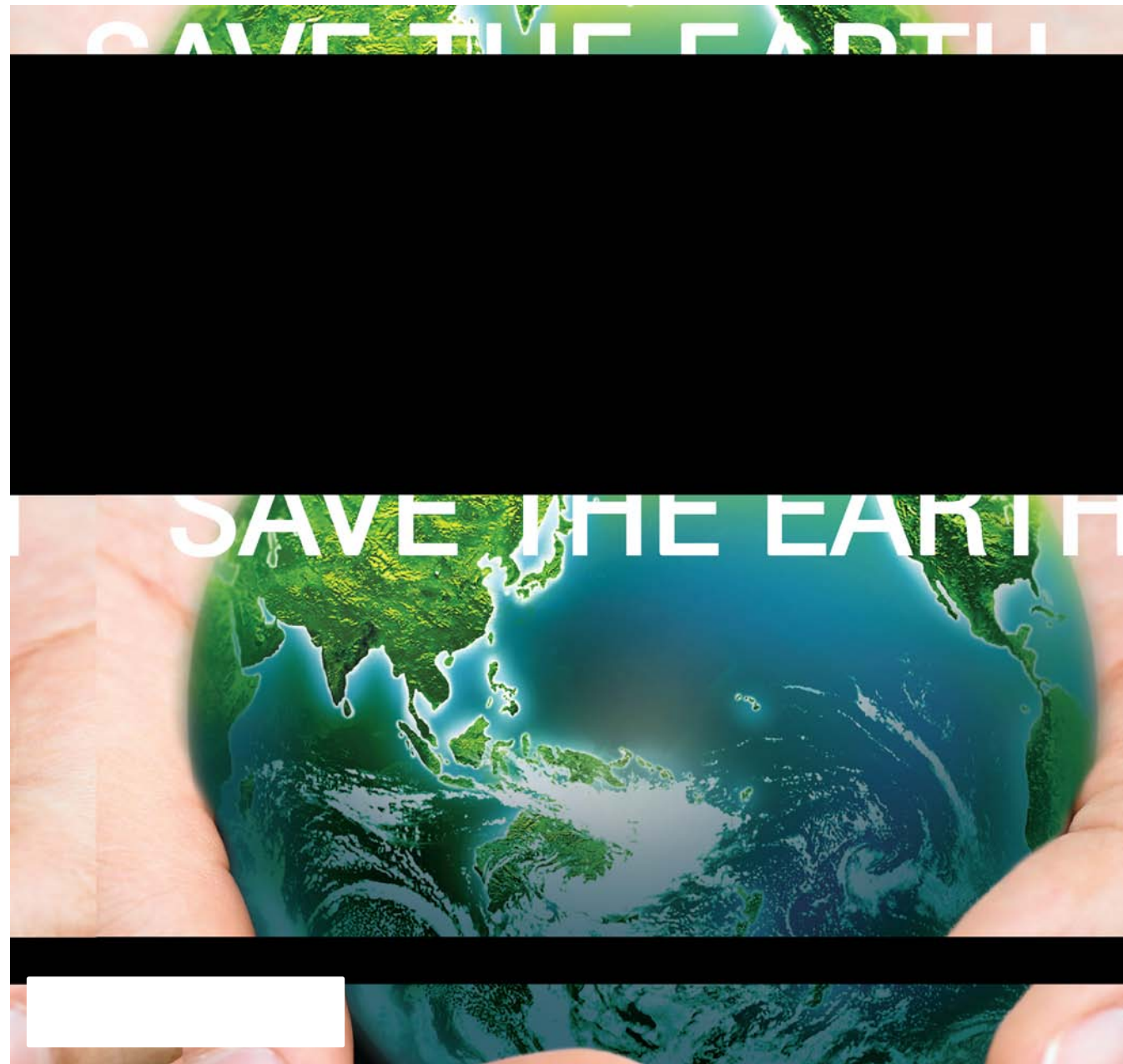


# SOIL ENGINEERING



2018. 09. 18



# **CONTENTS**

- **WHO WE ARE**

- **WHAT WE DO**

  - **Point Foundation method**

# COMPANY PHILOSOPHY

EXT was founded in 2004

1. Saves Resources
2. Protects Environment  
(low noise, eco-friendly)
3. Saves Cost & Time  
(Vale engineering)

## Value Creation

520 billion Won saved in construction costs  
51 years in construction period reductions

EXT Co., Ltd.'s extended head pile[Ext Pile] realizes construction costs savings as well as construction period reductions.  
For the past 15 years, our product has received positive reviews from large construction firms and field engineers.  
Through innovative technology, EXT Co., Ltd. creates new value for customers.

Total length of piles driven  
**17,600 km**

Radius of the Earth **6,400 km**

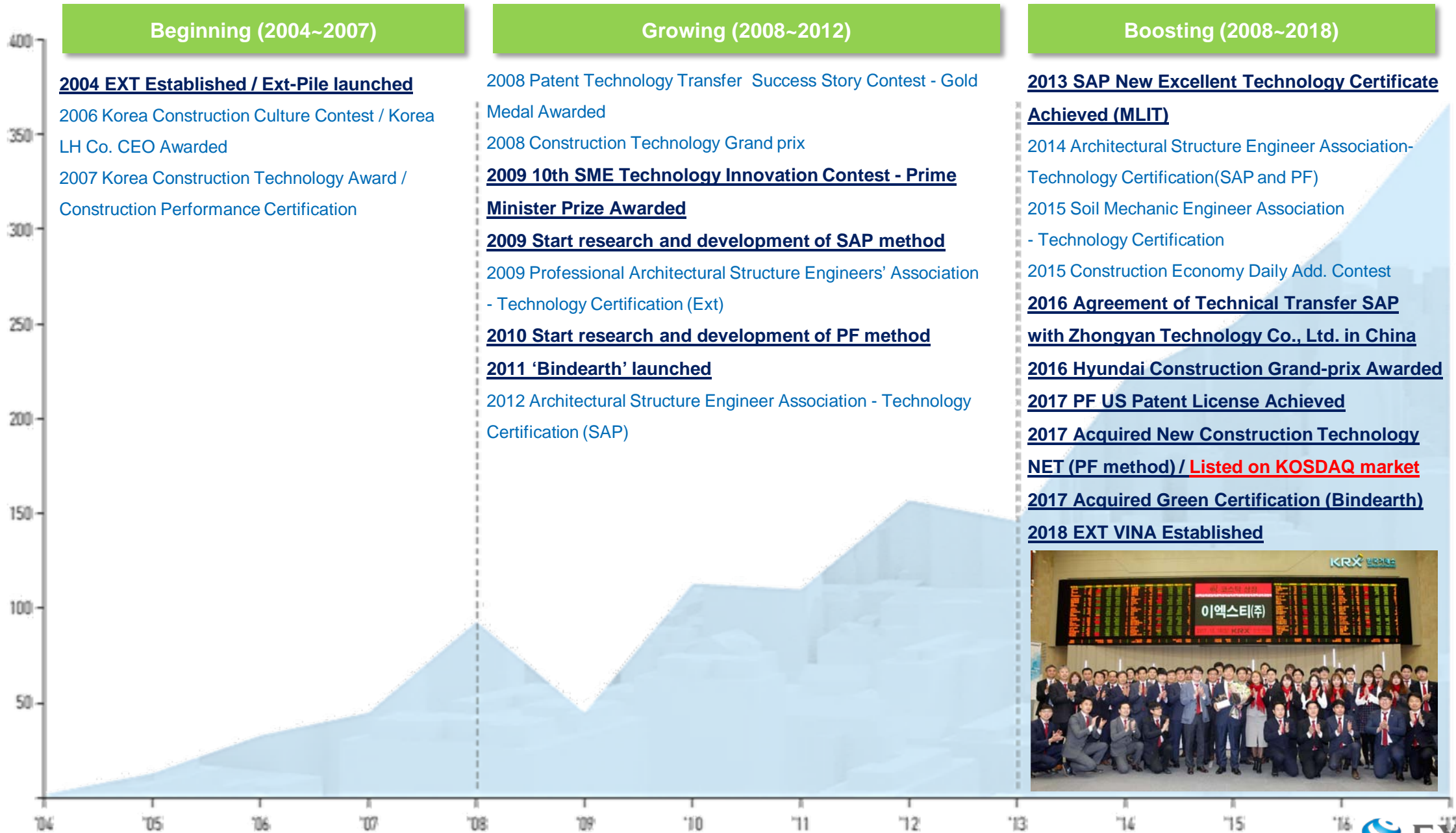
### Total piles driven

For the past 14 years, some 17,600km of EXT Co., Ltd.'s flagship product, the Ext Pile, has been driven.  
Last end-to-end, the piles would reach from ground level to the peak of Mt. Everest 1,970 times.  
Earth's radius is 6,400km, and this means all the Ext Piles driven until now would be able to bore a hole clean through the center of the Earth.

# COMPANY HISTORY

History of EXT Co.,Ltd from establishment

KRW 100M

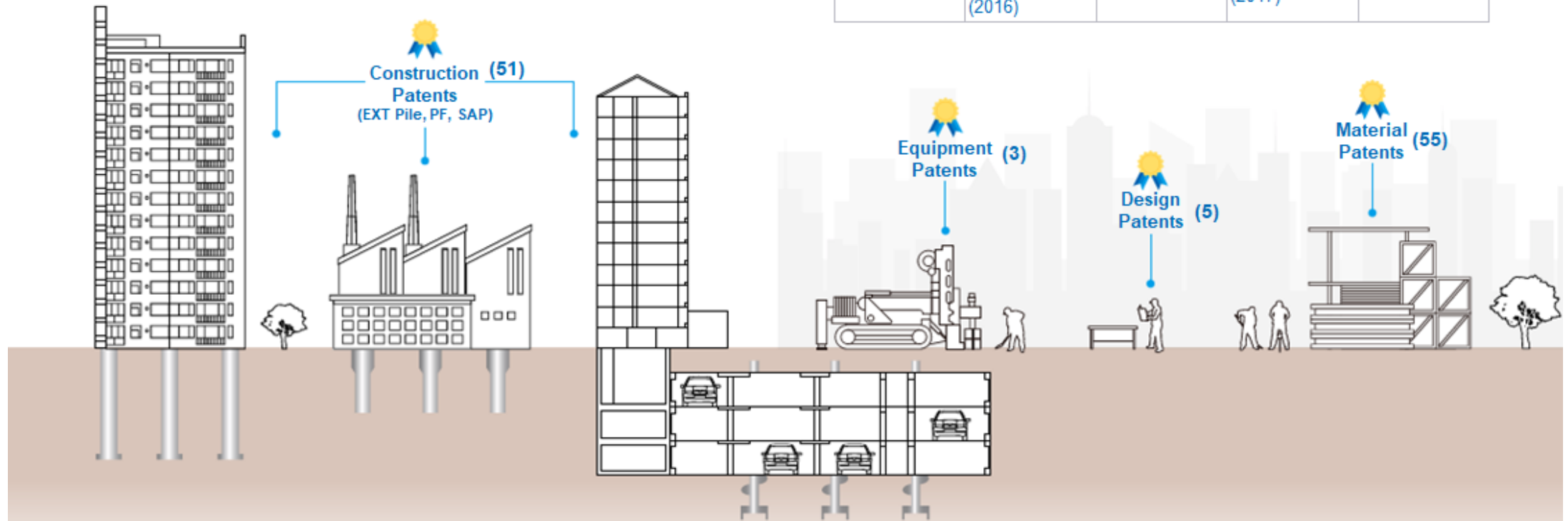


# INTELLECTUAL PROPERTY

EXT holds lots of patents & certifications

**EXT holds over 100 patents and certificates world wide**

Cetificates				
				
Technology certification from Korea Structural Engineers Association	Technology certification from Korea Association of Professional Engineers in Geotechnical Engineering (2016)	New Excellent Technology Certification No.816 (2017)	Green Certification (Bindearth) from Korea Institute for Advancement of Technology (2017)	Environmental certification from Korea Environmental Industry & Technology Institute (2013)



# BUSINESS PARTNER OF EXT

Most of our business partners are prominent companies



## EXT공법



삼성 전자소재 연구단지

- 시공사: 삼성물산
- 시공수량: 5,607만 / 100,055m
- 독이사항: 대구모던지
- 원가 절감액: 7.1억
- 단축공기: 20일



영월도시 정부형사 1단계 1구역 컨셉공사

- 발주처: 안전행정부
- 시공수량: 932만 / 16,600m
- 원가 절감액: 3.6억
- 단축공기: 22일



포항 광성 두산 웨브터제니스

- 시공사: 두산건설
- 시공수량: 5,793만 / 98,807m
- 독이사항: 어업지층(RCD대응)
- 원가 절감액: 188억
- 단축공기: 66일



서울 서남권 야구장

- 발주처: 서울특별시
- 시공수량: 2,777만 / 48,316m
- 원가 절감액: 6.1억
- 단축공기: 72일

## PF공법: 기타 구조물



산림청 1,2호기 려원사대 신축공사(한수원)

- 시공사: 한라건설
- 절감율: 22% (기존 설계 대비)
- 독이사항: 자갈, 전석층 전체 27개동 적용

## PF공법: 토목구조물



부산 신항 응용지구 1-1지구 조성공사

- 시공사: GS건설
- 절감율: 15% (기존 설계 대비)
- 독이사항: 도로보강공사 (D.C.M 대안)



부천대 제2캠퍼스 컨셉공사

- 시공사: GS건설
- 절감율: 23% (기존 설계 대비)
- 독이사항: 무속동 기초

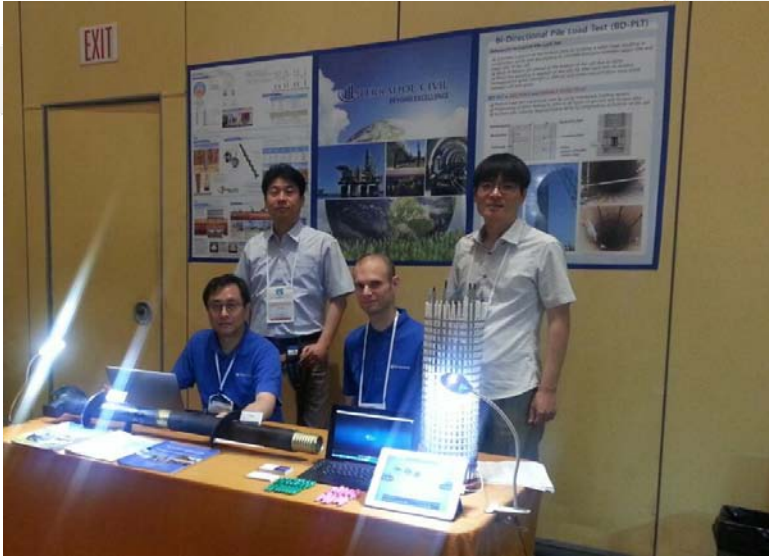


서울일반 산업단지

- 시공사: 태영
- 절감율: 18%
- 독이사항: 점도 연약지반 보강

# GLOBAL ACTIVITIES

We are not satisfied with domestic market. So, we are trying to advance into global market.



Attending exhibition "super pile'15 conference" in Florida USA, 2015

2015

2016



Technology transfer to China company, 2016

# GLOBAL ACTIVITIES

EXT Vina was founded in Hanoi to expand EXT global market business



EXT VINA was founded in Hanoi, 2018



Technical exchange seminar with Vietnam company, 2018



# GLOBAL ACTIVITIES

We are making business collaboration thorough global activities



MOA between EXT & IEV Malayisa



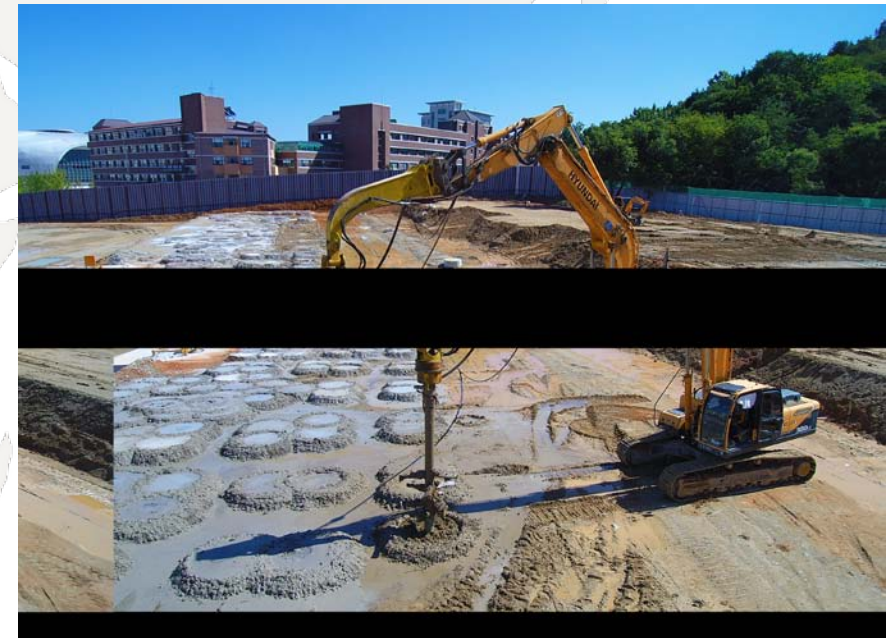
Business partnership with Bac nich province in Vietnam

# GLOBAL ACTIVITIES

We are trying to advance into Sri lanka market



Pre-mixing test for PEAT soil in Sri lanka

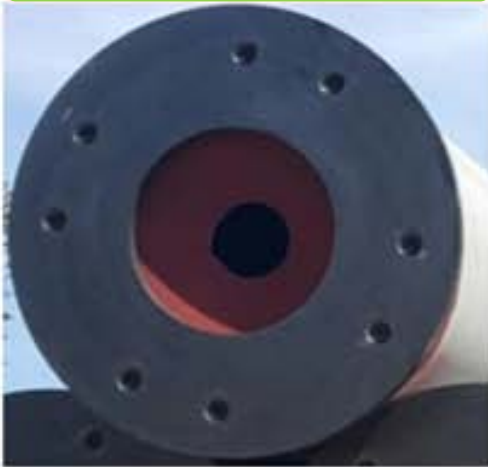


# MAIN TECHNOLOGIES

All of these technologies are applied to over 1,000 sites in Korea

“ New technology / Total Solution / Quality Control for geotechnical engineering ”

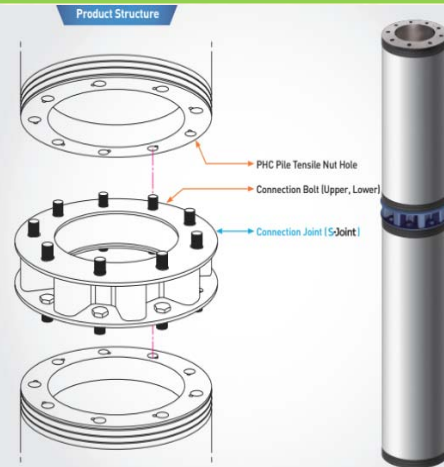
## EXT PILE



- ▶ Extend pile end
- ▶  $P_a = 105\sim 210\text{tf/ea}$
- ▶ Reduce quantity compare to general phc pile

High rise structure

## S-JOINT



- ▶ Extend pile end and pile wall thickness
- ▶  $P_a = 190\sim 250\text{tf/ea}$
- ▶ Reduce quantity compare to general phc pile

Pile modular

## Screw Anchor Pile



- ▶ Small diameter pile
- ▶  $\Phi 73$ ,  $P_a = 80\text{tf/ea}$
- ▶ Remodeling, Reinforcement
- ▶ New Technology No684 in Korea

Remodeling / Reinforcement

## Point Foundation



- ▶ Shallow foundation
- ▶  $Q_a = 10\sim 40\text{tf/m}^2$
- ▶ Eco-friendly method
- ▶ New Technology No816 in Korea

Low and mid-rise structure



## Chapter 2.

# Point Foundation

(called "PF" method)

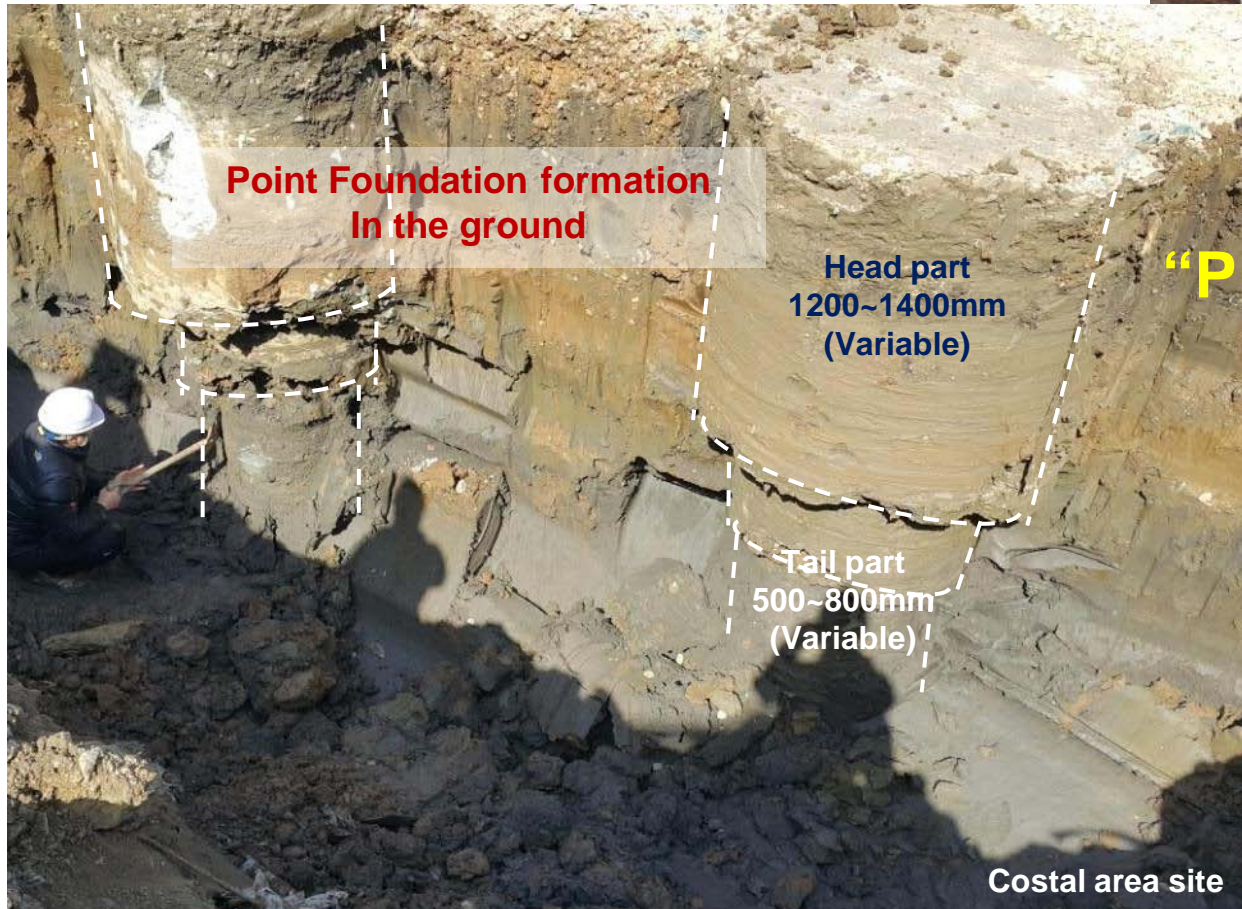
# Point Foundation (PF Method)

Leader in Soil & Foundation Engineering and Consulting



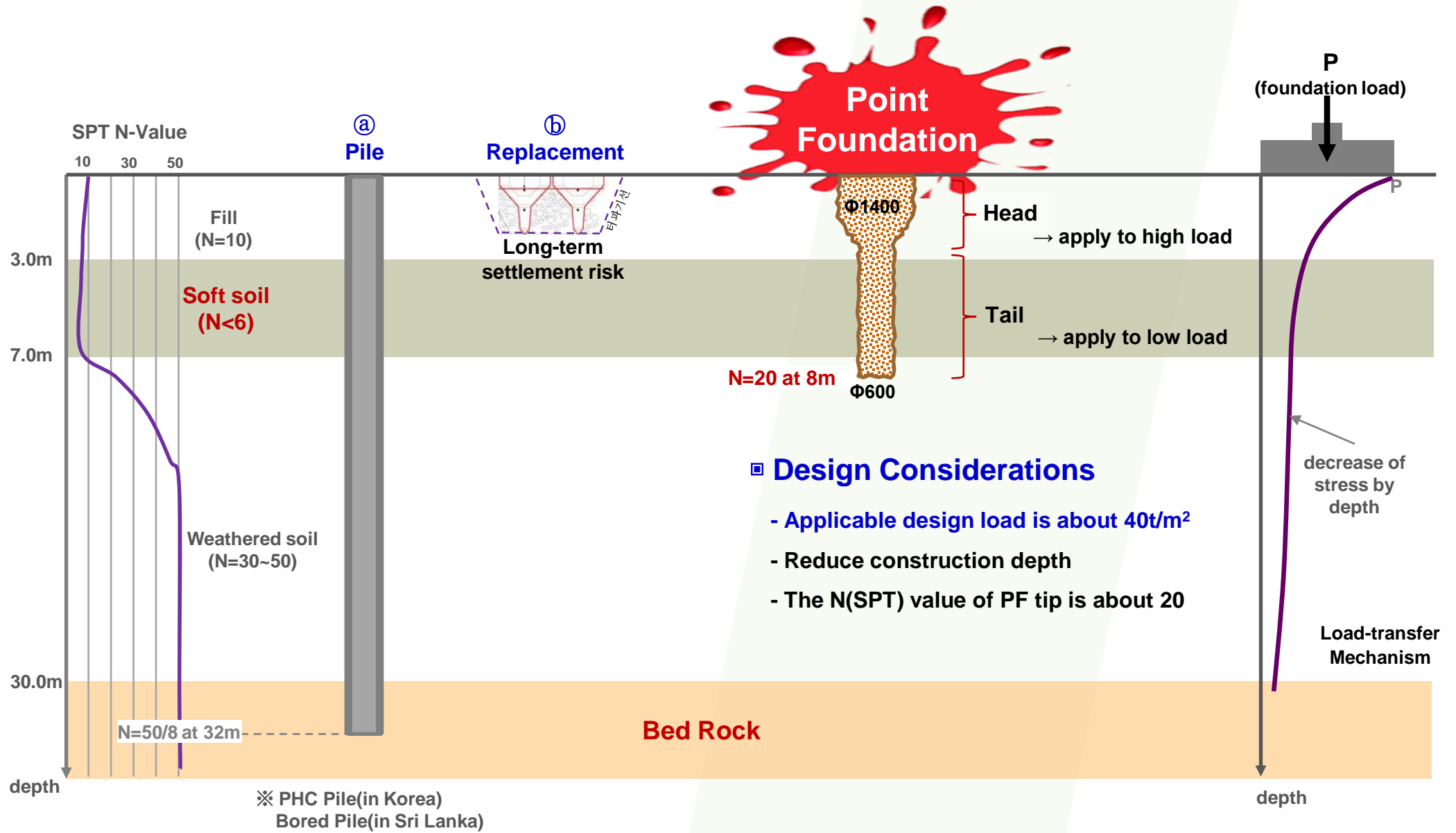
# WHAT IS THE POINT FOUNDATION

Soil stabilizing method without piling



# WHAT IS THE POINT FOUNDATION

Soil stabilizing method without piling



# WHAT IS THE POINT FOUNDATION

Soil stabilizing method without piling

## Pile Design Sample (8<sup>th</sup> floor building in Sri Lanka)

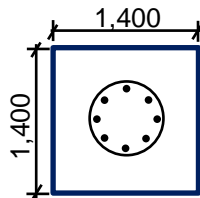
Foundation Type

Bored Pile  
Φ750

Bearing Capacity

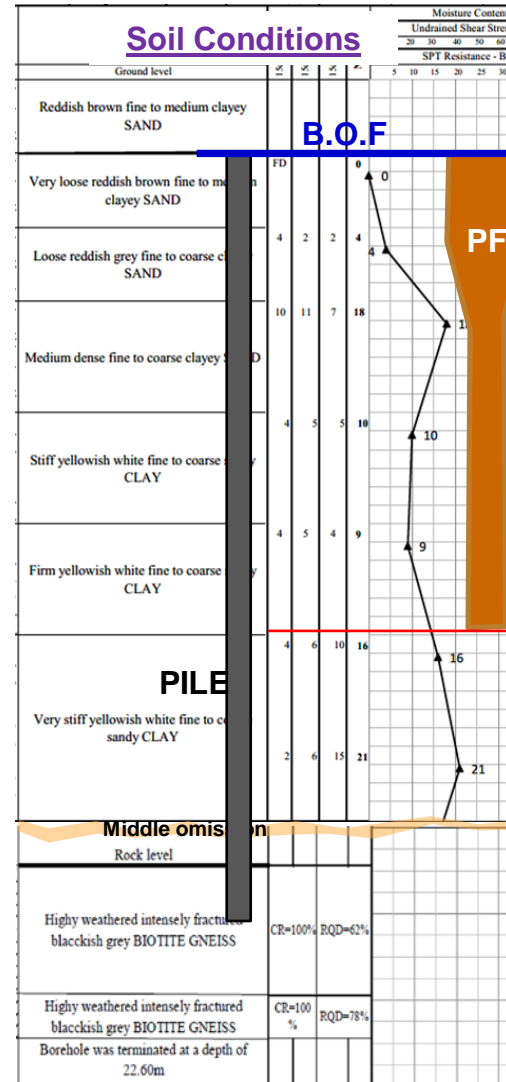
2,000kN/ea  
(Assumption)

Pile Arrangement



Pile Length

20m  
(rock socketed about 1m)



## Solutions from EXT

### Alternative 1 in (PHC Pile)

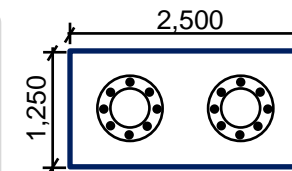
Foundation Type

PHC PILE  
Φ500

Bearing Capacity

1,200kN/ea

Pile Arrangement



Pile Length

21.5m  
(rock socketed about 3D)

### Alternative 2 (PF, recommended)

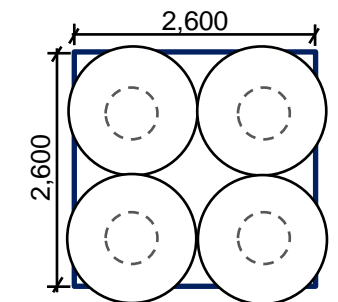
Foundation Type

PF  
HeadΦ1400/TailΦ600

Bearing Capacity

300kN/m<sup>2</sup>

Pile Arrangement



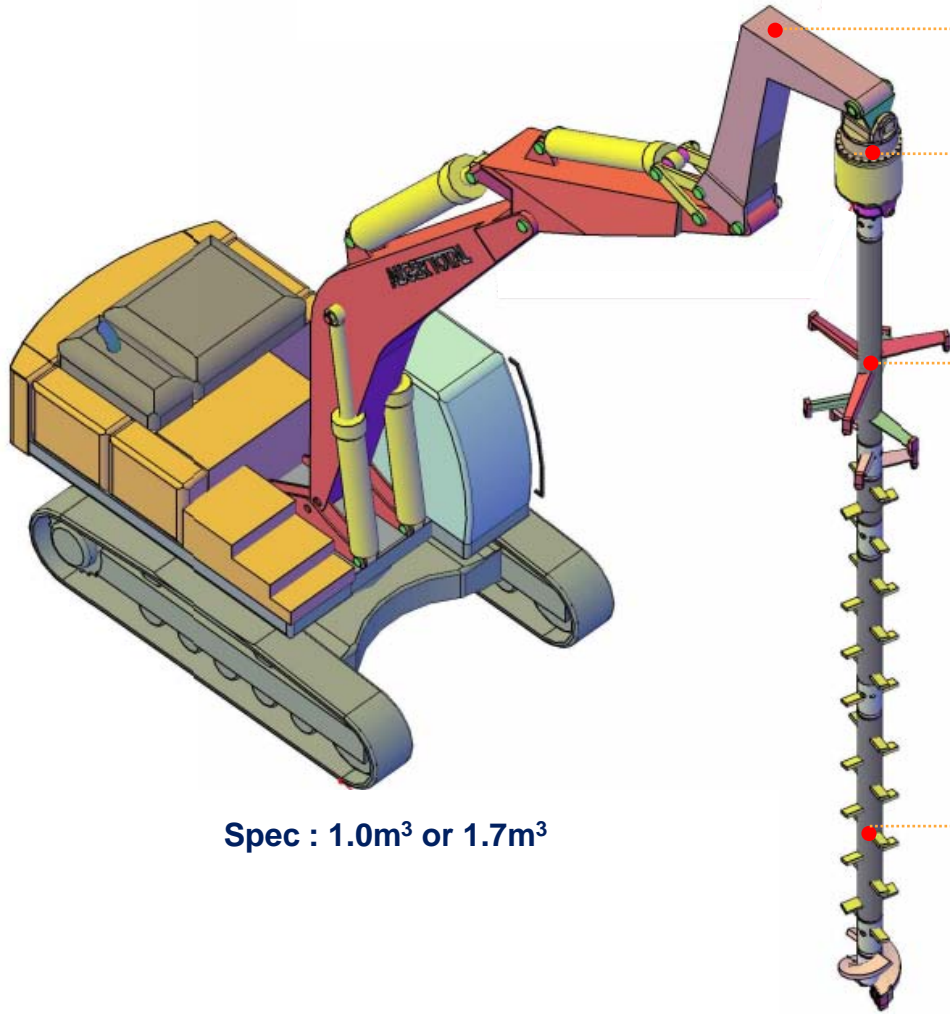
Pile Length

6.5m  
(N value 16, sandy clay)



# WHAT IS THE POINT FOUNDATION

Soil stabilizing method without piling



Spec : 1.0m<sup>3</sup> or 1.7m<sup>3</sup>

GENERAL EXCAVATOR + MIXING ROD



COMPLETE PRODUCTION FOR SRI LANKA  
(September, 7)

# WHAT IS THE POINT FOUNDATION

Soil stabilizing method without piling

## Small Equipment (excavator)



Work depth : 3~14m  
Rotation Speed : 6~25RPM  
Output Torque : 6,000(kg-m)



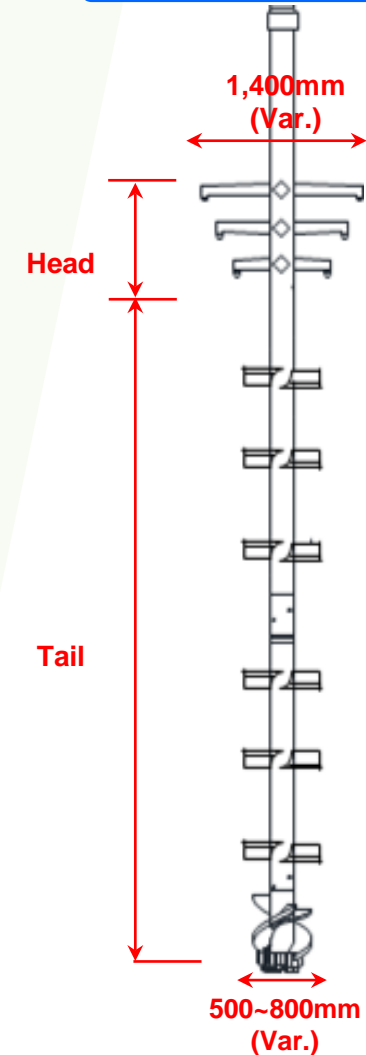
## Medium Equipment (pile driver)



Work Depth : 3~40m  
Rotation Speed : 6~25RPM  
Auger : 80HP

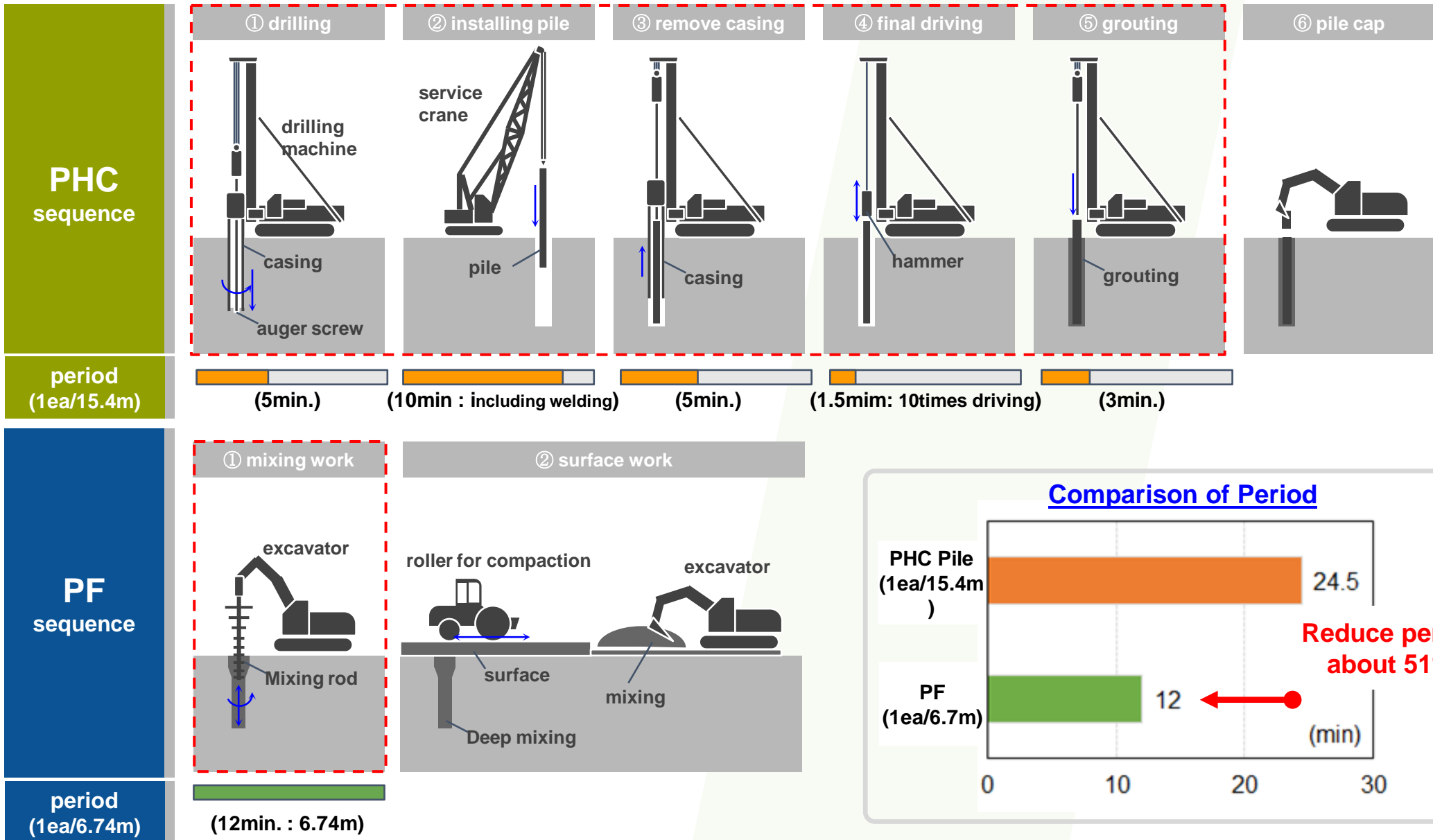


## Mixing Rod Type



# WHAT IS THE POINT FOUNDATION

Soil stabilizing method without piling



# WHAT IS THE POINT FOUNDATION

Soil stabilizing method without piling

## ● BINDEARTH Characters

- Special solidifying agent that is developed by EXT
- It is superior than other cement based materials

### ◎ Material

Fineness (cm <sup>2</sup> /g)	Ignition loss(%)	Specific gravity	Uniaxial compressive strength(Mpa)
More than 3,500	Less than 5%	2.75	More than 14



- Pre-mixing test is conducted to decision input quantity
- Normally, the BINDEARTH is applied at the level of about 200~280kg/m<sup>3</sup>

- ✓ Allowance settlements 1inch(2.54cm) in Korea
- ✓ It can be replaced with Sri Lanka Cement

Description	PF Compressive strength (MPa)		
	3days	7days	28days
BINDEARTH	1.73	2.02	2.86

## Total 21type harmful materials test

SGS 품질검사 성적서

시험명(생산국)	비인디스 고화토(필스태이트 영통 파일공사/지하주차장 지점공사)	발급번호	CMT2016QT - 1318
시험 채취 장소	필스태이트 영통 파일공사/지하주차장 지점공사 현장	접수일자	2016년 03월 10일
신뢰 이용 목적	품질관리 및 확인용		
공 사 명	필스태이트 영통 파일공사/지하주차장 지점공사		
발 주 자	현대건설		
시 공 자	현대건설		
의뢰인	서울특별시 금천구 가산디지털1로 165 GBC 1402호 오승환		
국가중요시설 여부	해당사항 없음		

연번	시험·검사 항목	단위	시험·검사 방법	시험·검사결과	적용기준치			시험·검사자	
					차이동작 및 차적동인호	성명	서명	성명	서명
1	Cd	mg/kg		1.13					
2	Cu	mg/kg		21.5					
3	Pb	mg/kg		8.1					
4	Zn	mg/kg		101.2					
5	Ni	mg/kg	토양오염공정시험기준 2015	5.8	건축용질시험 기준치 (9915905013M)	신도형	김요찬		
6	Cr(VI)	mg/kg		불검출					
7	시안	mg/kg		불검출					
8	Hg	mg/kg		불검출					
9	As	mg/kg		불검출					
10	몰스	mg/kg		288					

이 시험·검사 결과는 당초 의뢰 시 제출된 시료에 대한 결과이므로 다른 목적으로 이용을 금합니다.

2016년 03월 31일

한국에스지에스(주) 건설시험연구원 대표 권이성 (인)  
주소: 경기도 평택시 서탄면 수일암5길 66 전화번호: 031-668-0600

All test results value within standard value  
→ Eco-friendliness

# WHAT IS THE POINT FOUNDATION

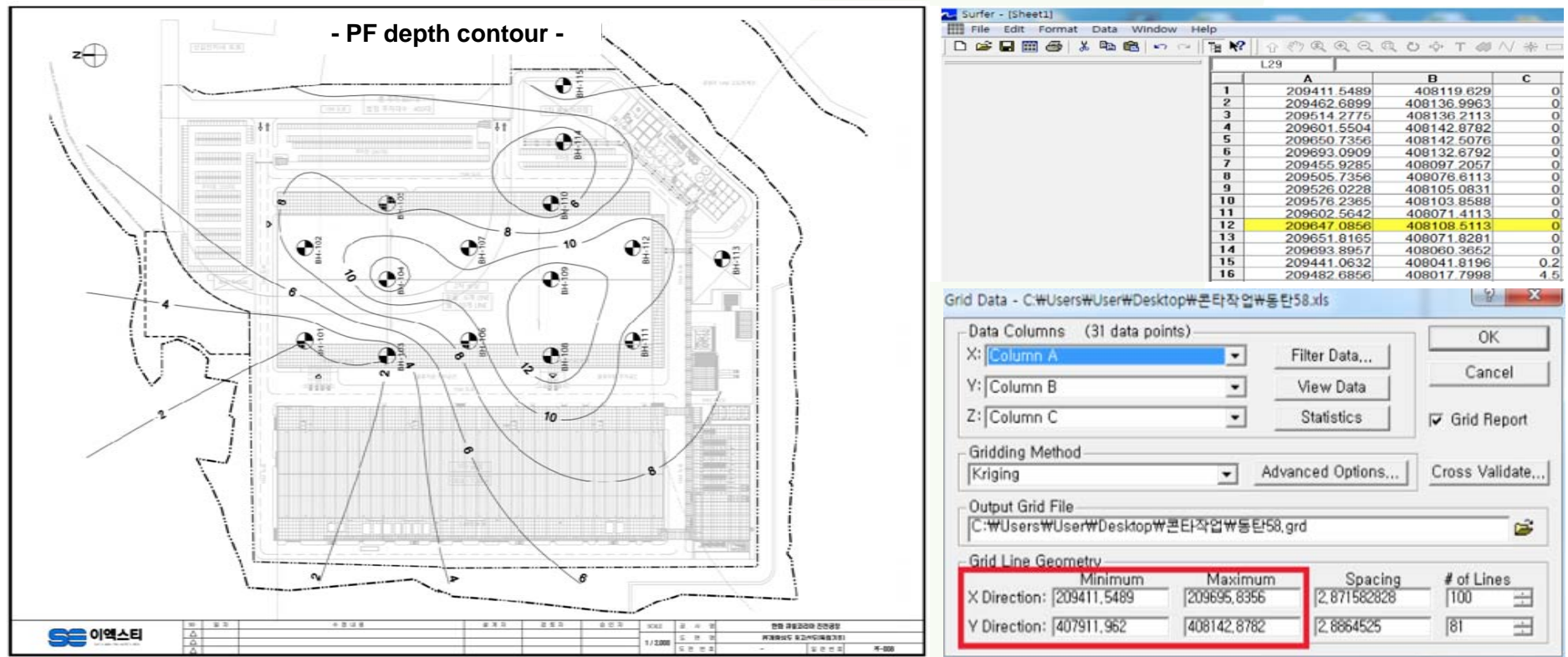
EXT has strict quality control sequence

Before  
Construction

During  
Construction

After  
Construction

## Design Control



✓ Determine the depth of Point Foundation after contouring work by using boring log position and coordinates

# WHAT IS THE POINT FOUNDATION

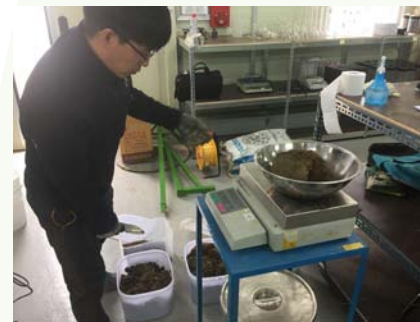
EXT has strict quality control sequence

**Before  
Construction**

Pre-mixing test in Laboratory

During  
Construction

After  
Construction

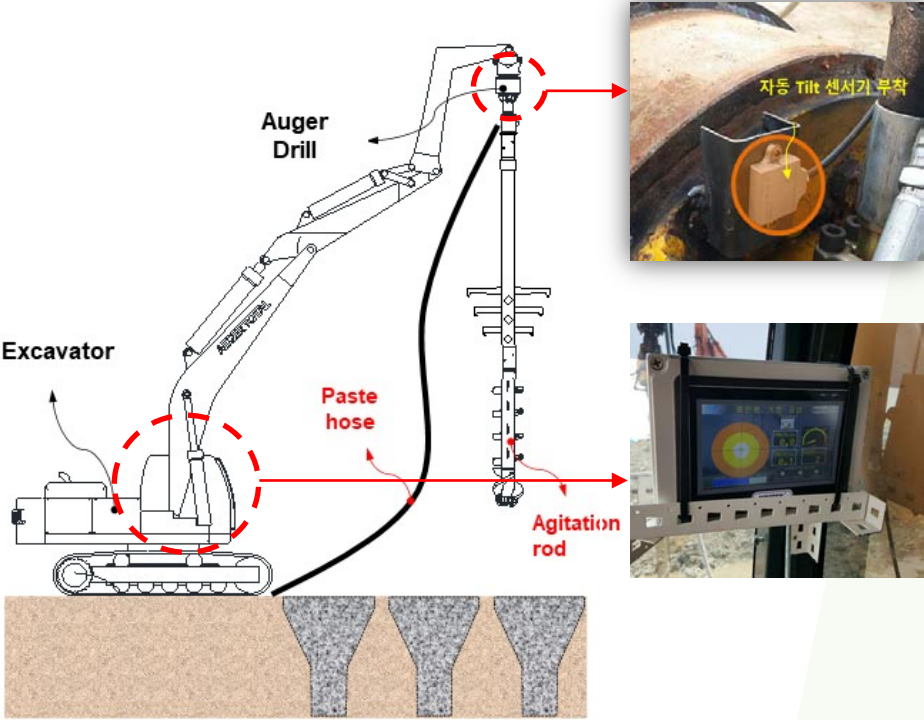
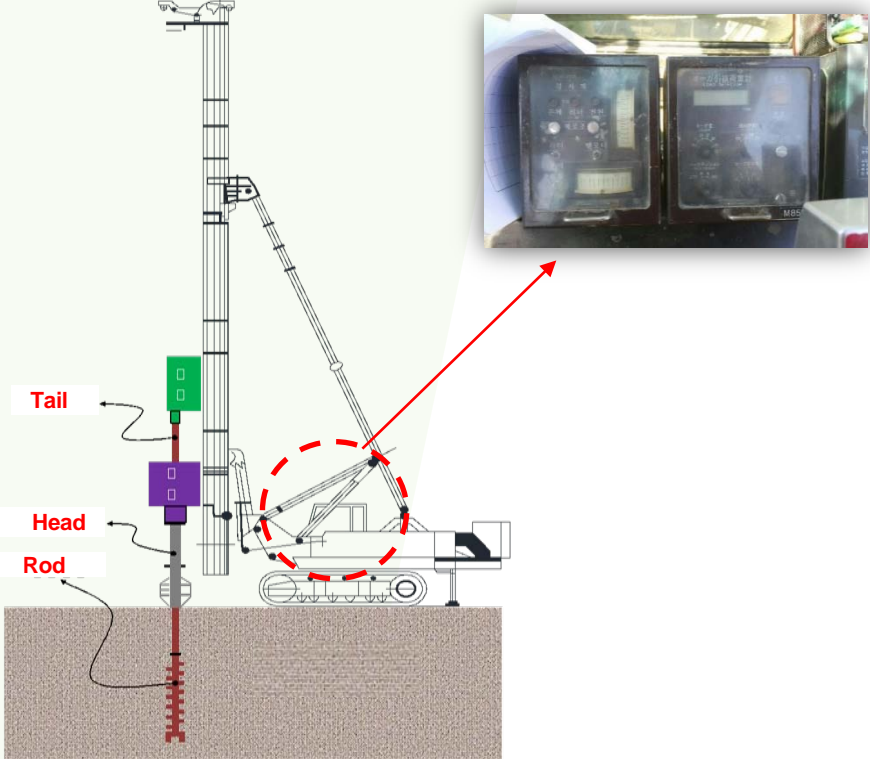


- ✓ Check the strength on 3day, 7day, 14day and 28day of mixing soil
- ✓ Adjusting the mixing quantity and material recipe through pre-mixing test

# WHAT IS THE POINT FOUNDATION



EXT has strict quality control sequence

## ❖ Verticality check (specification standard : 1/50 ~ 1/100)

Before Construction		
During Construction	<h3>Small equipment</h3>	<h3>Medium &amp; Heavy equipment</h3>
After Construction	 <p>Auger Drill</p> <p>Excavator</p> <p>Paste hose</p> <p>Agitation rod</p> <p>자동 Tilt 센서기 부착</p>	 <p>Tail</p> <p>Head</p> <p>Rod</p>
	<ul style="list-style-type: none"> <li>✓ Tilt sensor installation onto Auger</li> <li>✓ Operator maintains verticality while watching monitor</li> </ul>	<ul style="list-style-type: none"> <li>✓ Verticality management system installed inside the equipment</li> <li>✓ Manage the reader's verticality through sensor inside pile driver</li> </ul>

# WHAT IS THE POINT FOUNDATION

EXT has strict quality control sequence

Before Construction	<span>❖</span> <b>Bearing stratum (experience 200bar in Korea)</b>	
During Construction	Small equipment	Medium & Heavy equipment
After Construction		
	<ul style="list-style-type: none"> <li>✓ Auto measuring device developed by EXT</li> <li>✓ Check the hydraulic torque of equipment through trial construction</li> </ul>	<ul style="list-style-type: none"> <li>✓ Check the electric current value through trial construction</li> </ul>



# WHAT IS THE POINT FOUNDATION

EXT has strict quality control sequence

Before  
Construction

During  
Construction

After  
Construction

## Compressive strength test (shallow depth)



- ✓ Specimen by using polyvinyl pile and check the strength 7day, 28day
- ✓ Head part compressive strength check

# WHAT IS THE POINT FOUNDATION

EXT has strict quality control sequence

Before Construction

During Construction

After Construction

## Compressive strength test (deep depth, 2m over)



토질조건	현 장 명	시험지역	압축강도시험(MPa) (괄호는 평균값)				비 고
			시험실 배합		현장 염화비닐관 채취		
			7일 (1.5)	28일 (2.0)	7일 (1.5)	28일 (2.0)	
		인천 서구	1.31	3.55	1.67	3.86	
		경기 평택시	-	-	1.8	3.1	공사일정상 현장시험만 시행
		경기 수원시	-	-	2.2	3.3	공사일정상 현장시험만 시행
		서울 강남구	-	-	3.6	7.7	공사일정상 현장시험만 시행
		세종특별자치시	2.17	3.46	2.48	3.67	
							나일정상 현장시험만 시행
		충북 진천군	-	-	2.63	3.94	공사일정상 현장시험만 시행
		충북 음성군	-	-	2.4	5.4	공사일정상 현장시험만 시행
		경북 경주시	-	-	2.1	3.3	공사일정상 현장시험만 시행
		인천 송도	0.97	2.97	1.79	3.24	
		경기 수원시	-	-	3.29	5.25	공사일정상 현장시험만 시행
		경북 포항시	-	-	1.7	3.9	공사일정상 현장시험만 시행
		광주 광산구	1.41	2.07	2.85	4.14	



Collecting data of all sites

- ✓ Sampler installation on the agitation rod
- ✓ Specimen can be produced at any depth
- ✓ Obtain more than target strength

# WHAT IS THE POINT FOUNDATION

EXT has strict quality control sequence

Before  
Construction

During  
Construction

After  
Construction

## Compressive strength test – full core inspection



- ✓ All sampling from Point Foundation after 28days curing, if necessary.

# WHAT IS THE POINT FOUNDATION

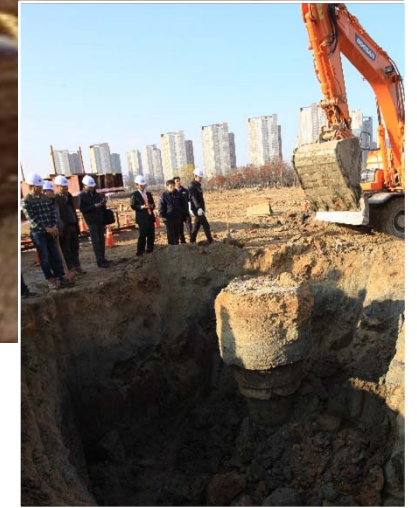
EXT has strict quality control sequence

Before  
Construction

During  
Construction

After  
Construction

## Visual Inspection after mixing work



✓ Formation check of Point Foundation after excavation

# WHAT IS THE POINT FOUNDATION

EXT has strict quality control sequence

## Full scale load test

Before Construction

During Construction

After Construction



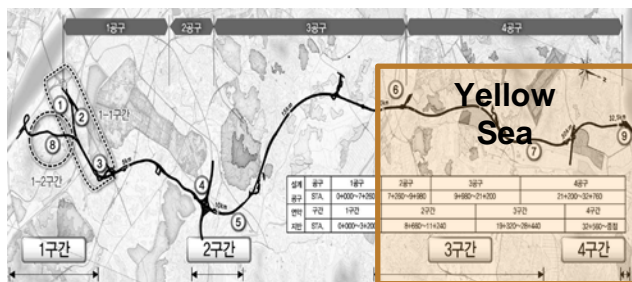
토질조건	현장명	시험지역	대형 평판재하시험 (1,000 x 1,000)			결과값	
			설계하중 (kN/m <sup>2</sup> )	최대시험하중 (kN/m <sup>2</sup> )	허용지지력 (kN/m <sup>2</sup> )	전체 침하량 (mm)	허용 침하량 (mm)
점성/사질토	청라 ic 대량 로제비앙 아파트 신축공사	인천 서구	350	700	350 이상	6.64	25.4
	안성 공도 용두지구 A1블럭 아파트 신축공사	경기 안성시	300	600	300 이상	4.29	25.4
	이천 시몬스 물류창고 신축공사	경기 이천시	300	600	300 이상	3.43	25.4
	화성 동탄 2차 SK 아파트 신축공사	경기 화성시	300	600	300 이상	6.67	25.4
사질토	<b>Collecting data of all sites</b>						25.4
	연천단 한솔교육 물류센터	강원 속초시	300	600	300 이상	2.44	25.4
	속초 정호지구 아이파크 신축공사	충북 진천군	150	300	150 이상	2.76	25.4
점토	송도재마동포타운 신축공사	인천 송도	300	600	300 이상	3.61	25.4
	힐스테이트 영통 파일공사/지하주차장 지정공사	경기 수원시	300	600	300 이상	5.16	25.4
	양산 물금 39블럭 라인(2차시험)	경남 양산시	300	600	300 이상	4.06	25.4
실트	광산구 산정동 연립주택 신축공사	광주 광산구	300	600	300 이상	3.28	25.4

- ✓ Full scale load test with 2times weight than design load
- ✓ Satisfied within allowable settlement and more than capacity

# WHAT IS THE POINT FOUNDATION

Point foundation is applied over 1,000 sites in Korea

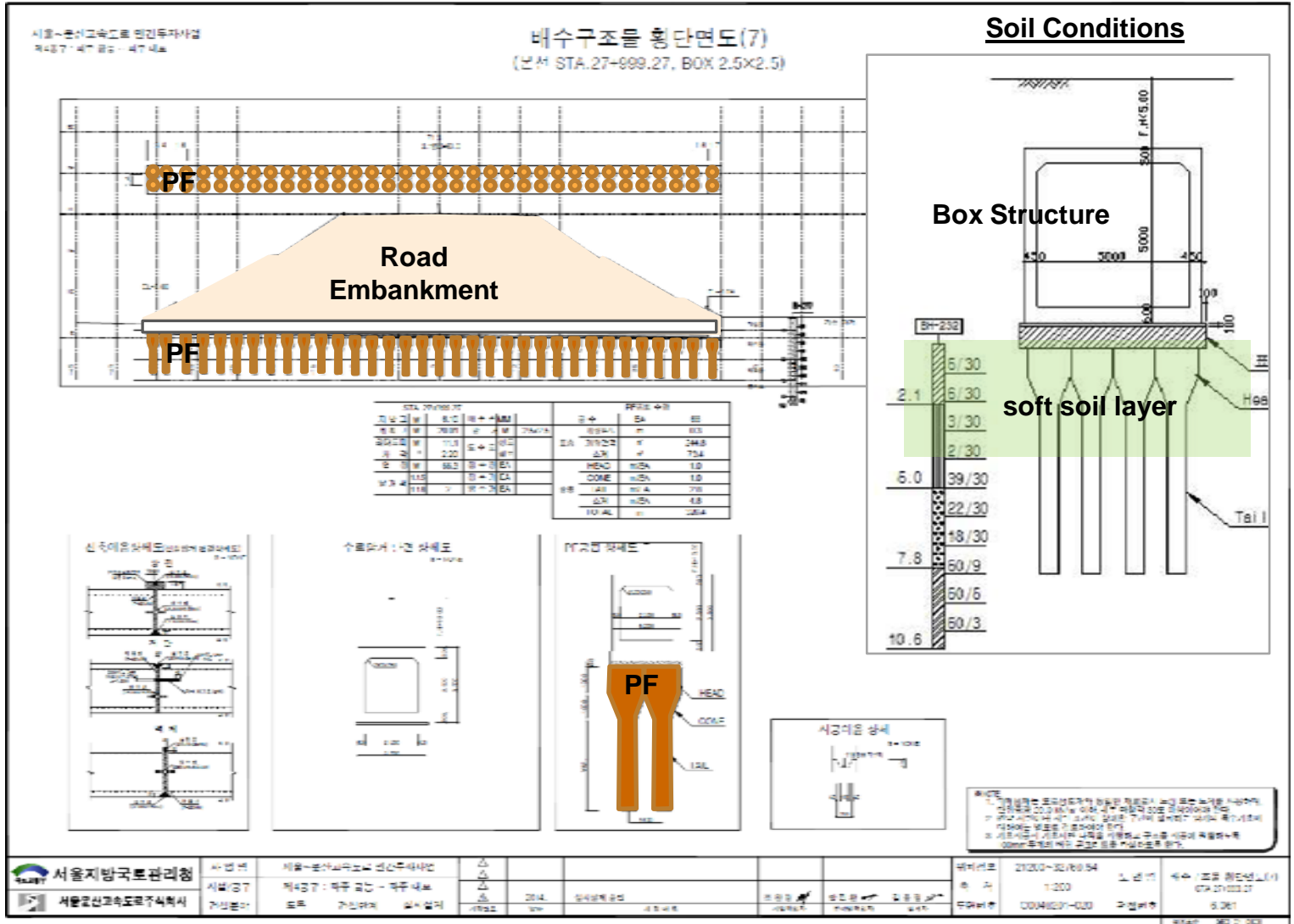
Project Name	Seoul~Musan highway construction in Korea	PF Design	-Installing length 4,207m -PF qu = 1.5MPa -Allowable settlement=25mm -Design load 15~25t/m <sup>2</sup>	Construction Period	2017.05.01~2017.07.31
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Original Design : Pre-loading (leaving 12 months)



PF applied to shorten construction period



# WHAT IS THE POINT FOUNDATION

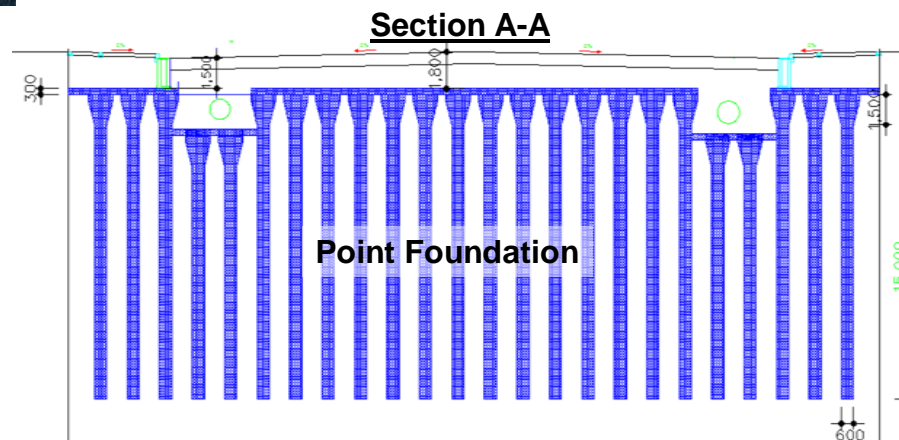
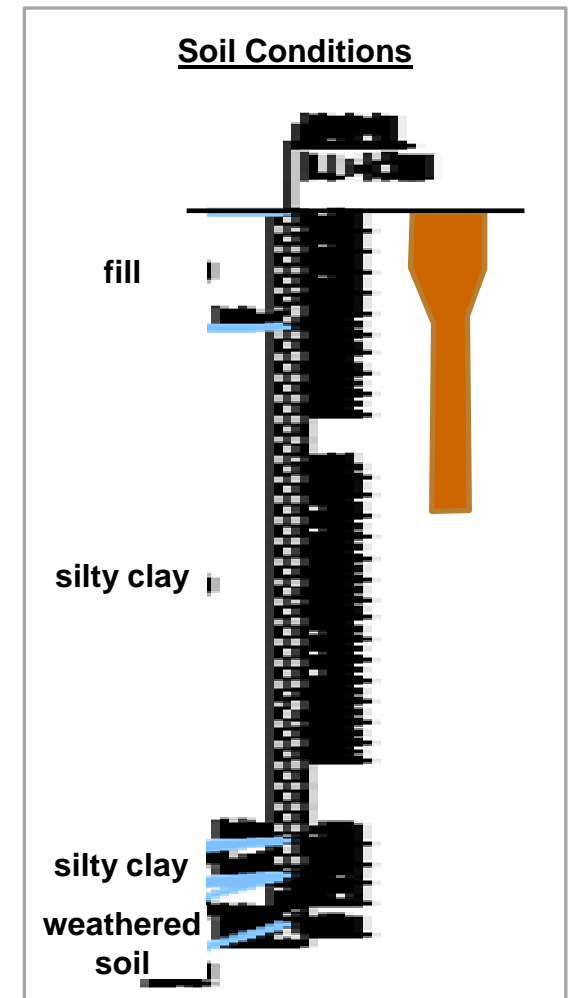
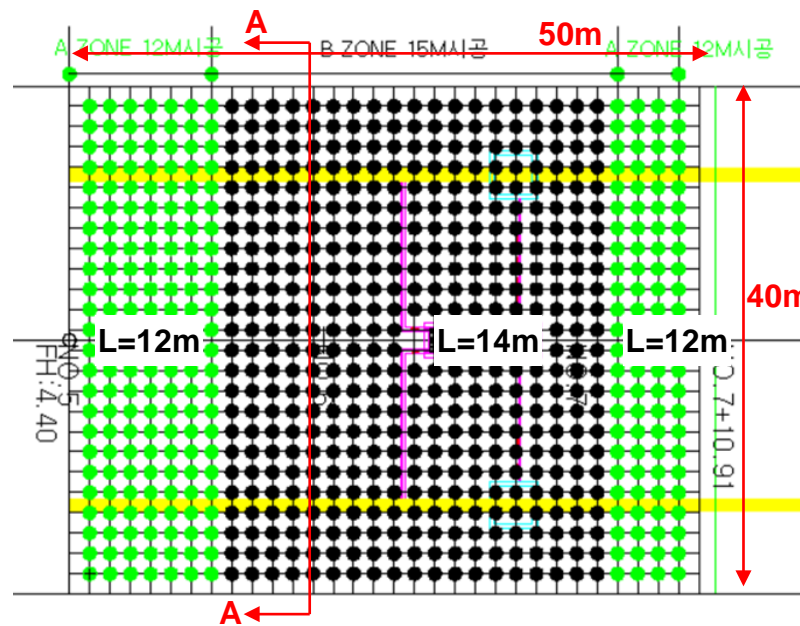
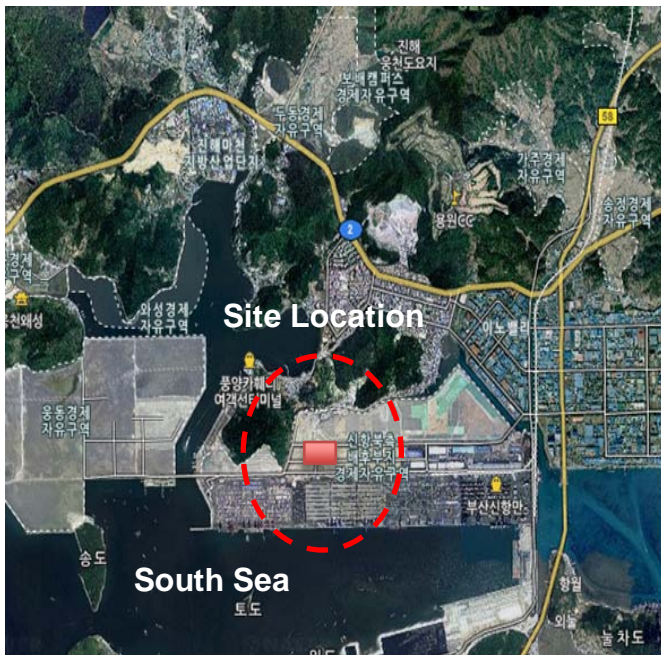
Point foundation is applied over 1,000 sites in Korea

Project Name	Seoul~Musan highway construction in Korea	PF Design	<ul style="list-style-type: none"> <li>-Installing length 4,207m</li> <li>-PF <math>q_u = 1.5\text{MPa}</math></li> <li>-Allowable settlement=25mm</li> <li>-Design load 15~25t/m<sup>2</sup></li> </ul>	Construction Period	2017.05.01~2017.07.31
<p data-bbox="267 1516 539 1585">① Pre-mixing test In laboratory</p> <p data-bbox="1206 867 1343 935">② mixing work</p> <p data-bbox="756 1175 1061 1209">③ After mixing work</p> <p data-bbox="1526 1123 1825 1158">④ Visual Inspection</p> <p data-bbox="1767 1561 2032 1595">⑤ Static load test</p>					

# WHAT IS THE POINT FOUNDATION

Point foundation is applied over 1,000 sites in Korea

<b>Project Name</b>	Port hinterland 1-1 sec. In the New Busan Port	<b>PF Design</b> <ul style="list-style-type: none"> <li>-Installing length 9,879m</li> <li>-PF <math>q_u=0.8\text{MPa}</math></li> <li>-Allowable settlement 10cm</li> <li>-Design load <math>5.3\text{t/m}^2</math></li> </ul>	<b>Construction Period</b>	2013.11.12~2013.12.10
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Original method is Pre-loading.  
But settlement occurred at 80cm



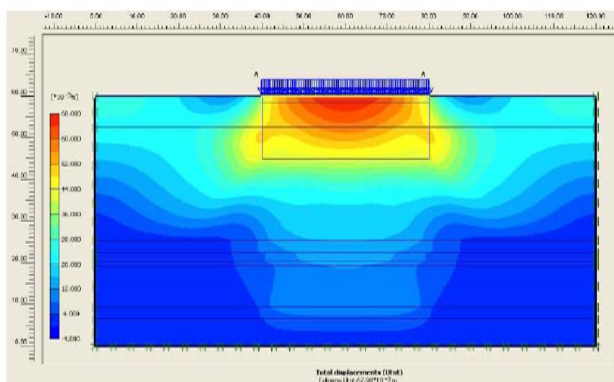
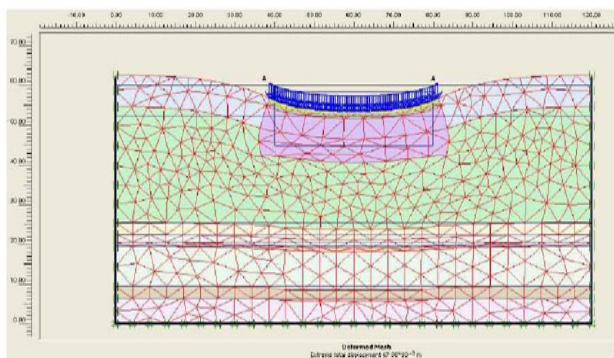
PF applied  
to protect the additional settlement.



# WHAT IS THE POINT FOUNDATION

Point foundation is applied over 1,000 sites in Korea

<b>Project Name</b>	Port hinterland 1-1 sec. In the New Busan Port	<b>PF Design</b>	-Installing length 9,879m -PF $q_u=0.8\text{MPa}$ -Allowable settlement 10cm -Design load $5.3\text{t/m}^2$	<b>Construction Period</b>	2013.11.12~2013.12.10
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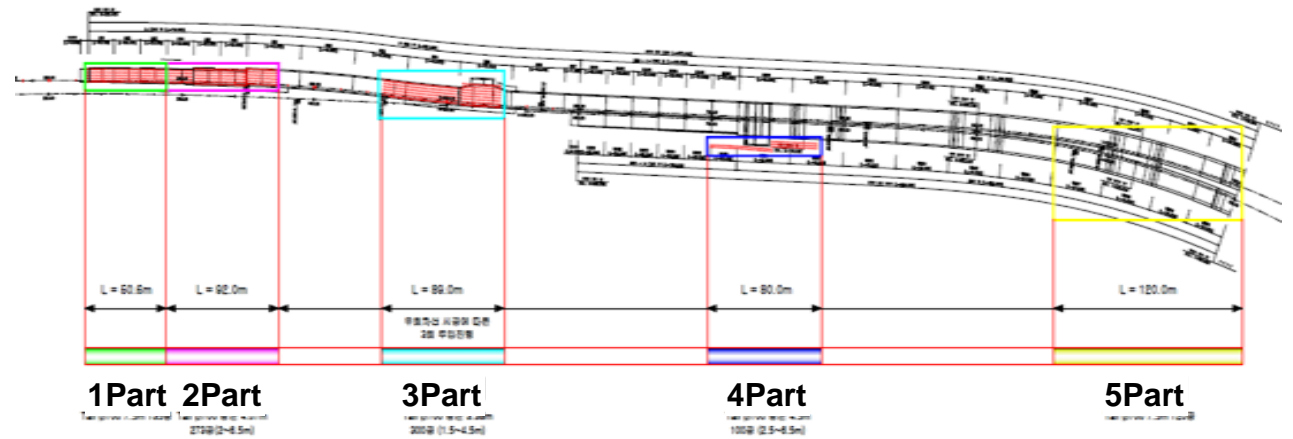
Ground water level is very high

PF

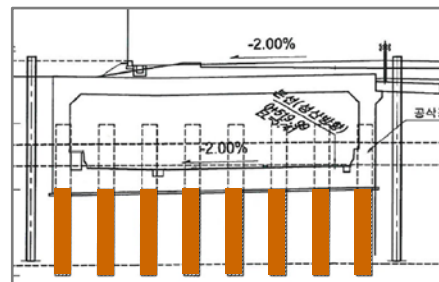
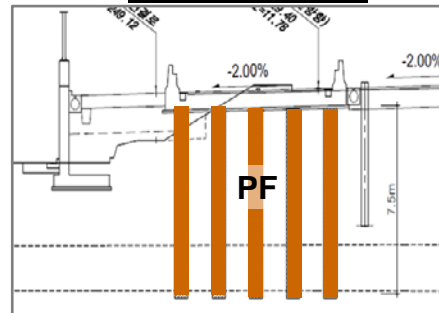
# WHAT IS THE POINT FOUNDATION

Point foundation is applied over 1,000 sites in Korea

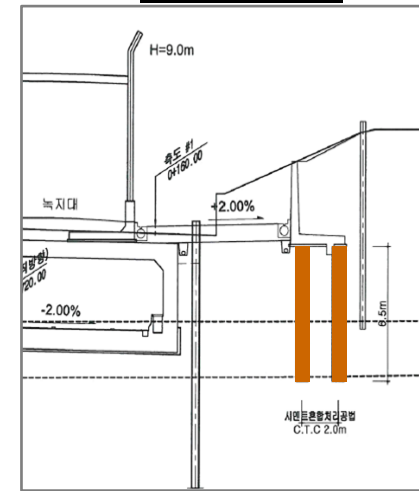
<b>Project Name</b>	Underground road construction in West Highway	<b>PF Design</b> <ul style="list-style-type: none"> <li>-Installing length 5,029m</li> <li>-PF <math>q_u=2.0\text{MPa}</math></li> <li>-Allowable settlement 25mm</li> <li>-Design load 10~30t/m<sup>2</sup></li> </ul>	<b>Construction Period</b>	2018.03.22~ under-construction
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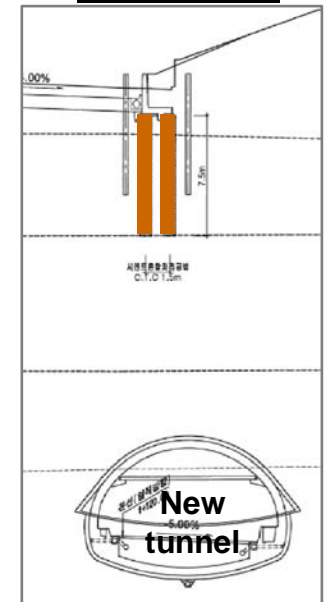
Section 1~3part



Section 4part



Section 5part

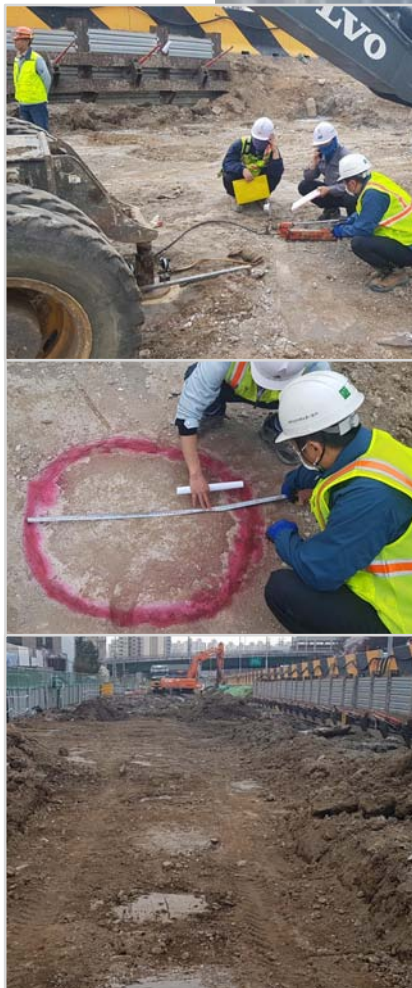


# WHAT IS THE POINT FOUNDATION

Point foundation is applied over 1,000 sites in Korea

<b>Project Name</b>	Underground road construction in West Highway	<b>PF Design</b>	-Installing length 5,029m -PF $q_u=2.0\text{MPa}$ -Allowable settlement 25mm -Design load 10~30t/m <sup>2</sup>	<b>Construction Period</b>	2018.03.22~ under-construction
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Quality check



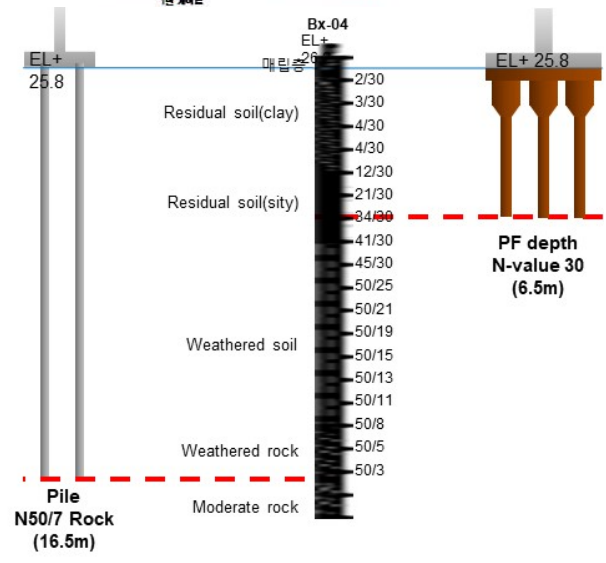
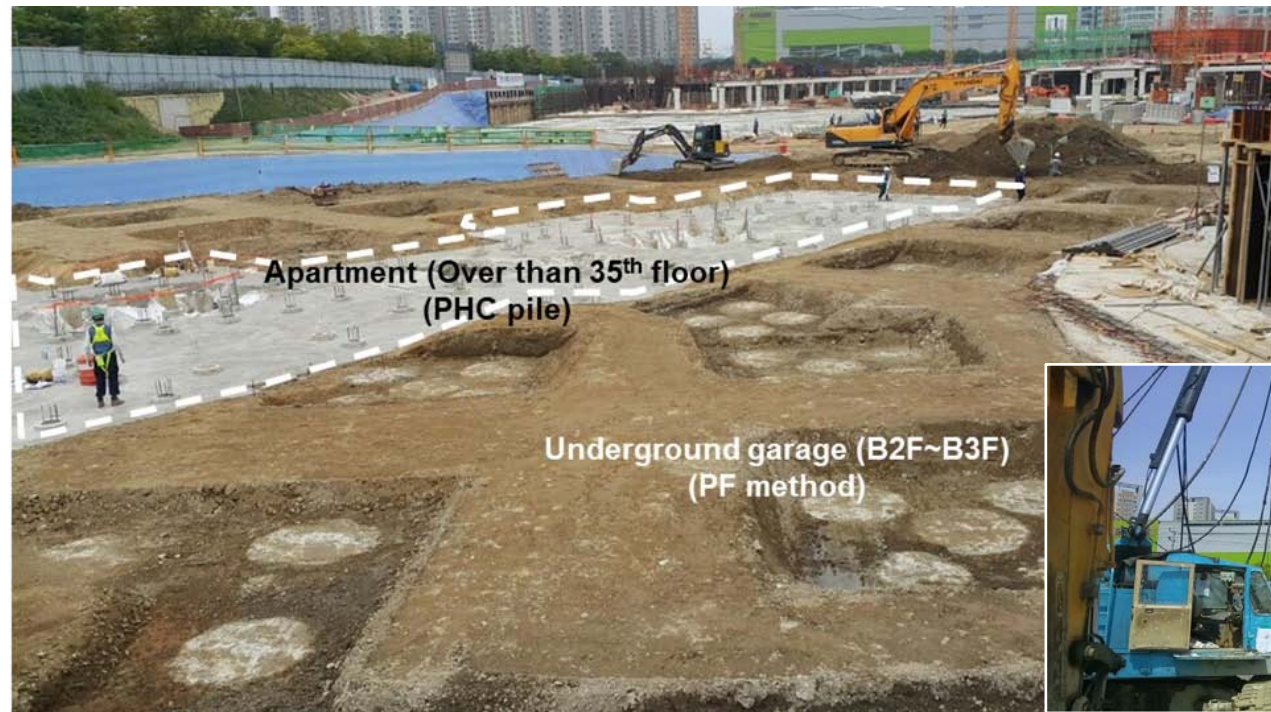
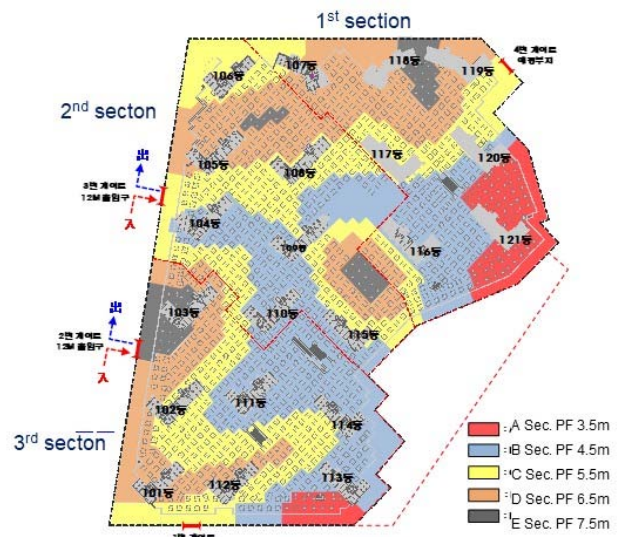
driving car  
▼

mixing work adjacent road

# WHAT IS THE POINT FOUNDATION

Point foundation is applied over 1,000 sites in Korea

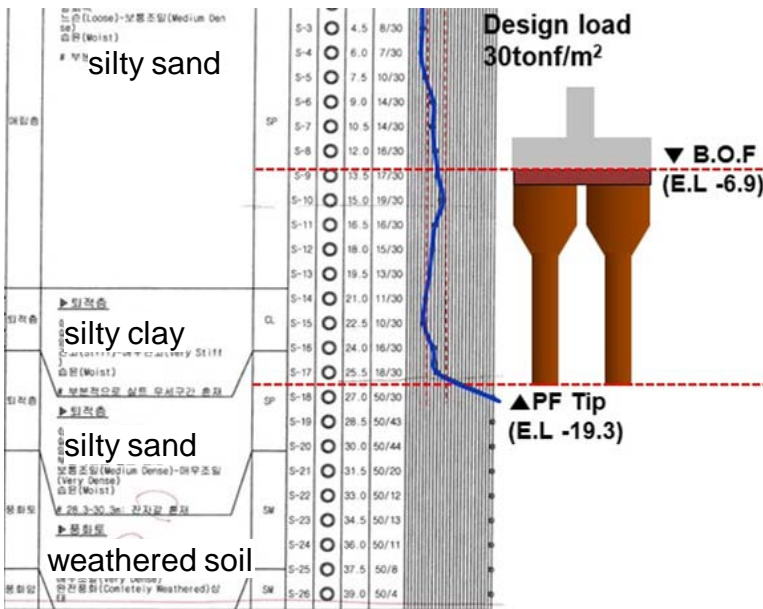
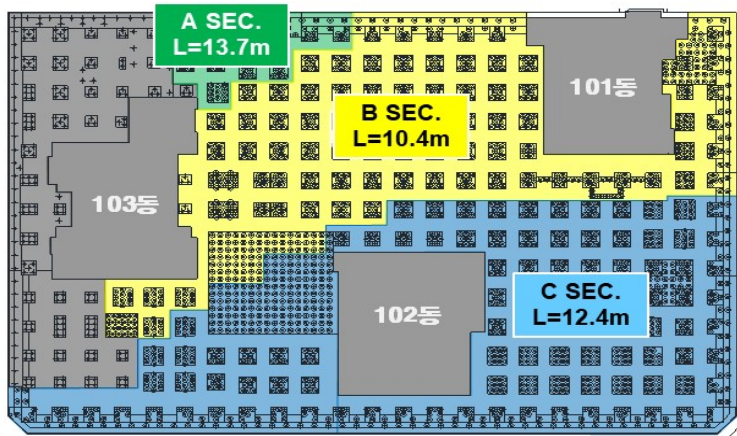
<b>Project Name</b>	<b>Yeong-tong Apatment (Underground garage)</b>	<b>PF Design</b>	-Installing length 32,699m -PF $q_u=2.0\text{MPa}$ -Allowable settlement 25mm -Design load 30t/m <sup>2</sup>	<b>Construction Period</b>	2015.04.12~2015.06.30
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# WHAT IS THE POINT FOUNDATION

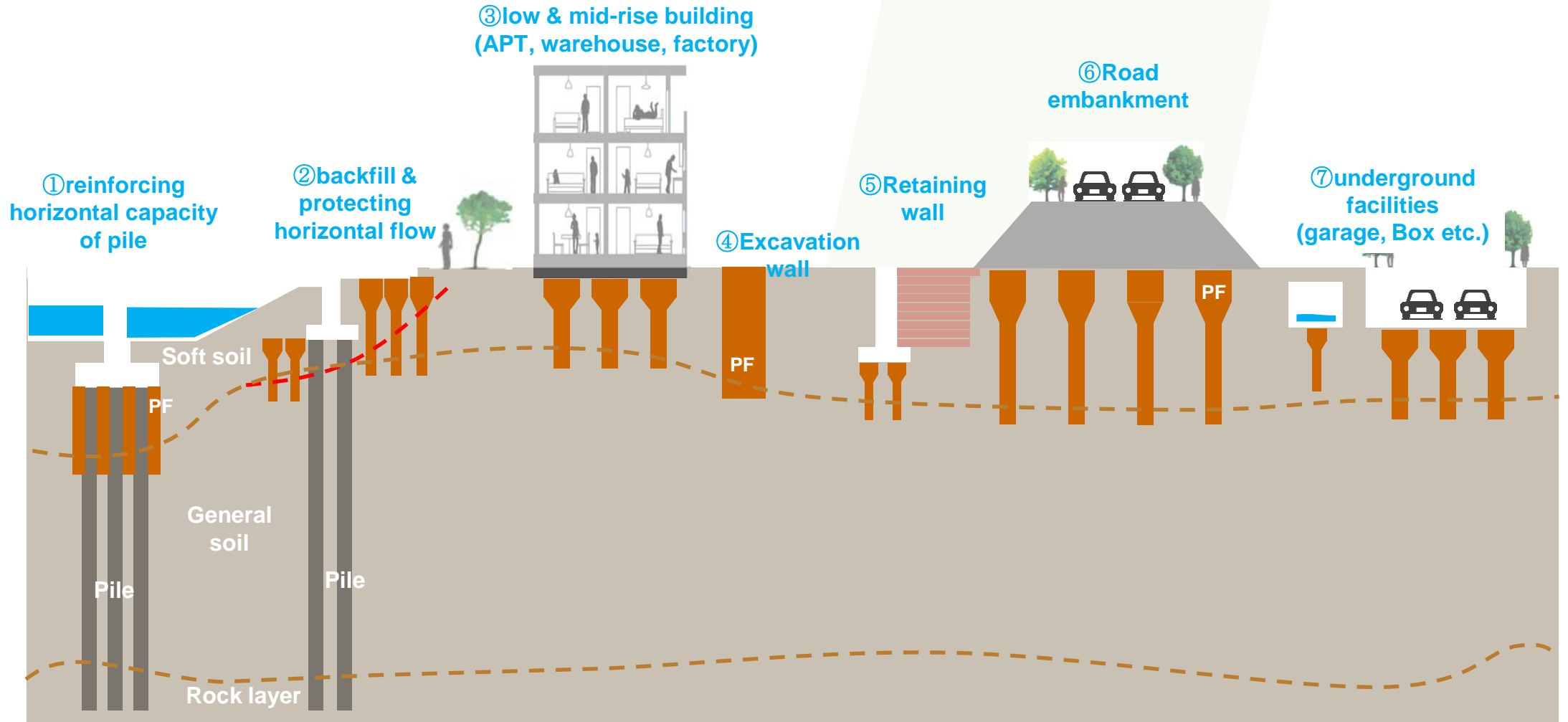
Point foundation is applied over 1,000 sites in Korea

<b>Project Name</b>	Song-do 00town construction	<b>PF Design</b>	-Installing length 24,453m -PF qu=2.0MPa -Allowable settlement 25mm -Design load 30t/m <sup>2</sup>	<b>Construction Period</b>	2016.02.11~2014.04.30
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# WHAT IS THE POINT FOUNDATION

Cost-effective alternative method for various kind of structures





**EXT**

Let's make the earth's skin

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