

The Analysis of GPS Signal Short-term Loss Influence on the Accuracy of Mobile Laser Scanning Data

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Content

1. Main elements of mobile laser scanning system;
2. Factors affecting measurement accuracy;
3. Initial data for investigations;
4. Mobile laser scanning data processing obtained with and without GPS data usage;
5. Relative and absolute accuracy estimation of data adjustment;
6. Conclusions.

Lynx Mobile Mapper M1



GPS

Digital cameras (2)

IMU

Control unit (in a car)

Laser scanners (2)

Factors affecting measurement accuracy

- ✓ technical characteristics of surveying system;
- ✓ surveying area type;
- ✓ weather conditions;
- ✓ number of base stations;
- ✓ data processing software;
- ✓ number of control points.

Investigated area



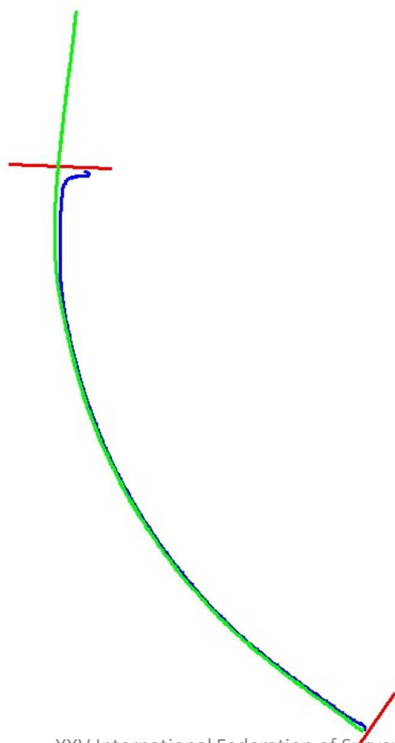
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Laser points of investigated area



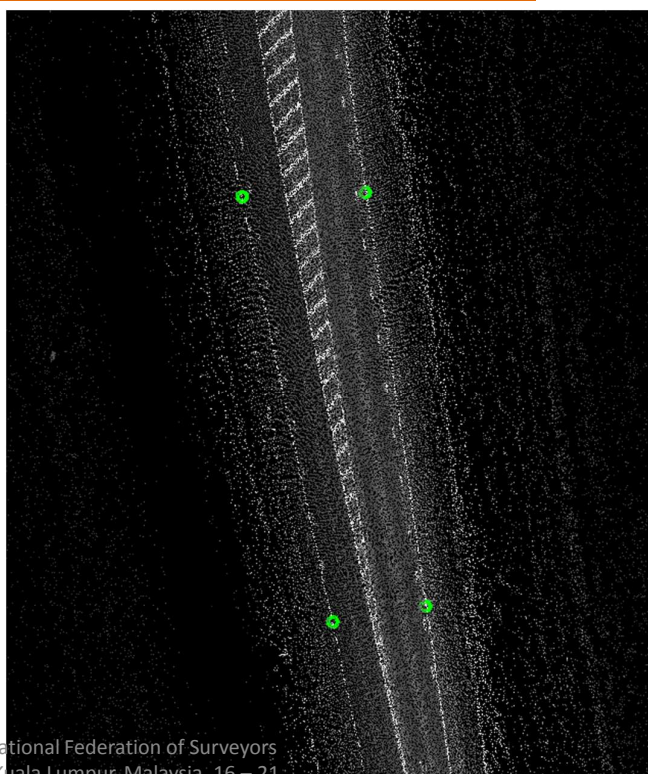
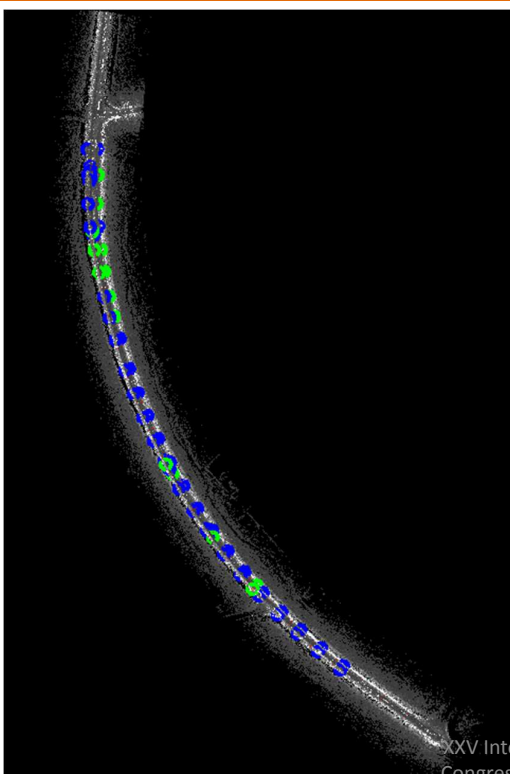
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Trajectory



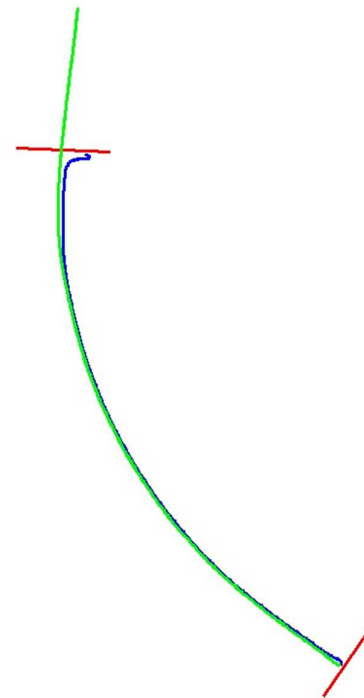
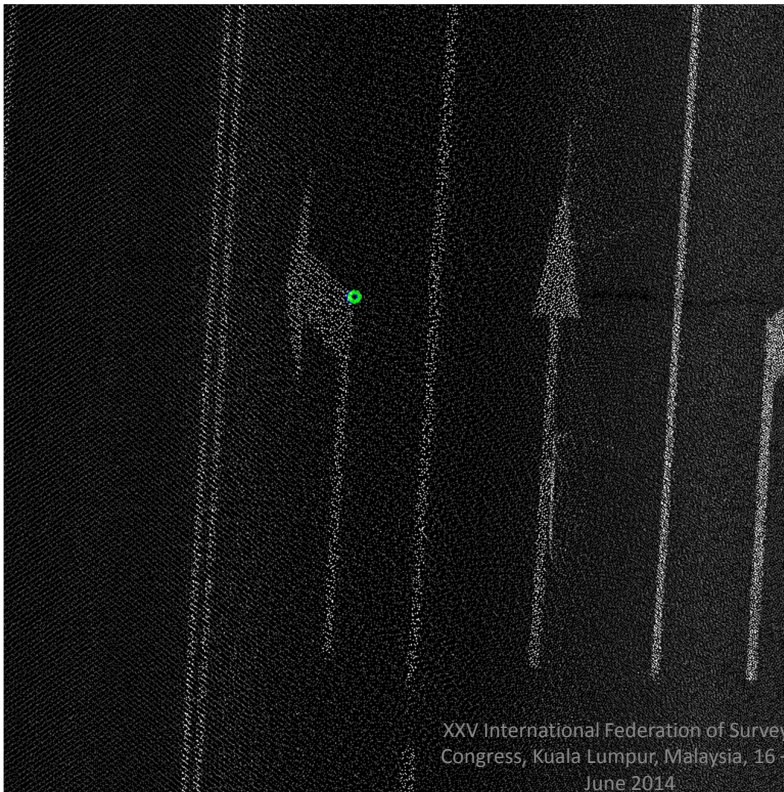
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Control points



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Control points on road marking corners



Mobile laser scanning data processing

First case – using all GPS data;

Second case – without GPS data within investigated area.

Used software

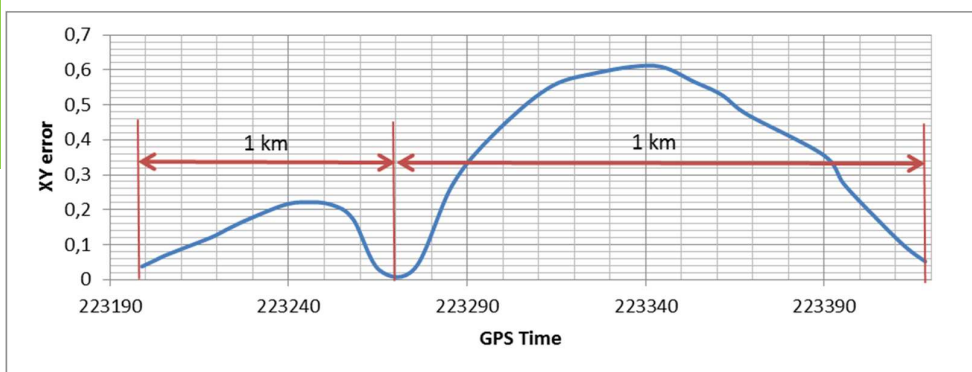
POSPac MMS – preliminary calculation of the trajectory;
DashMap and TerraSolid software – calibration and adjustment of laser points

Relative accuracy estimation of laser point location before adjustment

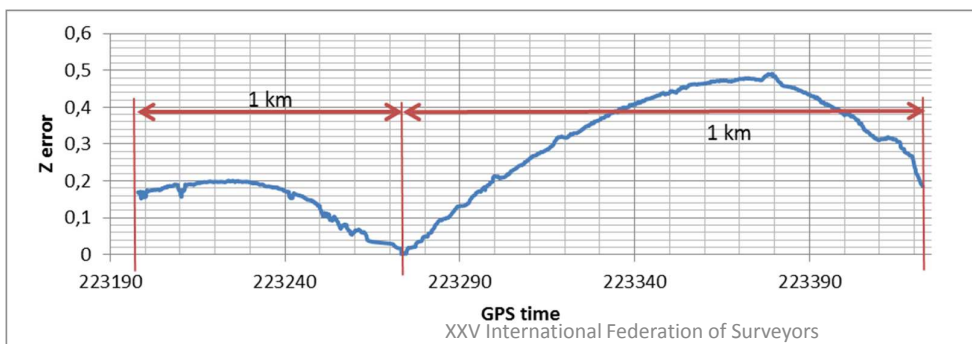
	With GPS data			Without GPS data		
	X, m	Y, m	Z, m	X, m	Y, m	Z, m
Mean error	0,026	0,024	0,003	0,169	0,303	0,242
Root mean square error	0,029	0,031	0,004	0,230	0,396	0,277
Maximum error	0,045	0,077	0,020	0,513	0,816	0,555

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Distribution of errors



in plane location of laser points, obtained without GPS data usage



in high-altitude location of laser points, obtained without GPS data usage

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Relative accuracy estimation of laser point adjustment

	Control points			Reference points		
	X, m	Y, m	Z, m	X, m	Y, m	Z, m
Mean error	0,000	0,001	0,001	0,013	0,012	0,001
Root mean square error	0,000	0,001	0,002	0,018	0,014	0,001
Maximum error	0,001	0,002	0,017	0,040	0,021	0,002

with GPS
data usage

	Control points			Reference points		
	X, m	Y, m	Z, m	X, m	Y, m	Z, m
Mean error	0,000	0,004	0,002	0,010	0,014	0,002
Root mean square error	0,002	0,005	0,003	0,014	0,019	0,003
Maximum error	0,003	0,007	0,021	0,025	0,036	0,005

without GPS
data usage

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Absolute accuracy estimation of laser point location before adjustment

	With GPS data			Without GPS data		
	X, m	Y, m	Z, m	X, m	Y, m	Z, m
Mean error	0,046	0,082	0,009	0,578	0,227	0,563
Root mean square error	0,070	0,095	0,012	0,702	0,271	0,566
Maximum error	0,149	0,173	0,036	1,343	0,424	0,635

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Absolute accuracy estimation of laser point adjustment

	Control points			Reference points		
	X, m	Y, m	Z, m	X, m	Y, m	Z, m
Mean error	0,000	0,001	0,003	0,007	0,017	0,008
Root mean square error	0,000	0,001	0,004	0,009	0,023	0,010
Maximum error	0,000	0,001	0,020	0,012	0,032	0,013

with GPS
data usage

	Control points			Reference points		
	X, m	Y, m	Z, m	X, m	Y, m	Z, m
Mean error	0,000	0,001	0,004	0,021	0,066	0,010
Root mean square error	0,000	0,001	0,006	0,026	0,066	0,013
Maximum error	0,000	0,002	0,027	0,036	0,073	0,022

without GPS
data usage

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Conclusions

- ✓ GPS signal loss was simulated when mobile laser scanning data saving;
- ✓ Comparable accuracy estimation of data adjustment obtained with GPS signal occurrence and without its simulated occurrence was implemented;
- ✓ It is possible to get laser point coordinates without GPS data usage with the same accuracy as laser point coordinates with GPS data usage;
- ✓ It is necessary to use control and reference points.

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Thank you for attention!

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