2004)
- height diff.: HVRS1875-HVRS71: 12 – 24 cm



HEIGHT SYSTEM HVRS71

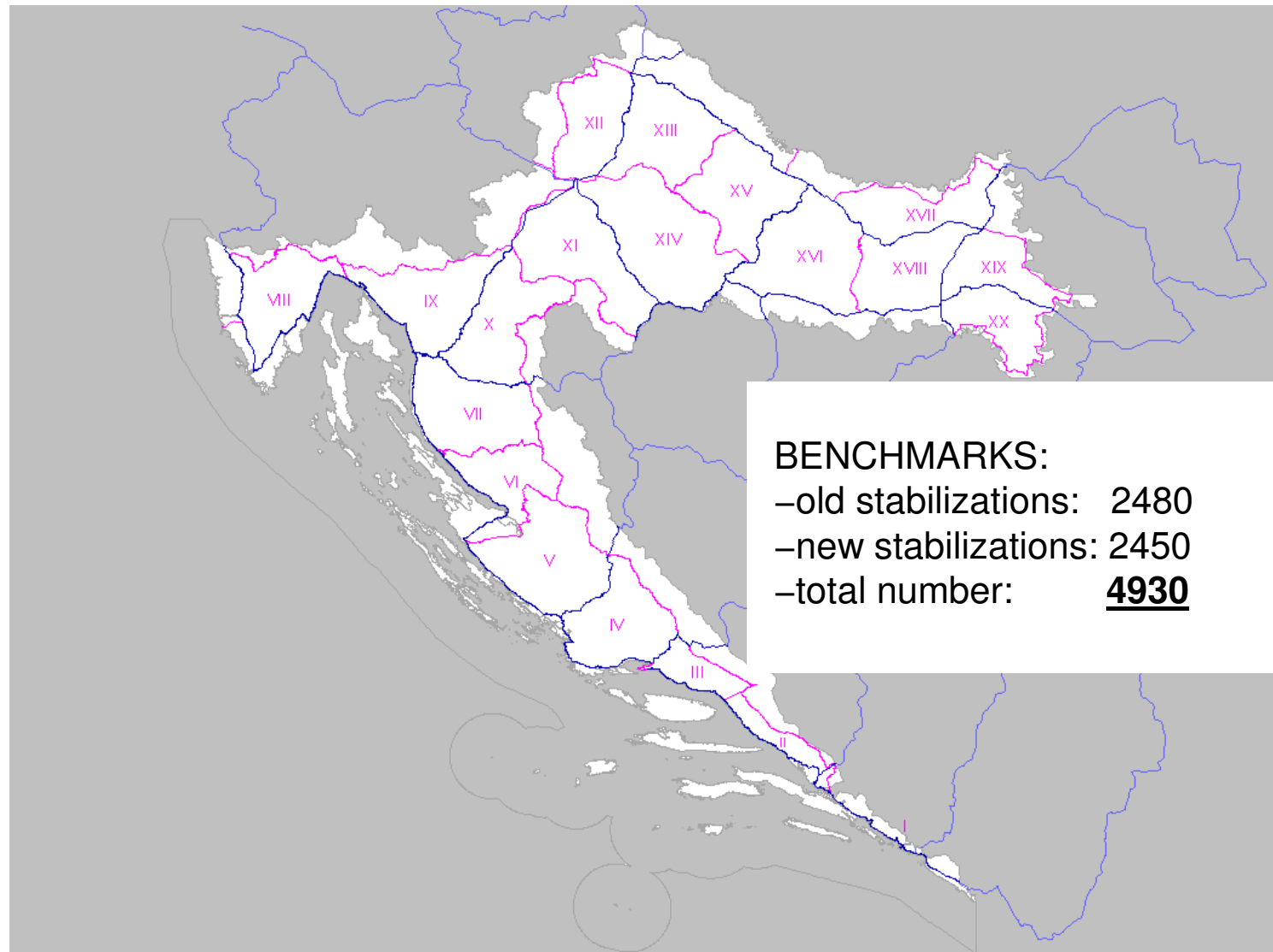
- 16 levelling polygons
- 448 levelling lines
- classification by levelling method

Order	Number of benchmarks (1973)	Revision (1993-1999)	Revision (2006-2008) – 81%
Levelling of high accuracy (II.NVT)	3207	2304	1835 (57%)
Levelling of high accuracy (I.NVT)	2976	1409	1311 (44%)
Precise levelling (PN)	3530	1558	1313 (37%)
Technical levelling of increased accuracy (TNPT)	9615	4115	3507 (36%)
Technical levelling (TN)	4259	1399	1199 (28%)
<u>TOTAL:</u>	<u>23587</u>	<u>10785</u>	<u>9562 (41%)</u>

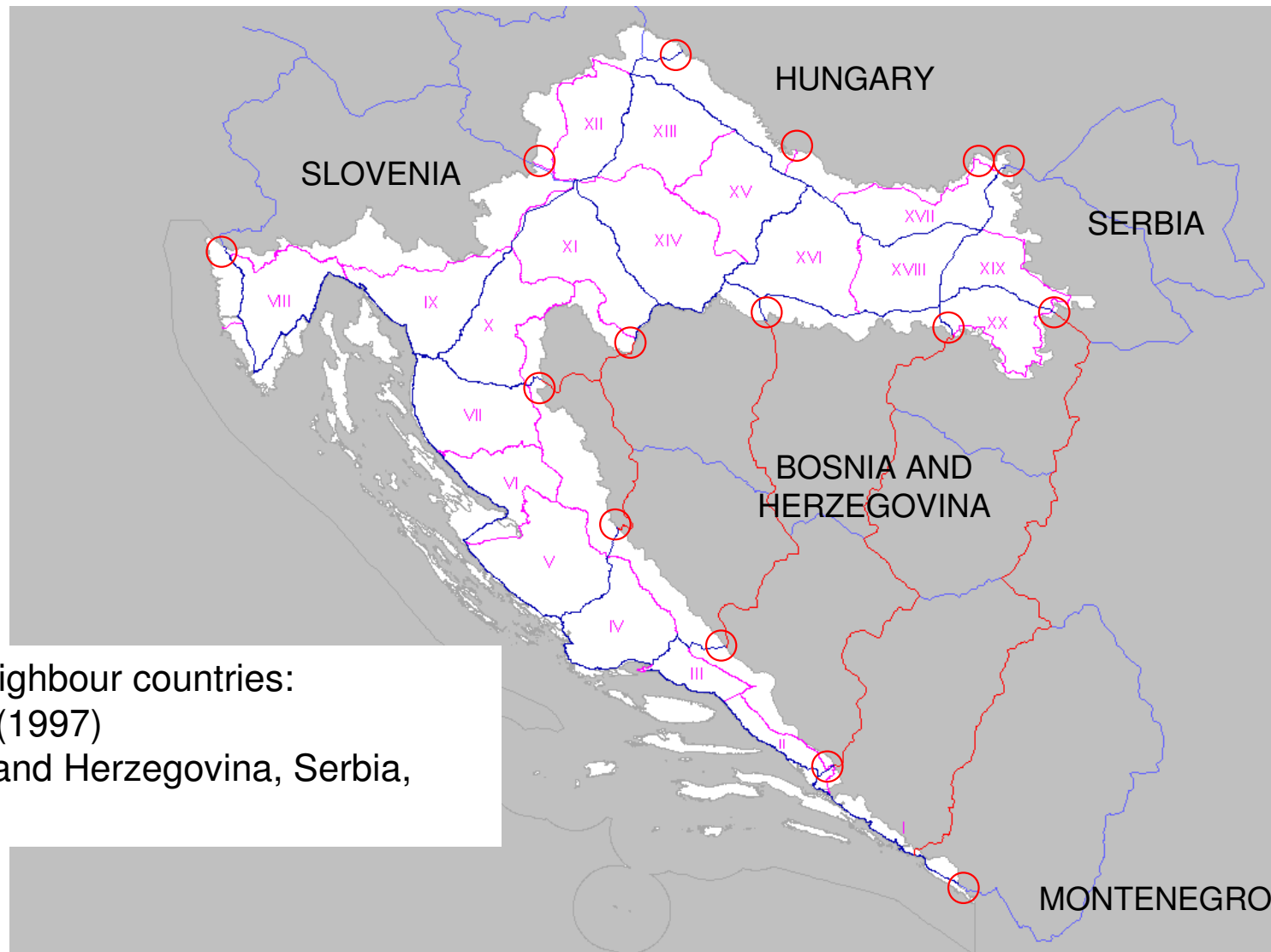
HEIGHT SYSTEM RECONSTRUCTION

NETWORK ORDER	DESCRIPTION	LEVELLING METHOD	TOLERANCE [mm] L=length [km]
0th order	tide gauges lines	levelling of high accuracy	$2 \cdot \sqrt{L}$
1st order	levelling polygons	levelling of high accuracy	$2 \cdot \sqrt{L}$
2nd order	lower order, city networks, islands	precise levelling, trigonometric levelling	$3 \cdot \sqrt{L}$
3rd order		technical levelling, precise levelling, trigonometric levelling	$5 \cdot \sqrt{L}$
4th order		technical levelling, precise levelling, trigonometric levelling	$6 \cdot \sqrt{L}$

HEIGHT SYSTEM RECONSTRUCTION



HEIGHT SYSTEM RECONSTRUCTION



Connection with neighbour countries:

- Hungary – UELN (1997)
- Slovenia, Bosnia and Herzegovina, Serbia, Montenegro

HEIGHT SYSTEM RECONSTRUCTION

BENCHMARK NAME CONVENTION

xyyyzzzz

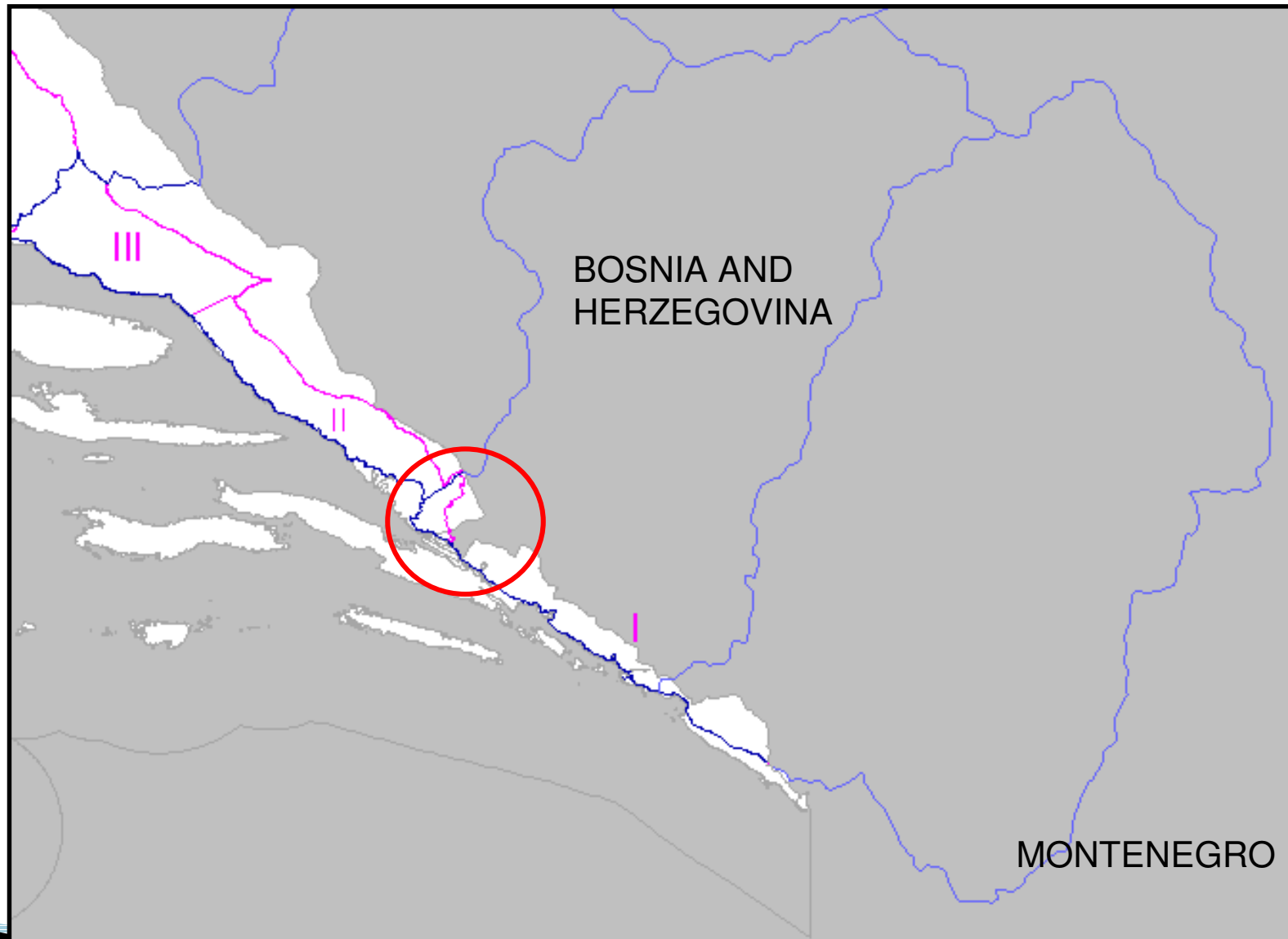
x = type of stabilization (number)

y = number of benchmark

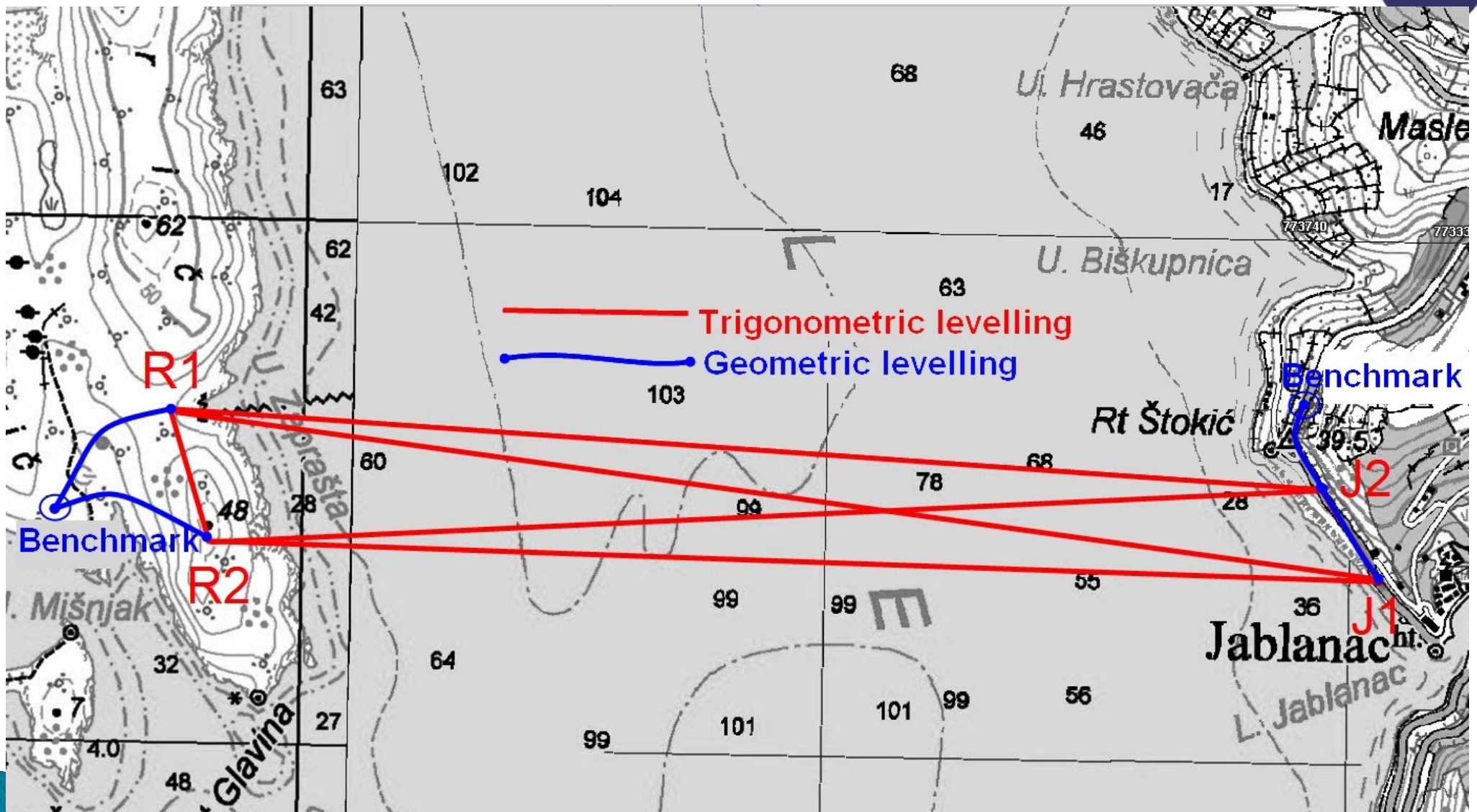
z = line number

Order	Line number	Benchmark number	Description
0.	0001 – 0004	0001 – 0099	tide gauges
1.	0005 – 0099	0100 – 1999	lev. polygons
2.	0100–0699	2000–2999	low order, city networks
3.	0700–1099	3000–3999	
4.	1100–1600	4000–4999	

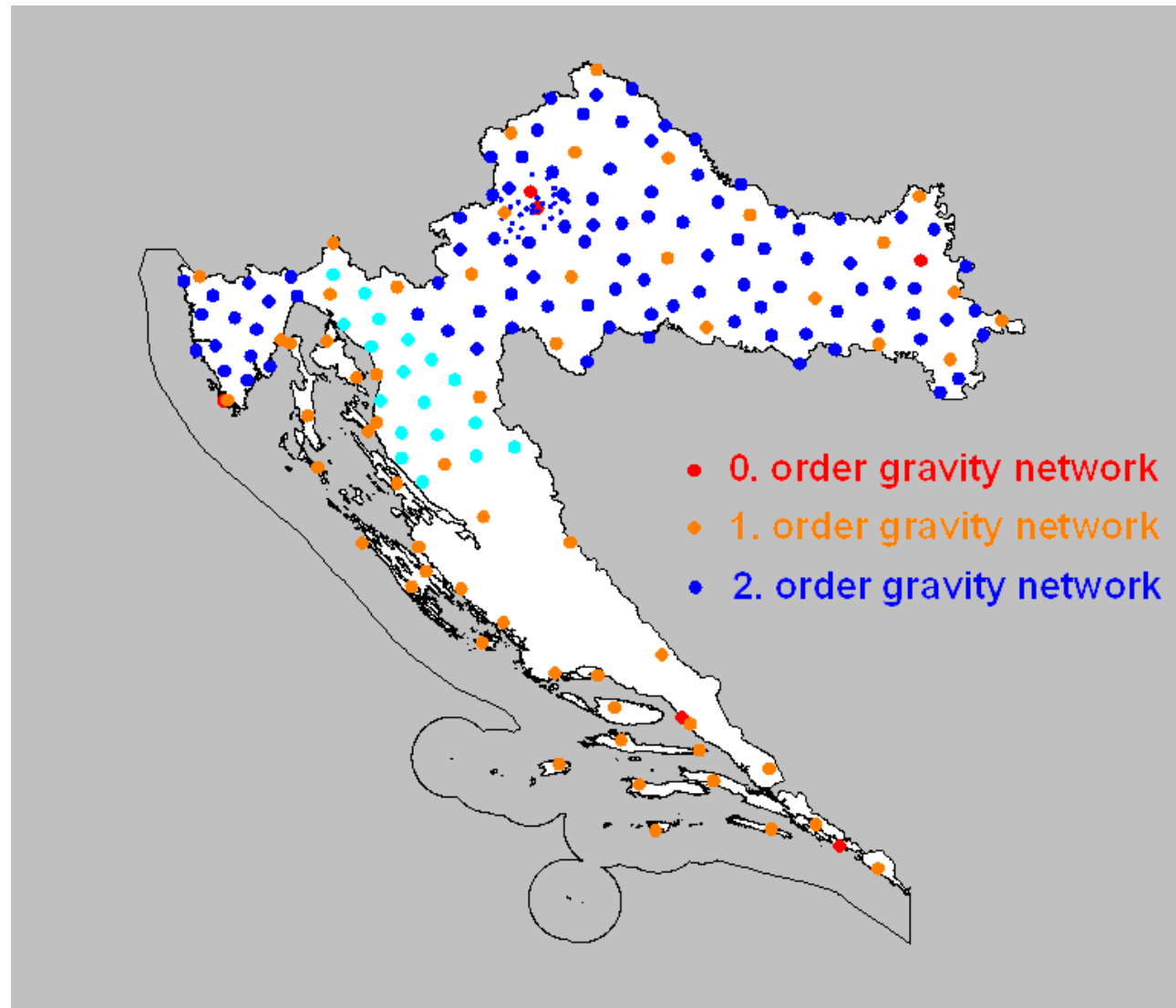
HEIGHT SYSTEM RECONSTRUCTION



CONNECTION WITH CROATIAN ISLANDS



GRAVITY NETWORKS



CONCLUSION



Reconstruction of the height system in Croatia will include many tasks in next few years:

- finalization of the second order gravity network,
- re-observation of the 0. order gravity network and stabilization of new points – absolute gravity measurements,
- connection of the gravity network with neighbour countries,
- new adjustment of the gravity networks,
- improvement of the actual geoid model HRG2009 - GNSS/levelling measurements (12-24h)
- define the project stages of the height system reconstruction - geometric levelling and gravity measurements,
- definition of the new vertical datum.

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