

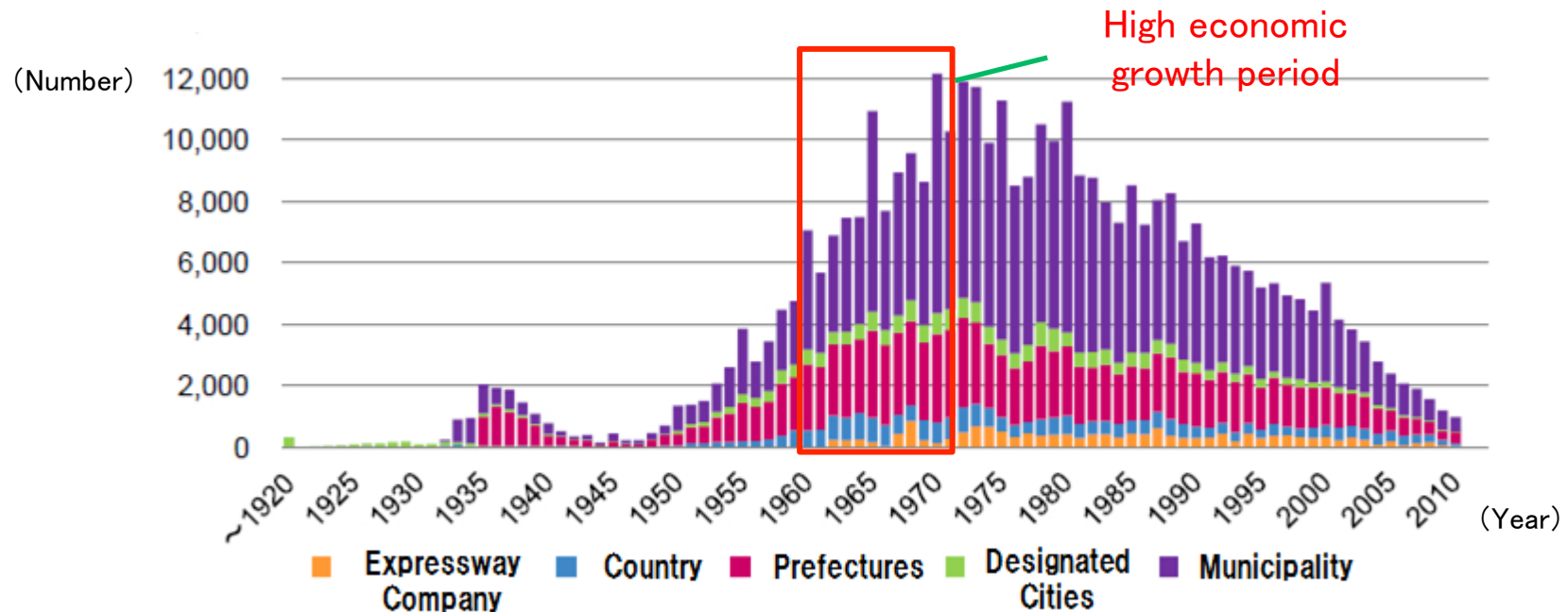
RESEARCH FOR GENERATING 2D-DRAWINGS OF SUPERSTRUCTURE IN HIGHWAY BRIDGE

Graduate School of Informatics, Kansai University ©Wenyuan
Jiang

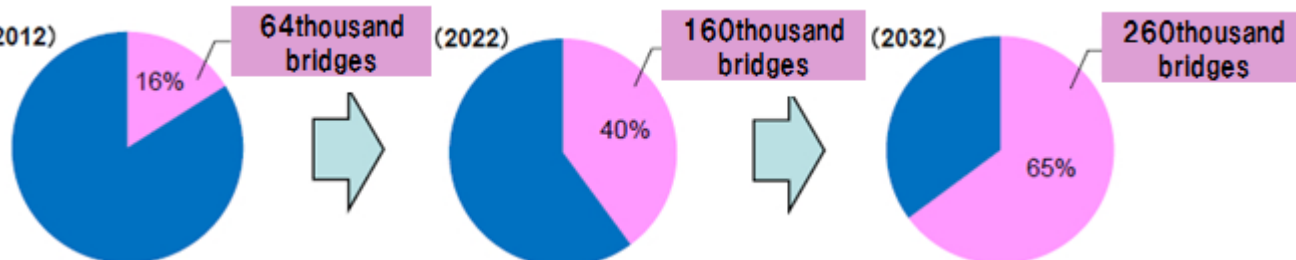
Faculty of Informatics, Kansai University
Shigenori Tanaka

Background(1/3)

□ Status of highway bridges in Japan



Number of bridges built (2012)
over 50 years



(【Source】 MLIT.: The current status of bridges in Japan)

Background(2/3)

- Concerning those highway bridges
 - Various damage
 - Effective and feasible maintenance plans



Corrosion of concrete

(【Source】Metropolitan Expressway
Company Limited : Shuto Expressway)

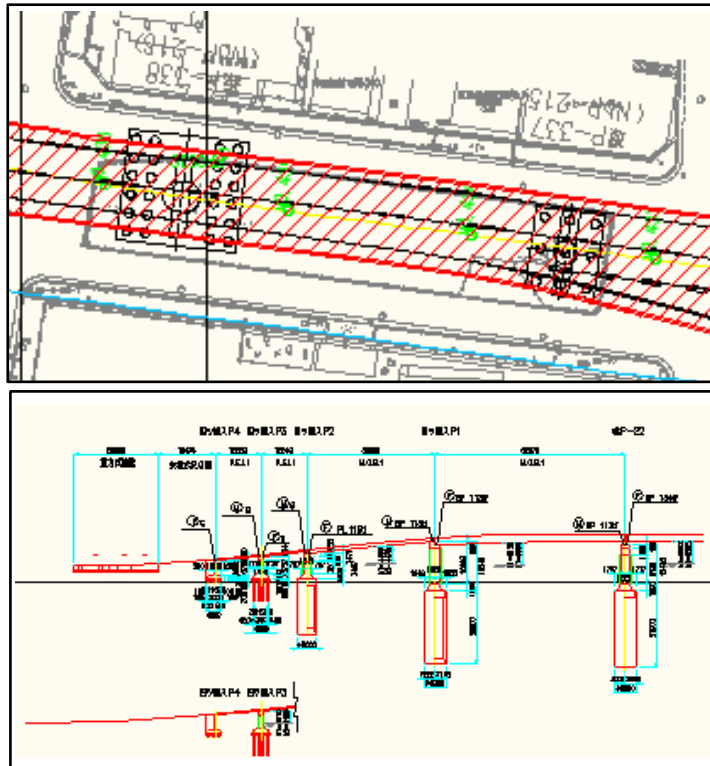


Gap of bridge joint

(【Source】East Nippon Expressway
Company Limited : Sendai Expressway)

Background(3/3)

- To ensure maintenance plans
- Current status drawings



Maintenance works of Hanshin Expressway
([Source] Hanshin Expressway Company Limited:
Construction of fresh-up on Ikeda route)

Problems (1/2)

- Document retention period of construction drawings
 - 30 years (About new guidelines of delivery by MLIT.)
- Media of drawings of highway bridges
 - Paper media before 1970's
 - Electronic delivery began in 2001
- Status of drawings
 - Disposed

The demands of maintenance plan:
Regeneration detail drawings

Image of
disposing drawings



Problems (2/2)

- Concerning regenerating detail drawings
 - Range of maintenance : Over several thousand meter
 - Status of highway bridge : Many vehicles are running on it
 - Result of field surveying : Road closure



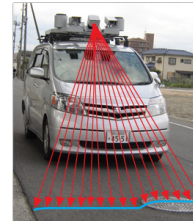
Problem: Huge Costs

Image of road closure

Previous Research

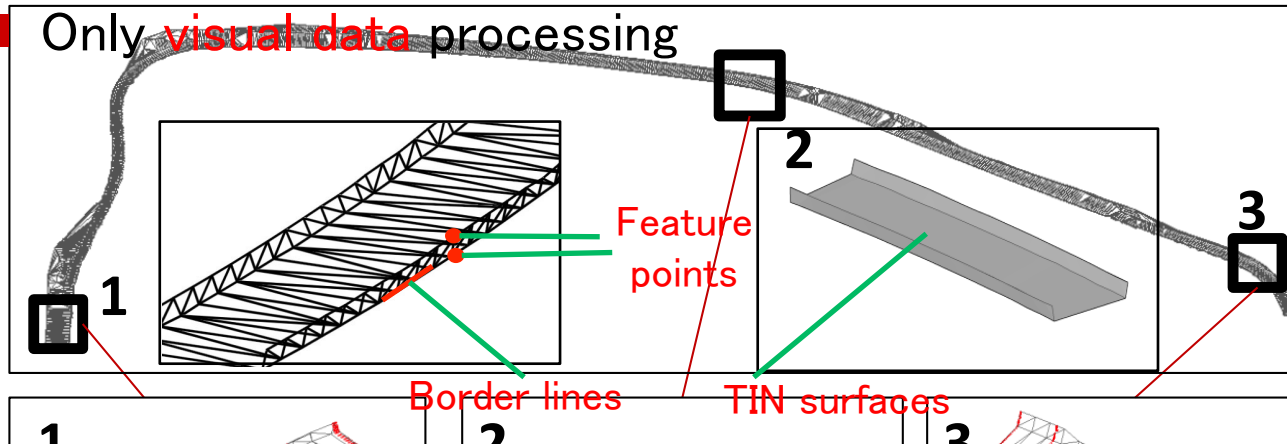
☐ To reduce the cost of field surveying

- Mobile Mapping System (MMS)
- Generate drawings in a low cost



☐ Issues of these research

- Only **visual data** processing

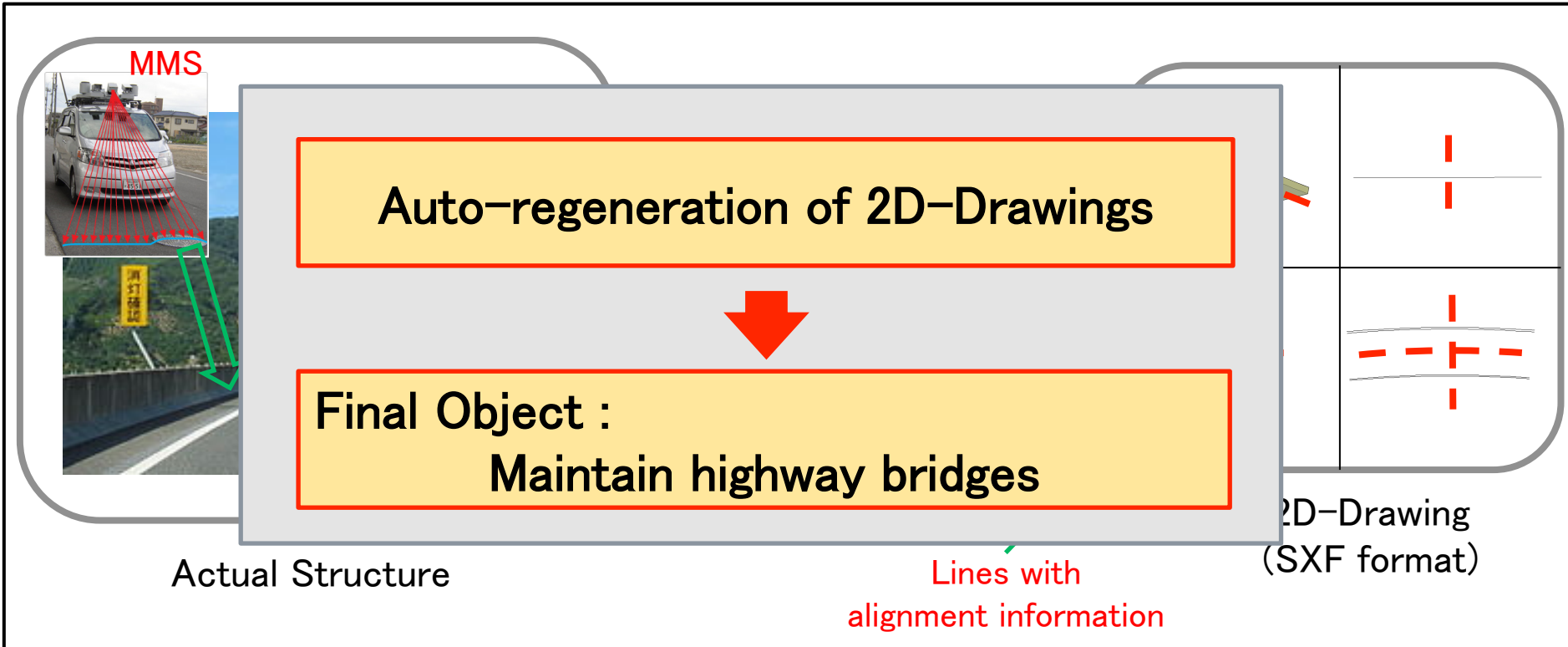


Problem for maintenance:

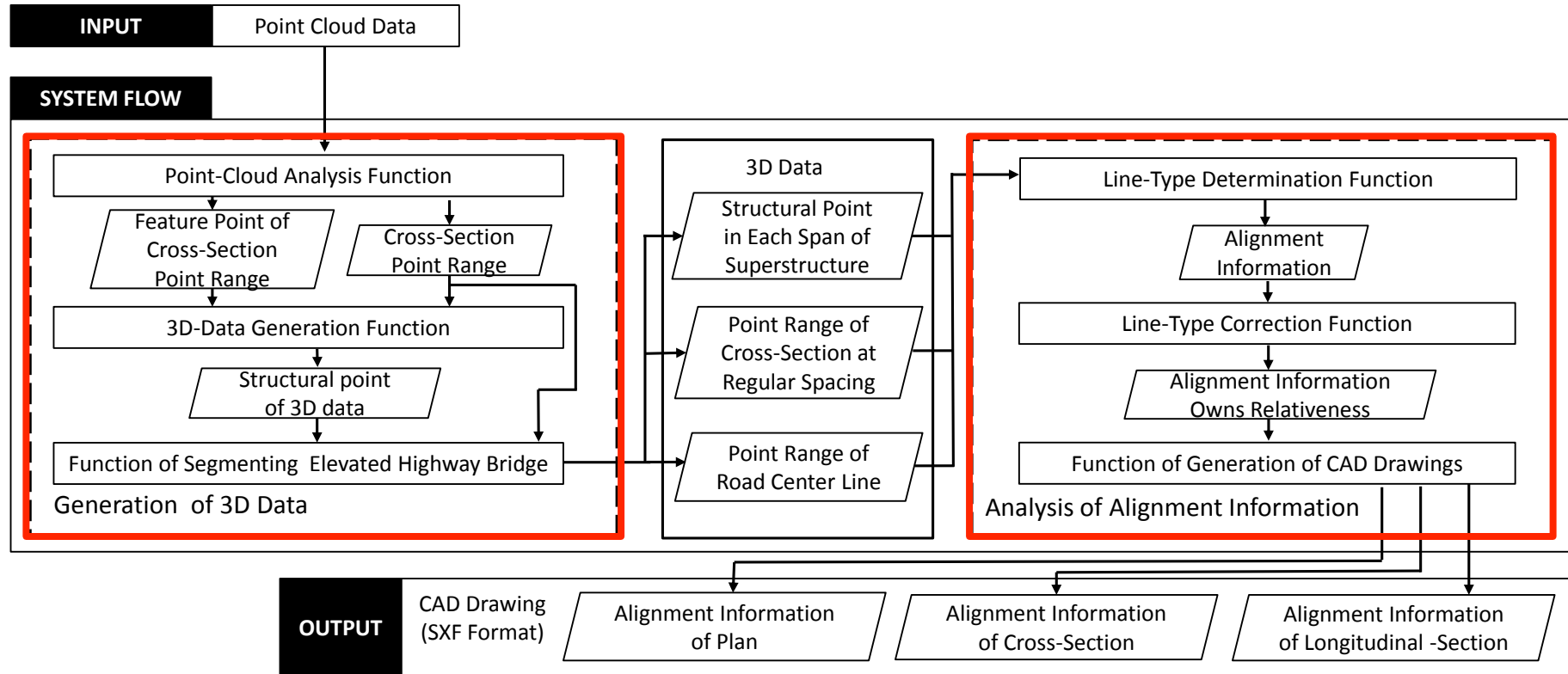
No alignment information

Research Object

- Regenerate CAD drawings
 - Extract alignment vector information
 - Use point cloud data of MMS



System Flow(1/7)

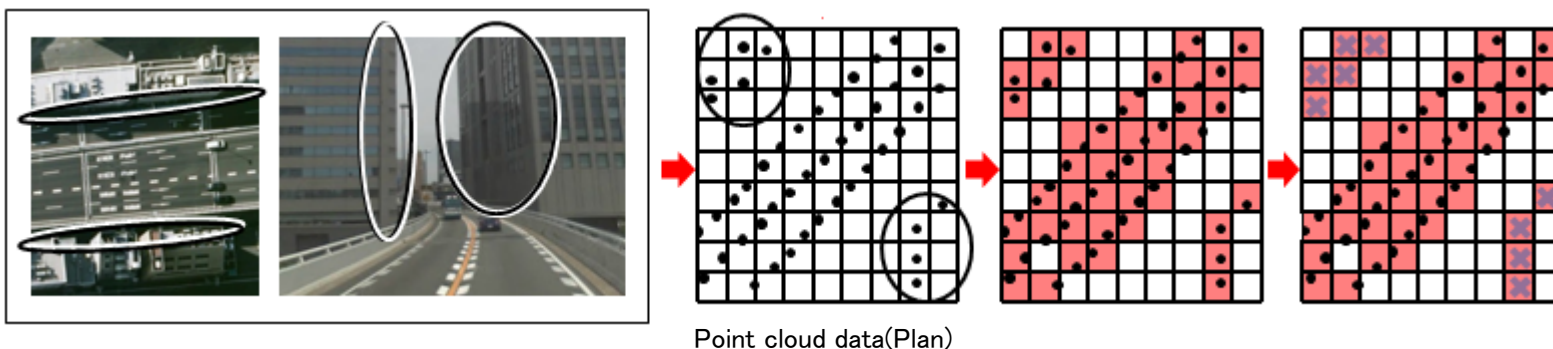


System Flow(2/7)

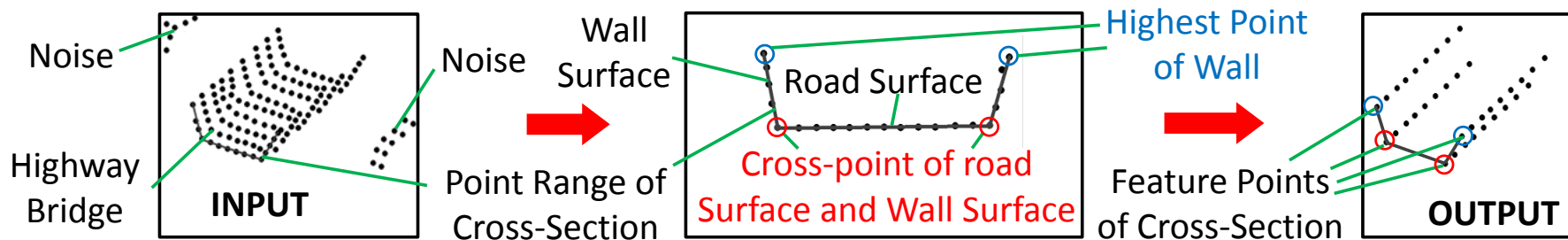
Point-Cloud Analysis Function
3D-Data Generation Function
Function of Segmenting Elevated Highway Bridge
Generation of 3D Data

□ Point-Cloud Analysis Function

Noise Reduction



Feature Points Extraction



System Flow(3/7)

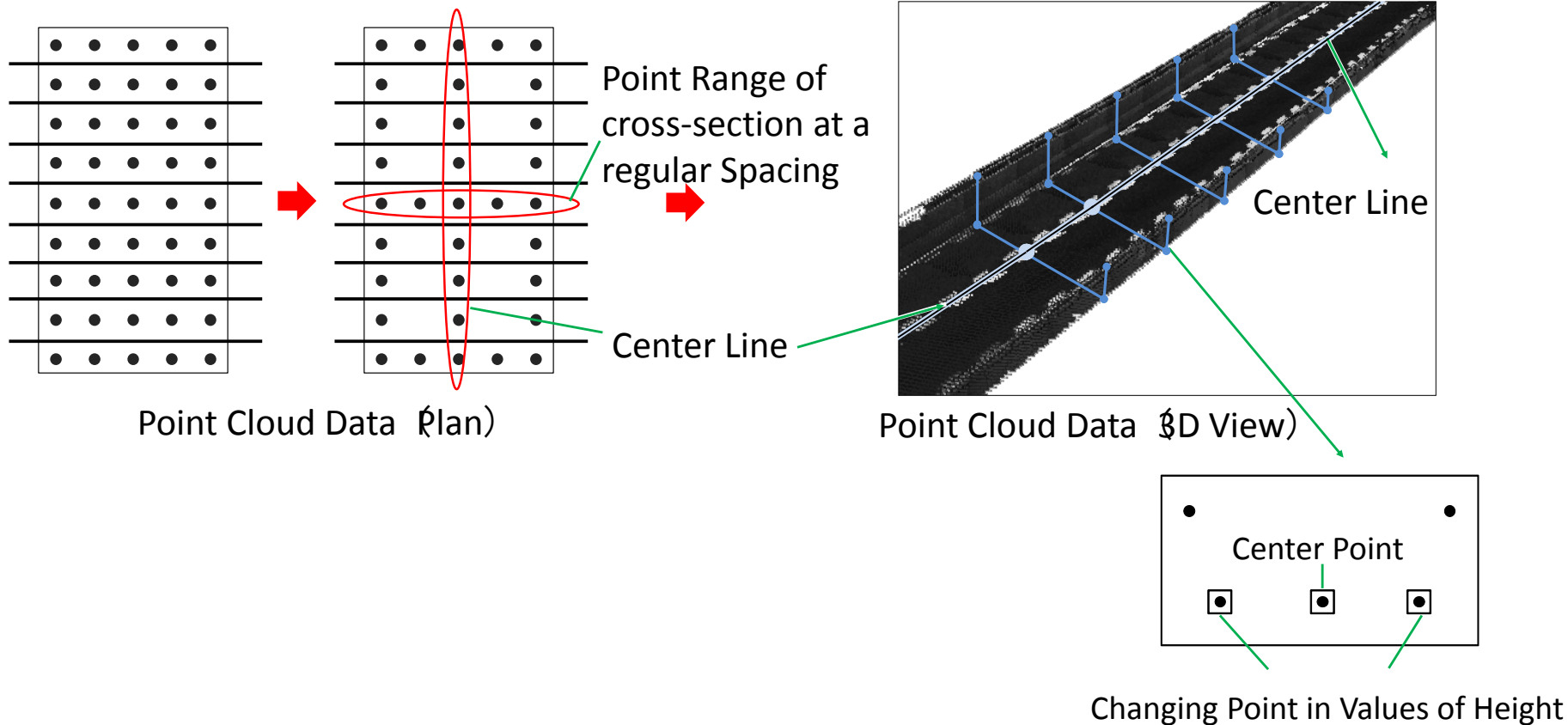
Point-Cloud Analysis Function

3D-Data Generation Function

Function of Segmenting Elevated Highway Bridge

Generation of 3D Data

□ 3D-Data Generation Function

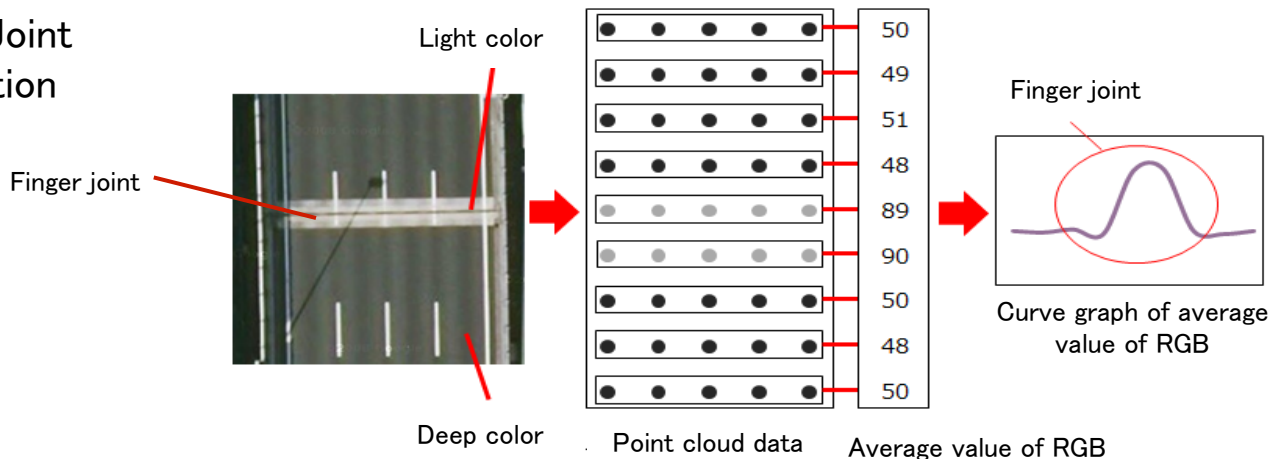


System Flow(4/7)

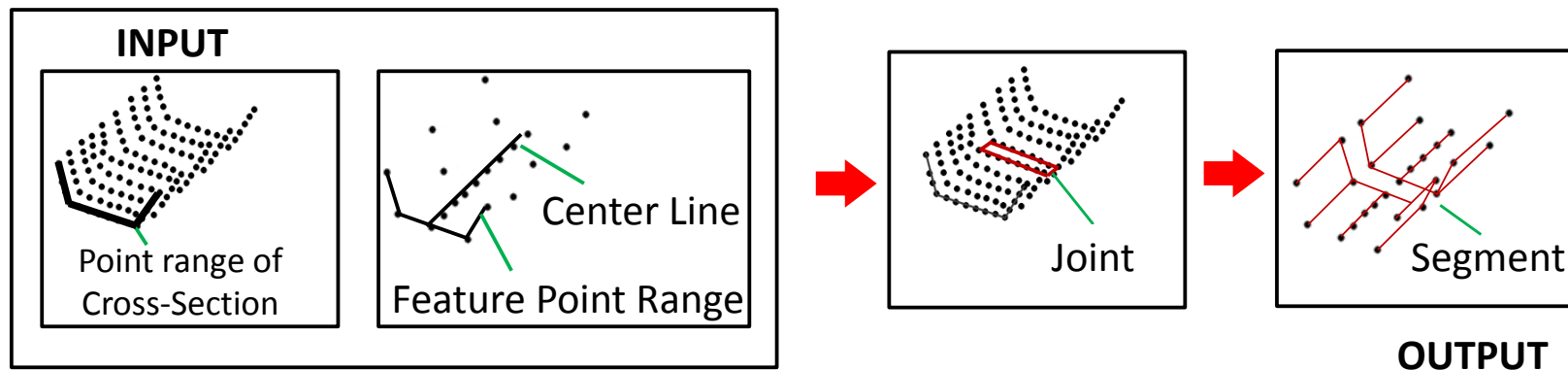
Point-Cloud Analysis Function
3D-Data Generation Function
Function of Segmenting Elevated Highway Bridge
Generation of 3D Data

□ Function of Segmenting Elevated Highway Bridge

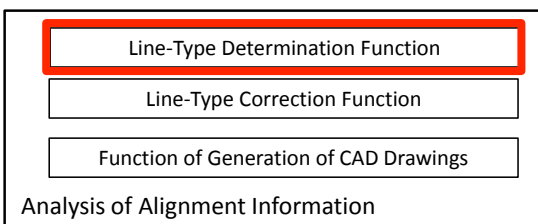
Finger Joint
Extraction



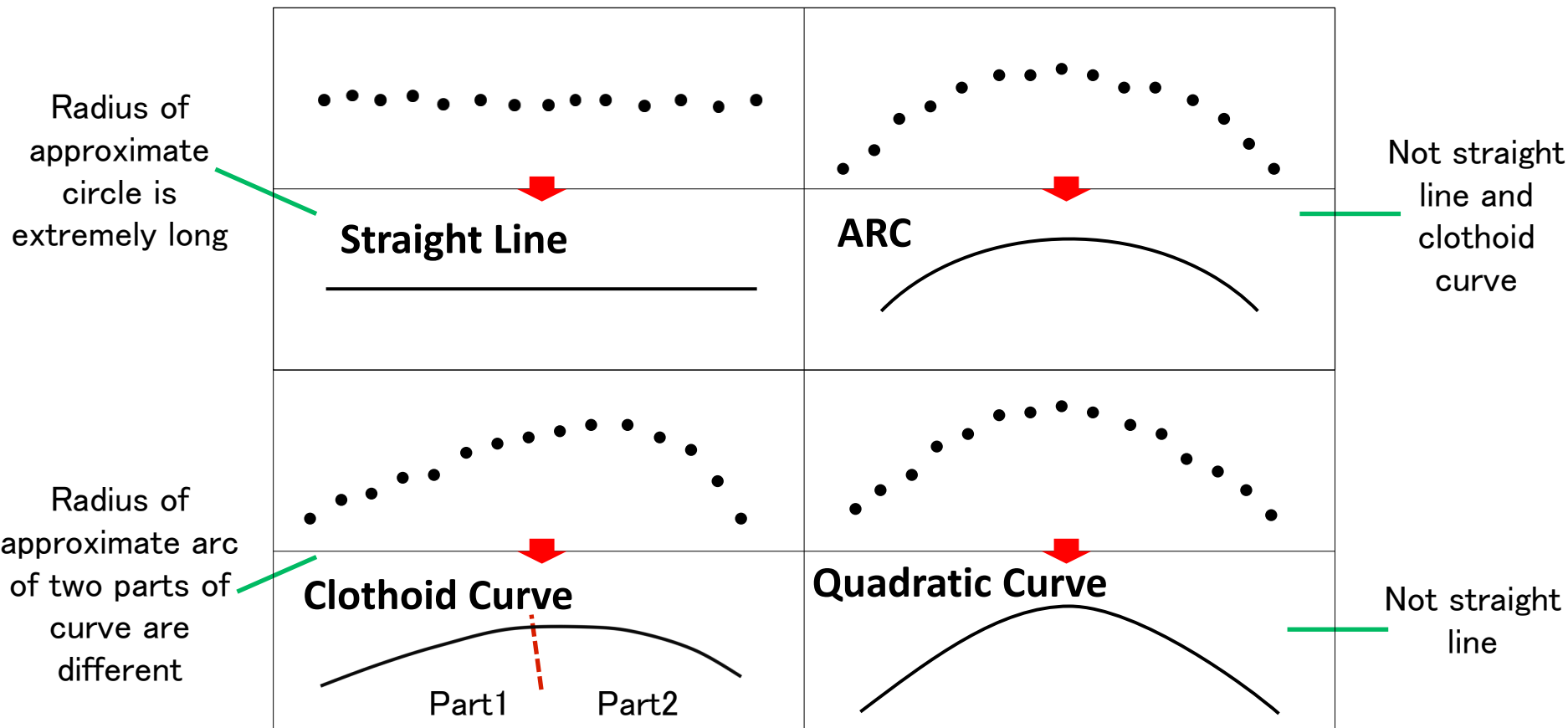
Segmentation



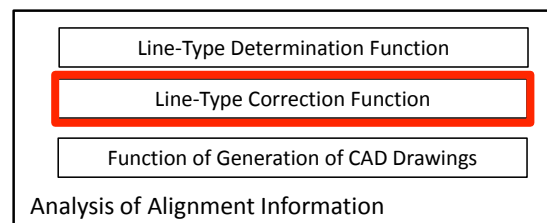
System Flow(5/7)



□ Line-Type Determination Function

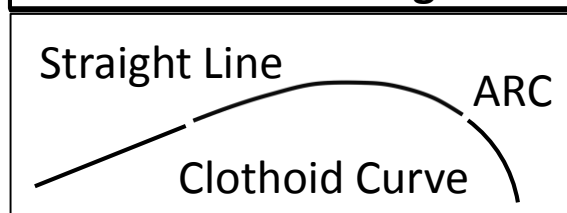


System Flow(6/7)

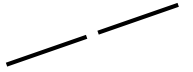



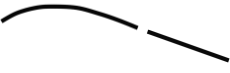

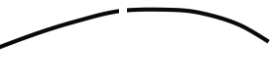
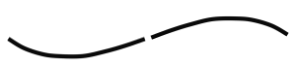


□ Line-Type Correction Function

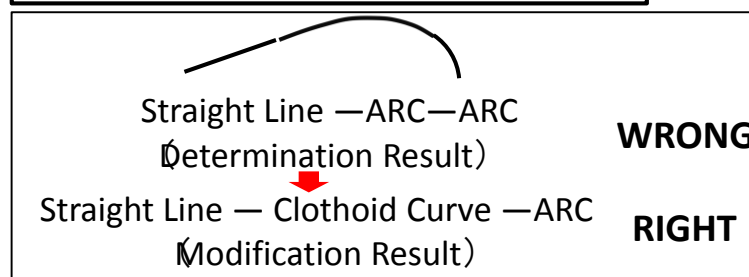
Feature of Road Alignment



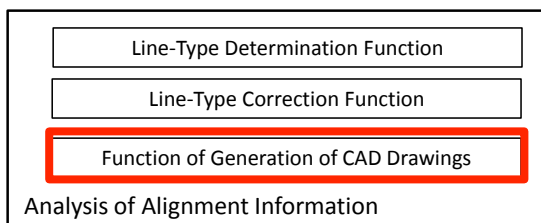
8 Linking Patterns

 Straight Line Linked with Straight Line	 Straight Line Linked with Clothoid Curve	 Arc Linked with Arc	 Arc Linked with Clothoid Curve
 Clothoid Curve Linked with Straight Line	 Clothoid Curve Linked with Arc	 Clothoid Curve Linked with Clothoid Curve	 Clothoid Curve Linked with Clothoid Curve

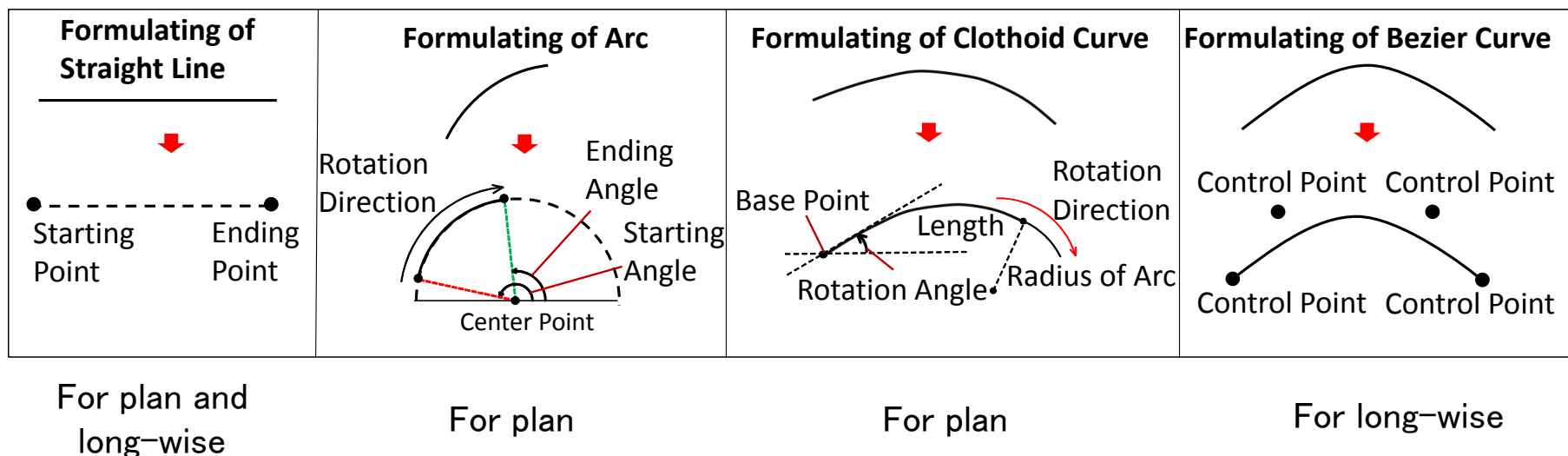
Line-Type Correction Function



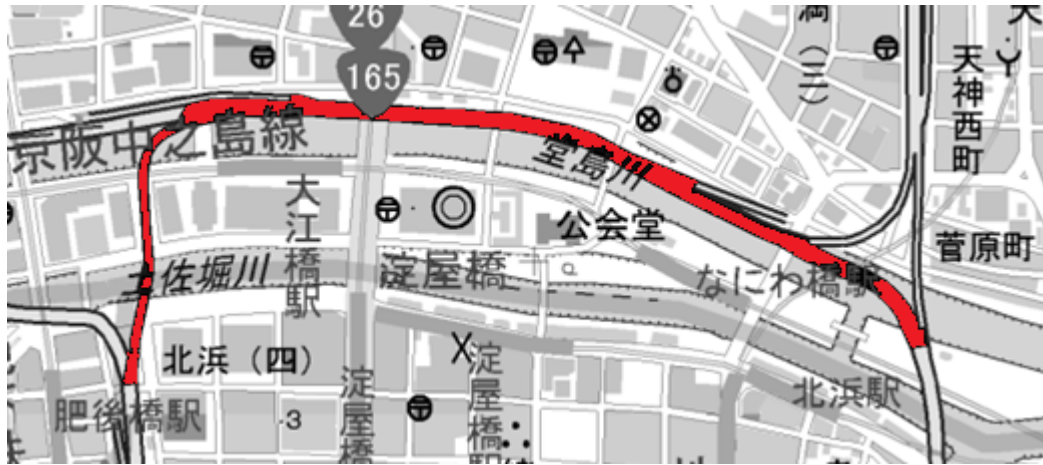
System Flow(7/7)



□ Function of Generation of CAD Drawings



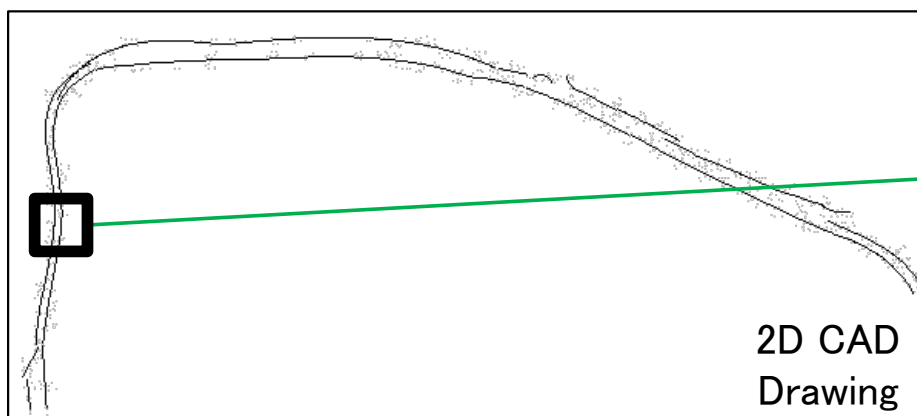
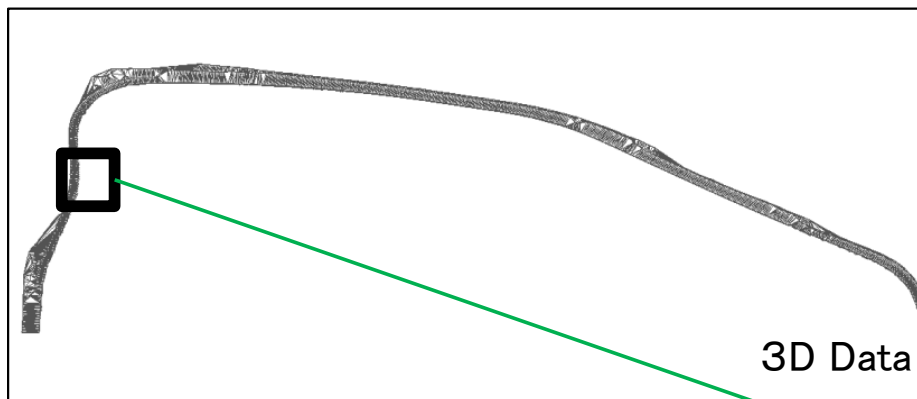
Experiment and Result(1/3)



Part of Route 1 Loop Route
(Osaka)

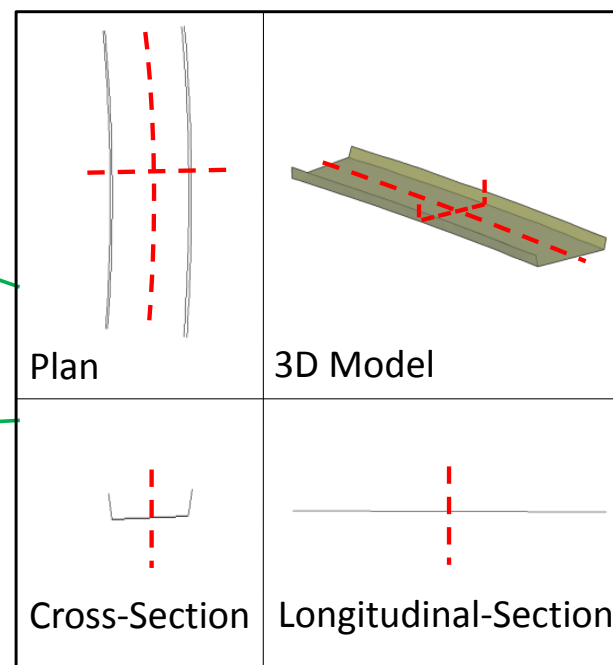


Experiment and Result(2/3)

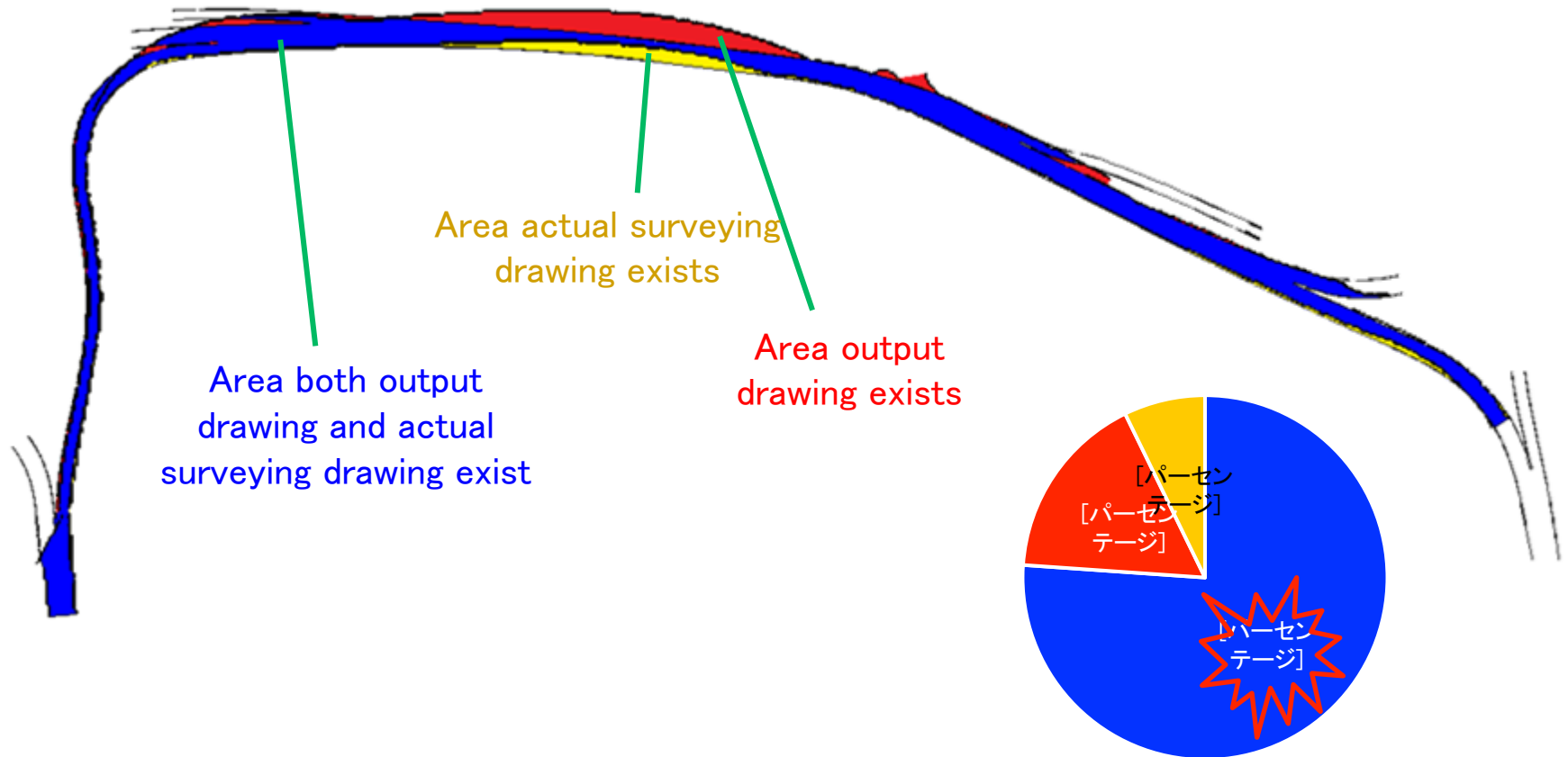


Experiment Result

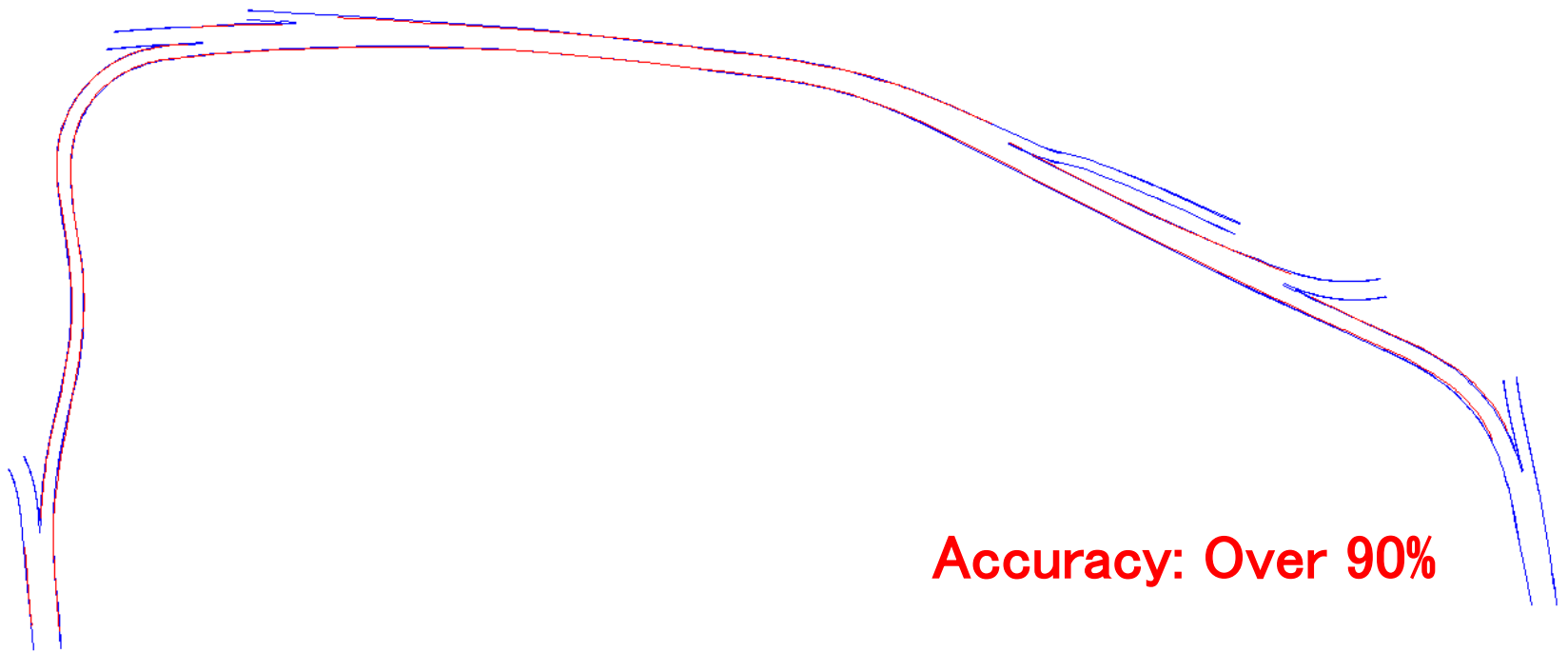
Number of evaluation points	168Points
Error range less than 10cm	113Points
Degree of approximation	67.26%



Experiment and Result(3/3)



Recent Result

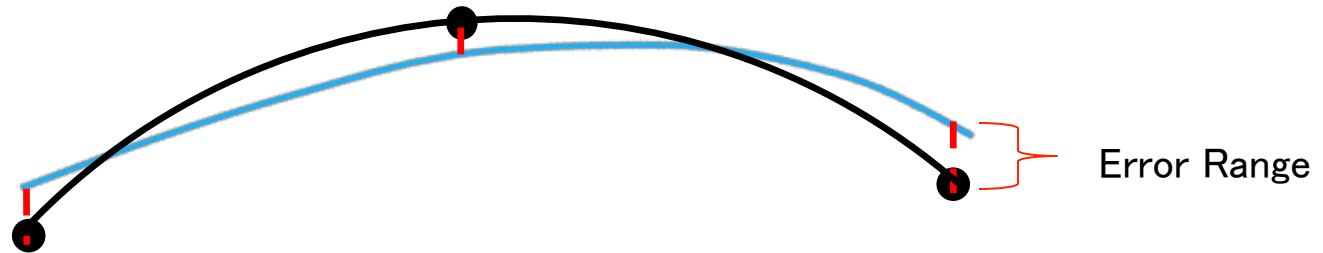


Conclusions

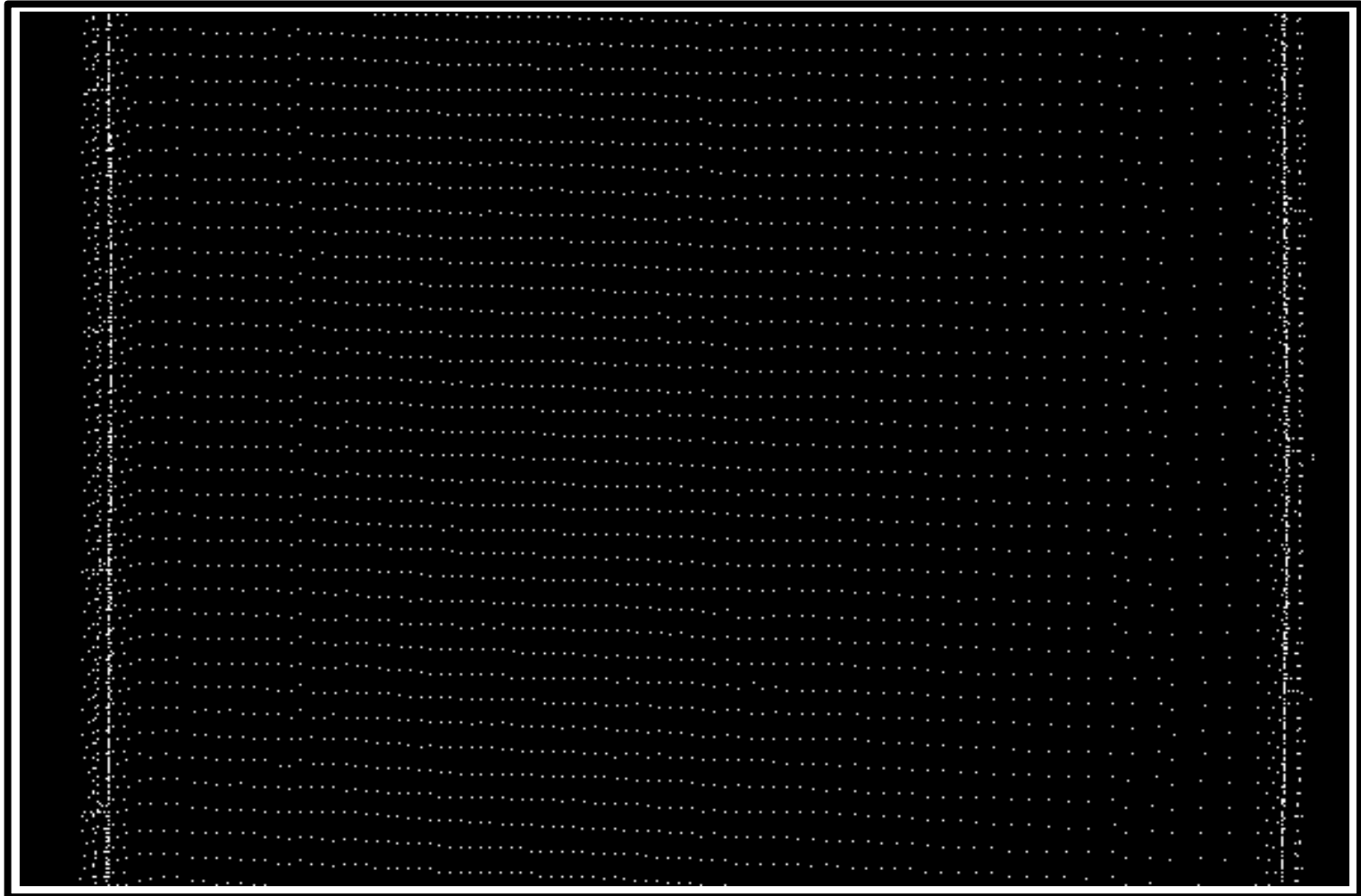
- Generate 2D CAD-Drawing by a method of extracting alignment information
- In the future
 - Improve the precision of alignments
 - Verify the applicability to practical business
- Final purpose
 - Municipalities in Japan can use output drawings of our system to maintain their highway bridges

Thank you for your attention

Evaluation Points and Error Range



Point Cloud Data



Recent Result

