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FIG

KUALA LUMPUR
2014

XXV FIG Congress

"Engaging the Challenges, Enhancing the Relevance"
16 - 21 JUNE 2014, MALAYSIA



Geodetic Monitoring of Arch-Span Bridge Construction in Novosibirsk Using Laser Scanning

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Andrey V. IVANOV
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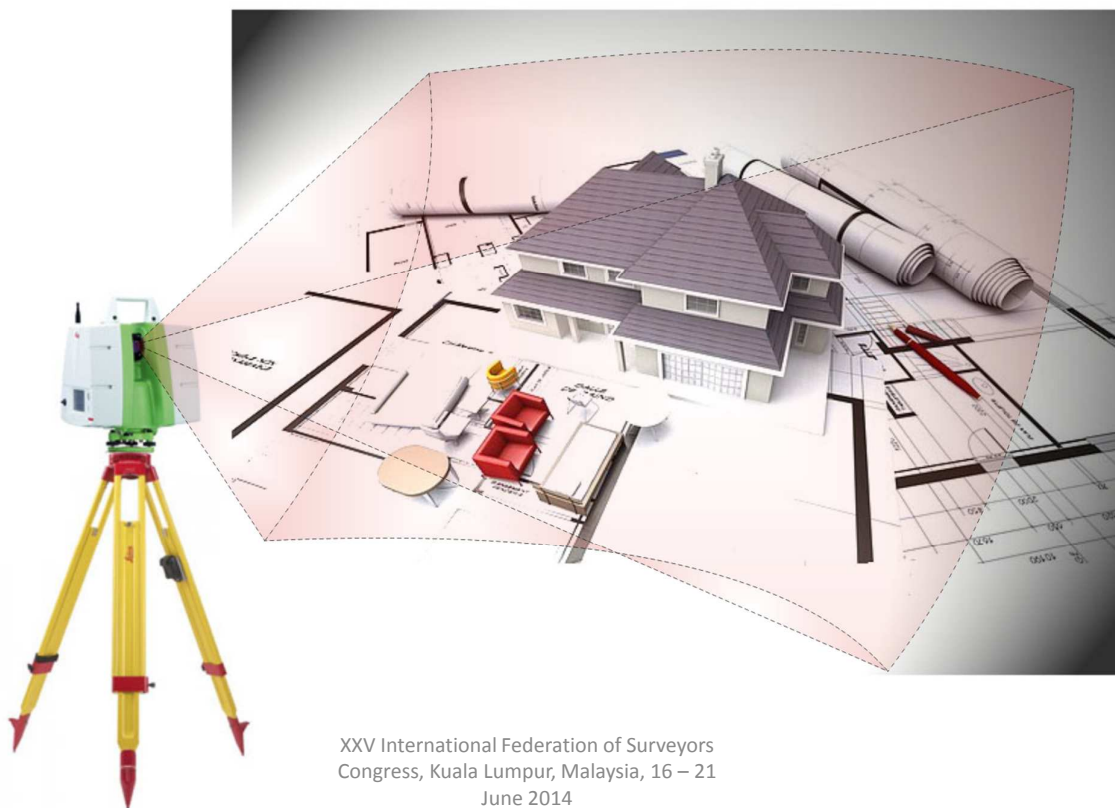
Regional Centre for Laser Scanning

Novosibirsk, Russian Federation 2014



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Laser scanning for engineering surveys



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“Bugrinskiy” bridge, Novosibirsk

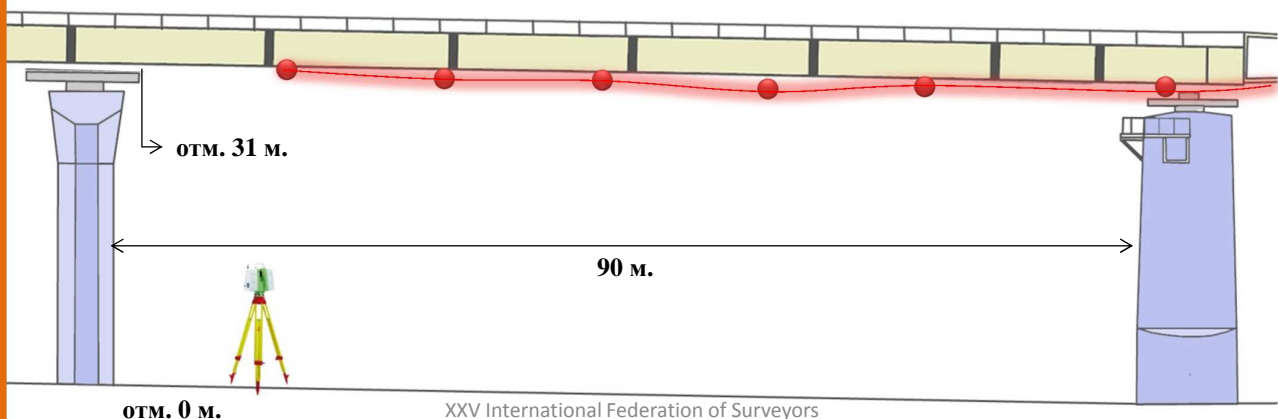


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A layout of arch-span launching measuring

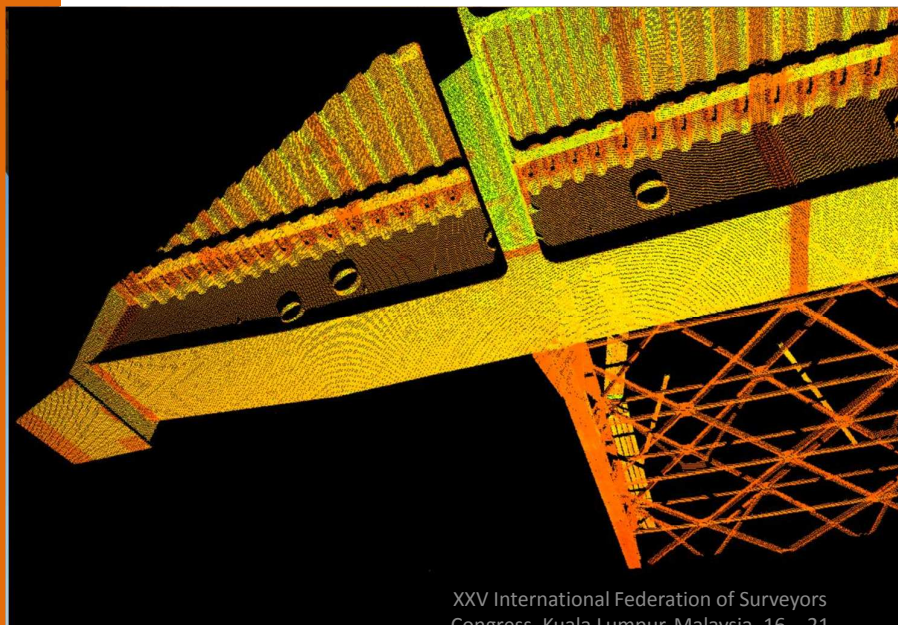
- Each span is measured from a single scan station
- 28 measurements were done for the left and right beams
- Moving length is 90 m



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Target points used for geodetic monitoring



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Scanning resolution:

in height – 10 мм

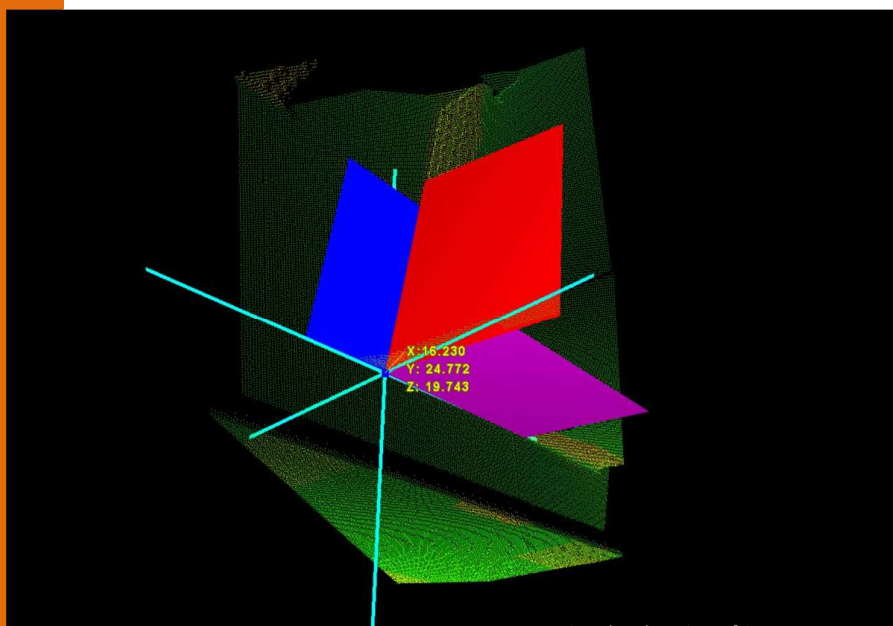
in plane – 5 мм

Scanning time:

4 – 5 minutes



Modeling of virtual target based on steel constructions crossing



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Plane modeling results

Region size – 0,3 m²

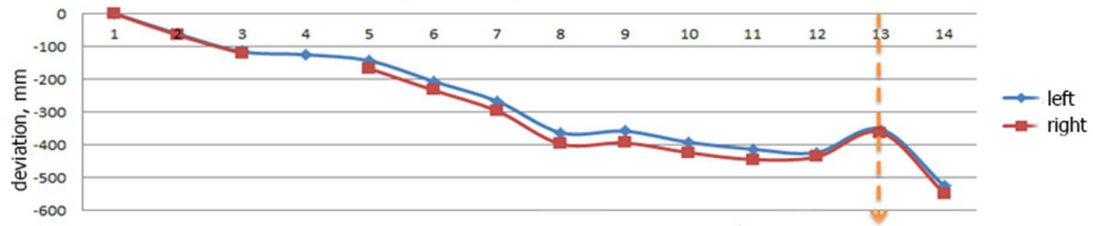
Number of points for each
region – 3500. RMS – 2
mm.

Segmenting: three crossed
planes at a point cloud.

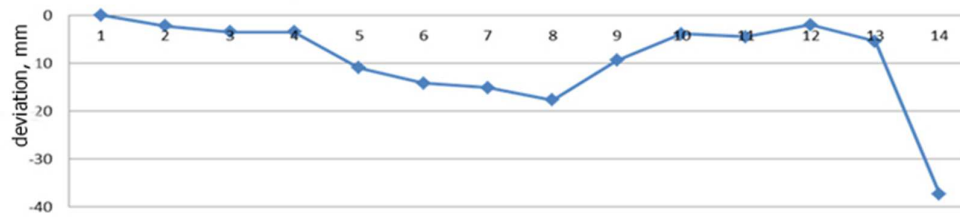


Results

Vertical deformations



Horizontal deformations

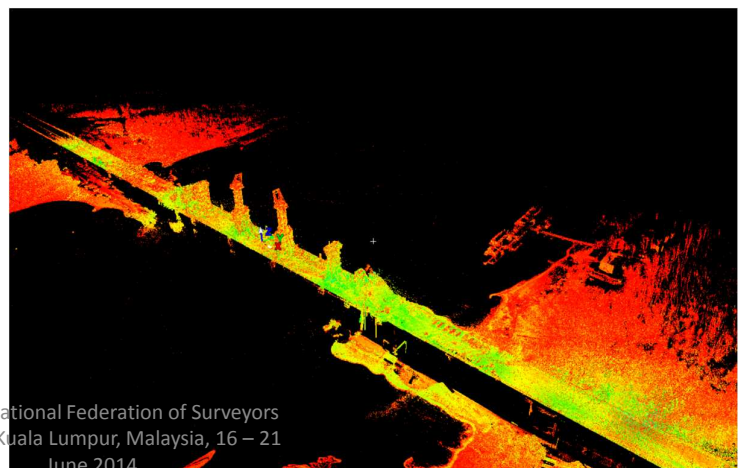


RMS error – 2 mm

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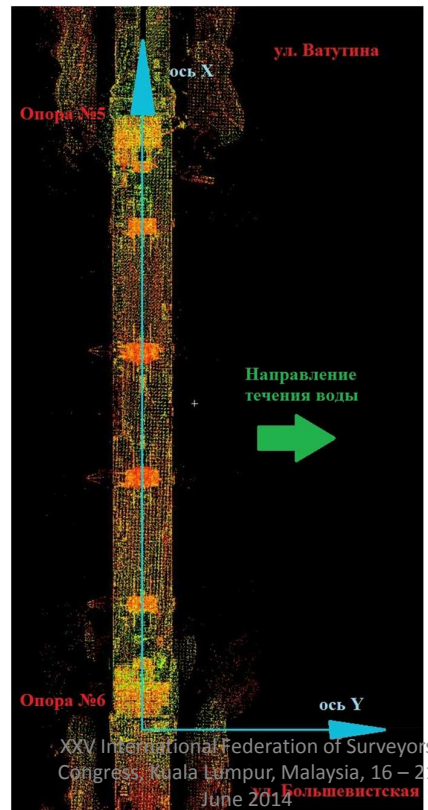
Bridge arches joining



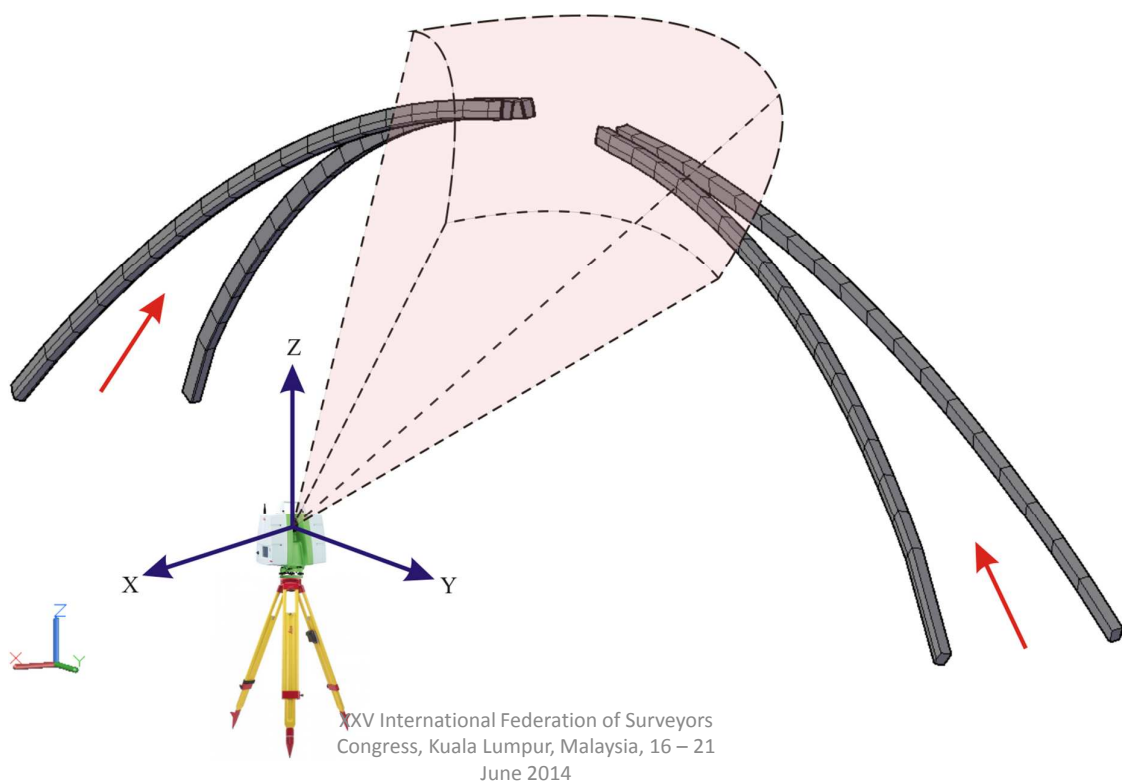
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Modeling of bridge axis using laser scanning data



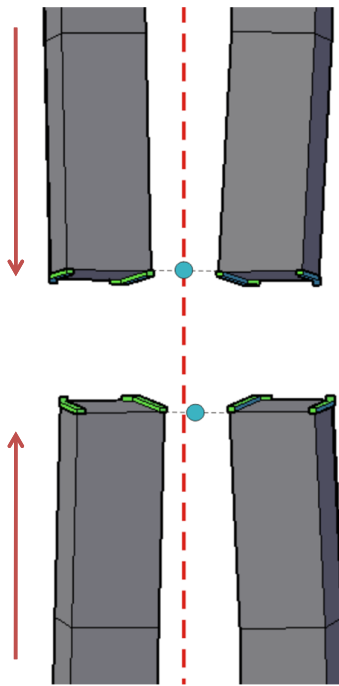
Overall laser scanning layout for bridge arches launching



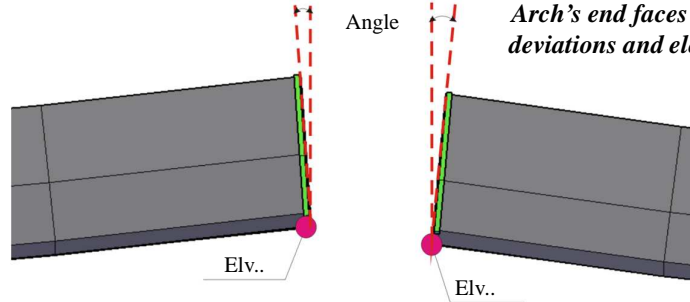


Controlled geometric parameters of bridge arch launching

Horizontal deviation

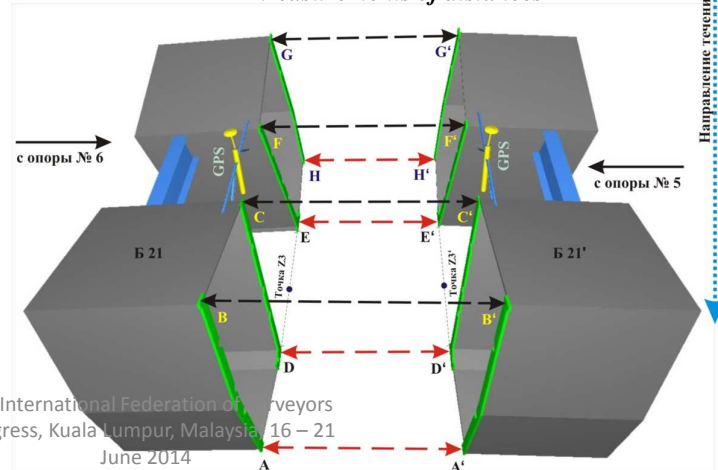


Angle

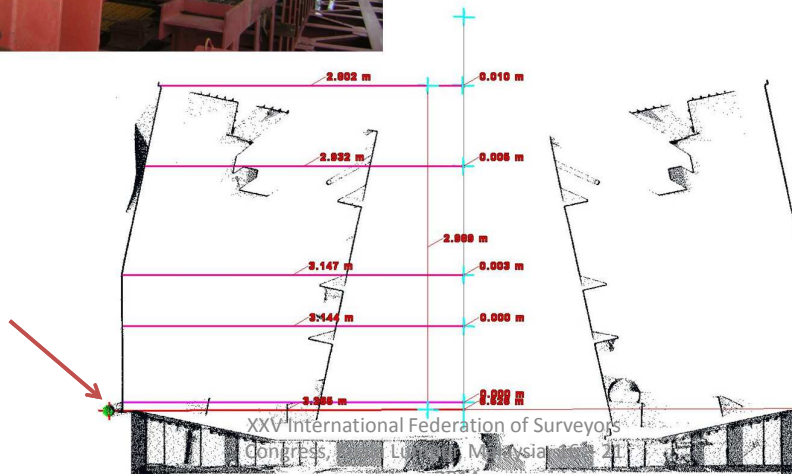
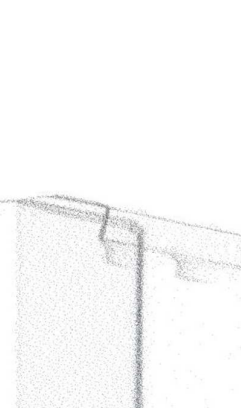
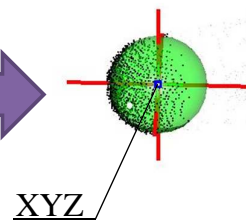
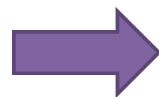


Arch's end faces vertical deviations and elevations

Measurements of distances



Measuring of arch docking segment

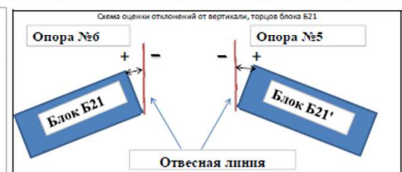
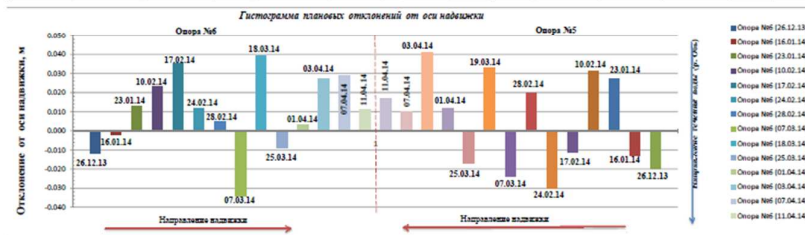




The results of bridge arch launching

Федеральное государственное бюджетное образовательное учреждение высшего профессионального образования "Сибирская государственная геодезическая академия"

Отклонение от оси валажники		Координаты точки Z3, контрольные параметры согласно 5-421-Р-ППР11.7 от 2014 г.						Отметка низа блока по направлению вала, м				Отклонение от верт. торца БЗ1		Время, ч				
Дата съемки	Опора №6, м	Опора №5, м	У, м	ось моста X, м	φ(факт) Z, м	дропскл. Z, м	Δ Z, м	У, м	ось моста X, м	φ(факт) Z, м	дропскл. Z, м	Δ Z, м	Опора №6		Опора №5	Опора №6	Опора №5	
26.12.2013	-0.013	-0.030																
16.01.2014	-0.002	-0.013																
25.01.2014	0.013	0.027																
10.02.2014	0.023	0.031	-0.023	101.624	166.065	166.182	-0.097	-0.031	384.293	164.740	164.903	-0.143	166.043	166.090	164.740	164.739		
17.02.2014	0.035	-0.011	-0.035	111.213	168.640	168.885	-0.245	0.011	277.048	167.636	167.897	-0.271	168.637	168.642	167.620	167.631		
24.02.2014	0.012	-0.020	-0.012	119.970	171.219	171.427	-0.108	0.020	368.211	170.129	170.415	-0.316	171.32	171.319	170.122	170.137		
28.02.2014	0.005	0.020	-0.005	129.778	173.815	174.040	-0.225	-0.020	258.488	172.736	172.833	-0.096	173.822	173.808	172.729	172.744		
07.03.2014	-0.024	-0.024	0.024	139.910	175.925	176.158	-0.232	0.024	348.838	175.021	175.265	-0.244	175.932	175.921	175.011	175.030		
18-19.03.2014	0.039	0.033	-0.039	149.332	177.378	177.678	-0.101	-0.033	239.193	нет возможности	177.112	-	177.576	177.580	-	-		
25.03.2014	-0.009	-0.017	0.009	159.484	178.832	178.968	-0.076	0.017	219.051	179.454	179.550	-0.086	178.885	178.879	179.459	179.469	+6°36'33.5"	+5°33'41.3"
01.04.2014	0.003	0.012	-0.003	169.476	179.892	179.940	-0.048	-0.012	208.961	180.232	180.330	-0.098	179.896	179.889	180.226	180.239	+4°44'15.2"	+3°29'02.1"
05.04.2014	0.027	0.041	-0.027	169.480	179.900	179.940	-0.040	-0.041	208.967	180.241	180.330	-0.089	179.902	179.898	180.234	180.249	+4°41'50.1"	+3°33'47.9"
07.04.2014	0.029	0.010	-0.029	179.413	180.339	180.532	0.007	-0.010	199.140	180.593	180.713	-0.120	180.538	180.539	180.583	180.602	+2°45'41.4"	+1°27'39.6"
11.04.2014	0.011	0.017	-0.011	189.625	180.639	180.691	-0.052	-0.017	191.180	180.537	180.658	-0.121	180.643	180.634	180.532	180.540	+0°23'51.3"	-0°21'37.3"



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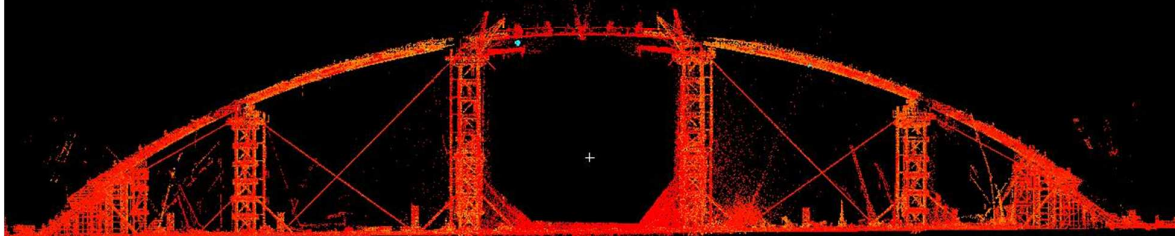
Составил: Вел. инженер РПЛС СГГА Назов А.В.



The result of bridge arch launching closure

Docking parameters of arch –

Axis deviation: right riverside +11 mm, left riverside +17 mm, relative deviation of docking segment's axis 6 mm



Project's height deviation: right riverside -52 mm, left riverside -121 mm, relative deviation of docking segment's axis 69 mm

Docking plane's inclination angles: right riverside +23.8', left riverside -21.6'
Relative deviation of docking segment's axis: 2.2' (2 mm)

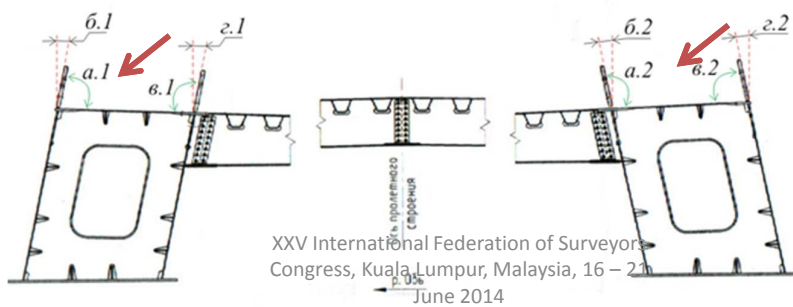
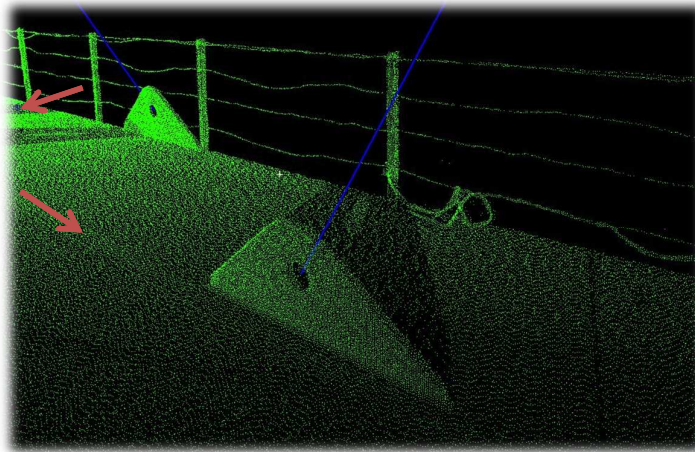
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Arch joining is successful !!!



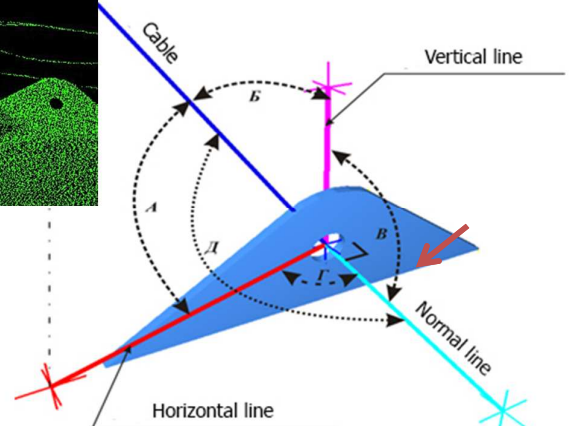
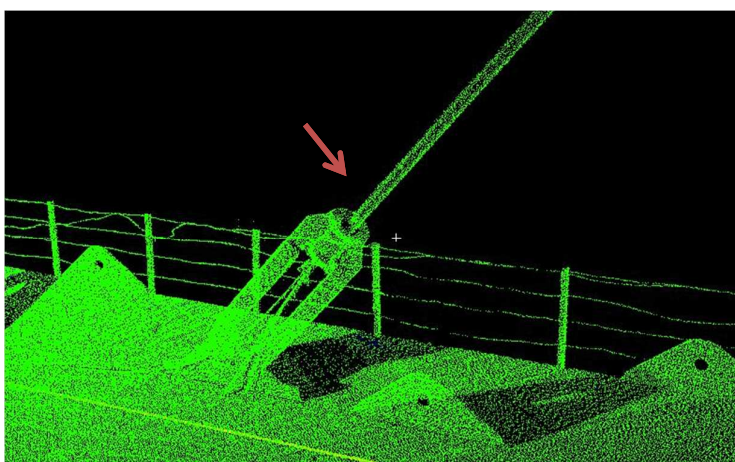
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New stage of construction – the assembling and tension of cables

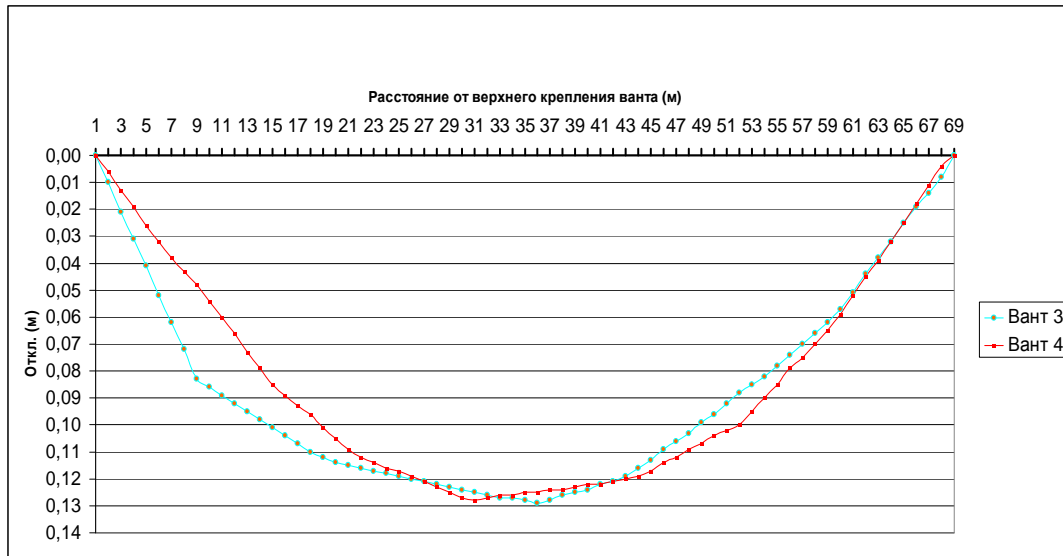


Angular parameters of cable tension areas with regard to the plane of their fixing





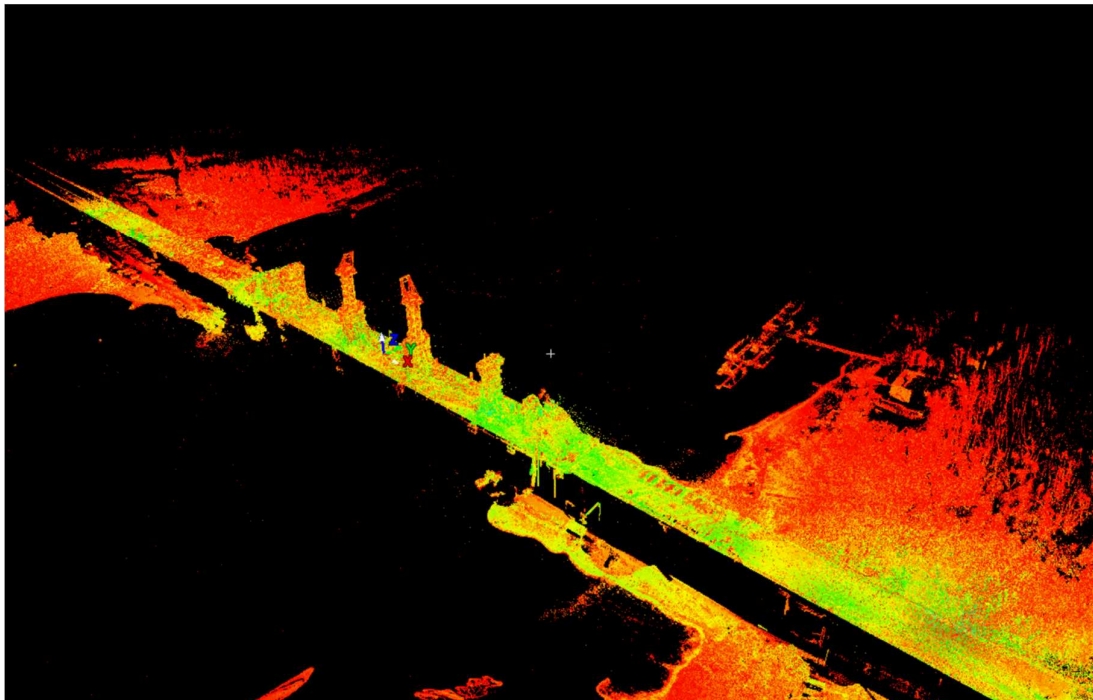
The control of cable slack parameters



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The result of scanning



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Thank you for your attention!

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