목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

-한국도로공사-

REV	DESCRIPTION	BY	DATE
3	Issued for 4th 3D Scanning Data	K.DY	2018.01.30
2	Issued for 3rd 3D Scanning Data	K.DY	2017.12.01
1	Issued for 2nd 3D Scanning Data	K.DY	2017.06.21
0	Issued for 1st 3D Scanning Data	K.DY	2017.02.09

CSS Engineering & Consulting Firm

ChungAmE&C

3D Scan Surveying & Monitoring Analysis by

LongtermENG™

522, 70 Dusanro, Geumcheongu, Seoul, KR

+82 2 2169 2965 측량업등록 #04-003780

SCALE:	AT A3 UNO
MATERIAL:	AS SPECIFIED
ISSUED:	2018.02.05
3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No: 한국도로공사

DRAWING NUMBER: No.000

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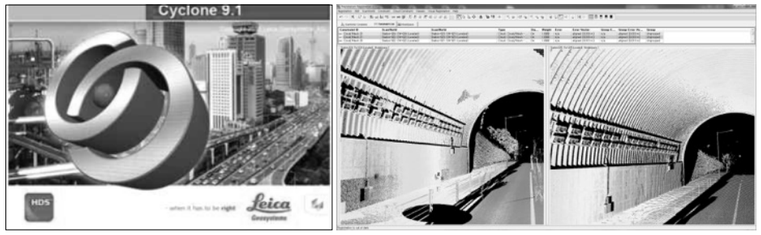
I. 3D Scan Method General Information

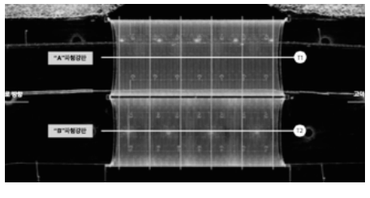
- 3D Laser Scan은 LiDAR (Li(ght) D(etection) A(nd) R(anging)) 방식으로 최대 초당 1,000,000 point의 Point Cloud Data(점군데이터)를 수집하는 방식임.
- 기존 측량의 단일 측점 개념이 아닌 Point Cloud Data(점군데이터)는 XYZ좌표, Intensity 및 RGB값을 보유하고 있음.
- 3D Scan되어 수집된 Point Cloud Data의 XYZ + Information Data를 Post Processing (Import, Conformation, Unify)을 통하여 대상체의 Distance, Elevation, Volume 등을 측정할 수 있음.
- Point Cloud Rendering, Contours Parameter, , Real Image Mapping, 3D Modeling을 통하여 대상체의 실체와 계획, 진행상황의 Data base의 비교 분석이 가능함.
- Point Cloud Data를 통하여 Post Processing을 통한 Noise Control 이후 3D Modeling을 통한 실대상체와 계획대상체 또는 가상대상체의 정확한 합성 가능하게 함으로써 BIM(Building Information Modeling) 적용가능.
- Point Cloud Data는 2D, 3D CAD프로그램 데이터 포맷으로 변환이 가능함. (DXF, DGN, XYZ, NEZ, TXT, PTX, ASCII..)

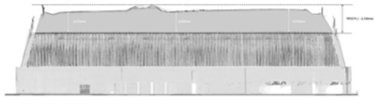
II. 파형강판 3D Scan General Information

- 파형강판 구조물의 변위를 측정하기 위하여 최소 내측 및 외측에서 5개 이상의 3D Scan 위치를 선정하여 실시한다.
- 3D Scanning 시 Point Cloud Data(점군데이터)와 내장된 카메라를 활용한 이미지 동시 취득을 실시하며, 병합을 진행한다. 이미지 취득시 외장형 고해상도 카메라를 병행 활용한다.
- 3D Scan Data는 전용 프로그램인 Leica Cyclone을 활용하여 정합과정을 실행한다.



- 최초 스캔시의 스캔위치는 부동의 대상체 3지점(회차별 중첩을 위한 기준점(Control Point)) 이상이 확보되는 위치를 선정한다.
- 정합된 데이터의 노이즈를 제거하며, 파형강판의 조립이후 뒤채움 전에 구조물 내·외측에서 5개 이상의 3D 스캔 위치를 선정하여 실시한다.
- Scan 실시 요청에 대하여 뒤채움중 및 뒤채움 완료, 공용중 파형강판 구조물의 변위 계측을 실시하며, 최초 데이터와 비교하여 보고서를 제출한다.
- 파형강판 변위계측 보고서의 기준은 “최대허용 변위: 국토교통부, 도로공사 표준시방서 2016, 5장 2-3 파형강판 암거 3.4 단면 변화측정” 으로 한다.
- 변위 측정을 위하여 종방향 절개위치 (Section Divided)는 최소 7.5m, 최대 30m로 하며, 횡단면의 변위는 그림과 같이 원설계 단면형상의 측정부위를 참고하여 변위 계측값을 산정한다. 요청시에 변경할 수 있다.





III. 3D Scan Equipment Specification

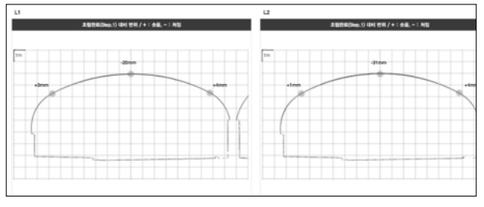
Model	Leica ScanStation P30
측정 거리	120m
측정 속도	1,000,000 points / sec.
측정 오차	3mm at 50m

Leica Geosystems
Calibration Certificate Blue
Calibration Certificate Blue without measurement values issued by Manufacturer
Product ScanStation P30
Article No. 809887
Serial No. 1850415
Equipment No. 6820178
Issued by Manufacturer
Leica Geosystems AG
Wilrijkei
Switzerland
Certificate No. 1850415-22102015
Inspection Date 2015.10.22
Order No.
PO No.
Ordered by
Customer
Compliance
The Calibration Certificate Blue without measurement values issued by Manufacturer corresponds to the Producer Inspection Certificate O in accordance with DIN SS 350 Part 18-4.2.1.
Certificate
We hereby certify that the product described has been tested and complies with the specifications of the product. The test equipment used is traceable to national standards or to recognized procedures. This is established by our Quality Management System, audited and certified to ISO 9001 by an independent national accredited certification body.
Leica Geosystems AG
2015.10.22
Simon Melcher
Manager
Patrick Kuhl
Team Leader
Leica Geosystems AG
Heinrich-Wild-Strasse
9435 Heerbrugg
Switzerland
Telephone +41 71 727 31 31
www.leica-geosystems.com

** Calibration certification number: 1850415-22102015*

IV. Post-Processing Output

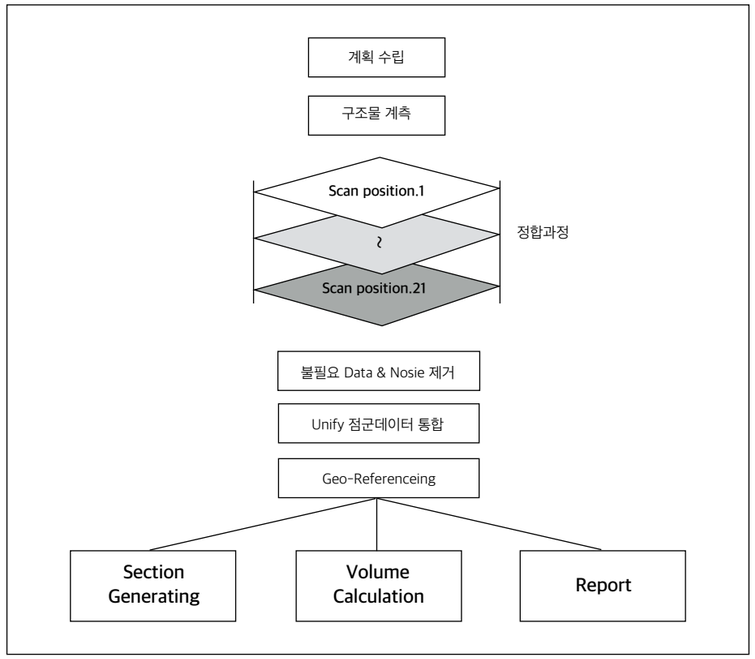
- Leica Cyclone은 3D Scanning으로 취득된 대용량 Point Cloud Data의 정합과 Noise 제거, 실측 수치 확인 등의 기능과 Section 기능을 통해 구성체를 단면별로 Divided하여 세밀한 부분의 수치화가 가능함.
- Cloudworx는 Cyclone에서 정합된 Point Cloud Data를 CAD 시스템으로의 연동을 지원하며, 다양한 Modeling 및 목적에 맞는 구성체의 CAD Data를 구성할 수 있음.



- TruView는 웹 시스템 기반의 Scan Data Viewer로 3D Scan으로 취득된 Point Cloud Data와 고해상도 Image Mapping을 통하여 실제 구조체 현황 파악을 위한 Software. Elevation, Distance, Markup등의 기능을 통해 현장 상황에 대해 용이하게 파악이 가능함.

V. Workflow chart

pcl



VI. Structure Information and Check list

	기관 & 회사명	직책, 담당자
발주처	한국도로공사	-
시공사.1	-	-
시공사.2	-	-
감리단	-	-

	주관사	기간	담당자	확인자
1차 3D SCAN	LongtermENG	’17.02.09	이남호	우성호
2차 3D SCAN	LongtermENG	’17.06.21	이남호	우성호
3차 3D SCAN	LongtermENG	’17.12.01	이남호	우성호
4차 3D SCAN	LongtermENG	’18.01.30	이남호	우성호

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SCALE: AT A3 UNO
MATERIAL: AS SPECIFIED
ISSUED: 2018.02.05
3D SCAN CHK: W.SH
ANAYSIS CHK: L.NH

CUSTOMER AND PROJECT DETAILS:
pointcloudlibrary
한국도로공사
목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No: 한국도로공사
DRAWING NUMBER: No.001

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목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

-구조물 현황 정밀 계측-

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3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No: 한국도로공사

DRAWING NUMBER: No.002

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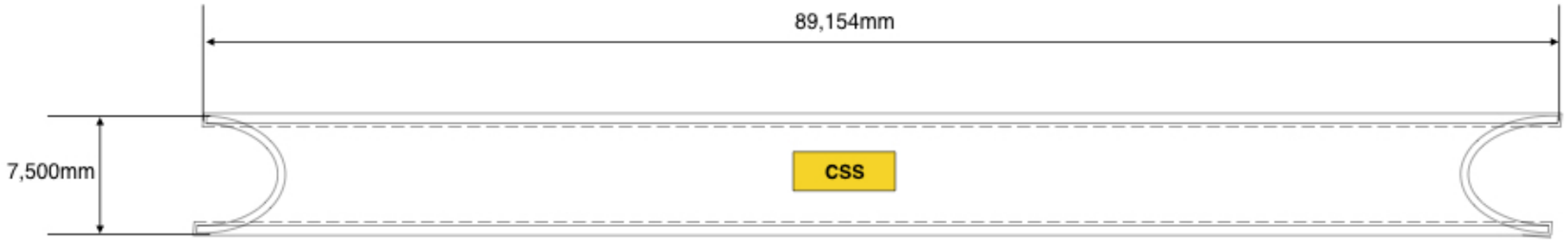
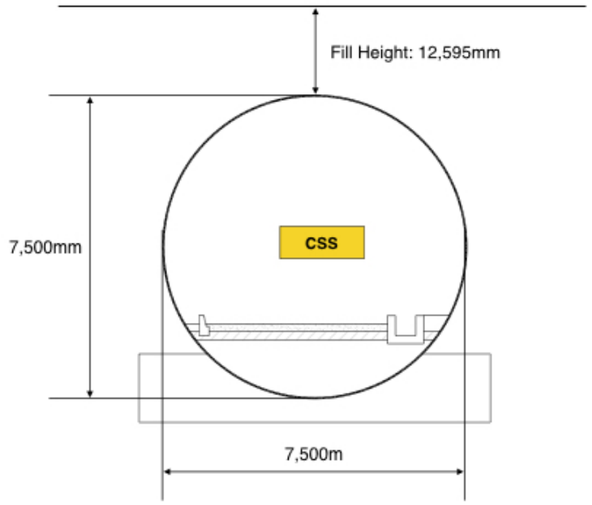
구조물 현황

- **현장명** 목포-광양 *6*공구 *4+982*
- **발주처** 한국도로공사
- **시공사** 한라건설
- **파형강판 Profile Type** 표준형 *150 by 50mm*

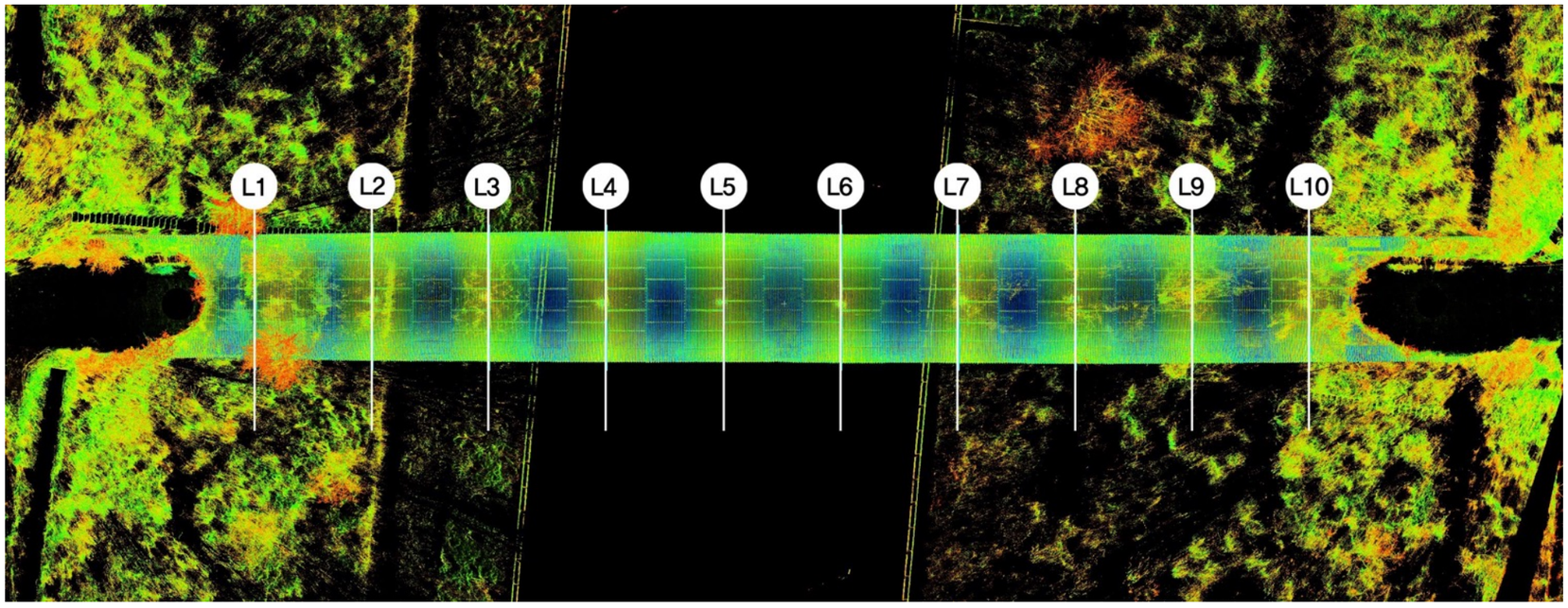


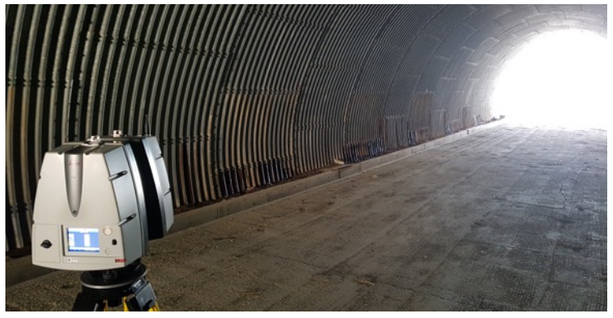


뒤채움 재료	다짐도	할선탄성계수
노상토	95%	12MPa

Material	7.0mm (fy:245MPa)
CSS Type	Pitch: 150mm Depth: 50mm

3차원 계측 진행





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ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

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DRAWING NUMBER: No.003

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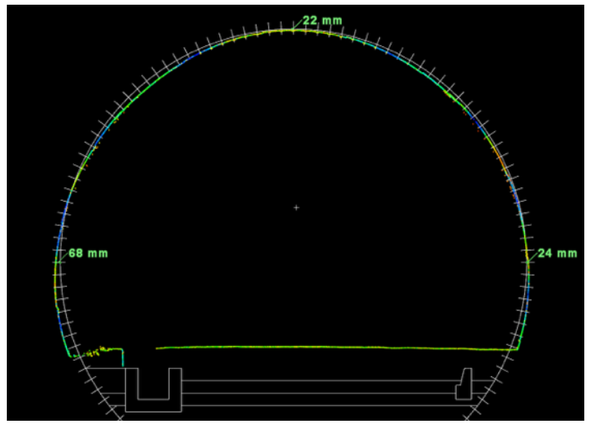
Displacement_Section



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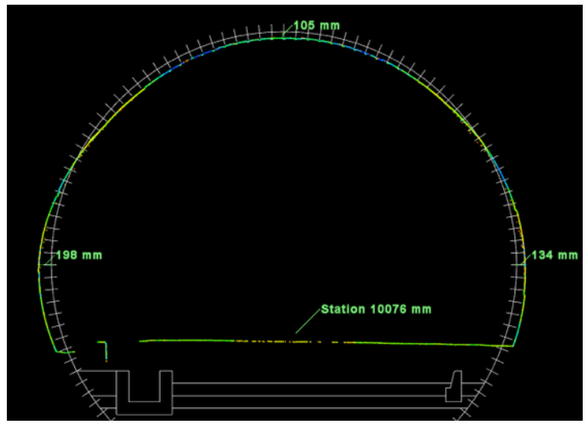

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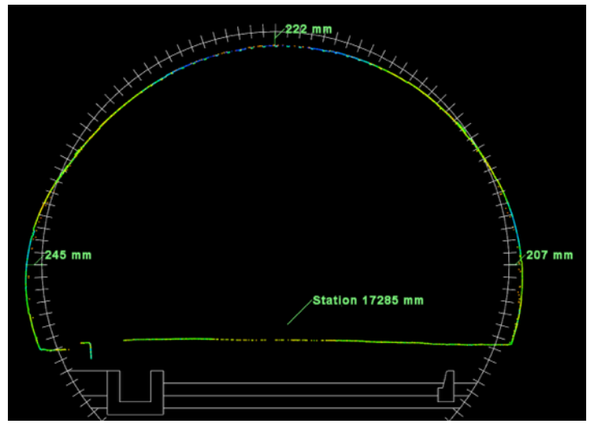

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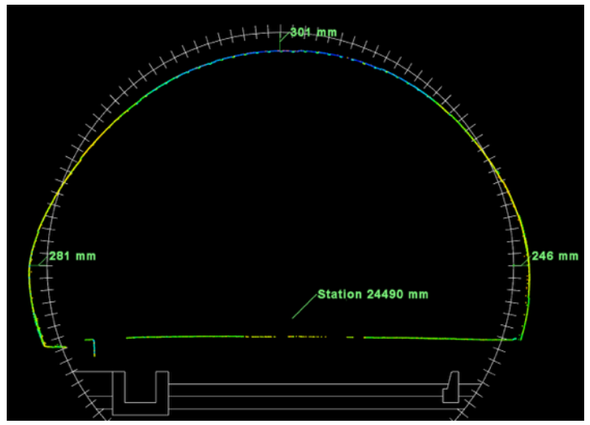

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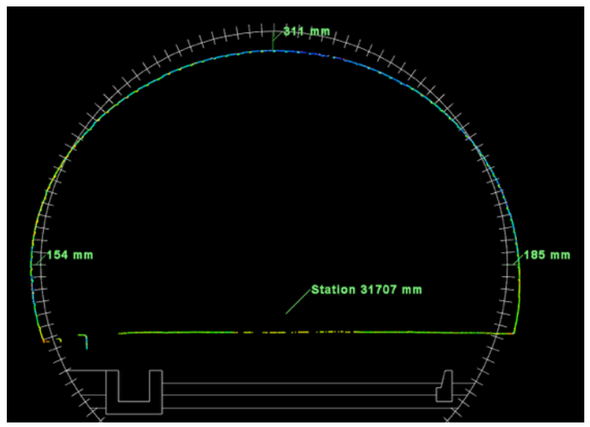

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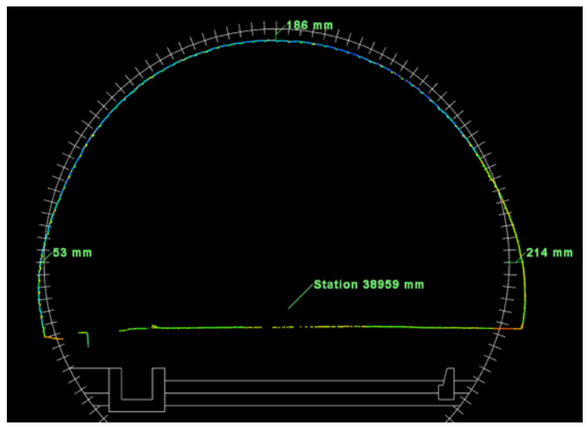

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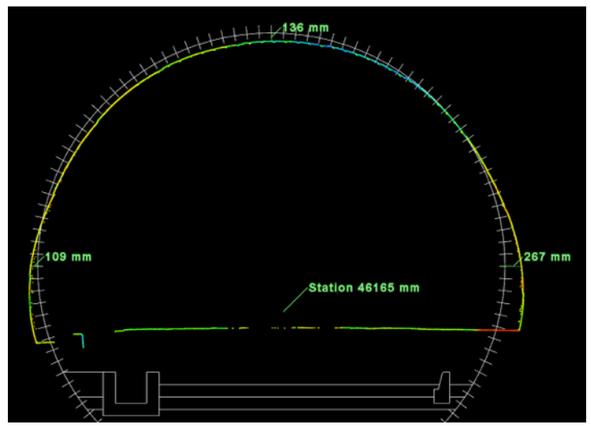

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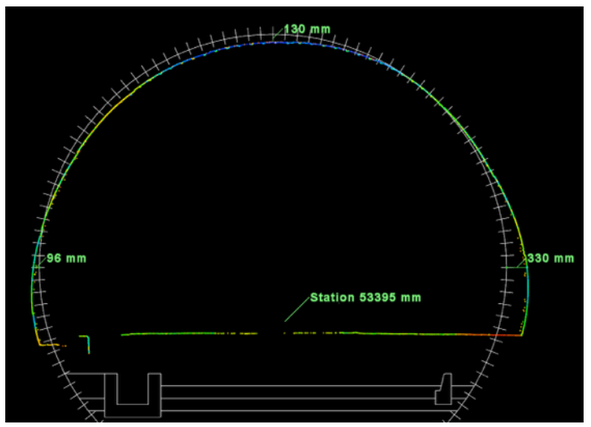

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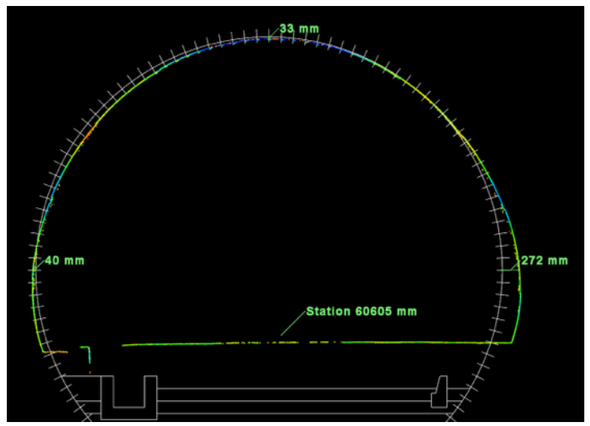

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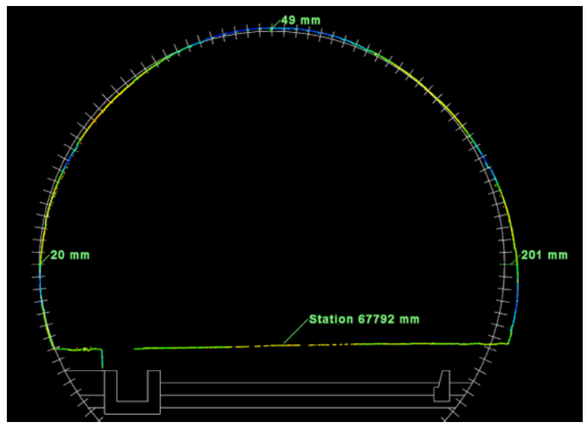

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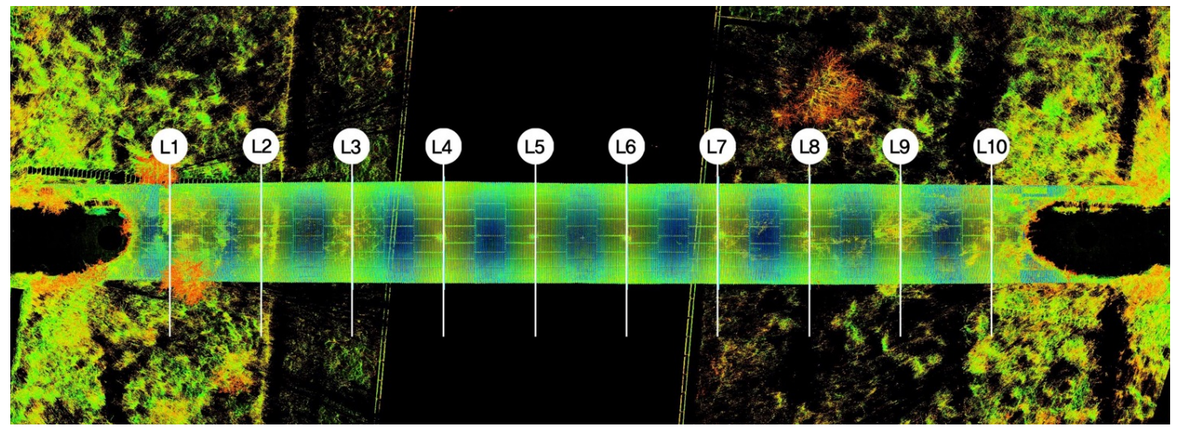

Monitoring Section Divide

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ANAYSIS CHK:	LNH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

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CUSTOMER REF. No: 한국도로공사

DRAWING NUMBER: No.004

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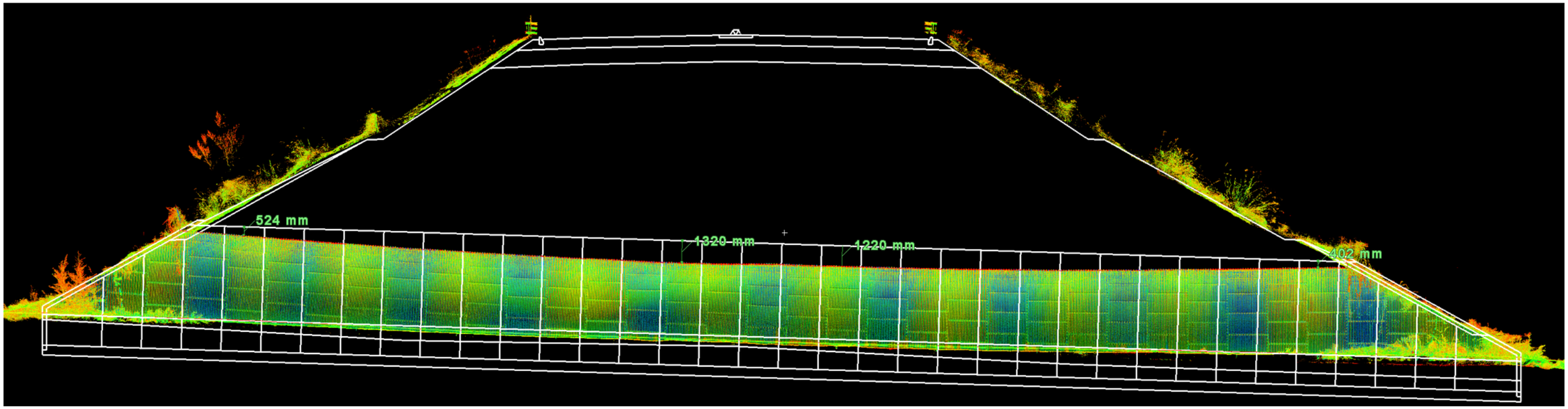
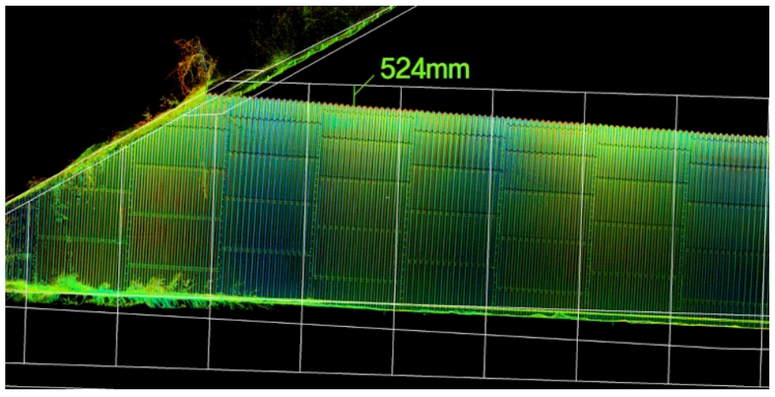
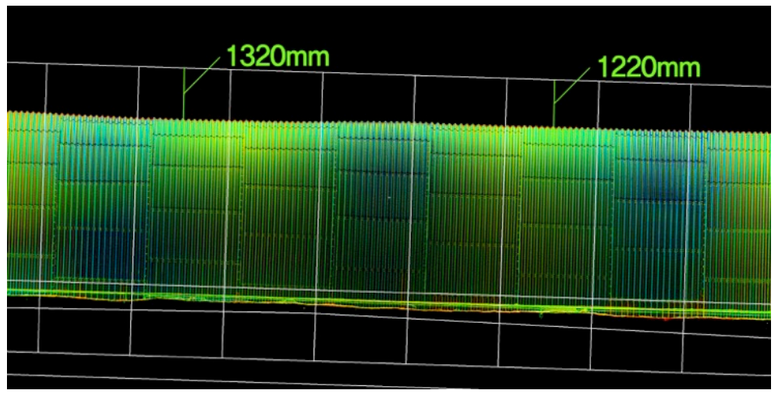
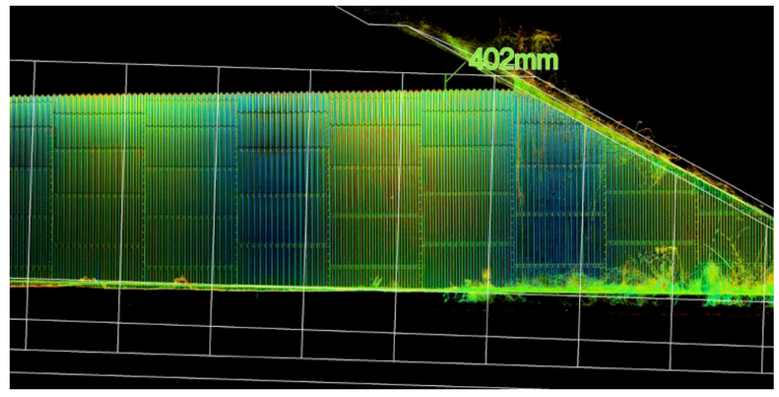
설계 대비 횡단면 변위

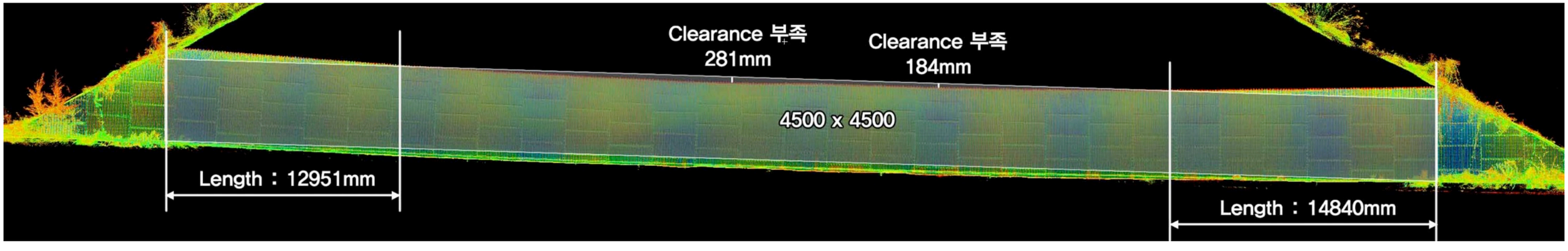








설계 Clearance



REV	DESCRIPTION	BY	DATE
3	Issued for 4th 3D Scanning Data	K.DY	2018.01.30
2	Issued for 3rd 3D Scanning Data	K.DY	2017.12.01
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CSS Engineering & Consulting Firm

ChungAmE&C

3D Scan Surveying & Monitoring Analysis by

LongtermENG™

522, 70 Dusanro, Geumcheongu, Seoul, KR

+82 2 2169 2965 측량업등록 #04-003780

SCALE:	AT A3 UNO
MATERIAL:	AS SPECIFIED
ISSUED:	2018.02.05
3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No: 한국도로공사

DRAWING NUMBER: No.005

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목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

-보강 구간 선정 및 최적단면 구성-

REV	DESCRIPTION	BY	DATE
3	Issued for 4th 3D Scanning Data	K.DY	2018.01.30
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3D Scan Surveying & Monitoring Analysis by

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+82 2 2169 2965 측량업등록 #04-003780

SCALE:	AT A3 UNO
MATERIAL:	AS SPECIFIED
ISSUED:	2018.02.05
3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No: 한국도로공사

DRAWING NUMBER: No.006

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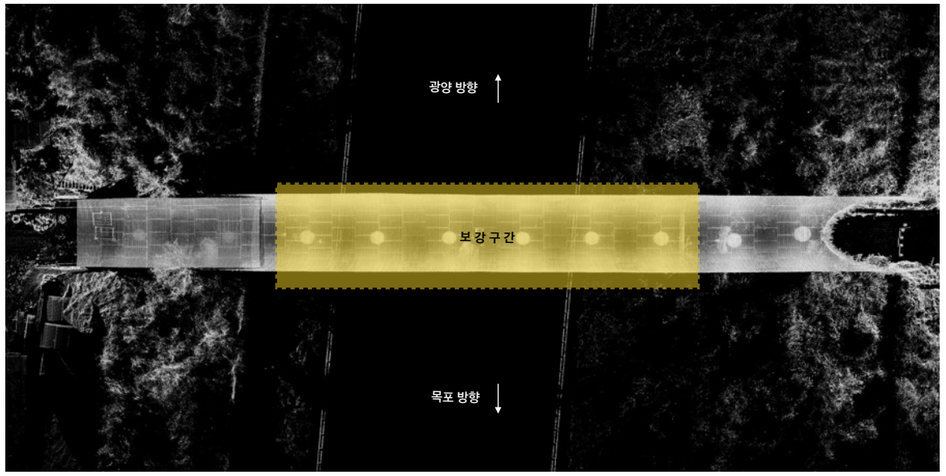
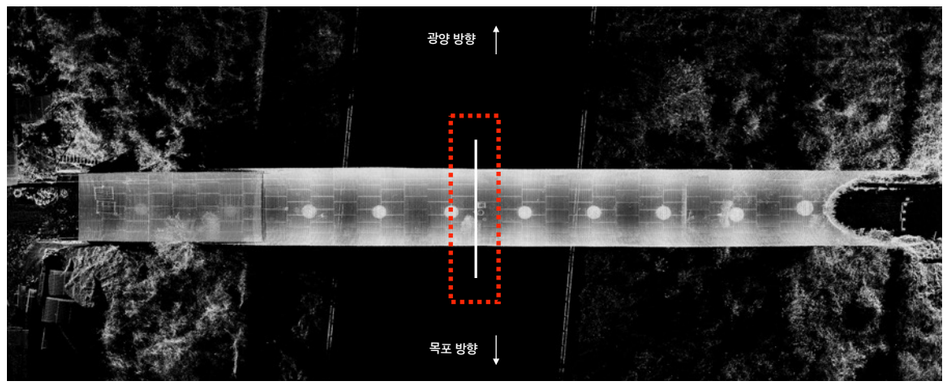
Keyplan



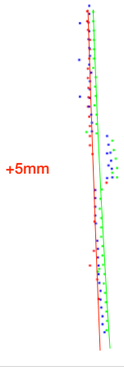
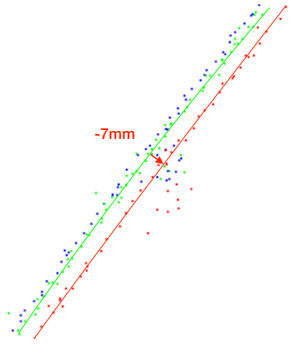
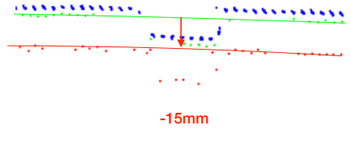
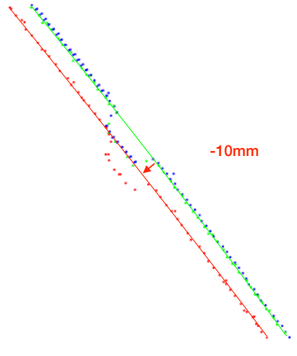
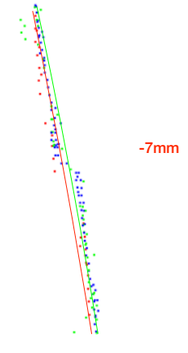


1차 Scan
2017/02/09

2차 Scan
2017/06/21

3차 Scan
2017/12/01

Monitoring Section Divide

C1	C2	C3	C4	C5
				

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CSS Engineering & Consulting Firm

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3D Scan Surveying & Monitoring Analysis by

LongtermENG™

522, 70 Dusanro, Geumcheongu, Seoul, KR

+82 2 2169 2965 측량업등록 #04-003780

SCALE:	AT A3 UNO
MATERIAL:	AS SPECIFIED
ISSUED:	2018.02.05
3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No: 한국도로공사

DRAWING NUMBER: No.007

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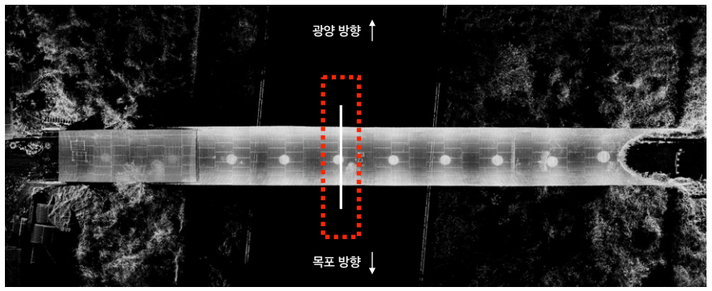
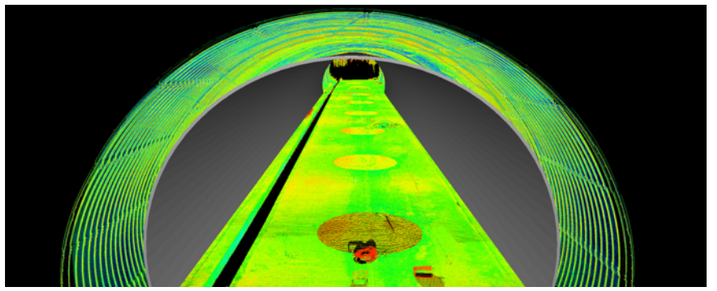
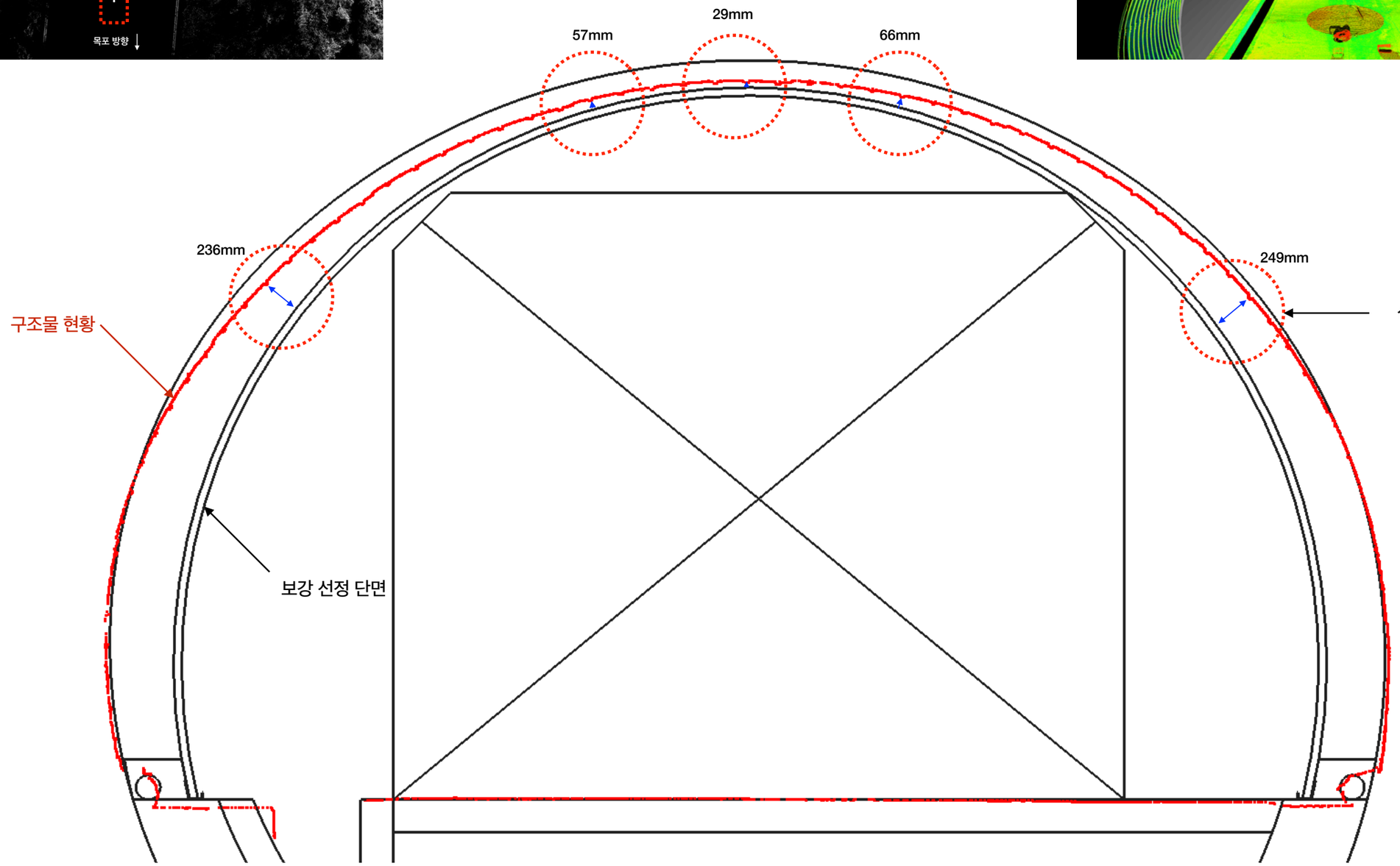
Keyplan



isometric view





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SCALE:	AT A3 UNO
MATERIAL:	AS SPECIFIED
ISSUED:	2018.02.05
3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No: 한국도로공사

DRAWING NUMBER: No.008

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목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

-보강 시공-

REV	DESCRIPTION	BY	DATE
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CSS Engineering & Consulting Firm

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3D Scan Surveying & Monitoring Analysis by

LongtermENG™

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+82 2 2169 2965 측량업등록 #04-003780

SCALE:	AT A3 UNO
MATERIAL:	AS SPECIFIED
ISSUED:	2018.02.05
3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No: 한국도로공사

DRAWING NUMBER: No.009

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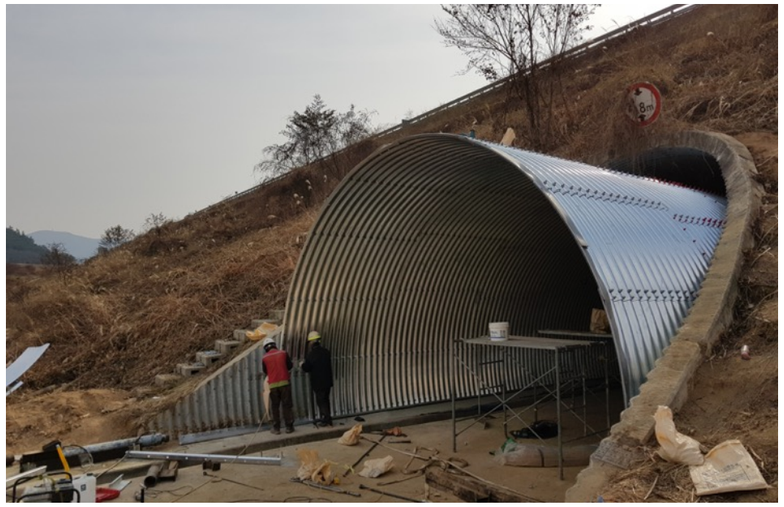
유도형 찬넬 설치



파형강판 조립

방수

파형강판 밀어넣기

거푸집 설치 및 콘크리트 타설

완료

REV	DESCRIPTION	BY	DATE
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SCALE:	AT A3 UNO
MATERIAL:	AS SPECIFIED
ISSUED:	2018.02.05
3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No:	한국도로공사	DRAWING NUMBER:	No.010

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목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

-보강 완료 후 구조물 정밀 계측-

REV	DESCRIPTION	BY	DATE
3	Issued for 4th 3D Scanning Data	K.DY	2018.01.30
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MATERIAL:	AS SPECIFIED
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3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No: 한국도로공사

DRAWING NUMBER: No.011

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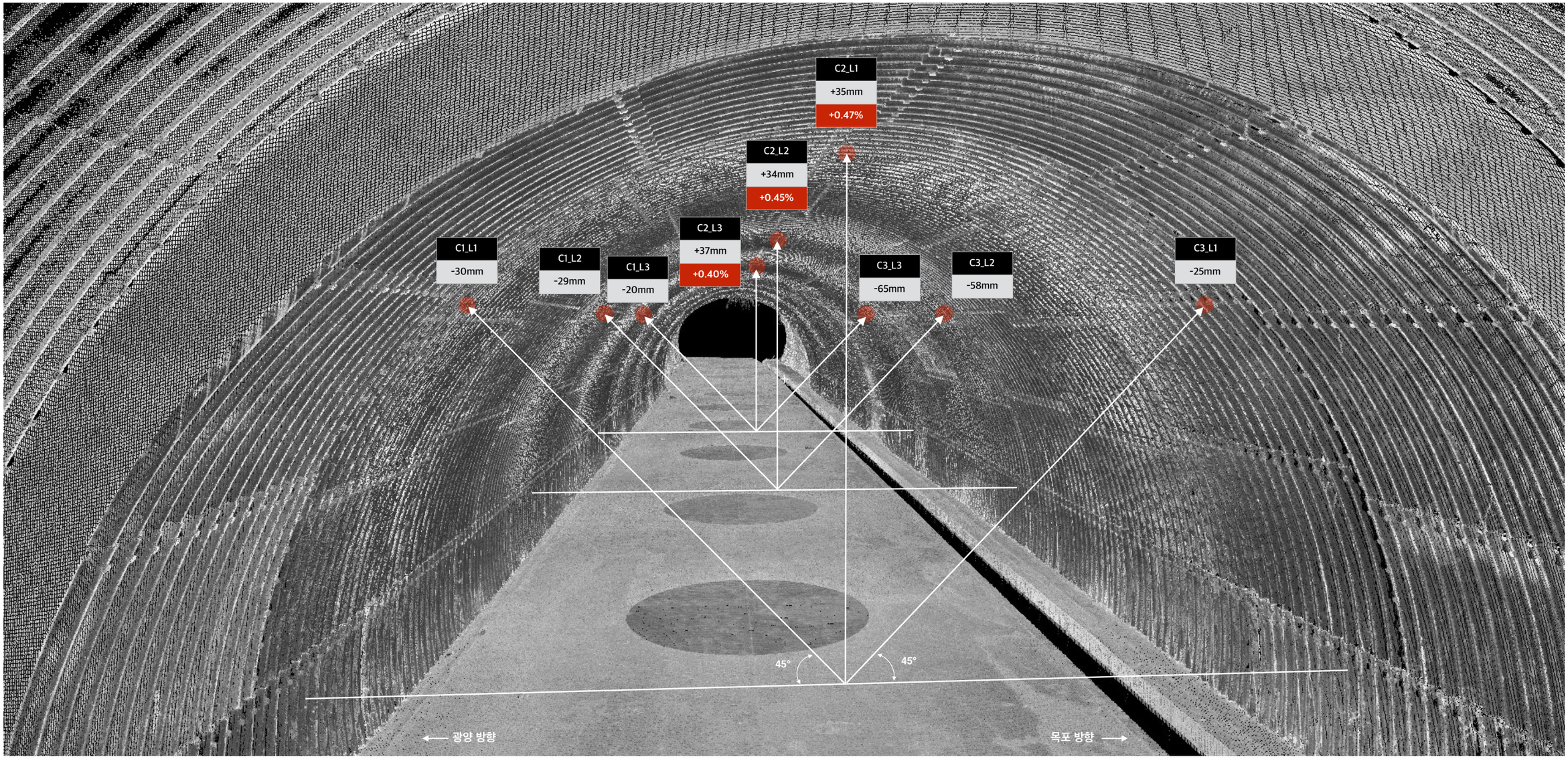
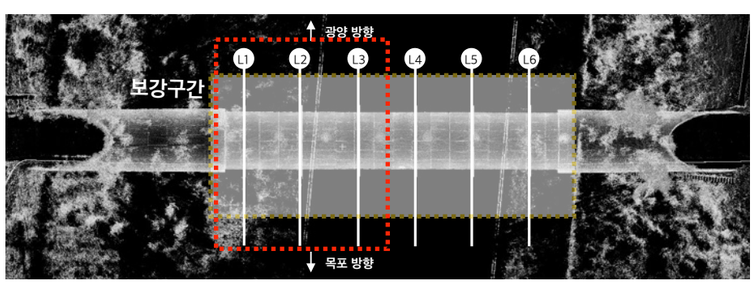
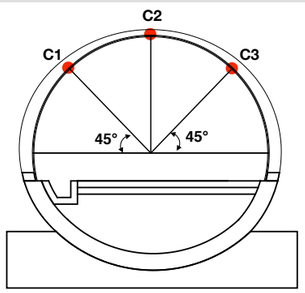


Monitoring Section Divide



Displacement Monitoring Target



Monitoring Target
설계도서(CAD Section) 대비 변위
파형강판 허용범위 % Rise(4,350mm) X 5% = 217.5mm

NOTE:

최대 허용 변위 : 국토교통부, 도로공사 표준시방서 2016, 5장 2-3 파형강판 암거 3.4 단면 변화측정

- 파형강판구조물은 1. 조립직후, 2. 뒤채움(토피부 포함) 도중, 3. 시공완료 직 후에 단면의 형상 크기 변화를 측정하여야 한다.
- 조립이 끝나면 뒤채움을 시작하기 전에 단면 크기를 측정하여 설계 형상에서 5% 이상 벗어난 경우에는 볼트를 느슨히 풀어 형상을 맞춘 후 다시 조립.
- 뒤채움이 시작되면 토피부 시공을 마칠 때까지 구조물 내 단면 크기를 측정하여 변형량을 파악하여야 한다.
- 허용 범위 : 표준형 강판(Pitch: 150mm Depth: 50mm)을 적용할 때 구조물 높이(Rise)의 5% 이내.
- 파형강판 허용범위 = Rise(4,350mm) X 5% = 217.5mm

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CSS Engineering & Consulting Firm

ChungAmE&C

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MATERIAL:	AS SPECIFIED
ISSUED:	2018.02.05
3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No:	한국도로공사	DRAWING NUMBER:	No.012

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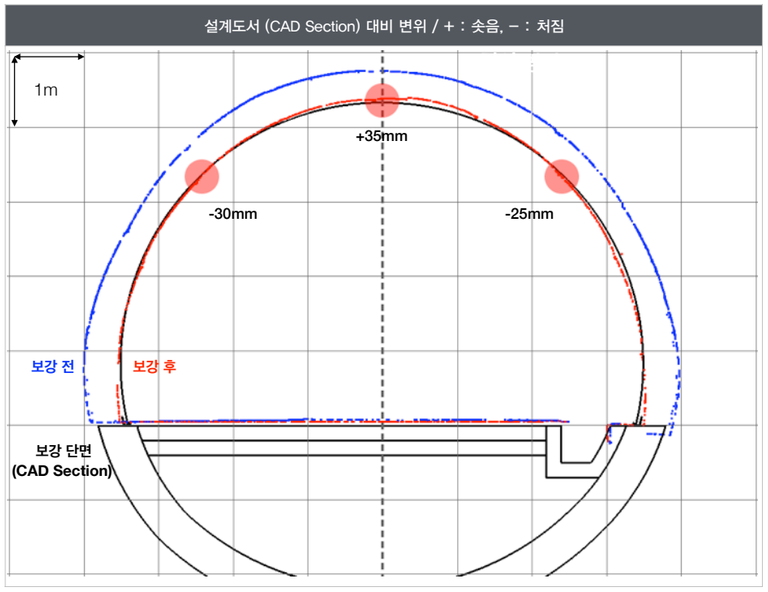
L1



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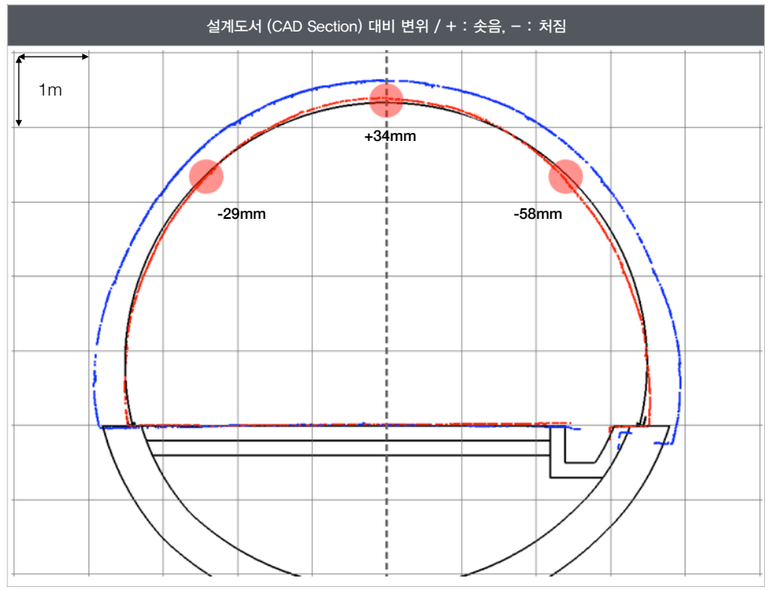

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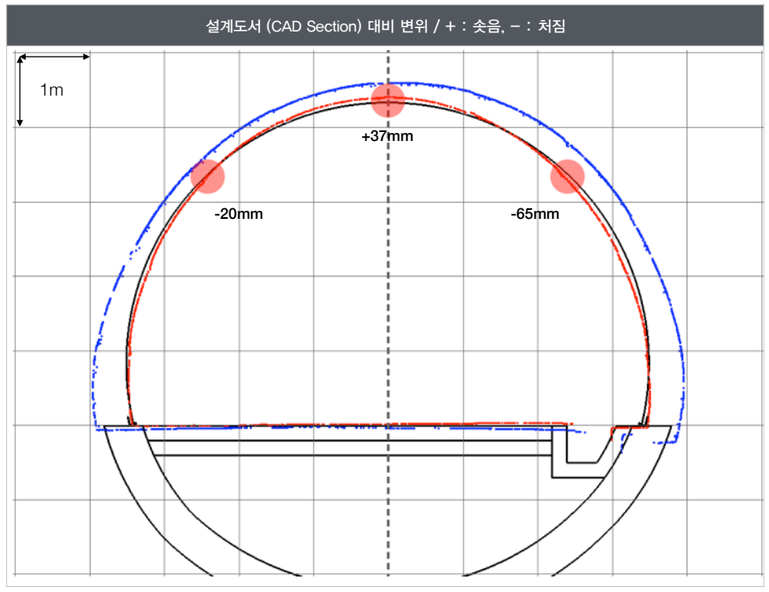
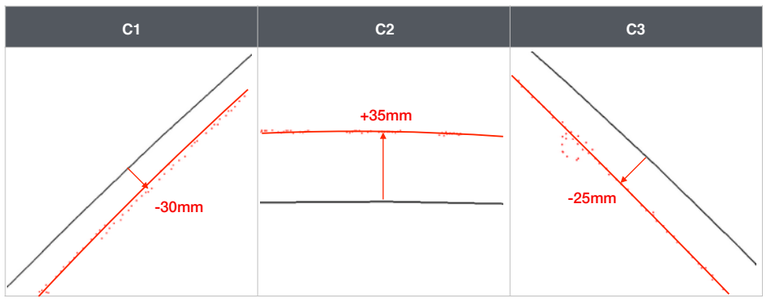
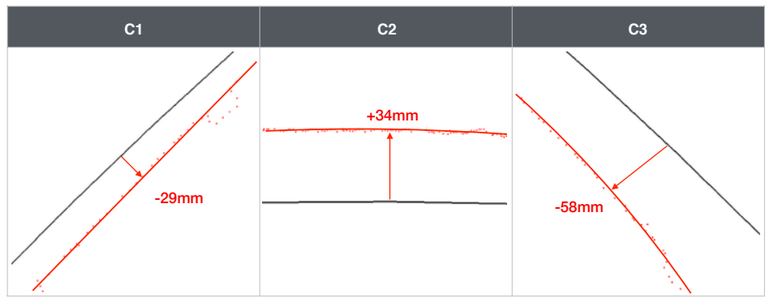
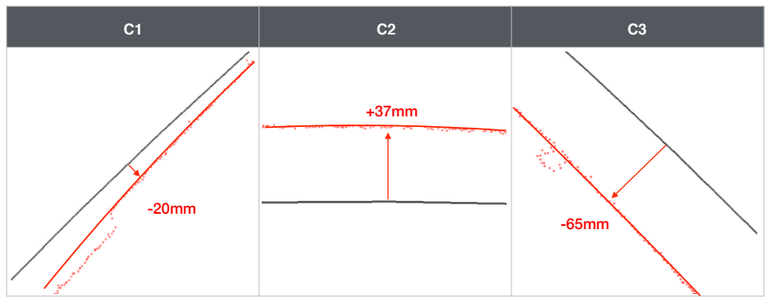






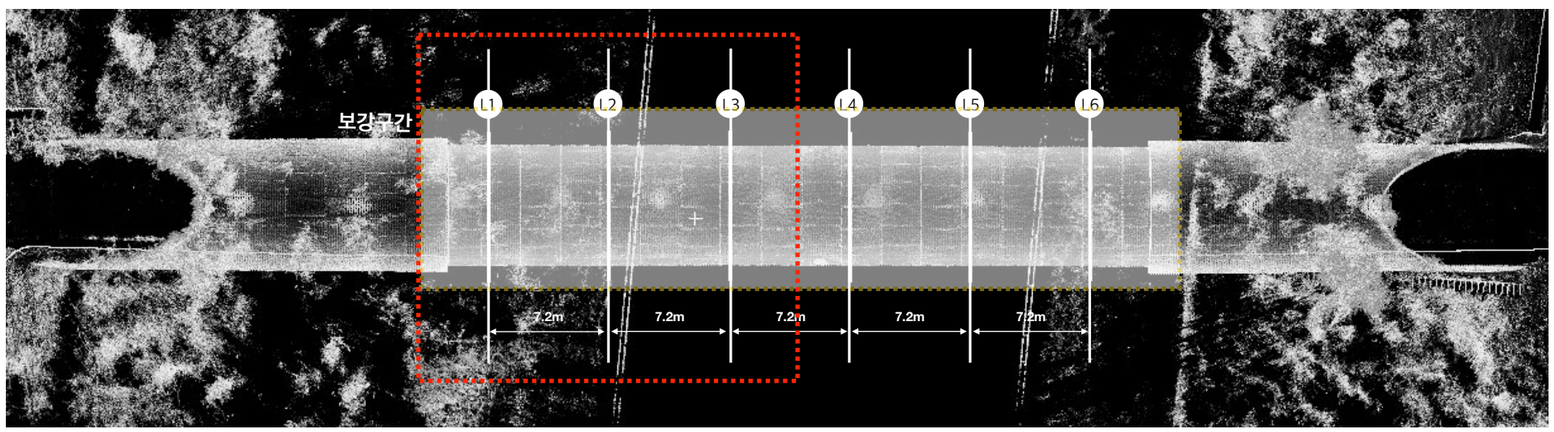


보강 설계 단면 (CAD Section)

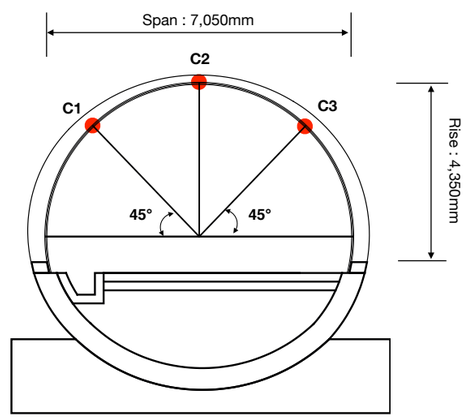
1차 Scan(보강 전) 2017/02/09

4차 Scan(보강 후) 2018/01/30

Monitoring Section Divide



Displacement Monitoring Target



REV	DESCRIPTION	BY	DATE
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2	Issued for 3rd 3D Scanning Data	K.DY	2017.12.01
1	Issued for 2nd 3D Scanning Data	K.DY	2017.06.21
0	Issued for 1st 3D Scanning Data	K.DY	2017.02.09

CSS Engineering & Consulting Firm

ChungAmE&C

3D Scan Surveying & Monitoring Analysis by

LongtermENG™

522, 70 Dusanro, Geumcheongu, Seoul, KR

+82 2 2169 2965 측량업등록 #04-003780

SCALE:	AT A3 UNO
MATERIAL:	AS SPECIFIED
ISSUED:	2018.02.05
3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No: 한국도로공사

DRAWING NUMBER: No.013

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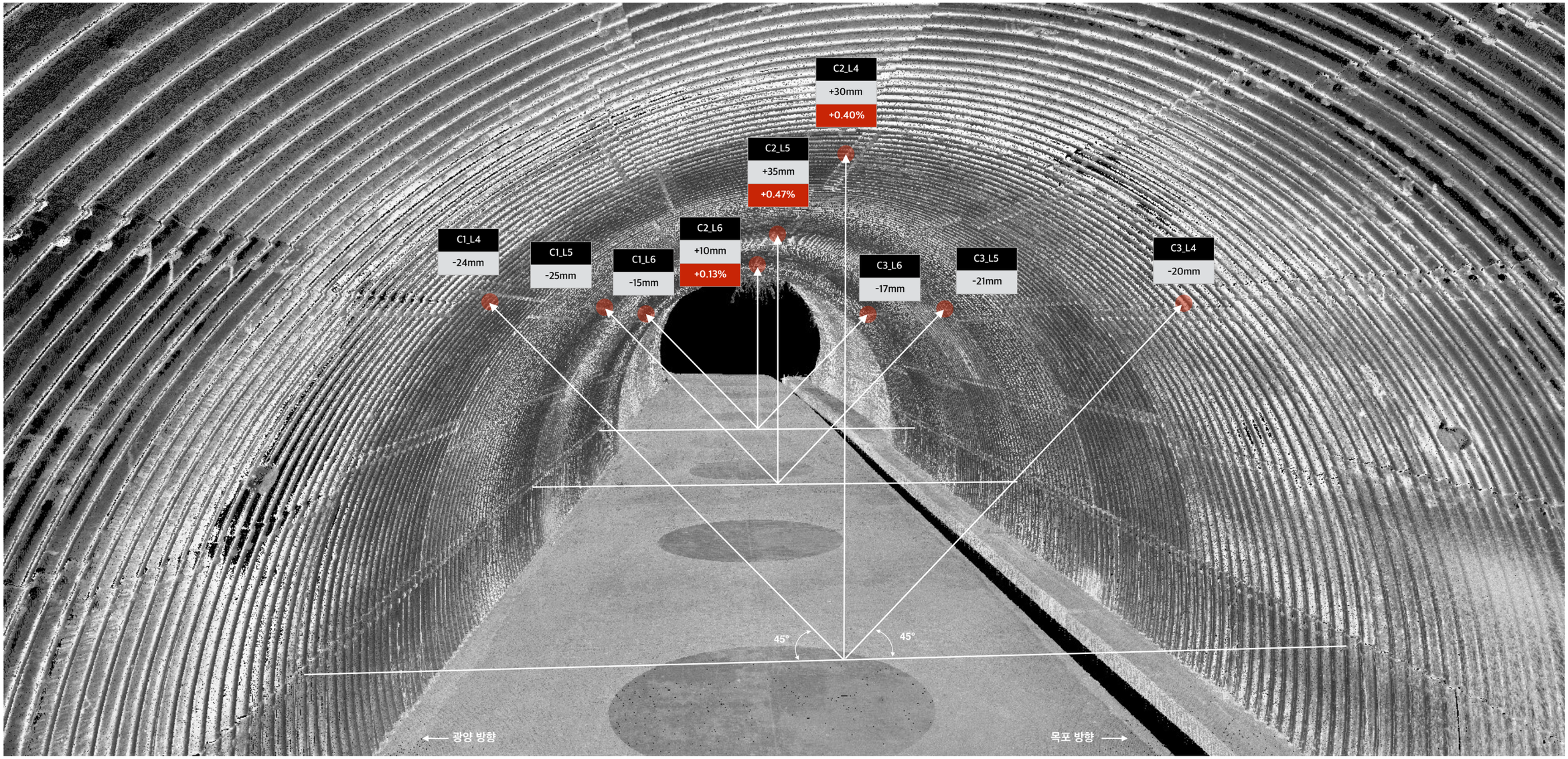
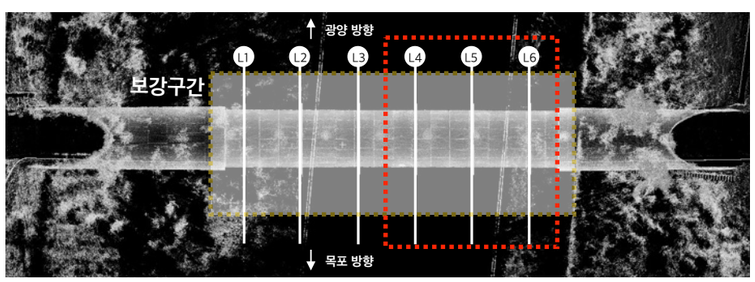
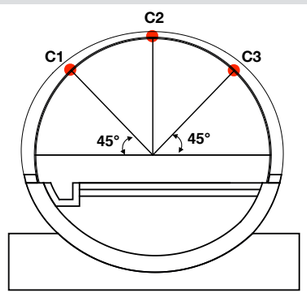


Monitoring Section Divide



Displacement Monitoring Target



Monitoring Target
설계도서(CAD Section) 대비 변위
파형강판 허용범위 % Rise(4,350mm) X 5% = 217.5mm

NOTE:

최대 허용 변위 : 국토교통부, 도로공사 표준시방서 2016, 5장 2-3 파형강판 암거 3.4 단면 변화측정

- 파형강판구조물은 1. 조립직후, 2. 뒤채움(토피부 포함) 도중, 3. 시공완료 직 후에 단면의 형상 크기 변화를 측정하여야 한다.
- 조립이 끝나면 뒤채움을 시작하기 전에 단면 크기를 측정하여 설계 형상에서 5% 이상 벗어난 경우에는 볼트를 느슨히 풀어 형상을 맞춘 후 다시 조립.
- 뒤채움이 시작되면 토피부 시공을 마칠 때까지 구조물 내 단면 크기를 측정하여 변형량을 파악하여야 한다.
- 허용 범위 : 표준형 강판(Pitch: 150mm Depth: 50mm)을 적용할 때 구조물 높이(Rise)의 5% 이내.
- 파형강판 허용범위 = Rise(4,350mm) X 5% = 217.5mm

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SCALE:	AT A3 UNO
MATERIAL:	AS SPECIFIED
ISSUED:	2018.02.05
3D SCAN CHK:	W.SH
ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF. No: 한국도로공사

DRAWING NUMBER: No.014

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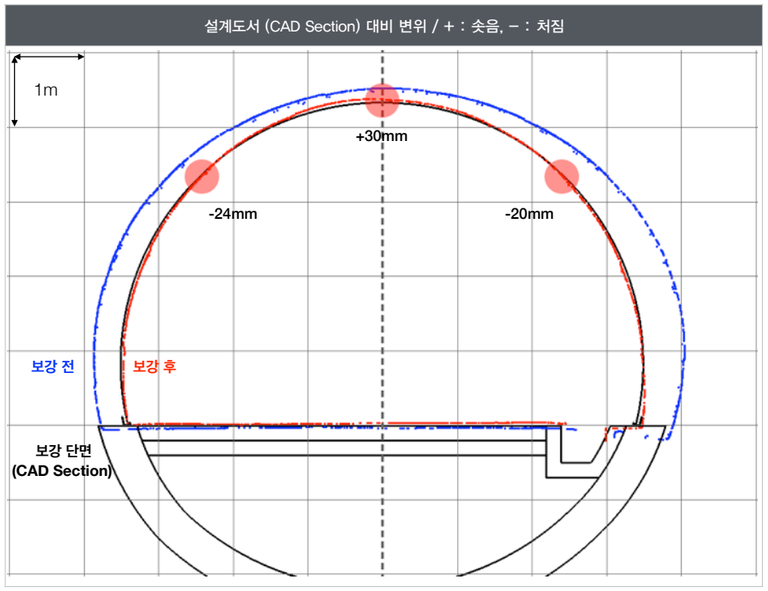
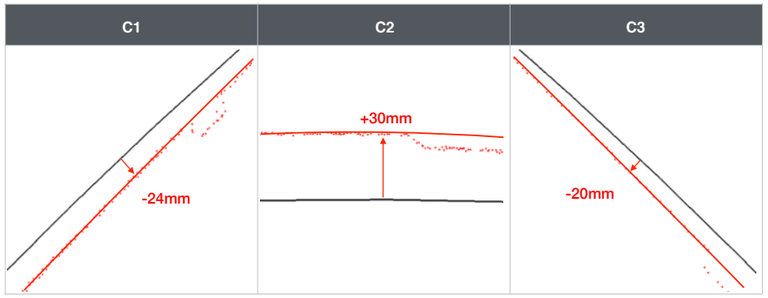
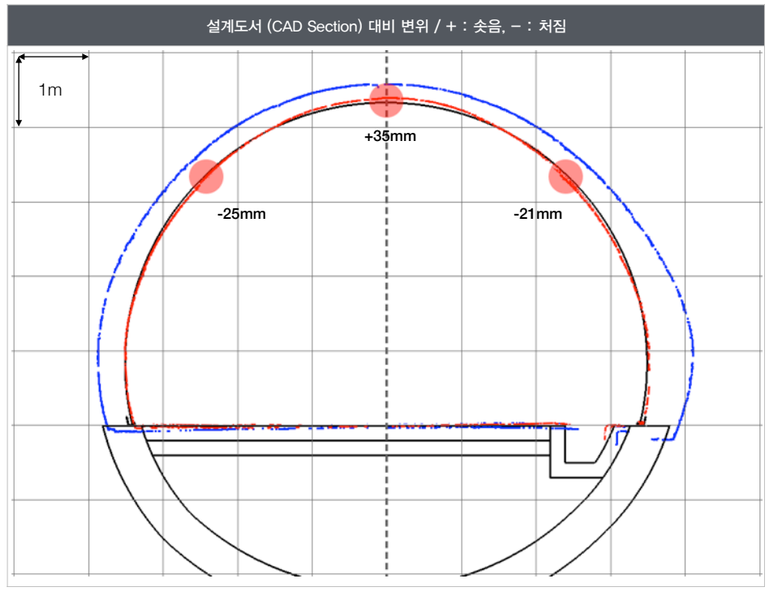
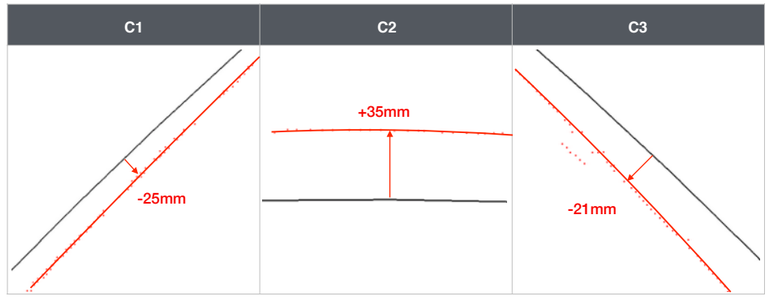
L4



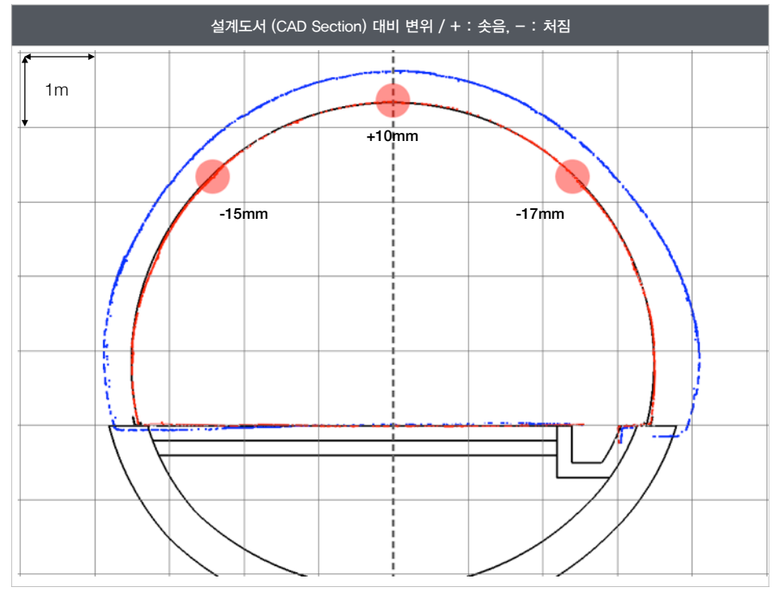


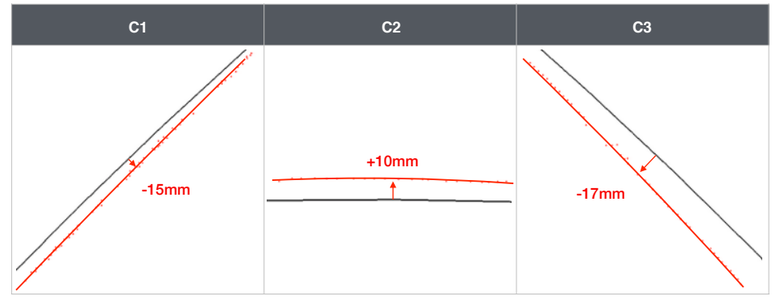
L5





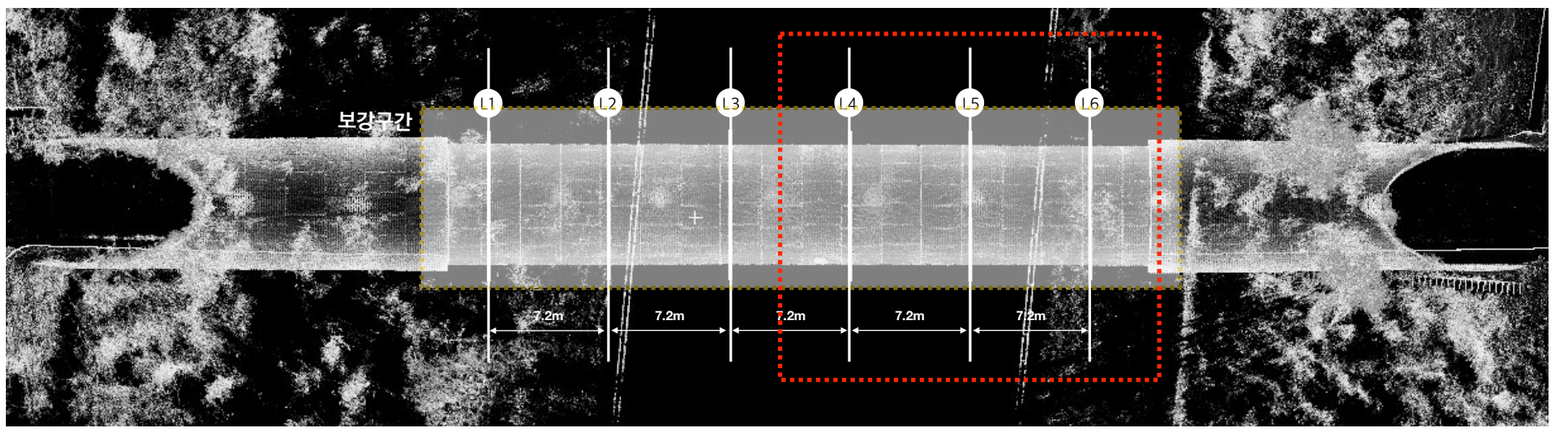
L6



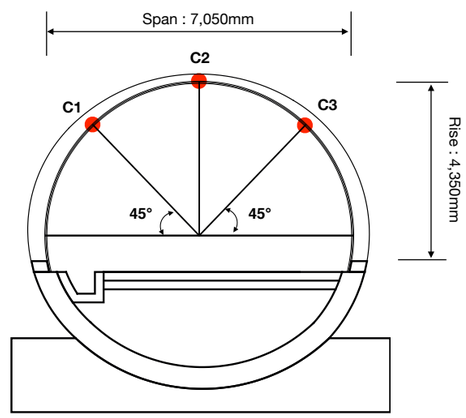


보강 설계 단면 (CAD Section) ——— 1차 Scan(보강 전) 2017/02/09 ——— 4차 Scan(보강 후) 2018/01/30 ———

Monitoring Section Divide



Displacement Monitoring Target



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ANAYSIS CHK:	L.NH

CUSTOMER AND PROJECT DETAILS:

pointcloudlibrary

한국도로공사

목포-광양 6공구(sta.4+982) 파형강판 밀어넣기 보강

CUSTOMER REF: No: 한국도로공사

DRAWING NUMBER: No.015

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