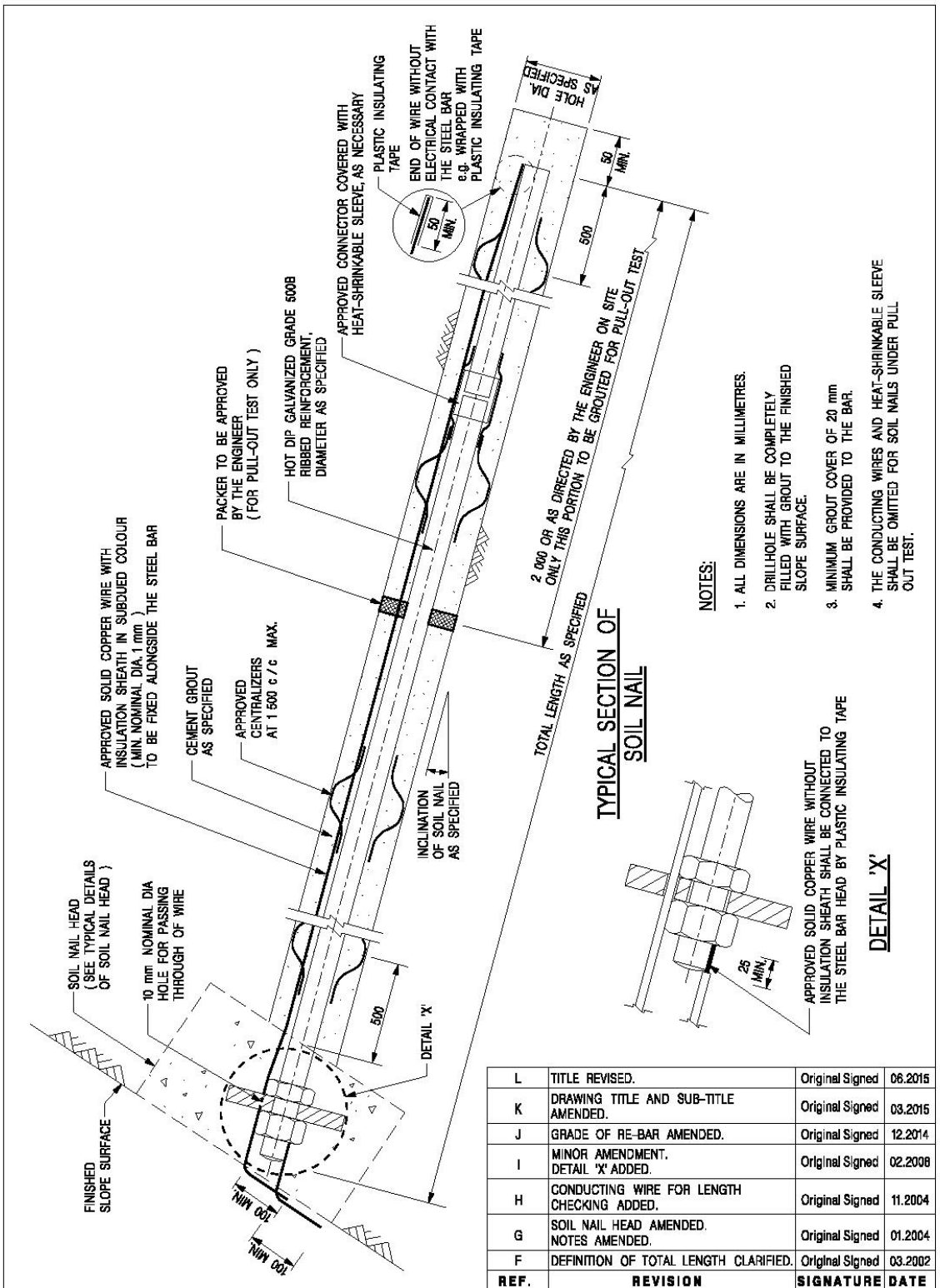


REF.	REVISION	SIGNATURE	DATE
L	TITLE REVISED.	Original Signed	06.2015
K	DRAWING TITLE AND SUB-TITLE AMENDED.	Original Signed	03.2015
J	GRADE OF RE-BAR AMENDED.	Original Signed	12.2014
I	MINOR AMENDMENT. DETAIL 'X' ADDED.	Original Signed	02.2008
H	CONDUCTING WIRE FOR LENGTH CHECKING ADDED.	Original Signed	11.2004
G	SOIL NAIL HEAD AMENDED. NOTES AMENDED.	Original Signed	01.2004
F	DEFINITION OF TOTAL LENGTH CLARIFIED.	Original Signed	03.2002

TYPICAL DETAILS OF SOIL NAIL (SHEET 1 OF 8)

CEDD **CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT**

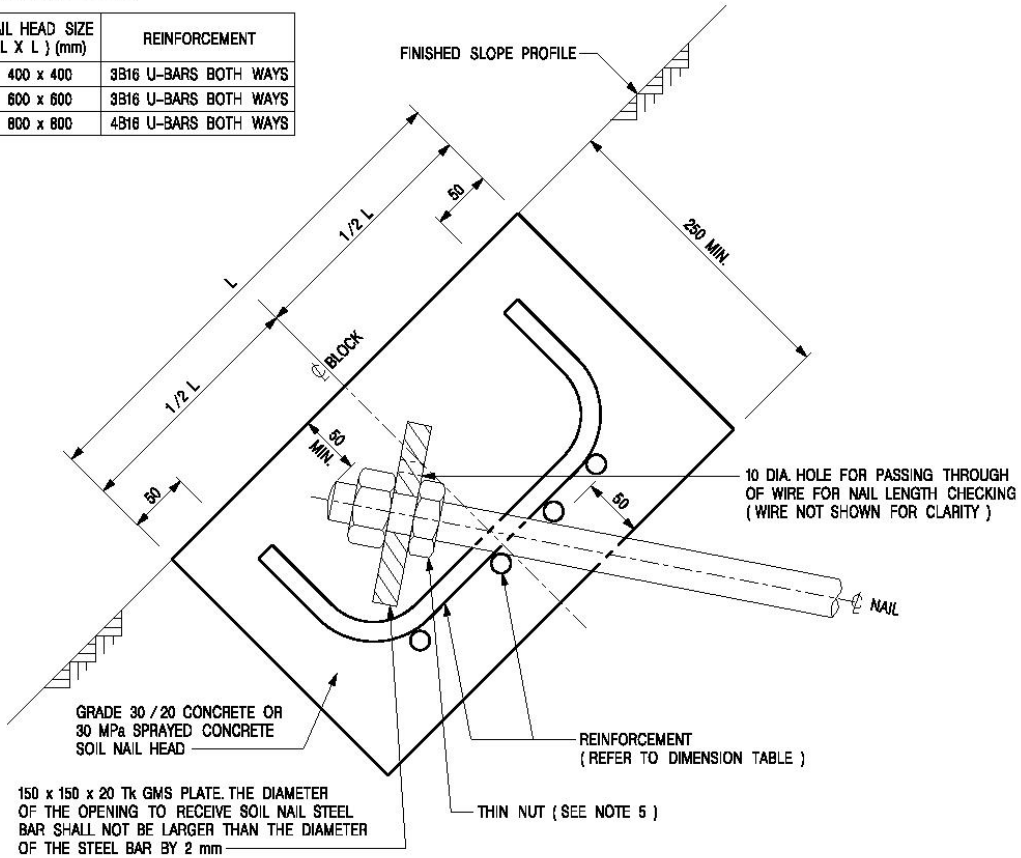
SCALE DIAGRAMMATIC **DRAWING NO.** C2106 / 1L

DATE MARCH 1990

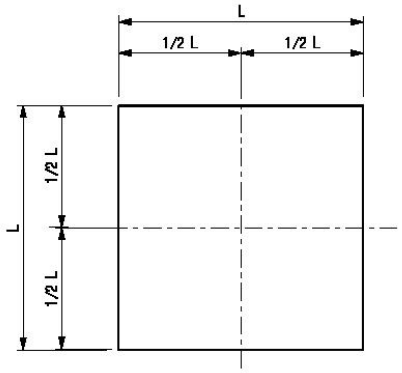
卓越工程 建設香港 We Engineer Hong Kong's Development

DIMENSION TABLE

NAIL HEAD SIZE (L X L) (mm)	REINFORCEMENT
400 x 400	3B16 U-BARS BOTH WAYS
600 x 600	3B16 U-BARS BOTH WAYS
800 x 800	4B16 U-BARS BOTH WAYS



TYPICAL SECTION OF SOIL NAIL HEAD



VIEW NORMAL TO SOIL NAIL HEAD

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. THE SIZE OF SOIL NAIL HEAD SHALL BE SPECIFIED BY THE ENGINEER.
3. CONSTRUCTION OF SOIL NAIL HEAD SHALL BE REFERRED TO GENERAL SPECIFICATION FOR CIVIL ENGINEERING WORKS.
4. B DENOTES GRADE 500B RIBBED REINFORCEMENT.
5. FOR SOIL NAIL HEADS CONSTRUCTED BY 2-STAGE SPRAYED CONCRETE ACCORDING TO GENERAL SPECIFICATION FOR CIVIL ENGINEERING WORKS, THE THIN NUT SHALL BE OMITTED.

REF.	REVISION	SIGNATURE	DATE
K	NOTE 3 AMENDED AND NOTE 5 ADDED.	Original Signed	04.2016
J	TITLE REVISED.	Original Signed	06.2015
H	DRAWING TITLE AND SUB-TITLE AMENDED.	Original Signed	03.2015
G	BAR NOTATIONS AMENDED.	Original Signed	12.2014
F	NOTES AMENDED.	Original Signed	02.2008
E	DIMENSION TABLE ADDED. 10 DIA. HOLE ON GMS PLATE ADDED.	Original Signed	01.2005
–	NEW ISSUE.	Original Signed	10.2003

TYPICAL DETAILS OF SOIL NAIL (SHEET 2 OF 8)

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

SCALE DIAGRAMMATIC

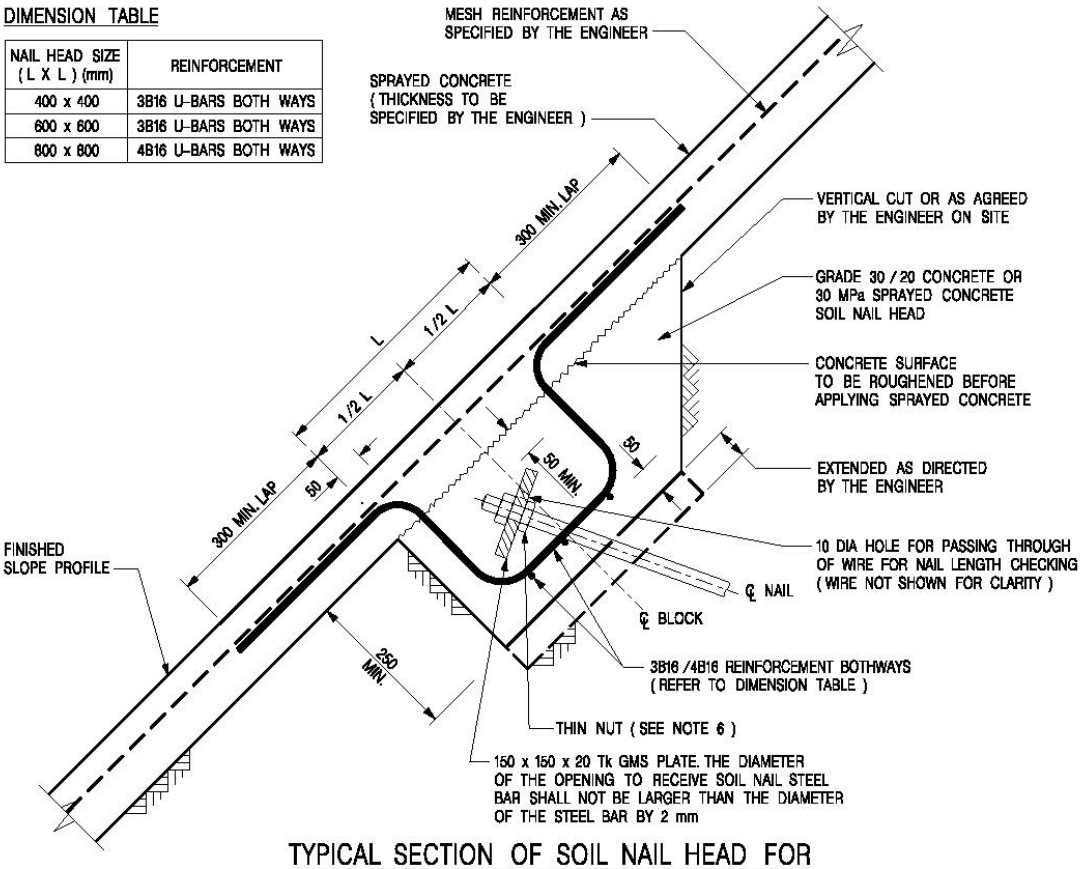
DATE OCT 2003

DRAWING NO. C2106 / 2K

卓越工程 建設香港 We Engineer Hong Kong's Development

DIMENSION TABLE

NAIL HEAD SIZE (L X L) (mm)	REINFORCEMENT
400 x 400	3B16 U-BARS BOTH WAYS
600 x 600	3B16 U-BARS BOTH WAYS
800 x 800	4B16 U-BARS BOTH WAYS

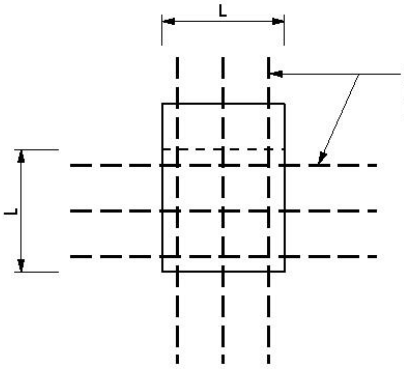


TYPICAL SECTION OF SOIL NAIL HEAD FOR SPRAYED CONCRETE SLOPE SURFACE

SCALE 1 : 10

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. MINIMUM CONCRETE COVER TO MESH REINFORCEMENT SHALL BE 25mm OR OTHERWISE SPECIFIED.
3. THE SIZE OF SOIL NAIL HEAD SHALL BE SPECIFIED BY THE ENGINEER.
4. CONSTRUCTION OF SOIL NAIL HEAD SHALL BE REFERRED TO GENERAL SPECIFICATION FOR CIVIL ENGINEERING WORKS.
5. B DENOTES GRADE 500B RIBBED REINFORCEMENT.
6. FOR SOIL NAIL HEADS CONSTRUCTED BY 2-STAGE SPRAYED CONCRETE ACCORDING TO GENERAL SPECIFICATION FOR CIVIL ENGINEERING WORKS, THE THIN NUT SHALL BE OMITTED.



VIEW NORMAL TO SOIL NAIL HEAD FOR SPRAYED CONCRETE SLOPE SURFACE

SCALE 1 : 20

REF.	REVISION	SIGNATURE	DATE
L	NOTE 4 AMENDED AND NOTE 6 ADDED.	Original Signed	04.2018
K	TITLE REVISED.	Original Signed	06.2015
J	DRAWING TITLE AND SUB-TITLE AMENDED.	Original Signed	03.2015
H	BAR NOTATIONS AMENDED.	Original Signed	12.2014
G	DIMENSION TABLE ADDED.	Original Signed	08.2014
F	NOTES AND REINFORCEMENT DETAILS AMENDED.	Original Signed	02.2008
E	10 DIA HOLE ON GMS PLATE ADDED.	Original Signed	01.2005

TYPICAL DETAILS OF SOIL NAIL (SHEET 3 OF 8)

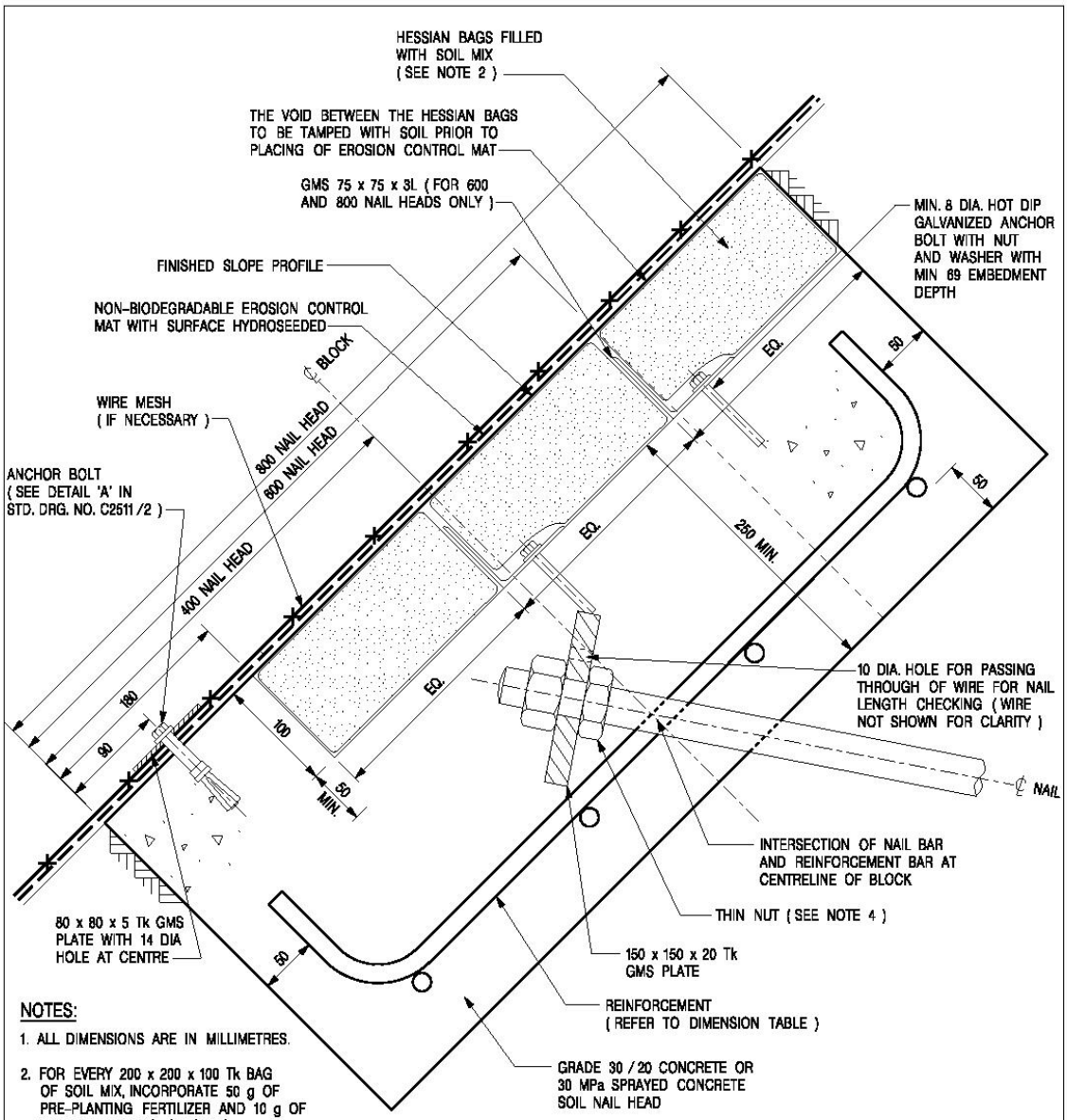
CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

SCALE AS SHOWN

DATE JAN 1991

DRAWING NO. C2106 / 3L

卓越工程 建設香港 We Engineer Hong Kong's Development



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. FOR EVERY 200 x 200 x 100 Tk BAG OF SOIL MIX, INCORPORATE 50 g OF PRE-PLANTING FERTILIZER AND 10 g OF WATER RETAINING CRYSTALS.
3. B DENOTES GRADE 500B RIBBED REINFORCEMENT.
4. FOR SOIL NAIL HEADS CONSTRUCTED BY 2-STAGE SPRAYED CONCRETE ACCORDING TO GENERAL SPECIFICATION FOR CIVIL ENGINEERING WORKS, THE THIN NUT SHALL BE OMITTED.

TYPICAL SECTION OF RECESSED SOIL NAIL HEAD FOR HYDROSEEDING SURFACE WITH NON-BIODEGRADABLE EROSION CONTROL MAT OR /AND WIRE MESH

SCALE 1 : 5

DIMENSION TABLE

NAIL HEAD SIZE (mm)	REINFORCEMENT
400 x 400	3B16 U BARS BOTHWAYS
600 x 600	3B16 U BARS BOTHWAYS
800 x 800	4B16 U BARS BOTHWAYS

REF.	REVISION	SIGNATURE	DATE
E	NOTE 4 ADDED.	Original Signed	04.2016
D	MINOR AMENDMENT.	Original Signed	06.2015
C	DRAWING TITLE AND SUB-TITLE AMENDED.	Original Signed	03.2015
B	BAR NOTATIONS AMENDED.	Original Signed	12.2014
A	DETAILS FOR ANCHOR BOLT REVISED. GMS ADDED FOR STEEL WORKS.	Original Signed	08.2007

TYPICAL DETAILS OF SOIL NAIL (SHEET 4 OF 8)

CEDD **CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT**

SCALE AS SHOWN

DATE DEC 2005

DRAWING NO. C2106 /4E

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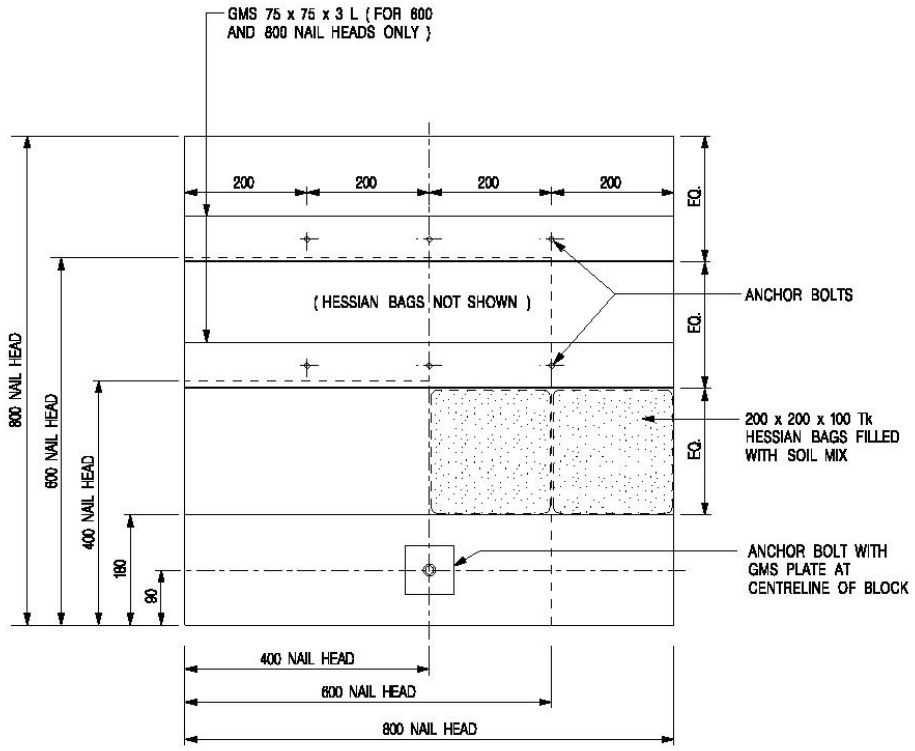


VIEW NORMAL TO RECESSED SOIL NAIL HEAD
FOR HYDROSEEDING SURFACE WITH NON-BIODEGRADABLE
EROSION CONTROL MAT OR /AND WIRE MESH

(EROSION CONTROL MAT AND WIRE MESH NOT SHOWN FOR CLARITY)
SCALE 1 : 10

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. FOR EVERY 200 x 200 x 100 Tk BAG OF SOIL MIX, INCORPORATE 50 g OF PRE-PLANTING FERTILIZER AND 10 g OF WATER RETAINING CRYSTALS.

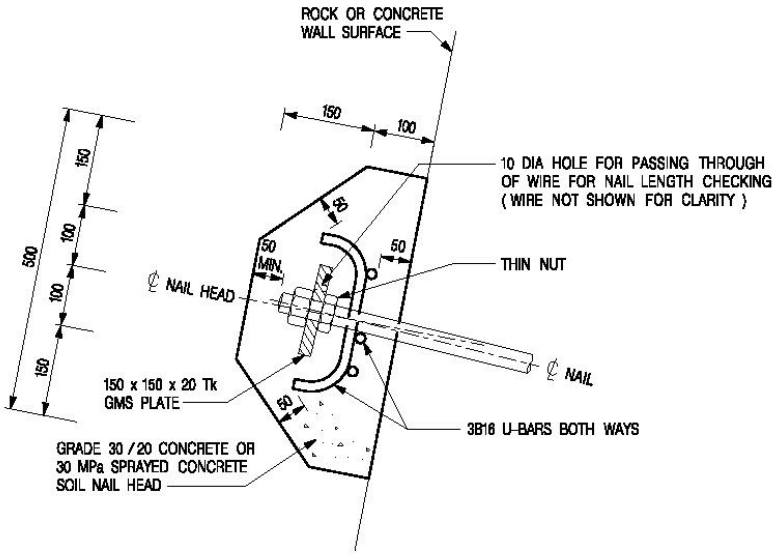
REF.	REVISION	SIGNATURE	DATE
C	DRAWING TITLE AMENDED.	Original Signed	06.2015
B	DRAWING TITLE AND SUB-TITLE AMENDED.	Original Signed	03.2015
A	GMS ADDED FOR STEEL WORKS.	Original Signed	08.2007

TYPICAL DETAILS OF SOIL NAIL (SHEET 5 OF 8)

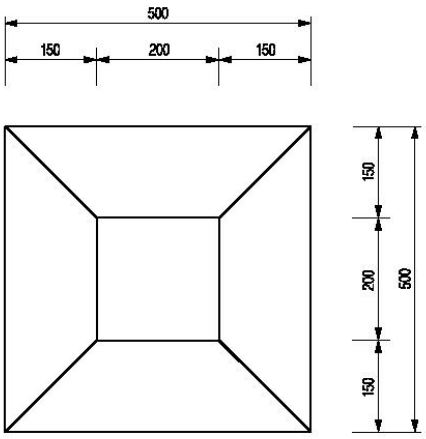
CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

SCALE AS SHOWN
DATE DEC 2005
DRAWING NO. C2106 /5C

卓越工程 建設香港 We Engineer Hong Kong's Development



TYPICAL SECTION OF SOIL NAIL HEAD
ON ROCK OR CONCRETE WALL SURFACE



VIEW NORMAL TO SOIL NAIL HEAD
ON ROCK OR CONCRETE WALL SURFACE

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. THE CLEARANCE BETWEEN THE EDGE OF CENTRAL HOLE AND NAIL STEEL BAR SHALL BE LESS THAN 2 mm.
3. CONSTRUCTION OF SOIL NAIL HEAD SHALL BE REFERRED TO PARTICULAR SPECIFICATIONS.
4. B DENOTES GRADE 500B RIBBED REINFORCEMENT.

REF.	REVISION	SIGNATURE	DATE
A	TITLE REVISED.	Original Signed	06.2015
-	FORMER DRAWING NO. C2522A. DRAWING TITLE AND SUB-TITLE AMENDED.	Original Signed	03.2015

TYPICAL DETAILS OF SOIL NAIL (SHEET 6 OF 8)

CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

SCALE 1 : 10

DATE JUNE 2009

DRAWING NO. C2106 / 6A

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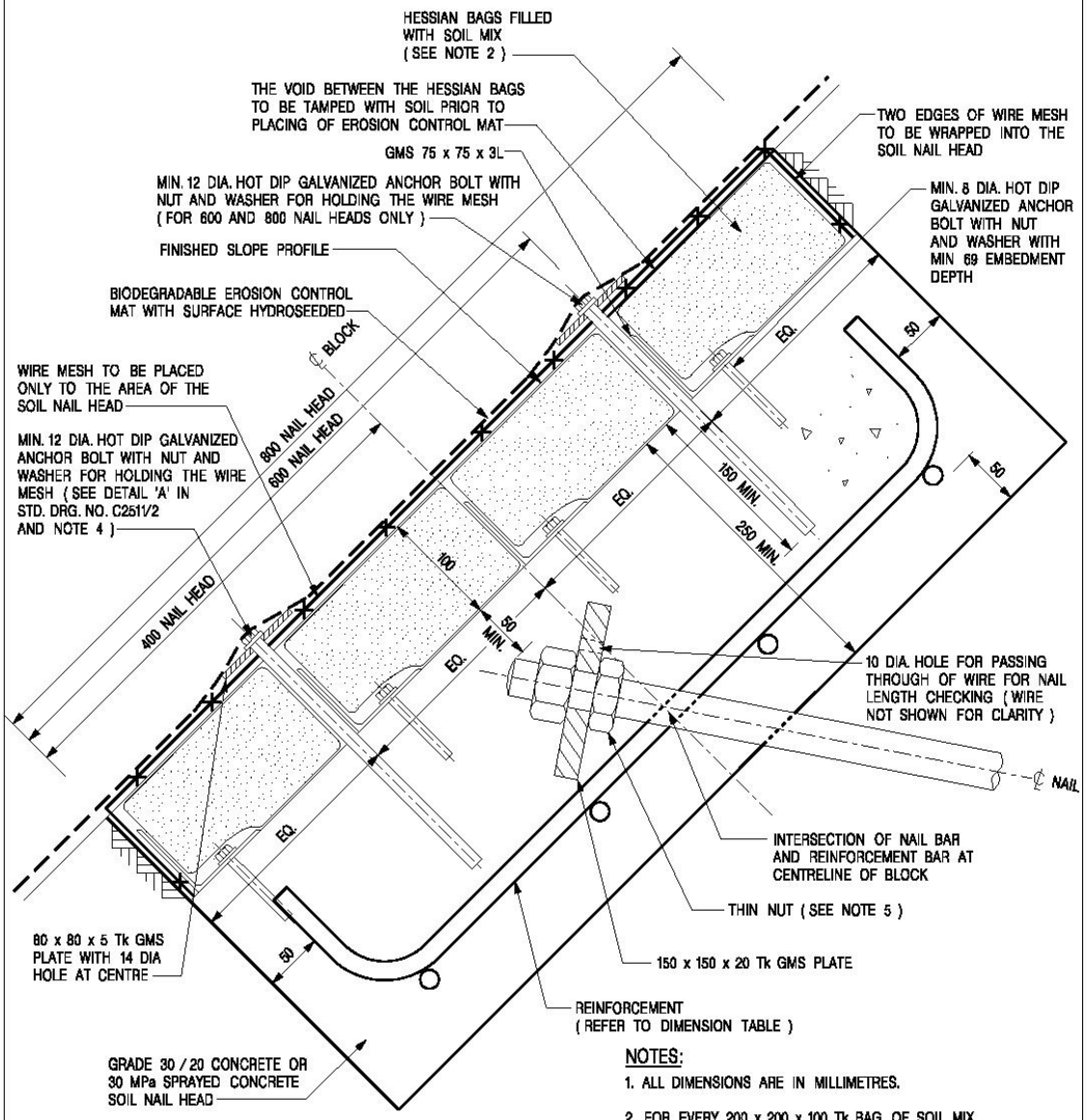


TYPICAL SECTION OF RECESSED SOIL NAIL HEAD FOR HYDROSEEDING SURFACE WITH BIODEGRADABLE EROSION CONTROL MAT

SCALE 1 : 5

DIMENSION TABLE

NAIL HEAD SIZE (mm)	REINFORCEMENT
400 x 400	3B16 U BARS BOTHWAYS
600 x 600	3B16 U BARS BOTHWAYS
800 x 800	4B16 U BARS BOTHWAYS

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. FOR EVERY 200 x 200 x 100 Tk BAG OF SOIL MIX, INCORPORATE 50 g OF PRE-PLANTING FERTILIZER AND 10 g OF WATER RETAINING CRYSTALS.
3. B DENOTES GRADE 500B RIBBED REINFORCEMENT.
4. WIRE MESH SHALL BE 80 x 60 x 2.2 DIA. PVC COATED GALVANIZED STEEL WIRE WOVEN INTO A DOUBLE TWIST HEXAGONAL MESH OR EQUIVALENT. COLOUR OF PVC COATING SHALL BE DARK GREEN OR AS SPECIFIED.
5. FOR SOIL NAIL HEADS CONSTRUCTED BY 2-STAGE SPRAYED CONCRETE ACCORDING TO GENERAL SPECIFICATION FOR CIVIL ENGINEERING WORKS, THE THIN NUT SHALL BE OMITTED.

REF.	REVISION	SIGNATURE	DATE
A	NOTE 5 ADDED.	Original Signed	04.2016
–	NEW ISSUE.	Original Signed	06.2015

TYPICAL DETAILS OF SOIL NAIL (SHEET 7 OF 8)

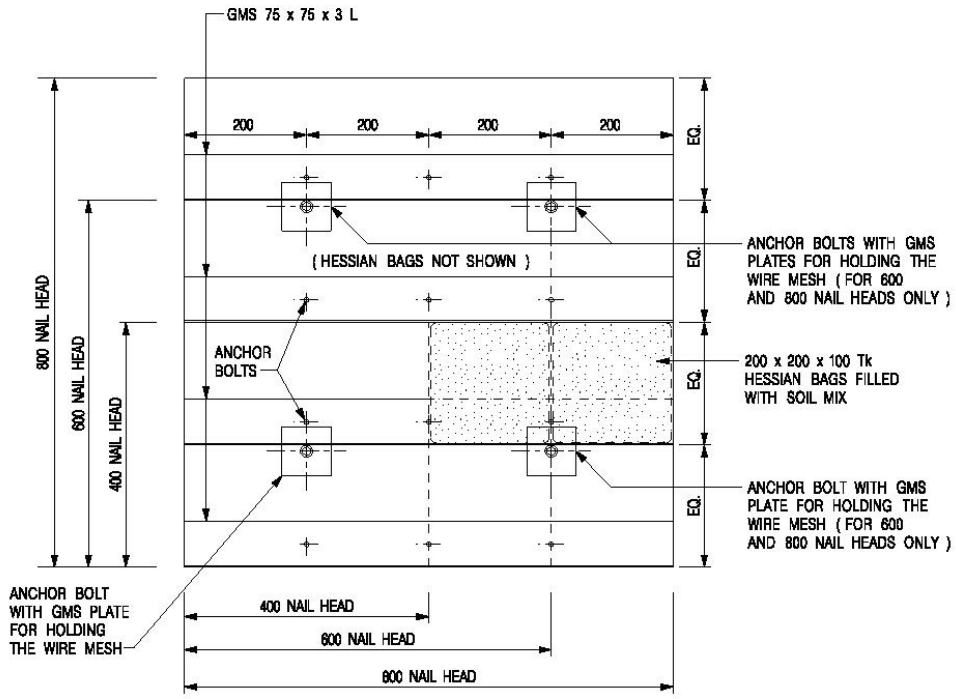
CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT

SCALE AS SHOWN

DATE JUN 2015

DRAWING NO. C2106 /7A

卓越工程 建設香港 We Engineer Hong Kong's Development



VIEW NORMAL TO RECESSED SOIL NAIL HEAD FOR HYDROSEEDING SURFACE WITH BIODEGRADABLE EROSION CONTROL MAT

(EROSION CONTROL MAT AND WIRE MESH NOT SHOWN FOR CLARITY)
SCALE 1 : 10

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. FOR EVERY 200 x 200 x 100 Tk BAG OF SOIL MIX, INCORPORATE 50 g OF PRE-PLANTING FERTILIZER AND 10 g OF WATER RETAINING CRYSTALS.

REF.	REVISION	SIGNATURE	DATE
–	NEW ISSUE.	Original Signed	06.2015

TYPICAL DETAILS OF SOIL NAIL (SHEET 8 OF 8)	CEDD CIVIL ENGINEERING AND DEVELOPMENT DEPARTMENT	
	SCALE AS SHOWN	DRAWING NO. C2106 /8
	DATE JUN 2015	
卓越工程 建設香港	We Engineer Hong Kong's Development	

Contract No.: GE/ / Works Order No.+ : _____

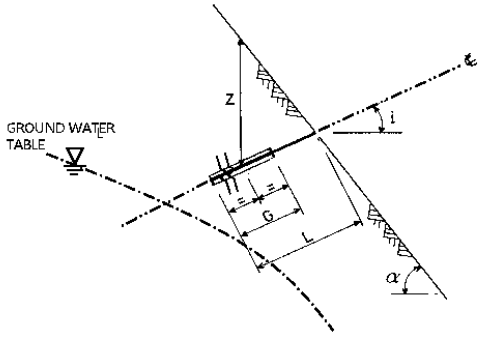
Slope No. & Location : _____

Soil Nail Pull-Out Test Record (Sheet 1 of 3 - Drilling and Grouting)

Pull-Out Test Ref. No.:_____

GENERAL RECORD

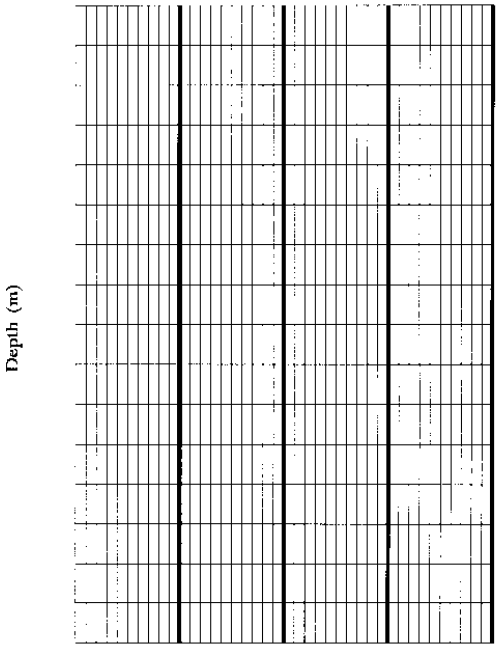
Co-ordinates of Head of Test Nail	N E mPD
Bar Length (L)	m
Bar Diameter	mm
Bar Steel Grade	
Specified Grouted Length (G)	m
Measured Grouted Length	m
Depth to Mid Point of Grouted Length (Z)	m
Slope Angle (α)	°
Bar Inclination (i)	°
Design Test Load, T_{DL}	kN
Represented Row No. (refer to construction drawings)	
Nearest GI Station (can be more than one)	



Geological informaion (from G.I.)
Material type
at bonded section : _____

Groundwater information (from piezometer monitoring)
Groundwater table *below/ above
bonded section : _____ m

Observations during drilling
1. Outflow from drillhole : * Yes / No
2. Condition of blow-out material from bonded section : * wet / dry * clayey / sandy
3. Others : _____
(e.g. collapse of drillhole)



DRILLING RECORD

DRILLING RECORDS

Hole Diameter	mm
Date Drilled	/ /
Drilling Method	
Flushing Medium	

GROUTING RECORD

Date of Grouting	/ /	Time of Efflux from Flow Cone Test (sec.)	
Grout Mix			
Water Cement Ratio		3 day/7 day Cube Strength (MPa)	
Calculated Grout Volume		Actual Grout Take	

Prepared By (Sheets 1 to 3): Pull-out Test (including drilling and grouting) supervised by :

_____ _____

(Contractor's Representative) (WS/AIOW/IOW*)(Date)

Legends : * Delete as appropriate + Leave blank if not applicable

GEO/CA/13-1 (15/8/2008)

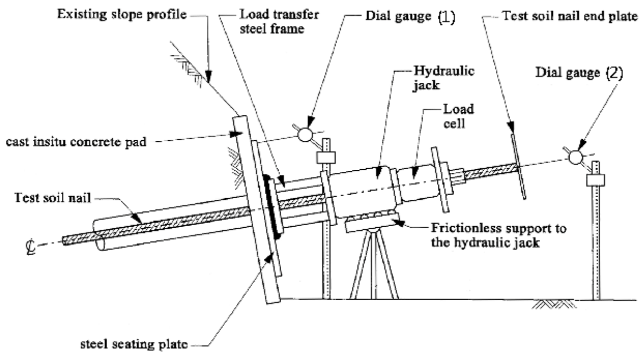
Contract No.: GE / / Works Order No.+ : _______________

Slope No. & Location : ____

Soil Nail Pull-Out Test Record (Sheet 2 of 3 - Pull Out Test)

Pull-Out Test Ref. No. : _____________ Date of Testing : ______________

Legend : + Leave blank if not applicable



SEE NOTES ON SHEET 3

	T_a	kN
	T_{DL1}	kN
	T_{DL2}	kN
*	T_P / T_{ult}	kN
	T_{DL1}	mins.
	T_{DL2}	mins.
*	T_P / T_{ult}	mins.

Notes : 1. Load T_{DL1}, T_{DL2} & T_p to be maintained for at least one hour
2. Load deformation measurements to be extended for another hour if the deformation exceeds the acceptance criterion for the first hour
3. Bar extension shall be based on the dial gauge (2) readings

Time after Test started (hr/min)	Pressure gauge Reading	Applied Load (kN)	Dial Gauge (1) Reading	Dial Gauge (2) Reading	Bar Extension (mm)

Position of Dial Gauge Probe on end plate

Show positions of Dial Gauge Probe tip at

1. commencement of test
2. T_a
3. T_{DL1}
4. T_{DL2}
5. $*T_p / T_{ult}$

Remarks :

Can the test nail sustain the following loadings

a. T_{DL1} (Y/N *)

b. T_{DL2} (Y/N *)

c. $*T_p / T_{ult}$ (Y/N *)

* Delete as appropriate

GEO/CA/13-2 (15/8/2008)

Contract No. : GE / /

Works Order No. $^{+}$: _____

Slope No. & Location: _____

Soil Nail Pull-Out Test Record (Sheet 3 of 3 - Pull Out Test Data Plotting Sheet)

Pull-Out Test Ref. No. : _____

Checked By : _____ (Design Engineer)

Legend : + Leave blank if not applicable

T_p	Δ_p	Δ_{ep}	$\varepsilon\Delta_{ep}$
T_{alt}	Δ_{alt}	Δ_{ealt}	
T_{DL2}	Δ_{DL2}	Δ_{eDL2}	$\varepsilon\Delta_{eDL2}$
T_{DL1}	Δ_{DL1}	Δ_{eDL1}	$\varepsilon\Delta_{eDL1}$
T_s			

NOTES :

Δ_{DL1}, Δ_{DL2} & Δ_p or Δ_{alt} : Extensions up to time when load is maintained

Δ_{eDL1}, Δ_{eDL2} & Δ_{ep} or Δ_{ealt} : Extensions while the load is maintained for 60 min.

$^{\varepsilon}\Delta_{eDL1}$, $^{\varepsilon}\Delta_{eDL2}$ & $^{\varepsilon}\Delta_{ep}$: Further extensions for additional 60 min. under the situation where Δ_{eDL1}, Δ_{eDL2} & Δ_{ep} exceeds the acceptance criteria

T_p shall be $0.9f_y$ x steel bar cross sectional area (A)
where f_y = yield strength of the steel bar

T_{alt} = The failure load, i.e. ultimate soil-grout bond load

$T_{DL2} = T_{DL1} \times F_p$
where F_p = Factor of safety against pull-out failure at soil-grout interface

T_{DL1} shall be the load corresponding to the allowable pull-out resistance of the test nail

T_s shall be T_{DL1} or 5% of T_p, whichever is smaller

ACCEPTANCE CRITERION :

At T_{DL1} and T_{DL2} cycles, $\Delta_{60\ min.} - \Delta_{5\ min.}$ (< 0.1% of Grouted Length of Test Nail or 2mm) = _____ mm

At T_{DL1} Cycle,
$\Delta_{60\ min.}$ = _____ mm $\Delta_{5\ min.}$ = _____ mm **Difference =** _____ mm

At T_{DL2} Cycle,
$\Delta_{60\ min.}$ = _____ mm $\Delta_{5\ min.}$ = _____ mm **Difference =** _____ mm

At T_p,
$\Delta_{60\ min.}$ = _____ mm $\Delta_{5\ min.}$ = _____ mm **Difference =** _____ mm

Replacement Tests Required *Y / N

GEO/PA/13-3 (15/8/2008)