Study on Measurement of Road Alignments using Point Cloud and Reflection Intensity Data of Airbone LiDAR

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INTRODACTION

To construct next generation's advanced ITS, it is necessary to do modeling of highly 3D figure of road. Road register and digital road mapping is data to express traditional road alignments. However, these data is proximate curve, makes a distortion to measurement road by dividing, and doesn't have elevation data. Therefore, it is difficult to use in supporting of safe driving that position accuracy of centimeter class to vehicle side is required and automatic driving. Then, this research suggests application of Airbone LiDAR as the system that can survey road continually, addition to make the measurement method of 3D road alignments and to consider the applicability of Airbone LiDAR to modeling of highly 3D figure of road.

Airbone LiDAR is survey system to research land form accurately while laser light irradiates land surface by laser scanner carried on airplane. Airbone LiDAR can measure wide area short time from sky.

METHOD OF THIS RESEARCH

In this research, observed data in metropolis road No.123 Sakai-Chofu line (Osawa Mitaka-city Tokyo) is used as point cloud data of Airbone LiDAR. Distance of point is 0.22m as standard in measurement from altitude of 1000m.

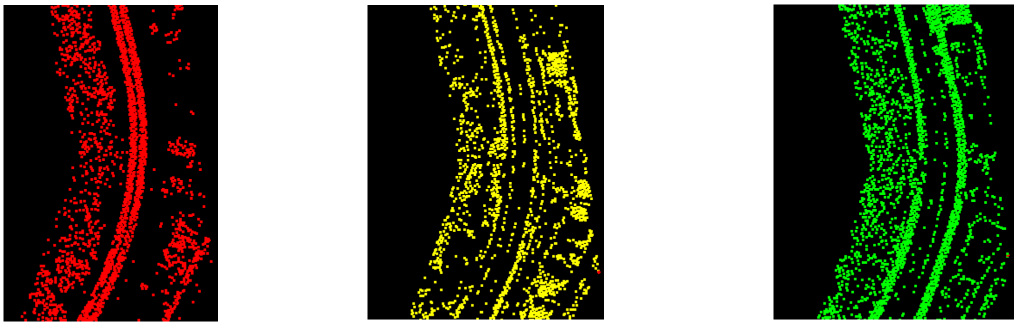
Point cloud data of Airbone LiDAR is classified and roadway space and road face are extracted by filtering of reflection intensity. Moreover, road is classified asphalt, center and side line using the range of reflection intensity. Finally, road alignments (road width, circular curve, transition curve, superelevation, cross section grade and profile grade) are estimated using classified data.

FILTERING USING REFLECTION INTENSITY DATA

Data of reflection intensity is one of the data obtained from Airbone LiDAR. The range of reflection intensity is from 0 to 255. Part of a highly reflection paint such as pedestrian crossing and center line are caught clearly white, and the range of reflection intensity is large. As shown in figure1, reflection intensity of part of asphalt is used from 5 to 15, part of white line use 100 and part of center line use 50.

MEASUREMENT OF ROAD ALIGNMENTS AND RESULT

Table1 is comparing estimation results of road alignments using point cloud of Airbone LiDAR and data of road layout figure. Figure2 superimposes road layout figure and point cloud data of white and center line of Airbone LiDAR, besides



Reflection intensity : from 5 to 15　　Reflection intensity :100　　Reflection intensity : 50

Figure 1. Filtering by each range of reflection intensity (asphalt, white line and center line)

Parameters	Point cloud	Layout figure	Error
Road width	8.24m	8.25m	-0.01m
Radius of circular curve R	150m	150m	±0m
Cerve length L	37.5m	37.5m	±0m
Transition curve parameters A	75	75	±0
Super elevation	7.8%(average)	7.61%	+0.19%
Cross section grade	1.2%(average)	1.5%	+0.3%
Profile grade	2.4%	2.5%	-0.1%

Table 1. Comparison of estimation results

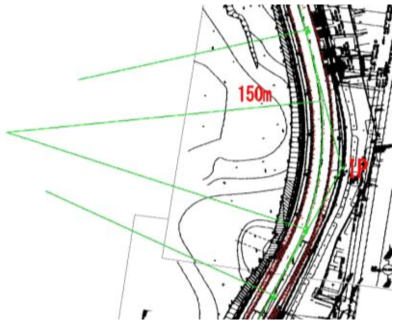


Figure 2. Plane figure

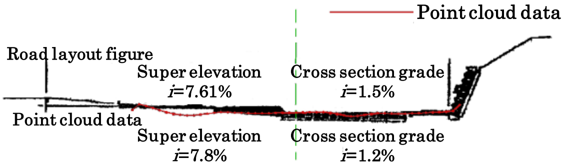


Figure 3. Cross section profile

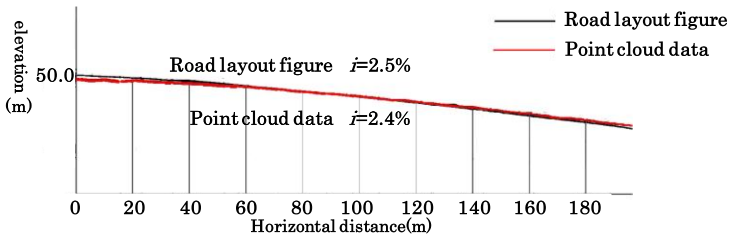


Figure 4. Longitudinal profile

figure2 is the result of plane figure that has been drawing straight line, circle curve and transition curve on the road. figure3 draws cross section profile using data of asphalt, white and center line of Airbone LiDAR superelevation and cross section grade besides compared drawn cross section profile and road layout figure. Figure4 drew longitudinal profile using data of asphalt, white and center line of Airbone LiDAR and estimated profile grade, compared drawn longitudinal profile and road layout figure.

CONCLUSIONS

In this research, road alignments were measured using point cloud and reflection intensity data of Airbone LiDAR, the estimation results of road alignments using point cloud data of Airbone LiDAR, correspond well to data of road layout figure. Though grades have some errors, point cloud data of Airbone LiDAR satisfies requirement of map information level 500, road register and AHS automatic driving level. In the future, part of large error when measurement road alignments in this research, should be investigated, besides research target will be two-level crossing road and will analyze using data of Airbone LiDAR and MMS.

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