

2020. August

Humus-B Soil Stabilized Method (HSSM) for Sub Base / Base of Pavement



InnoCSR Co., Ltd
KOREA

B&F E&C LIMITED
BANGLADESH

CONTENTS

What is HSSM?

Construction & Equipment

References

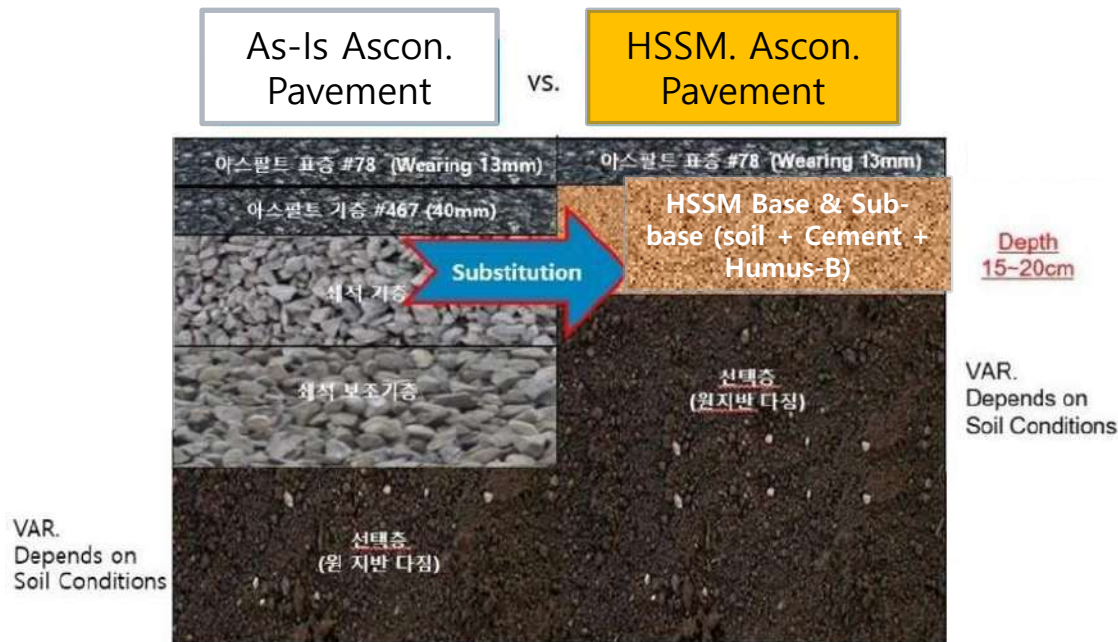
Appendix

Comparison of HSSM & Soil Cement

Attachments

What is the HSSM?

- Humus-B Soil Stabilized Method (**HSSM**) is cost effective construction method for Pavement Sub(base) using highly compacted mixture of soil/aggregate with **cement**, and extra small amount of **Humus-B** (Chemical admixture, i.e. Soil Stabilizer)
- **Normal Mixing Ratio: Appr. Soil (91.8~95.8%) + 0.2% (Humus-B) + 4~8% (Cement)**
- **Subbase and Base Thickness (15cm ~ 20cm) reduction with high strength and durability** ⇒ **Green Solution for Low Cost, Fast Construction, and Better Quality**



Outstanding Features of HSSM

A. Low Cost

- Reduced Excavation/Reclamation
- Granular Material of Subbase/Base
- Cut in Construction Time (**Min. 50%**)
- A bituminous surface thickness

Reduction (Min. 20%)

Removal of unsuitable material	Mineral base layer	Bitumen	Soil stabilization on sub-grade level	Construction time	Immobilization of hazardous material
Omits 10,000m ² x53cm	Omits 10,000m ² x45cm	50% Omits 10,000m ² x8cm	Omits 10,000m ² x40cm	5 days	No Extra Cost
↓	↓	↓	↓	↓	↓
5,300 m³	4,500 m³	1,800 t	4,000 m³	Saving 70%	Saving



Source: GeoCrete Homepage www.geocrete.com

B. Quality Improvement

- Differential Settlement with Stiffness
- Crack from Differential Settlement
- Sink Hole, Potholes, Puddles, etc

Prevention

At least 25% Cost Saving



Analysis of Cost Saving by HSSM

➤ Case Study: Dongtan 5-1 Area, South Korea/ Traditional Method

Quantity Estimation (560 m2, in Dongtan 5-1 Area, South Korea)

1. Road Design.															
Length	140 m	Road Designn Spec. (560 m2)	Layer	Specification	Depth	Remarks	As-Is Method								
width	4 m		1. Wearing (surface)	Ascon(#78, WC-2)	6 cm										
Surface Layer	0.26 m		2. Ascon Middle layer	Ascon(#67, WC-4)	5 cm										
Base Layer Depth	0.4 m		3. Ascon Base Layer	Ascon(#467, BB-2)	10 cm										
			4. Aggregates Sub-Base	40mm	40 cm										
2. Quotation Detail															
(Unit : US \$)															
Classification	Process & Standard	unit	quantity	Material		Labor			Equipment cost			SUM.		Remarks	
				unit price	sum	unit price	Work day	sum	unit price	Work day	sum	unit price	sum		
Material	Aggregates	m3	224 m3	20	4,480							20	4,480	Ex Spot Price	
	Ascon (#467)	ton	134.4 ton	55	7,392							55	7,392		
	Ascon (#67)	ton	67.2 ton	58	3,898							58	3,898		
	Ascon (#78)	ton	80.64 ton	60	4,838							60	4,838	Ascon Gravity =2.4	
	Sub-Total				20,608								20,608		
Equipment for paving	Back Hoe (6W)	ea	1						600	7	4,200		4,200		
	Roller (Tandum)	ea	1						600	8	4,800		4,800		
	Asphalt Finisher	ea	1						800	1	800		800		
	Dump Truck	ea	1						500	8	4,000		4,000		
	Sub-Total												13,800		
Labour for pavement	Labour Local	person	3			300	24	21,600					21,600		
	Korean Expert	person	1			600	8	4,800					4,800		
	Sub-Total							26,400					26,400		
Grand Total					20,608			26,400			13,800		60,808		
Daily Transportation : Daily 40MT 500-1000 Trucks															
Total Days: 8 Days															

Total Period: 8 Days
Total Cost: Appr. 60K USD

Analysis of Cost Saving by HSSM

➤ Case Study: Dongtan 5-1 Area, South Korea/ New Method

Quantity Estimation (560 m2, in Dongtan 5-1 Area, South Korea: Soil Stabilizer)

1. Road Design.		2. Component Consumption		Road Designn (560 m2)		Layer		Specification		Depth	
Length	140 m	HUMMUS	3 kg/m3	1. Wearing	Ascon(#78, WC-2)	9 cm					
width	4 m	CEMENT	130 kg/m3	2. Ascon Base	Ascon (#467)	0					
Surface Layer	0.09 m	Soil	1800 kg/m3	3. Base layer	Humus-B	20 cm					
Base Layer Depth	0.2 m	Volume	112 m3								

3. Quotation Detail													(Unit : US \$)	
Classification	Process & Standard	unit	quantity	material Cost		Labour cost			Equipment cost			SUM.		Remarks
				unit price	sum	unit price	Work day	sum	unit price	Work day	sum	unit price	sum	
Material for HUMMUS (Soil Stabilizer) Compaction	HUMUS-B	m3	336 kg	20.0	6,720							20	6,720	FOB Korea
	Cement	m3	14560 kg	0.06	874							0.06	874	Portland
	Soil	m3	201600 kg	-	-							-	-	free of cost
	Ascon (#78, WC-2)	ton	121 ton	60	7,258							60	7,258	Ascon Gravity =2.4
	Sub-Total				14,851								14,851	
Equipment for paving	Back Hoe (6W)	ea	1						600	1	600		600	
	Roller (Tandum)	ea	1						600	2	1,200		1,200	
	Asphalt Finisher	ea	1						800	2	1,600		1,600	
	Dump Truck	ea	1						500	2	1,000		1,000	
	Sub-Total												4,400	
Labour for pavement	Labour Local	person	3			300	6	5,400					5,400	
	Korean Expert	person	1			600	2	1,200					1,200	
	Sub-Total							6,600					6,600	
Grand Total					14,851			6,600		4,400			25,851	

Daily Transportation : Daily 40MT 500-1000 Trucks

Total Days: 2 Days

Total Period: 2 Days

Total Cost: Appr. 25K USD (60% Saving)



2

Chapter

Construction & Equipment

HSSM Construction Sequence

HSSM - Simple and Easy Two STEP Construction Method

- 1st STEP: **Mixing** (Mixing ratio: Soil 92~94% + 0.2% Humus-B + 5~8% Cement + Water)
- 2nd STEP: **Normal Compaction** for only two Layer (Each Layer: 20 ~ 30cm)

1st STEP : Mixing (4 Option for Field Condition)



2nd STEP : Normal Compaction



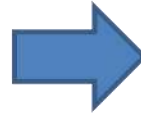
Application with General Paving Facility



Field Mixing by Back Hoe



Field Mixing : Mobile Mixer



① Humus-B Paving



② Rolling



③ in case of Permeable Road



④ Bearing Capacity Test

Asphalt Paving after curing



Block Paving on Permeable Road





3

Chapter

References

Construction Site Photo (at LH Dongtan 5-1 in Korea)

Before (2018 May.19 : 8 AM)



After (2018 May.20 : 3 PM)



AADT(annual Average Daily Traffic : 1,000 units 40 ton Dump Trucks

Construction Site Video (at LH Dongtan 5-1 in Korea)

1^{st.} Day :
HSSM Mixing, Paving
and Compaction



VIDEO -1

2^{nd.} Day :
Tack Coating &
ASCONE Paving



VIDEO -2

Construction Site Video (at LH Dongtan 5-1 in Korea)

Before

(2018 May.18 : 3 PM)



After

(2018 May.23 : 11 AM)



VIDEO -1

VIDEO -2

Coring & Compressive Test (at LH Dongtan 5-1 in Korea)



(주)한국건설품질시험연구원
Korea Construction Quality Test Institute

시험 성적서

시료 명 : 휴머스 B (H-30cm) 좌측, 우측, (H-40cm) 좌측, 우측	접수 번호 : KT118-LRS-0706-01
시료 채취 장소 : 동탄 5-1 급구 진입로 시험시공(도로포장) 구간	발급 번호 : KT118-TRS-0711-01
시험 용도 : 시험시공 후 일축압축강도 평가	접수 일자 : 2018년07월06일
업체 명 : 지하정보기술㈜	발급 일자 : 2018년07월11일
의뢰자 : 김창동	페이지 : 1/3
주소 : 경기도 의왕시 이미로 40 인덕원 IT 벨리 D동 609 호	

귀하가 의뢰한 위 시료에 대해서 아래 시험 방법에 따라 시험한 결과를 다음과 같이 알려드립니다.

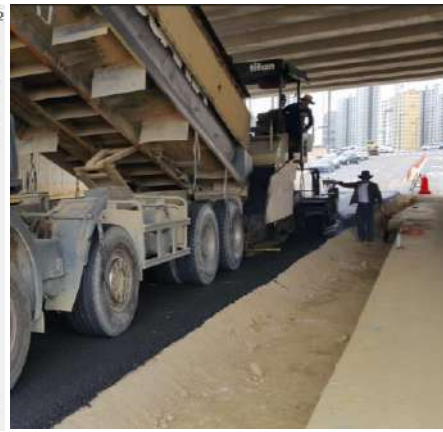
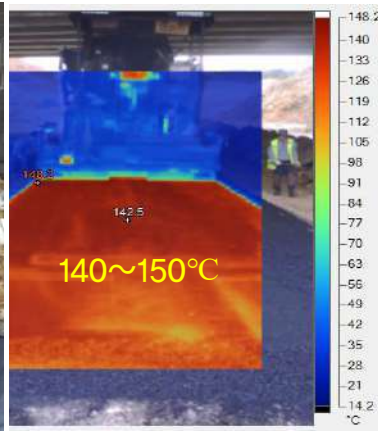
- 결 과 -

시험항목	시험방법	단위	시험결과	비고
일축강도	#(H-30cm) 좌측	의뢰자 제시	MPa	5.20
	#(H-30cm) 우측		MPa	5.98
	#(H-40cm) 좌측		MPa	5.96
	#(H-40cm) 우측		MPa	5.21

Compare HSSM vs. conventional Paving



Asphalt Pavement



After 6 months Road Layer



Appendix



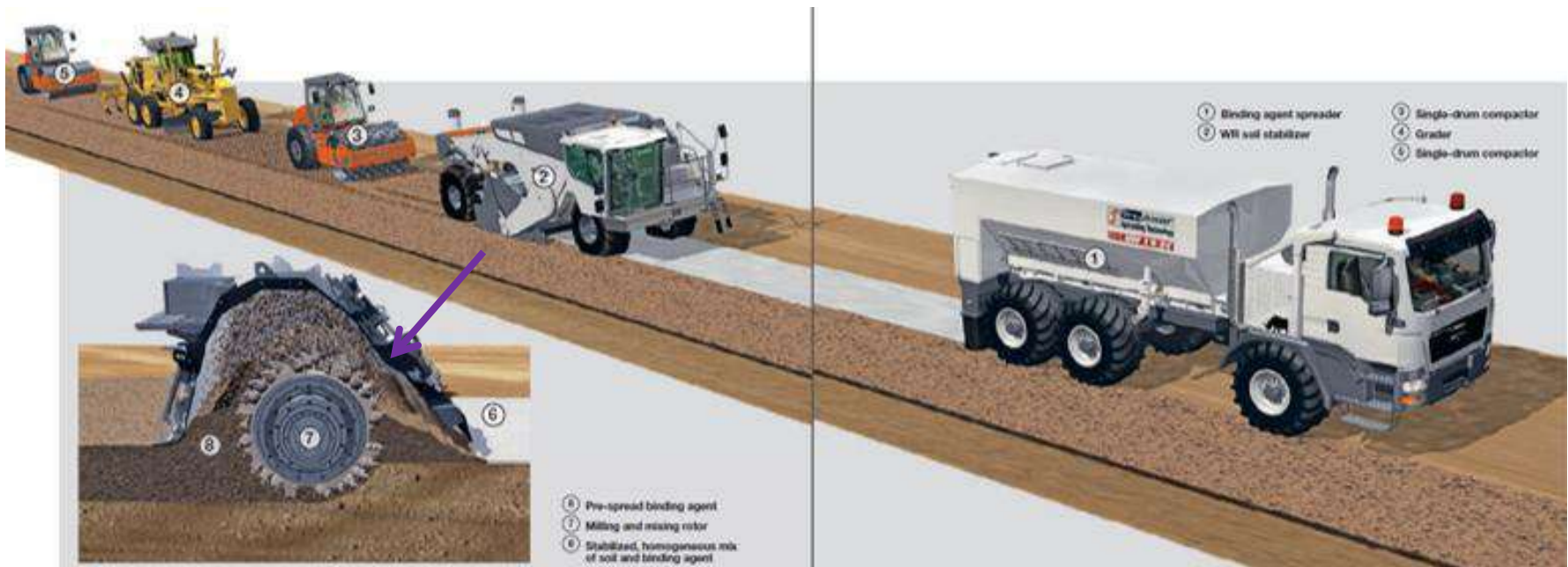
Comparison of HSSM & Soil Cement

Overview of Soil Cement

What is Soil Cement?

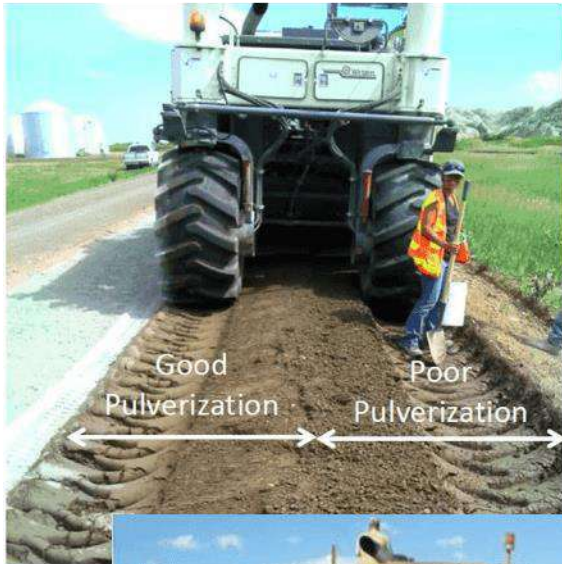
Soil cement is a construction material, **a mix of pulverized soil with measured amounts of cement and water**, usually processed in mixing and compacted to high density. Hard, semi-rigid durable material is formed by hydration of the cement particles.

Since it was first applied to road construction in the United States in 1935, it has been widely used not only in advanced countries such as the US and Europe but also in Southeast Asia.



Overview of Soil Cement

Problems Applying Soil Cement in Pulverization Method



Damage by 200 Ton Oil Rig Movement (2011)



Cause

Result

Repair Methods:
No Depression Area: Remove BST & fabric, new BST full width
Depression Area: Re-soil cement, 3" Gravel & BST Full width



Comparison of HSSM & Soil Cement

Description	Soil Cement (Specification)		HSSM
Max. Size of Soil and Aggregate	Soil above 80% pass #4 (4.76mm) sieve.	PCA (Portland Cement Association 2017 USA)	Less than 40 mm
Allowing Mixing Time	Within 2 hours		Within 12 hours
Construction Joint	Need		No need
Construction Method	In situ Pulverizing (Special Equipment)		Ready Mix (Normal Equipment)

What is the HSSM?

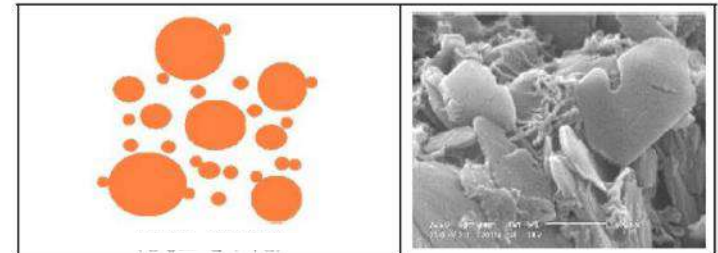
Humus-B?



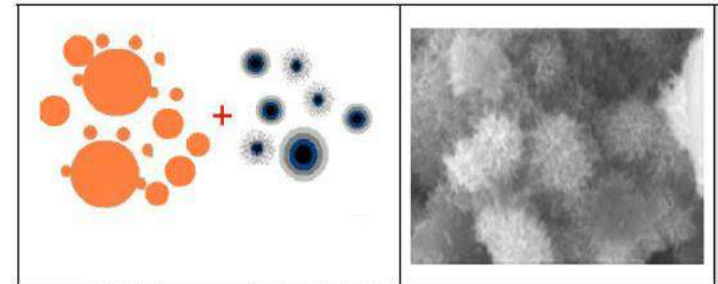
1. **Chemical Admixture** made by a Korean Technology (Patented)
2. **Eco-friendly Powder** composed of inorganic materials
3. **Excellent on-site applicability** due to adaptability to most of soil composition

Green Solution for Low Cost, Fast Construction, and Better Quality

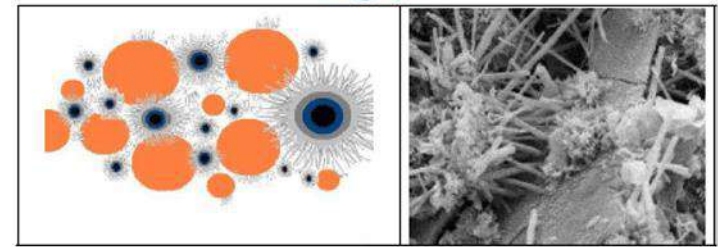
Solidification Process with Humus-B (by electron Microscope)



Cohesive soil with round Shape

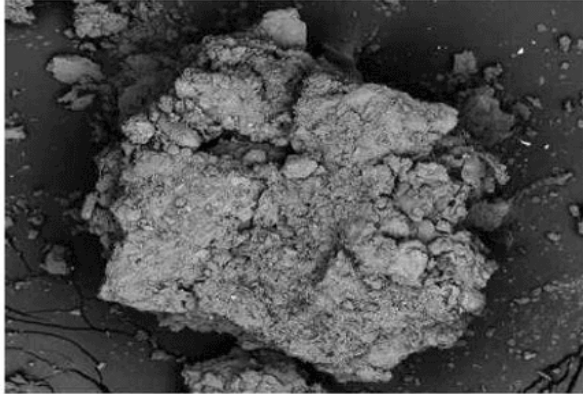
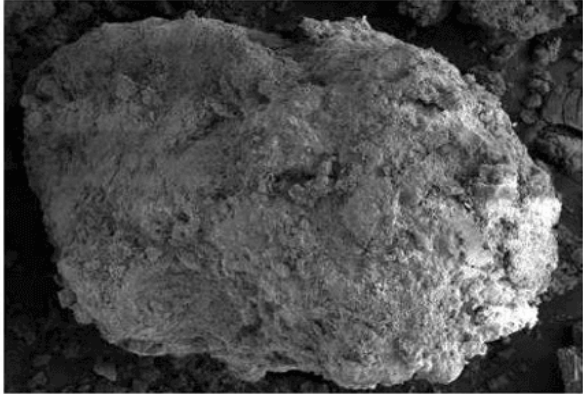

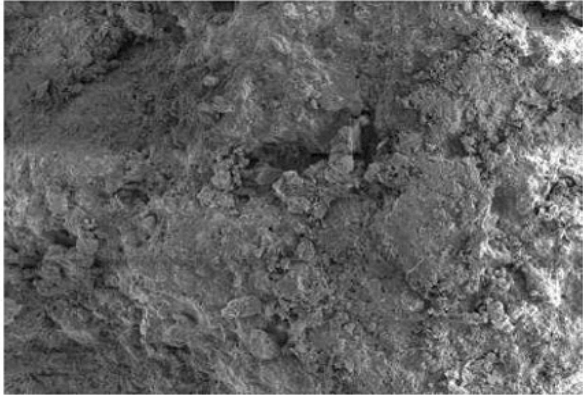


Cohesive soil with Cement and Humus-B



Pozzolanic reactions due to the ionic bonding of organic matter with addition of Humus-B

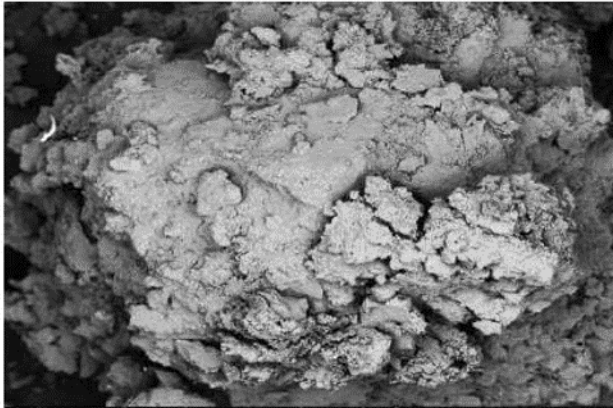
Humus-B Additive Effects – by SEM

×200		
	Cement + Soil + Humus-B (0%)	Cement + Soil + Humus-B (0.2%)
×500		
	Cement + Soil + Humus-B (0%)	Cement + Soil + Humus-B (0.2%)

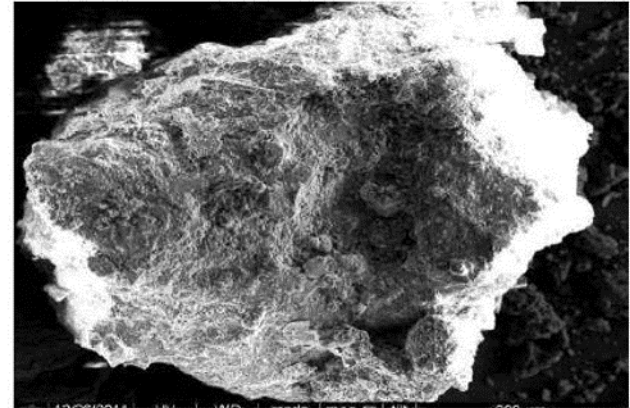
SEM Picture (After 7 days curing)

Humus-B Additive Effects – by SEM

×200

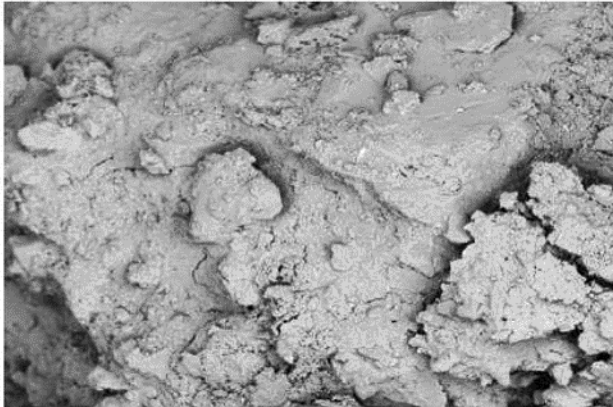


Cement + Soil + Humus-B (0%)

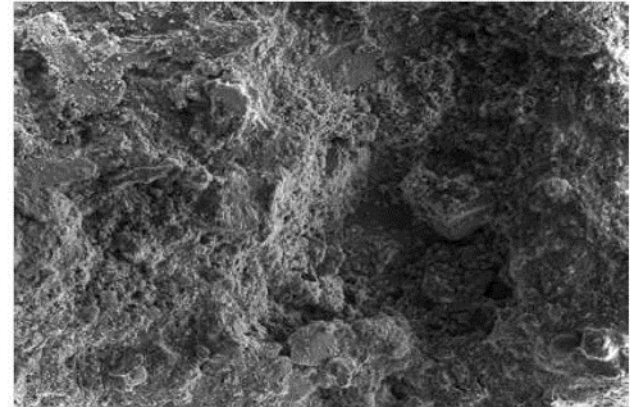


Cement + Soil + Humus-B (0.2%)

×500



Cement + Soil + Humus-B (0%)

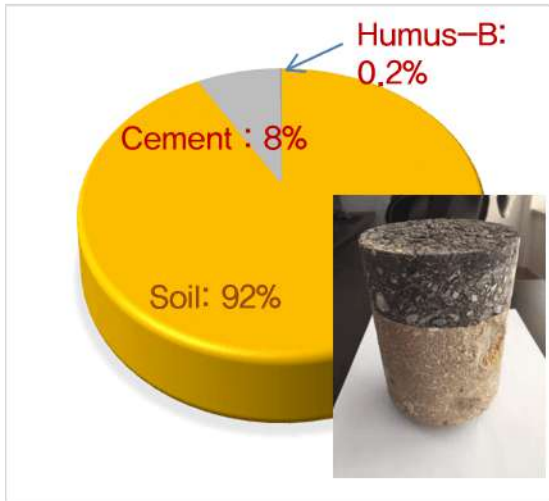


Cement + Soil + Humus-B (0.2%)

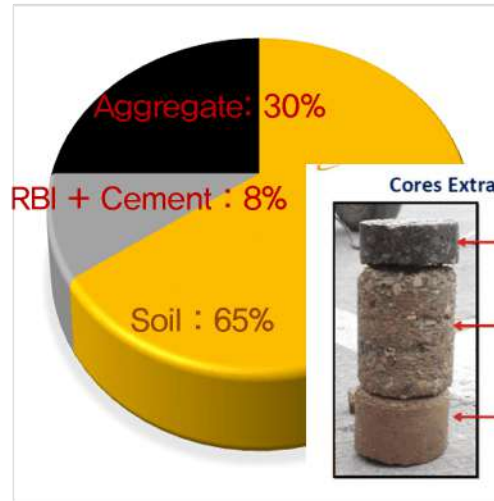
SEM Picture (After 28 days curing)

Comparing Humus-B vs. Other Chemical Admixtures

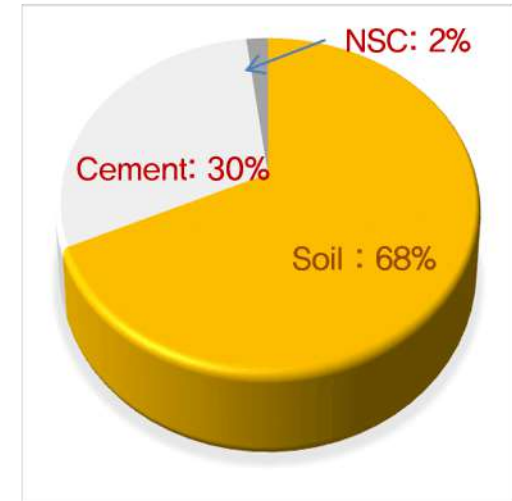
Humus-B (HSSM)



RBI- 81 (Netherland)



NSC (Japan)



– 92% Soil + 0.2% Humus-B + 8% Cement Mix ⇒ Highly strength and Durability

Desc.	Humus-B	RBI-81	NSC	Remarks
Cement(%)	5 ~ 8	8 ~ 10	30% or more	Cement Min. vs. NSC
Aggregate (%)	-	30	-	Only RBI necessary
Strength (7days)	4 ~ 8 MPa	0.1 ~ 3 MPa	2 ~ 6 MPa	Highly Strength

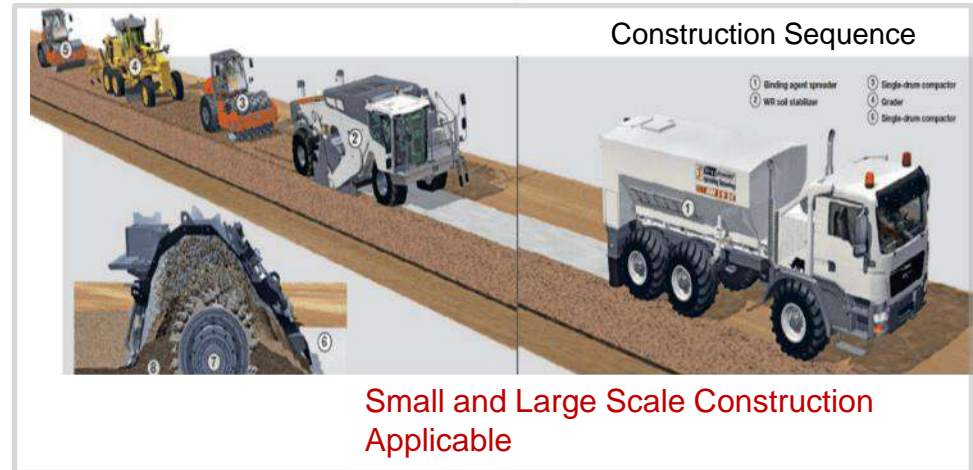
Outstanding Features of HSSM

C. Constructability

- Exc./Rec. sequence reduction
- Simple Series of Construction
- Curing time reduction
- Construction Equipment Min.



Constructability Increase



D. Maintenance

- Design stage: Structural safety secure
- Const. stage: Simple Mix and Compaction
- Public use : Surface Smoothness, bearing Cap.
- Maintenance : Low Cost, Low deflection, Low Fatigue life, Lower asphalt strains, No Breaker



Easy and Beneficial Maintenance



Surface Smoothness Secure



Applied to Various Soil (Sand, Silt, Clay etc.)

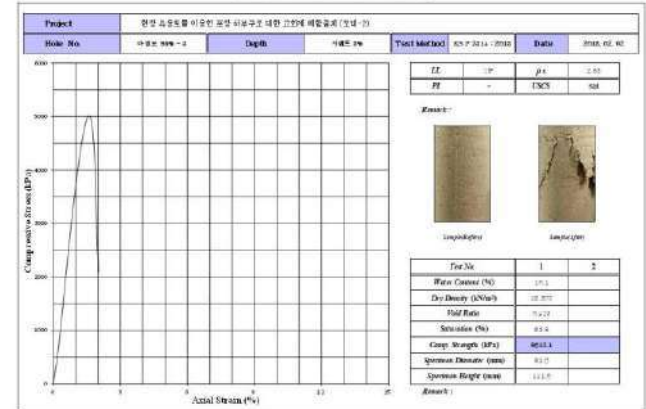
SM : Sand



CL : Clay

ML : Silt

Unconfined Compression Test



Unconfined Compression Test



Recyclable (Harmless and No Soil Pollution)



05115121, Yangcheon-gil, Ochang-eup, Cheongwon-gu, Chungbuk, Korea
Tel: 043711-8995 Fax: 043711-8994

TEST REPORT

APPLICANT : SUBSURFACE INFORMATION TECH. REPORT NO. : M281-18-00187
 SAMPLE RECEIVED DATE : 2018-06-20
 REPORT ISSUED DATE : 2018-07-09
 PAGE : 1 OF 2

DESCRIPTION : ONE(1) PIECE OF SUBMITTED CUTTING SAID TO BE SOIL.

ITEM : BASE / SUBBASE COURSE OF PAVEMENT WITH HUMUS-B(SOIL STABILIZER)

TEST CONDUCTED : AS REQUESTED BY THE APPLICANT, FOR DETAILS PLEASE SEE ATTACHED PAGES.

PREPARED AND CHECKED BY
FOR FITI

Hak Joo, Lee
HAK JOO, LEE
QUALITY MANAGER

AUTHORIZED BY
FOR FITI

Jun Je Goo
JE-GOO JUN
PRESIDENT

* Report Verification No.: 1HST-RQLK-1LR4 *
(You can see the authenticity of your test report through the above "Report Verification No." at FITI homepage.)

DOCUMENT SERVICE

The test results contained in this report are limited to results at the sampling point specified by client and are not necessarily indicative or representative of the condition of the lot from which the sample was taken or of all products. Results contained in this report are not based on the quality certification of service by the FITI quality certification program unless specifically requested by the client. Further use of the results of this report is prohibited unless allowed under a separate agreement set forth in an official document that is established between the client specified in this order and the FITI. This test report is prepared to KCA's accreditation.



05115121, Yangcheon-gil, Ochang-eup, Cheongwon-gu, Chungbuk, Korea
Tel: 043711-8995 Fax: 043711-8994

REPORT NO.: M281-18-00187
PAGE : 2 OF 2

TEST ITEMS	UNIT	DETECTION LIMIT	THE WORSE SOME LEVELS OF SOIL CONTAMINATION			TEST RESULTS #1	TEST METHOD
			LEVEL.1	LEVEL.2	LEVEL.3		
CADMIUM (Cd)	mg/kg	0.10	4	10	60	0.13	NATIONAL INSTITUTE OF ENVIRONMENTAL RESEARCH NO.2017-22 (2017.8.11)
COPPER (Cu)	mg/kg	1.0	150	500	2 000	9.3	
ARSENIC (As)	mg/kg	1.50	25	50	200	2.95	
MERCURY (Hg)	mg/kg	0.01	4	10	20	ND	
LEAD (Pb)	mg/kg	1.5	200	400	700	26.9	
HEXAVALENT CHROMIUM (Cr ^{VI})	mg/kg	0.5	5	15	40	ND	
ZINC (Zn)	mg/kg	1.0	300	600	2 000	45.8	
NICKEL (Ni)	mg/kg	0.4	100	200	600	2.8	
FLUORINE (F)	mg/kg	10	400	400	600	253	
ORPs	mg/kg	0.05	10	10	30	ND	
PCBs	mg/kg	0.05	1	4	12	ND	
CYANIDE (CN)	mg/kg	0.2	2	2	120	ND	
PHENOL	mg/kg	0.02	4	4	20	ND	
BENZENE	mg/kg	0.1	1	1	3	ND	
TOLUENE	mg/kg	0.1	20	20	60	ND	
ETHYLBENZENE	mg/kg	0.1	50	50	340	ND	
XYLENE	mg/kg	0.1	15	15	45	ND	
TPH	mg/kg	50	500	600	2 000	199	
TCE	mg/kg	0.1	8	8	40	ND	
PCE	mg/kg	0.1	4	4	25	ND	
BENZO[<i>a</i>]PYRENE	mg/kg	0.005	0.7	2	7	ND	

NOTE) ND = NOT DETECTED = LESS THAN DETECTION LIMIT

** End of The Report **

DOCUMENT SERVICE

The test results contained in this report are limited to results at the sampling point specified by client and are not necessarily indicative or representative of the condition of the lot from which the sample was taken or of all products. Results contained in this report are not based on the quality certification of service by the FITI quality certification program unless specifically requested by the client. Further use of the results of this report is prohibited unless allowed under a separate agreement set forth in an official document that is established between the client specified in this order and the FITI. This test report is prepared to KCA's accreditation.

Coring & Compressive Test (at LH Dongtan 5-1 in Korea)



ity Test Institute

(주)한국건설품질시험연구원
Korea Construction Quality Test Institute

시험 성적서

시료 명 : 휴머스 B (H-30cm) 좌측, 우측, (H-40cm) 좌측, 우측	접수 번호 : KT118-LRS-0706-01
시료 채취 장소 : 동탄 5-1 급구 진입로 시험시공(도로포장) 구간	발급 번호 : KT118-TRS-0711-01
시험 용도 : 시험시공 후 일축압축강도 평가	접수 일자 : 2018년07월06일
업체 명 : 지하정보기술㈜	발급 일자 : 2018년07월11일
의뢰자 : 김창동	페이지 : 1/3
주소 : 경기도 의왕시 이미로 40 인덕원 IT 벨리 D동 609 호	

귀하가 의뢰한 위 시료에 대해서 아래 시험 방법에 따라 시험한 결과를 다음과 같이 알려드립니다.

- 결 과 -

시험항목	시험방법	단위	시험결과	비고
일축강도	#(H-30cm) 좌측	의뢰자 제시	MPa	5.20
	#(H-30cm) 우측		MPa	5.98
	#(H-40cm) 좌측		MPa	5.96
	#(H-40cm) 우측		MPa	5.21



ATTACHMENT

Comparison of Estimation calculation(Bangladesh)
Normal Road type VS GRSS (using Soil Stabilizer)

S/L	Specifications	Details		
		Low Quality GRSS (\$7)	High Quality GRSS (\$20)	Normal Method
1	Basic Road detail			
	Length of Road	1000 m	1000 m	1000 m
	Width of Road	7 m	7 m	7 m
	Surface Layer	0 m	0	0
	Base Layer (Below Surface layer)	0.15 m	0.15 m	0.3 m
	Volume	1050 m3	1050 m3	2100 m3
	Area	7000 m2	7000 m2	7000 m2
2	GRSS Details			
	Total Cost of GRSS (BDT)	1,896,300	5,418,000	NA
	Cost of GRSS (\$)	22,050	63,000	NA
	Total quantity of GRSS (kg)	3,150	3,150	NA
3	Cement Details			
	Total quantity of Cement (kg)	105,000	105,000	NA
4	Road Cost			
	Total Cost of Road	3,431,700	6,953,400	0
	Total Cost of Road (Excluding SS cost)	1,535,400	1,535,400	NA
	Korean Consultant Cost	Not included	Not included	NA
	Total % saving using SS	71.25%	41.75%	

Comparison of Estimation calculation(Bangladesh)

Normal Road type VS GRSS (using Soil Stabilizer)

S/L	Classification	GRSS (\$7)		Normal Road		Difference in amount (NR-GRSS - LQ)		Remarks
		BDT	USD	BDT	USD	BDT	USD	
1	Material	3366300	39143.02	9840113.52	114,419.92	6,473,813.52	75,276.90	
2	Equipment	60000	697.67	1047204.38	12,176.80	987,204.38	11,479.12	
3	Labour	5400	62.79	1048915.00	12,196.69	1,043,515.00	12,133.90	
	Total Sum=	3431700	39903.49	11936232.89	138,793.41	8,504,532.89	98,889.92	
	Total % saving using GRSS		71.25%					

S/L	Classification	GRSS (\$20)		Normal Road		Difference in amount (BDT-GRSS - HQ)		Remarks
		BDT	USD	BDT	USD	BDT	USD	
1	Material	6888000	80093.02	9840113.52	114419.92	2,952,113.52	90	34,326.
2	Equipment	60000	697.67	1047204.38	12176.80	987,204.38	12	11,479.
3	Labour	5400	62.79	1048915.00	12196.69	1,043,515.00	90	12,133.
	Total Sum=	6953400	80853.49	11936232.89	138793.41	4,982,832.89	92	57,939.
	Total % saving using GRSS		41.75%					

Note : Above shown estimation calculations are for reference purpose only. The actual price may be subject to change .

1. Road Design.	
Length	1000 m
width	7 m
Surface Layer	0 m
Base Layer Depth	0.15 m
Dollar Rate(1\$=BDT)	86
Soil Stabilizer rate(\$)	7

2. Component Consumption	
HUMMUS	3 kg/m3
CEMENT	100 kg/m3
Soil	1800 kg/m3
Volume	1050 m3

Road Design Spec.	Layer	Specification	Depth
	1. Wearing	Premix Carpet	0cm
	2. Base layer	GRSS - Low Quality	20 cm

3. Quotation Detail

Classification	Process & Standard	unit	quantity	material Cost		Labour cost			Equipment cost			SUM.		
				unit price	sum	unit price	Work day	sum	unit price	Work day	sum	unit price	sum(BDT)	USD
Material for GRSS (Soil Stabilizer) Compaction	GRSS- LQ	m3	3150 kg	602.00	1,896,300							602	1,896,300	22,050
	Cement	m3	105000 kg	14.00	1,470,000							14.00	1,470,000	17,093
	Soil	m3	1890000 kg	-	-							-	-	-
	Premix carpet	m3	-	-	-							0	-	-
	Sub-Total				3,366,300								3,366,300	39,143
Equipment for paving	Back Hoe (6W)	hr	1						12,000	1	12,000		12,000	140
	Roller (Tandum)	hr	1						12,000	2	24,000		24,000	279
	Asphalt Finisher	hr	1						12,000	-	-		-	-
	Tipper/Truck	hr	1						12,000	2	24,000		24,000	279
	Sub-Total												60,000	698
Labour for pavement	Labour Local	person	3			900	2	5,400					5,400	63
	Korean Expert	person	1			51,600	-	-					-	-
	Sub-Total							5,400					5,400	63
	Grand Total				3,366,300			5,400			60,000		3,431,700	39,903

Daily Transportation : Daily 40MT 500-1000 Trucks

Total Days: 2 Days

1. Road Design.	
Length	1000 m
width	7 m
Surface Layer	0 m
Base Layer Depth	0.15 m
Dollar Rate(1\$=BDT)	86
Soil Stabilizer rate(\$)	20

2. Component Consumption	
GRSS	3 kg/m3
CEMENT	100 kg/m3
Soil	1800 kg/m3
Volume	1050 m3

Road Design Spec.	Layer	Specification	Depth
	1. Wearing	Premix Carpet	4 cm
	2. Base layer	GRSS	20 cm

3. Quotation Detail

Classification	Process & Standard	unit	quantity	material Cost		Labour cost			Equipment cost			SUM.			Percentage
				unit price	sum	unit price	Work day	sum	unit price	Work day	sum	unit price	sum(BDT)	USD	
Material for GRSS (Soil Stabilizer) Compaction	GRSS - HQ	m3	3150 kg	1,720.00	5,418,000							1,720	5,418,000	63,000	
	Cement	m3	105000 kg	14.00	1,470,000							14.00	1,470,000	17,093	
	Soil	m3	1890000 kg	-	-							-	-	-	
	Premix carpet	m3	-	-	-							0	-	-	
	Sub-Total				6,888,000								6,888,000	80,093	
Equipment for paving	Back Hoe (6W)	hr	1						12,000	1	12,000		12,000	140	
	Roller (Tandum)	hr	1						12,000	2	24,000		24,000	279	
	Asphalt Finisher	hr	1						12,000	-	-		-	-	
	Tipper/Truck	hr	1						12,000	2	24,000		24,000	279	
	Sub-Total												60,000	698	
Labour for pavement	Labour Local	person	3			900	2	5,400					5,400	63	
	Korean Expert	person	1			51,600	-	-					-	-	
	Sub-Total							5,400					5,400	63	
Grand Total					6,888,000			5,400			60,000		6,953,400	80,853	0%

Daily Transportation : Daily 40MT 500-1000 Trucks

Total Days: 2 Days

1. Road Design.	
Length	1000 m
width	7 m
Surface Layer	0 m
Base & subbase Layer Depth	0.3 m
Surface Area	7000 m ²
Volume(upto Base)	2100 m ³
Dollar Rate(1\$=BDT)	86

Road Design Spec.	Layer	Specification	Depth
	Surface Layer	Premix carpet	0
	Base Layer	CRM	0.15 m
	Sub Base Layer	Aggregates	0.15 m
	Sub Grade Layer	Soil Compaction & levelling	

2. Quotation Detail														
S.No.	Classification	Process & Standard	unit	Specification			quantity	Unit price		Sum		Percentage	Sum BDT	Sum BDT
				Length	Width	Depth		Unit price	sum	BDT	USD			
	1.Material													
1	Earthworks	Roadway excavation of soil,construction of shoulders including disposal of excavated material at approved environmentally safe tipping sites.	cum	1000 m	7 m	0.3 m	2,415	942.63	2,276,456	2,276,456.28	26,470.4			
2	Sub grade	Preparation of subgrade to designed grade and camber including watering and compaction.	sqm	1000 m	7 m	-	7,000	14.03	98,210	98,210.00	1,142.0			
3	Sub Base Layer	Supply, place and compact quarry sieved subbase material.	cum	1000 m	7 m	0.15 m	1,050	2,446.28	2,568,594	2,568,594.00	29,867.4			
4	Base Layer	Providing, laying, spreading, levelling and compaction of crusher run materials (CRM) for base course.	cum	1000 m	7 m	0.15 m	1,050	2,896.41	3,041,234	3,041,233.65	35,363.2			
5	Surface Layer	Providing, mixing, laying and compaction of premixed carpet - all complete as mentioned in the specification and directed by the Engineer.	cum	1000 m	7 m	0 m	-	19,041.01	-	-	-			
6	Prime Coat	Providing and spraying bituminous prime coat MC30/MC70 including cleaning the road surface using wire, brushes, broom etc before applying prime coat as mentioned in the specification. Spray rate as instructed by engineer	sqm	1000 m	7 m	-	7,000	176.73	1,237,080	1,237,079.73	14,384.6			
7	Tack Coat	Providing and spraying bituminous tack coat MC30/MC70 including cleaning the road surface using wire, brushes, broom etc before applying tack coat as mentioned in the specification. Spray rate as instructed by engineer	sqm	1000 m	7 m	-	3,500	176.73	618,540	618,539.86	7,192.3			
8	Sand Seal	Providing and laying Sand seal over premix carpet	sqm	1000 m	7 m	-	-	129.11	-	-	-			
		Sub-Total								9,840,113.52	114419.92		-	-

S.No.	Classification	Process & Standard	unit	Specification			quantity			Sum		Percentage	Sum	Sum
				Length	Width	Depth		Unit price	sum	BDT	USD			
	2. Equipment													
1	Earthworks	Roadway excavation of soil,construction of shoulders including disposal of excavated material at approved environmentally safe tipping sites.	cum	1000 m	7 m	0.3 m	2,415	50.60	122,199	122,199.00	1,420.9			
2	Sub grade	Preparation of subgrade to designed grade and camber including watering and compaction.	sqm	1000 m	7 m	-	7,000	62.10	434,700	434,700.00	5,054.7			
3	Sub Base Layer	Supply, place and compact quarry sieved subbase material.	cum	1000 m	7 m	0.15 m	1,050	150.54	158,062	158,061.75	1,837.9			
4	Base Layer	Providing, laying, spreading, levelling and compaction of crusher run materials (CRM) for base course.	cum	1000 m	7 m	0.15 m	1,050	191.07	200,626	200,626.13	2,332.9			
5	Surface Layer	Providing, mixing, laying and compaction of premixed carpet - all complete as mentioned in the specification and directed by the Engineer.	cum	1000 m	7 m	0 m	-	2,300.00	-	-	-			
6	Prime Coat	Providing and spraying bituminous prime coat MC30/MC70 including cleaning the road surface using wire, brushes, broom etc before applying prime coat as mentioned in the specification. Spray rate as instructed by engineer	sqm	1000 m	7 m	-	7,000	12.54	87,745	87,745.00	1,020.3			
7	Tack Coat	Providing and spraying bituminous tack coat MC30/MC70 including cleaning the road surface using wire, brushes, broom etc before applying tack coat as mentioned in the specification. Spray rate as instructed by engineer	sqm	1000 m	7 m	-	3,500	12.54	43,873	43,872.50	510.1			
8	Sand Seal	Providing and laying Sand seal over premix carpet	sqm	1000 m	7 m	-	-	20.70	-	-	-			
		Sub-Total								1,047,204.38	12,176.80		-	-

S.No.	Classification	Process & Standard	unit	Specification			quantity			Sum		Percentage	Sum	Sum
				Length	Width	Depth		Unit price	sum	BDT	USD			
	3. Labour													
1	Earthworks	Roadway excavation of soil,construction of shoulders including disposal of excavated material at approved environmentally safe tipping sites.	cum	1000 m	7 m	0.3 m	2,100	15.53	32,603	32,602.50	379.1			
2	Sub grade	Preparation of subgrade to designed grade and camber including watering and compaction.	sqm	1000 m	7 m	-	7,000	132.25	925,750	925,750.00	10,764.5			
3	Sub Base Layer	Supply, place and compact quarry sieved subbase material.	cum	1000 m	7 m	0.15 m	1,050	54.63	57,356	57,356.25	666.9			
4	Base Layer	Providing, laying, spreading, levelling and compaction of crusher run materials (CRM) for base course.	cum	1000 m	7 m	0.15 m	1,050	31.63	33,206	33,206.25	386.1			
5	Surface Layer	Providing, mixing, laying and compaction of premixed carpet - all complete as mentioned in the specification and directed by the Engineer.	cum	1000 m	7 m	0 m	-	5,951.25	-	-	-			
6	Prime Coat	Providing and spraying bituminous prime coat MC30/MC70 including cleaning the road surface using wire, brushes, broom etc before applying prime coat as mentioned in the specification. Spray rate as instructed by engineer	sqm	1000 m	7 m	-	7,000	58.08	406,525	N/A	N/A			
7	Tack Coat	Providing and spraying bituminous tack coat MC30/MC70 including cleaning the road surface using wire, brushes, broom etc before applying tack coat as mentioned in the specification. Spray rate as instructed by engineer	sqm	1000 m	7 m	-	3,500	58.08	203,263	N/A	N/A			
8	Sand Seal	Providing and laying Sand seal over premix carpet	sqm	1000 m	7 m	-	-	33.35	-	-	-			
		Sub-Total								1,048,915.00	12,196.69		-	-



Asian Development Bank

Private Sector Operations Department

26 July 2020

Dear Mr. Yoon Suk Lee:

**Subject: TA 9620 REG: Preparation of the ADB Ventures Facility
— Approval of SEED grant**

On the 15 June 2020, the Asian Development Bank (ADB) approved [REDACTED] reimbursable technical assistance (TA) funding to InnoCSR Co. Ltd. ("InnoCSR") that provides ADB the right to invest equity from ADB Ventures investment fund [REDACTED]. [REDACTED] Details of this arrangement between ADB and InnoCSR are contained in the Technical Assistance Agreement (TAA) and Reimbursement Alternative Agreement (RAA).

Korea-based InnoCSR developed the Good Bricks System, a solution that enables brick manufacturers to harden bricks without the need for kiln baking. The Good Bricks System uses a proprietary soil stabilizer and a press machine to catalyze a chemical and physical bonding process that yields industry-grade bricks. ADB Ventures believes this technology has potential to generate climate impact so provided reimbursable TA funding to support InnoCSR expand their operations in Nepal.

Sincerely,

Dominic Mellor
Senior Investment Specialist
ADB Ventures
Private Sector Operations Department