

Figure 5.14 Boring Log (14), Kok-Ing No.2 Tunnel

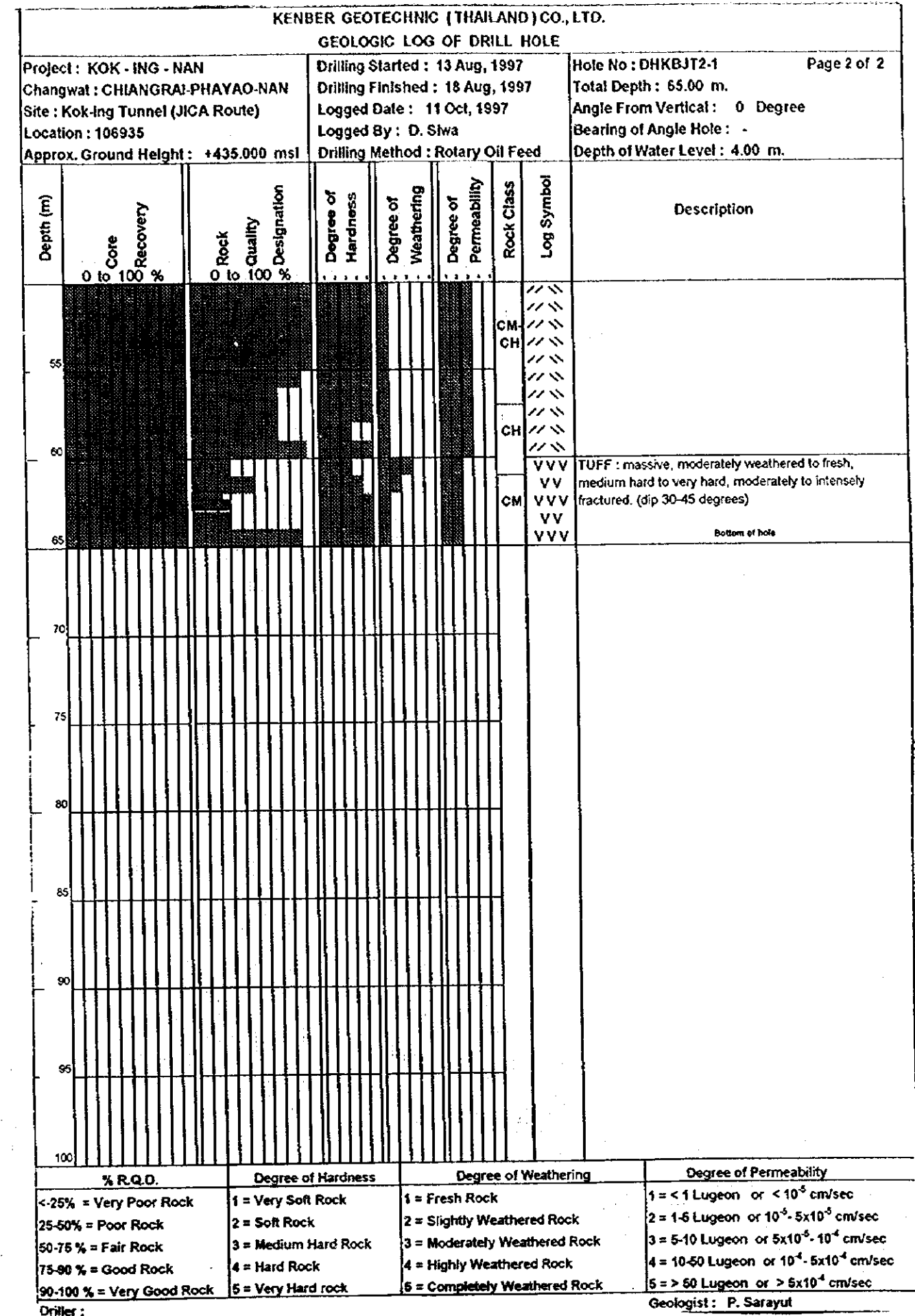
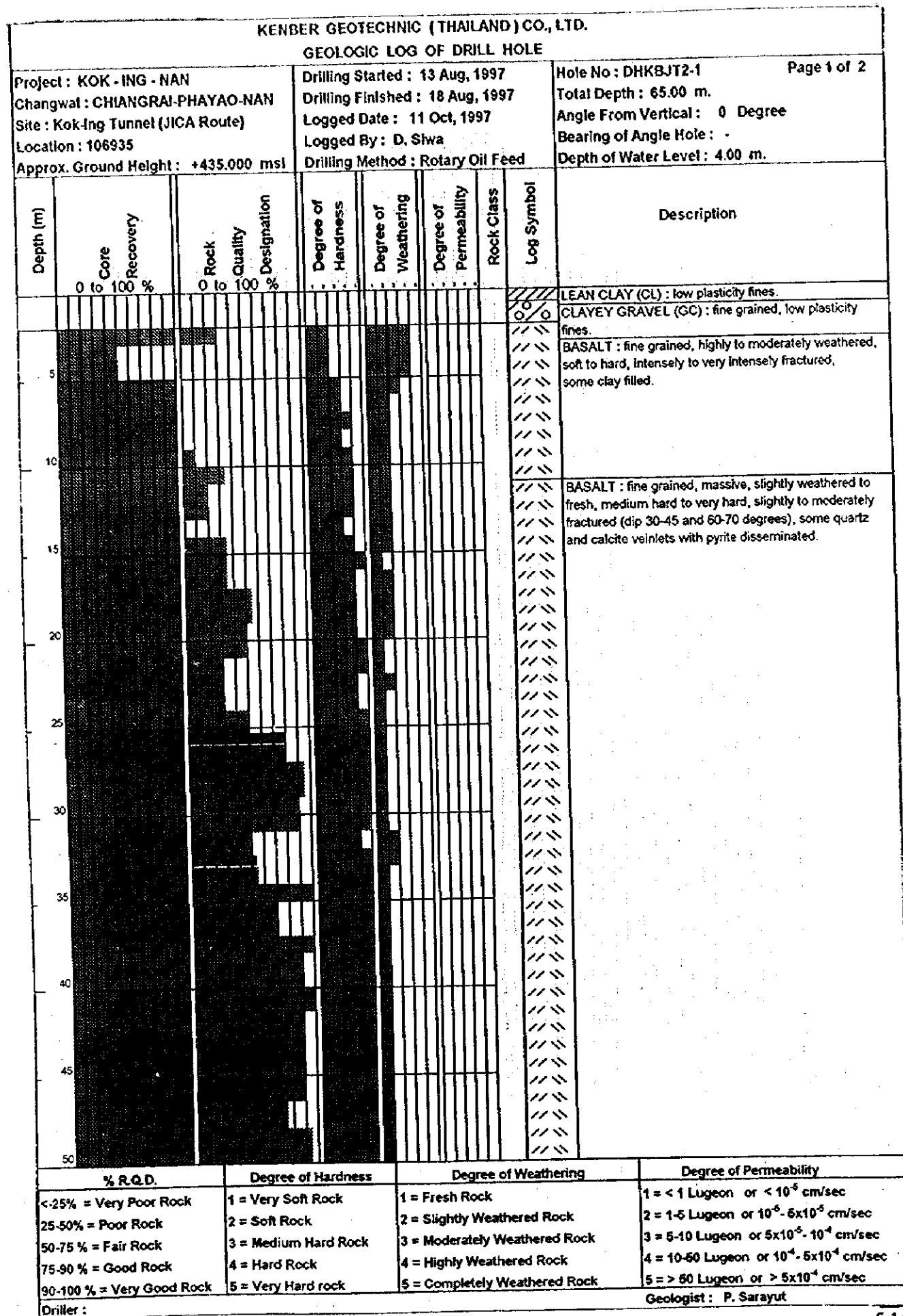


Figure 5.15 Boring Log (15), Kok-Ing No.2 Tunnel

KENBER GEOTECHNIC (THAILAND) CO., LTD.								
GEOLOGIC LOG OF DRILL HOLE								
Project : KOK - ING - NAN		Drilling Started : 8 Sep, 1997		Hole No : DHKBJT2-2		Page 1 of 2		
Changwat : CHIANGRAI-PHAYAO-NAN		Drilling Finished : 14 Sep, 1997		Total Depth : 55.00 m.				
Site : Kok-Ing Tunnel (JICA Route)		Logged Date : 10 Oct, 1997		Angle From Vertical : 0 Degree				
Location : 117923		Logged By : P. Sarayut		Bearing of Angle Hole : -				
Approx. Ground Height : +420.000 msl		Drilling Method : Rotary Oil Feed		Depth of Water Level : 8.00 m.				
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description
5								LEAN CLAY (CL) : low plasticity fines, reddish brown.
10								
15							VVV	TUFF : fine to medium grained, massive, highly weathered, soft, moderately to very intensely fractured. (dip 0-10 degrees)
20						D	VVV	
25							VVV	
30							VVV	
35							VVV	
40							VVV	
45							VVV	
50							VVV	
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability		
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁶ cm/sec		
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁶ cm/sec		
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 6-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec		
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec		
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec		
Driller :								Geologist : P. Sarayut

KENBER GEOTECHNIC (THAILAND) CO., LTD.								
GEOLOGIC LOG OF DRILL HOLE								
Project : KOK - ING - NAN		Drilling Started : 8 Sep, 1997		Hole No : DHKBJT2-2		Page 2 of 2		
Changwat : CHIANGRAI-PHAYAO-NAN		Drilling Finished : 14 Sep, 1997		Total Depth : 55.00 m.				
Site : Kok-Ing Tunnel (JICA Route)		Logged Date : 10 Oct, 1997		Angle From Vertical : 0 Degree				
Location : 117923		Logged By : P. Sarayut		Bearing of Angle Hole : -				
Approx. Ground Height : +420.000 msl		Drilling Method : Rotary Oil Feed		Depth of Water Level : 8.00 m.				
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description
55						D	VVV	Bottom of hole
60							VVV	
65							VVV	
70							VVV	
75							VVV	
80							VVV	
85							VVV	
90							VVV	
95							VVV	
100							VVV	
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability		
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁶ cm/sec		
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁶ cm/sec		
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec		
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec		
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec		
Driller :								Geologist : P. Sarayut

Figure 5.16 Boring Log (16), Kok-Ing No.2 Tunnel

Geologic log of drill hole
Hole No. DHBJ 4.5

Depth (m)	Core Recovery		Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description
	0 to 100 %	0 to 100 %							
5									LEAN CLAY : residual soil, clay with some gravel.
10									SHALE : highly weathered, very soft to soft, intensely to very intensely fractured, dip 30°-40°, interbedded with siltstone and fine grained sandstone.
15									
20							D		
25									
30									SANDSTONE : fine to medium grained, highly to moderately weathered, soft to medium hard, intensely to very intensely fractured, dip 30°-40°, Fe-oxide stained, interbedded with shale and siltstone.
36							CL		
40									
45							D		SANDSTONE : fine to medium grained, highly weathered, soft, intensely to very intensely fractured, dip 30°-50°, Fe-oxide stained, clay filled.
50									

Geologic log of drill hole
Hole No. DHBJ 4.5

Depth (m)	Core Recovery		Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description
	0 to 100 %	0 to 100 %							
55									SANDSTONE : fine to coarse grained, highly to moderately weathered, soft to medium hard, moderately to very intensely fractured, dip 40° and 70°, some quartz veins and veinlets.
60									
65									
70									
75									SHALE : highly to moderately weathered, soft to medium hard, intensely to very intensely fractured, interbedded with sandstone.
80									
85									
90									
95									
100									SANDSTONE : fine to medium grained, slightly weathered, hard, some quartz veins and veinlets, slightly to intensely fractured, dip 40° - 50°.

Figure 5.17 Boring Log (17), Kok-Ing No.2 Tunnel

Geologic log of drill hole
Hole No. DHBJ 4.5

Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness 1 2 3 4 5	Degree of Weathering 1 2 3 4 5	Degree of Permeability 1 2 3 4 5	Rock Class	Log Symbol	Description
100						CL		
						CM		
						CL		SHALE : highly to moderately weathered, soft to medium hard, intensely to very intensely fractured.
						D		SANDSTONE : fine grained, slightly to moderately weathered, medium hard, intensely to very intensely fractured.
110						CL		
						D		
115								SHALE : slightly weathered, medium hard, intensely to very intensely fractured, some quartz veinlets, sandstone intercalated.
120						CL		
								ANDESITE : slightly weathered, medium hard, some quartz veinlets, intensely fractured.
								SHALE : slightly to moderately weathered, medium hard to hard, intensely fractured, dip 50°-60° sandstone interbedded
125						D		ANDESITE : moderately weathered, medium hard, quartz veins, moderately fractured, dip 30° - 40°.
						CL		SHALE : moderately weathered, medium hard to hard, intensely fractured, sandstone interbedded
130								ANDESITE : slightly weathered, hard
								SHALE : moderately weathered, medium hard.
135								ANDESITE : slightly weathered, hard.
						CM		SANDSTONE : fine to medium grained, slightly weathered, medium hard, intensely fractured.
								ANDESITE : slightly weathered, hard
140								SHALE/SANDSTONE : slightly weathered, medium hard to hard, slightly to intensely fractured, dip 45°-60°, some quartz veinlets.
								ANDESITE : slightly to moderately weathered, medium hard to very hard, moderately to intensely fractured, dip 60° - 70°, some quartz veins and veinlets.
145						CC		
						CM		
						CL		
						CM		
150								

Geologic log of drill hole
Hole No. DHBJ 4.5

Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness 1 2 3 4 5	Degree of Weathering 1 2 3 4 5	Degree of Permeability 1 2 3 4 5	Rock Class	Log Symbol	Description
155						CL		SANDSTONE : fine to medium grained, slightly to moderately weathered, medium hard to very hard, slightly to intensely fractured, some quartz veinlets, shale interbedded.
160						CL		
						CM		
165						CL		BOTTOM OF HOLE
170								
175								
180								
185								
190								
195								
200								

Figure 5.18 Boring Log (18), Ing Diversion Weir

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI-PHAYAO-NAN Site : Kok-Ing Diversion Location : 243754 Approx. Ground Height : +362.000 msl			Drilling Started : 20 Sep, 1997 Drilling Finished : 26 Sep, 1997 Logged Date : 10 Oct, 1997 Logged By : S. Worapot Drilling Method : Rotary Oil Feed			Hole No : DHID-1 Total Depth : 40.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 1.00 m.			Page 1 of 1
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
5								LEAN CLAY (CL) : medium plasticity fines, trace of sand.	
5								SILTY SAND (SM) : fine to medium sand, low plasticity fines.	
5								SILTY SAND (SM) : fine to coarse sand, nonplastic fines.	
10								LEAN CLAY WITH SAND (CL) : medium plasticity fines, fine to coarse sand and gravel.	
10								SILTY SAND (SM) : fine to coarse sand, nonplastic fines.	
10								SILTY SAND WITH GRAVEL (SM) : fine to coarse sand, nonplastic fines, few gravel.	
20								SILTY SAND (SM) : fine to coarse sand, few nonplastic fines, trace of gravel.	
40								Bottom of hole	

% R.Q.D.	Degree of Hardness	Degree of Weathering	Degree of Permeability
<25% = Very Poor Rock	1 = Very Soft Rock	1 = Fresh Rock	1 = <1 Lugeon or <10 ⁻⁶ cm/sec
25-50% = Poor Rock	2 = Soft Rock	2 = Slightly Weathered Rock	2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁶ cm/sec
50-75% = Fair Rock	3 = Medium Hard Rock	3 = Moderately Weathered Rock	3 = 6-10 Lugeon or 5x10 ⁻⁶ - 10 ⁻⁴ cm/sec
75-90% = Good Rock	4 = Hard Rock	4 = Highly Weathered Rock	4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec
90-100% = Very Good Rock	5 = Very Hard rock	5 = Completely Weathered Rock	5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec

Driller : Geologist : P. Sarayut

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI-PHAYAO-NAN Site : Kok-Ing Diversion Location : 244754 Approx. Ground Height : +362.000 msl			Drilling Started : 20 Sep, 1997 Drilling Finished : 29 Sep, 1997 Logged Date : 10 Oct, 1997 Logged By : S. Thanakorn Drilling Method : Rotary Oil Feed			Hole No : DHID-2 Total Depth : 40.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 0.10 m.			Page 1 of 1
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
5								LEAN CLAY (CL) : medium plasticity fines.	
5								SILTY SAND (SM) : fine to coarse sand, low plasticity fines.	
10								SILTY SAND (SM) : fine to coarse sand, nonplastic fines, gray.	
40								Bottom of hole	

% R.Q.D.	Degree of Hardness	Degree of Weathering	Degree of Permeability
<25% = Very Poor Rock	1 = Very Soft Rock	1 = Fresh Rock	1 = <1 Lugeon or <10 ⁻⁶ cm/sec
25-50% = Poor Rock	2 = Soft Rock	2 = Slightly Weathered Rock	2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁶ cm/sec
50-75% = Fair Rock	3 = Medium Hard Rock	3 = Moderately Weathered Rock	3 = 5-10 Lugeon or 5x10 ⁻⁶ - 10 ⁻⁴ cm/sec
75-90% = Good Rock	4 = Hard Rock	4 = Highly Weathered Rock	4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec
90-100% = Very Good Rock	5 = Very Hard rock	5 = Completely Weathered Rock	5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec

Driller : Geologist : S. Thanakorn

Figure 5.19 Boring Log (19), Ing Diversion Weir and Ing-Yot No.1 Tunnel

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI-PHAYAO-NAN Site : Kok-Ing Diversion Location : 246754 Approx. Ground Height : +364.000 msl			Drilling Started : 15 Sep, 1997 Drilling Finished : 1 Oct, 1997 Logged Date : 10 Oct, 1997 Logged By : S. Worapot Drilling Method : Rotary Oil Feed			Hole No : DHID-3 Total Depth : 40.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 0.20 m.			Page 1 of 1
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
0								LEAN CLAY (CL) : medium plasticity fines, brown. FAT CLAY (CH) : high plasticity fines.	
5								SANDY LEAN CLAY (CL) : medium plasticity fines, fine sand. FAT CLAY (CH) : high plasticity fines.	
10								CLAYEY SAND (SC) : fine to coarse sand. FAT CLAY (CH) : high plasticity fines.	
15								POORLY GRADED SAND (SP) AND POORLY GRAVEL (GP) : angular to subrounded.	
20								CLAYEY SAND (SC) : fine to coarse sand, medium plasticity fines. SILTY SAND WITH GRAVEL (SM) : fine to coarse sand, nonplastic fines.	
25									
30								POORLY GRADED SAND WITH GRAVEL (SP) : fine to coarse sand and gravel, gray.	
35									
40									Bottom of hole
45									
50									
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = <1 Lugeon or <10 ⁻⁶ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁵ cm/sec			
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec			
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec			
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : P. Sarayut									

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI-PHAYAO-NAN Site : Tunnel (Ing Div.-Ing Yot Div.) Location : 274745 Approx. Ground Height : +394.000 msl			Drilling Started : 19 June, 1997 Drilling Finished : 21 Jul, 1997 Logged Date : 11 Nov, 1997 Logged By : D. Siwa Drilling Method : Rotary Oil Feed			Hole No : DHIV-1 Total Depth : 50.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 6.50 m.			Page 1 of 1
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
0								SILT (ML) : nonplastic fines, few fine gravel, fine to coarse sand with fine gravel and low plasticity fines.	
5							VVV VV VVV VV VVV VV	TUFF : fine to medium grained, moderately weathered, medium hard, intensely to very intensely fractured. (dip 45-50 degrees)	
10							VVV VV VVV VV VVV VV	TUFF : fine to medium grained, moderately to slightly weathered, medium hard to hard, intensely fractured. (dip 30 and 60 degrees)	
15							VVV VV VVV VV VVV VV		
20							VVV VV VVV VV VVV VV		
25							VVV VV VVV VV VVV VV		
30							VVV VV VVV VV VVV VV		
35							VVV VV VVV VV VVV VV		
40							VVV VV VVV VV VVV VV		
45							VVV VV VVV VV VVV VV		
50							VVV VV VVV VV VVV VV		Bottom of hole
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = <1 Lugeon or <10 ⁻⁶ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁵ cm/sec			
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec			
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec			
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : P. Sarayut									

Figure 5.20 Boring Log (20), Ing-Yot No.1 Tunnel

KENBER GEOTECHNIC (THAILAND) CO., LTD.								
GEOLOGIC LOG OF DRILL HOLE								
Project : KOK - ING - NAN		Drilling Started : 3 Sep, 1997		Hole No : DHIY-2		Page 1 of 1		
Changwat : CHIANGRAI-PHAYAO-NAN		Drilling Finished : 8 Sep, 1997		Total Depth : 30.00 m.		Angle From Vertical : 0 Degree		
Site : Tunnel (Ing Div.-Ing Yot Div.)		Logged Date : 11 Oct, 1997		Bearing of Angle Hole : -		Depth of Water Level : 4.00 m.		
Location : 286744		Logged By : P. Sarayut		Drilling Method : Rotary Oil Feed				
Approx. Ground Height : +373.000 msl								
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description
0-15	100%	100%	1	1				SANDY LEAN CLAY (CL) : low plasticity fines, fine to very fine sand. (talus)
15-20	100%	100%	2	2		D	VVV VV VVV VV VVV VV VVV	TUFF : fine to medium grained, highly weathered, soft to medium hard, intensely to very intensely fractured.
20-25	100%	100%	3	3		CL	VVV VV VVV	TUFF : fine to medium grained, moderately weathered, medium hard to very hard, moderately to intensely fractured. (dip 40-60 degrees)
25-30	100%	100%	4	4		CM	VV VVV VV VVV	
30-35	100%	100%	5	5		CL	VV VVV	Bottom of hole
35-50								

% R.Q.D.	Degree of Hardness	Degree of Weathering	Degree of Permeability
<-25% = Very Poor Rock	1 = Very Soft Rock	1 = Fresh Rock	1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec
25-50% = Poor Rock	2 = Soft Rock	2 = Slightly Weathered Rock	2 = 1-5 Lugeon or 10 ⁻⁵ -5x10 ⁻⁶ cm/sec
50-75% = Fair Rock	3 = Medium Hard Rock	3 = Moderately Weathered Rock	3 = 6-10 Lugeon or 5x10 ⁻⁵ -10 ⁻⁴ cm/sec
75-90% = Good Rock	4 = Hard Rock	4 = Highly Weathered Rock	4 = 10-50 Lugeon or 10 ⁻⁴ -5x10 ⁻⁴ cm/sec
90-100% = Very Good Rock	5 = Very Hard rock	5 = Completely Weathered Rock	5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec

Driller : _____ Geologist : P. Sarayut

Figure 5.21 Boring Log (21), Ing-Yot No.2 Tunnel Adit

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI-PHAYAO-NAN Site : Ing-Yot Tunnel (Adit1) Location : 405743 Approx. Ground Height : +482.00 msl			Drilling Started : 10 Jul, 1997 Drilling Finished : 15 Jul, 1997 Logged Date : 20 Jul, 1997 Logged By : D.Siwa Drilling Method : Rotary Oil Feed			Hole No : DH1AD1 Total Depth : 65.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 44.00 m.		Page 1 of 2	
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
0								TOP SOIL (OL) :	
0								LEAN CLAY WITH GRAVEL (CL) : low plasticity fines, fine gravel.	
5								COMPLETELY WEATHERED OF SHALE : weathered to lean clay.	
10						D		SHALE AND SANDSTONE ALTERATION : completely weathered, soft.	
15								SHALE : highly to completely weathered, very soft, intensely to moderately fractured (dip 40-45 degrees).	
20						D			
25									
30									
35									
40									
45								LIMESTONE : massive, slightly weathered to fresh, medium hard, intensely to moderately fractured (dip 40-60 degrees), calcite vein and veinlets.	
50						CM			
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁶ cm/sec			
50-75 % = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec			
75-90 % = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec			
90-100 % = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : P. Sarayut									

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI-PHAYAO-NAN Site : Ing-Yot Tunnel (Adit1) Location : 405743 Approx. Ground Height : +482.00 msl			Drilling Started : 10 Jul, 1997 Drilling Finished : 15 Jul, 1997 Logged Date : 20 Jul, 1997 Logged By : D.Siwa Drilling Method : Rotary Oil Feed			Hole No : DH1AD1 Total Depth : 65.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 44.00 m.		Page 2 of 2	
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
55								CM	
60								CL	
65								CM	Bottom of hole
70									
75									
80									
85									
90									
95									
100									
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁶ cm/sec			
50-75 % = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec			
75-90 % = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec			
90-100 % = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : P. Sarayut									

Figure 5.22 Boring Log (22), Ing-Yot No.2 Tunnel Adit

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAJ-PHAYAO-NAN Site : Ing-Yot Tunnel (Adit2) Location : 455739 Approx. Ground Height : +495.000 msl			Drilling Started : 2 Jul, 1997 Drilling Finished : 5 Jul, 1997 Logged Date : 20 Jul, 1997 Logged By : D. Siwa Drilling Method : Rotary Oil Feed			Hole No : DH2AD1SP Total Depth : 90.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 5.00 m.			Page 1 of 2
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
5								SILT (ML) : low plasticity fines.	
5								LEAN CLAY WITH GRAVEL (CL) : low plasticity fines, fine gravel.	
10								SHALE : completely weathered, soft.	
15								SANDSTONE : completely weathered, soft.	
20						D		SHALE : completely weathered, low plasticity fines, fine silt.	
25								SHALE INTERBEDDED WITH THIN SANDSTONE : alternate to lean clay, fine gravel, dark brown to greenish brown.	
30									
35						D			
40									
45									
50									

% R.Q.D.	Degree of Hardness	Degree of Weathering	Degree of Permeability
<25% = Very Poor Rock	1 = Very Soft Rock	1 = Fresh Rock	1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec
25-50% = Poor Rock	2 = Soft Rock	2 = Slightly Weathered Rock	2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁵ cm/sec
50-75% = Fair Rock	3 = Medium Hard Rock	3 = Moderately Weathered Rock	3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec
75-90% = Good Rock	4 = Hard Rock	4 = Highly Weathered Rock	4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec
90-100% = Very Good Rock	5 = Very Hard rock	5 = Completely Weathered Rock	5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec

Driller : Geologist : P. Sarayut

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAJ-PHAYAO-NAN Site : Ing-Yot Tunnel (Adit2) Location : 455739 Approx. Ground Height : +495.000 msl			Drilling Started : 2 Jul, 1997 Drilling Finished : 5 Jul, 1997 Logged Date : 20 Jul, 1997 Logged By : D. Siwa Drilling Method : Rotary Oil Feed			Hole No : DH2AD1SP Total Depth : 90.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 5.00 m.			Page 2 of 2
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
55						D			
60								SHALE : highly weathered, soft to very soft, intensely to very intensely fractured, interbedded with siltstone (tuffaceous).	
65						D			
70									
75						CL		SHALE : moderately to slightly weathered, medium hard to hard, intensely fractured (dip 30-45 degrees), some quartz veins with pyrite disseminated (tuffaceous).	
80						CL-CM			
85						CL			
90						CL-CM		Bottom of hole	
95									
100									

% R.Q.D.	Degree of Hardness	Degree of Weathering	Degree of Permeability
<25% = Very Poor Rock	1 = Very Soft Rock	1 = Fresh Rock	1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec
25-50% = Poor Rock	2 = Soft Rock	2 = Slightly Weathered Rock	2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁵ cm/sec
50-75% = Fair Rock	3 = Medium Hard Rock	3 = Moderately Weathered Rock	3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec
75-90% = Good Rock	4 = Hard Rock	4 = Highly Weathered Rock	4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec
90-100% = Very Good Rock	5 = Very Hard rock	5 = Completely Weathered Rock	5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec

Driller : Geologist : P. Sarayut

Figure 5.23 Boring Log (23), Ing-Yot No.2 Tunnel Adit

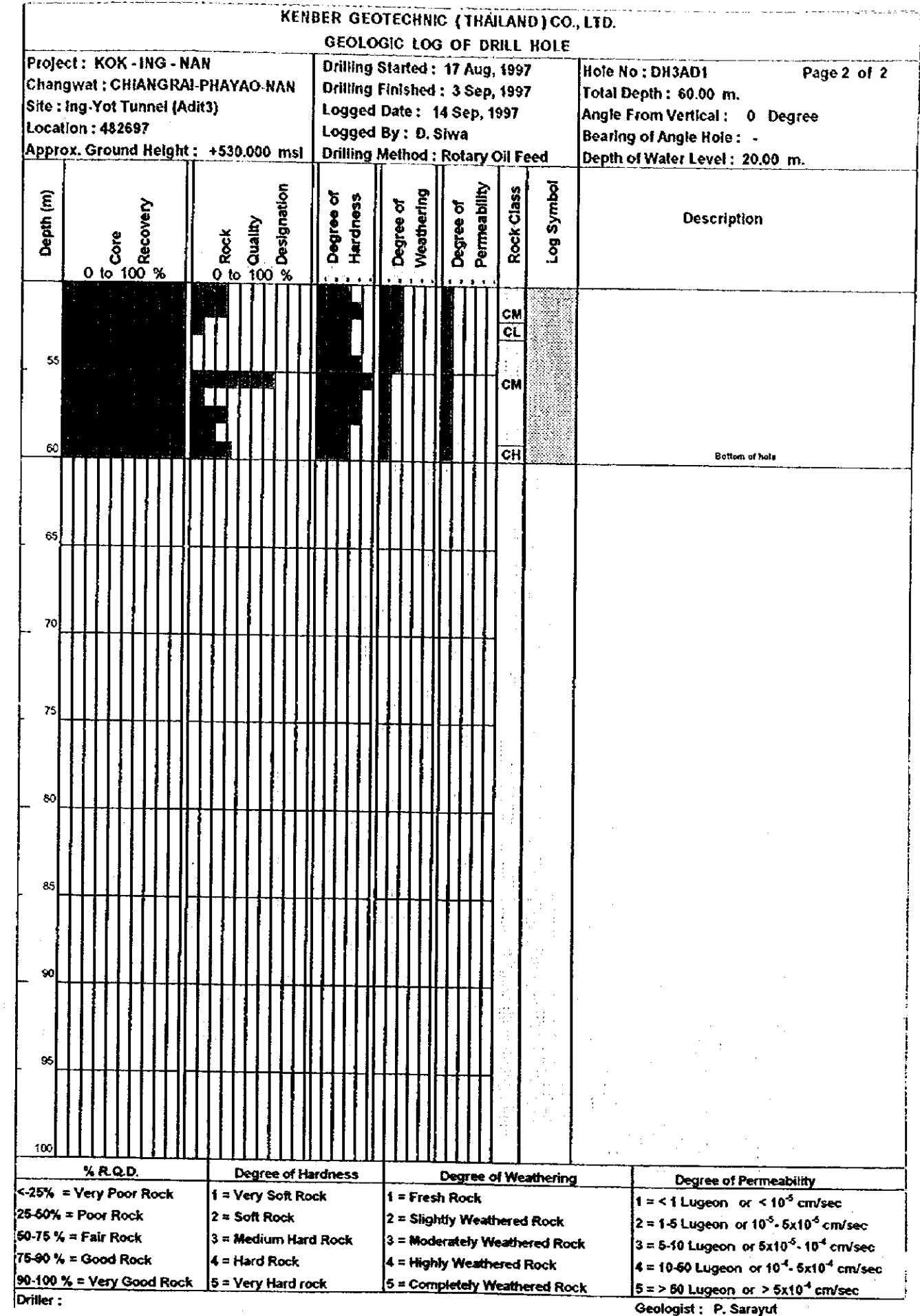
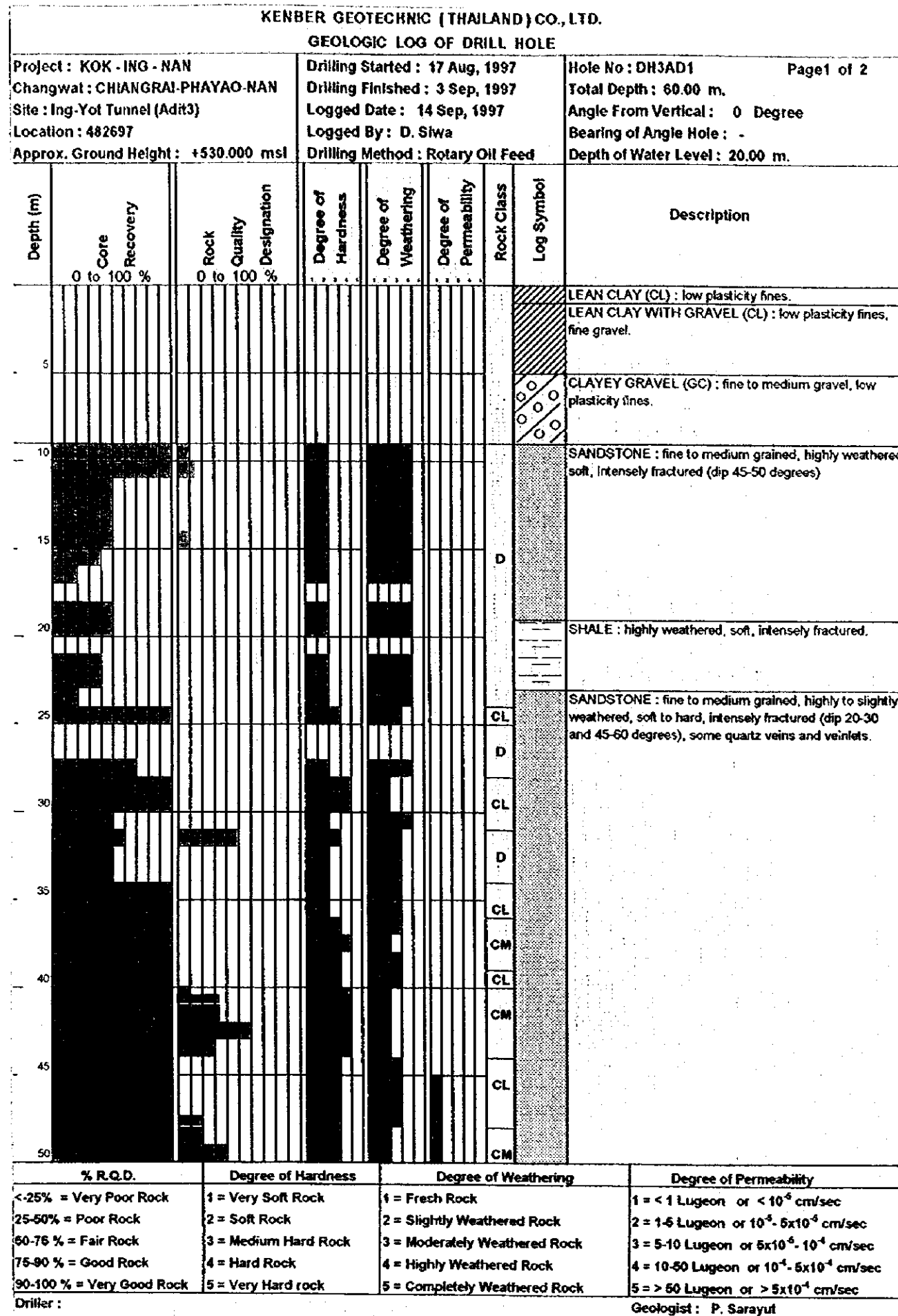


Figure 5.24 Boring Log (24), Ing-Yot No.2 Tunnel Adit

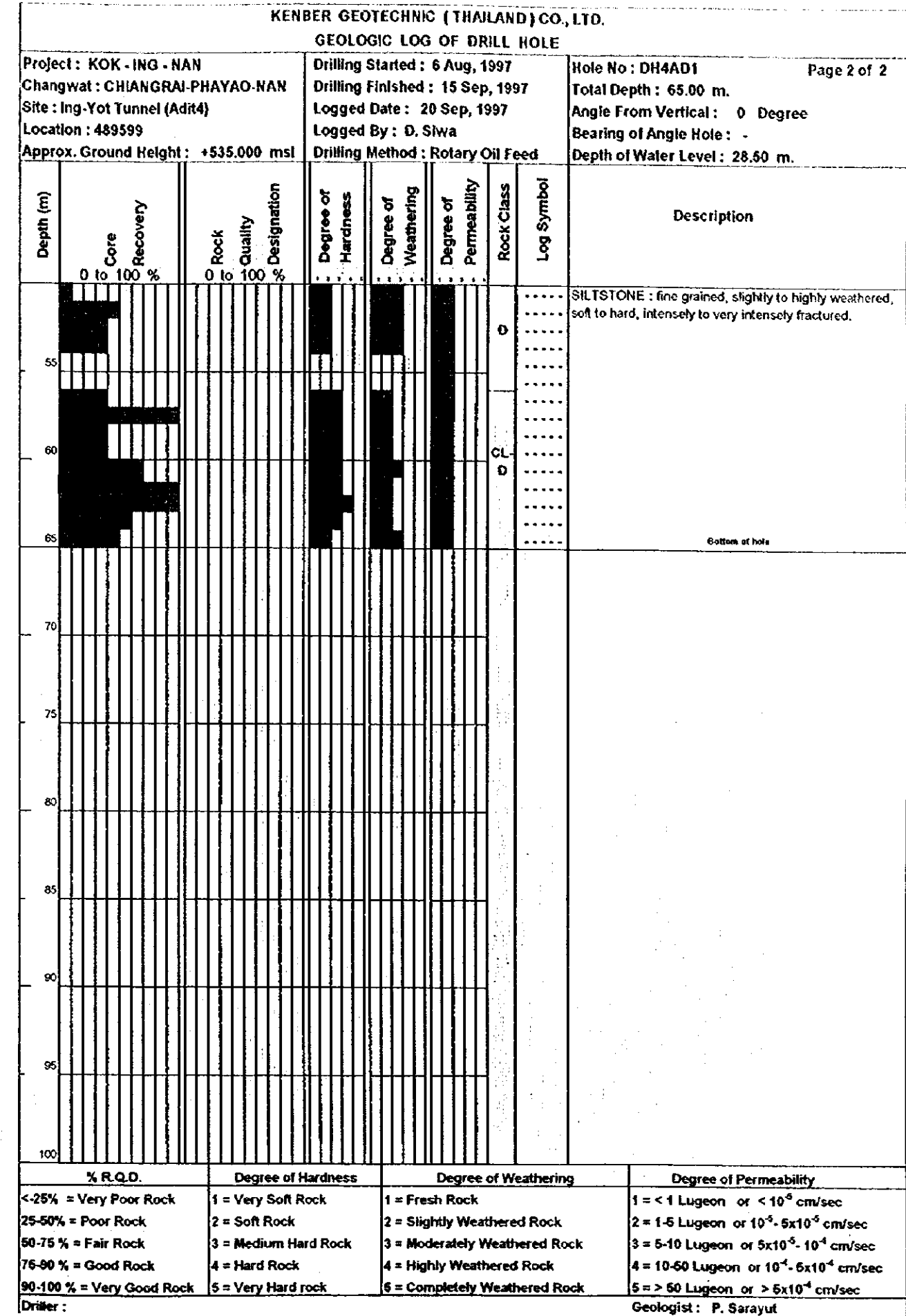
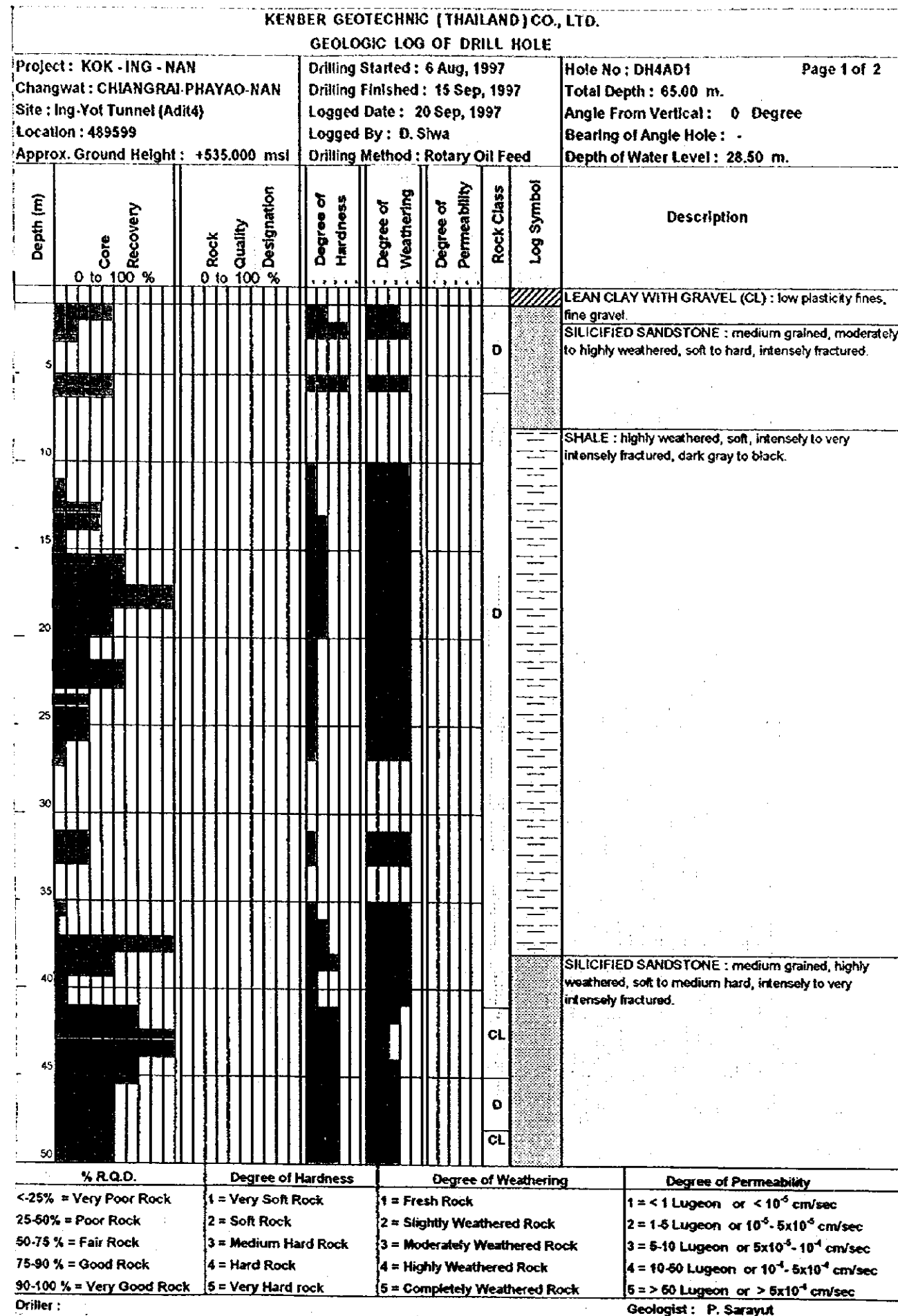


Figure 5.25 Boring Log (25), Ing-Yot No.2 Tunnel Adit

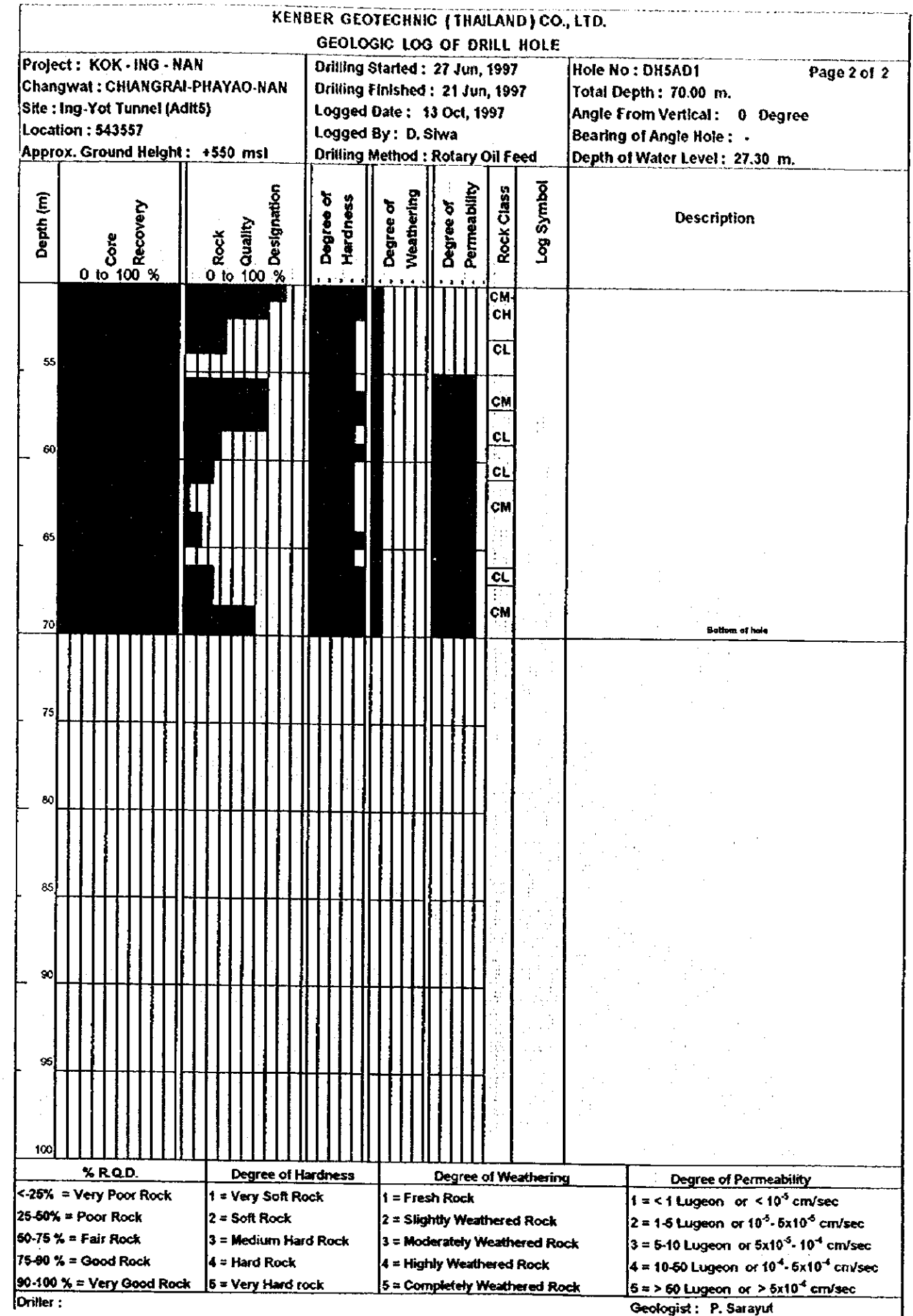
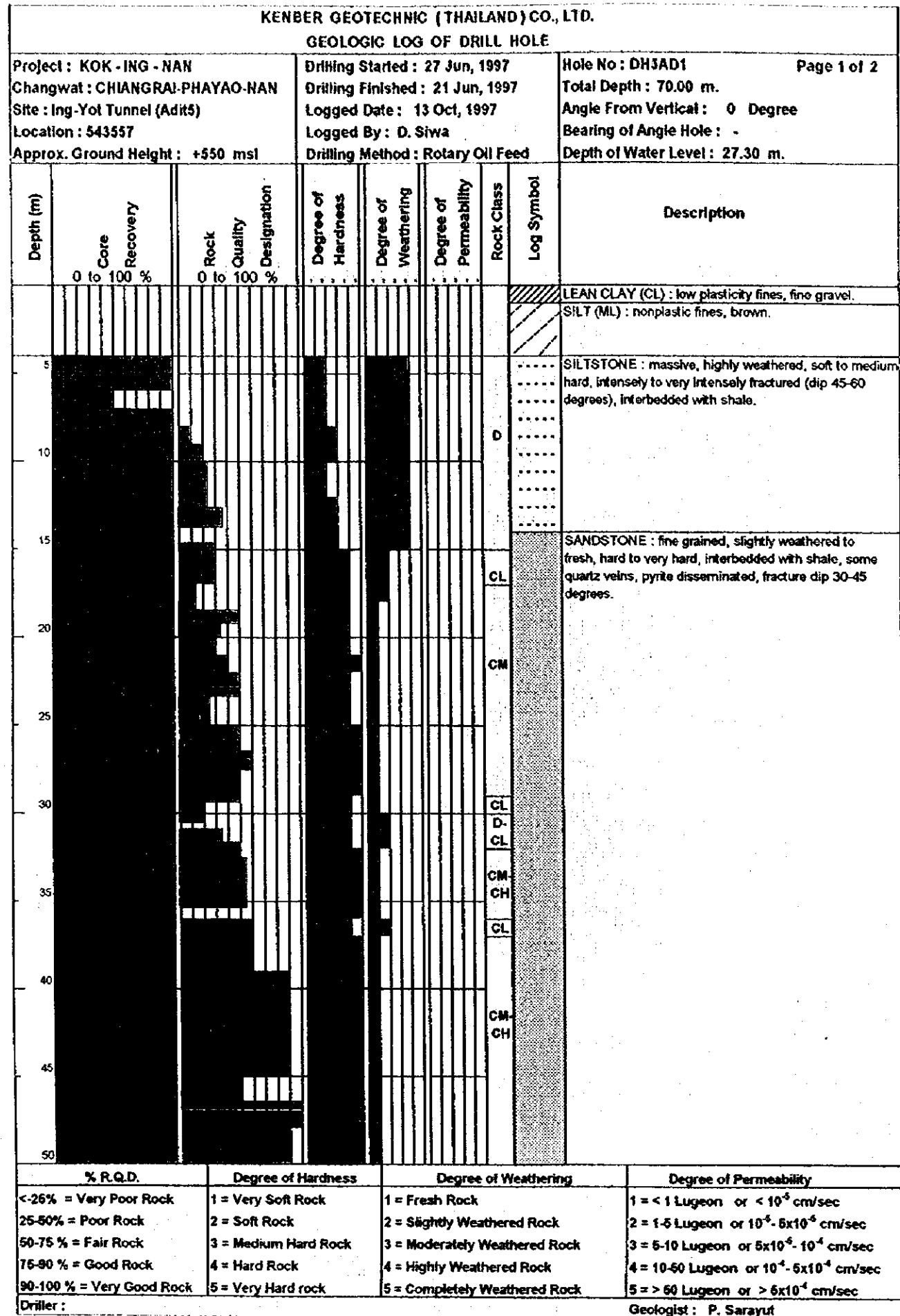


Figure 5.26 Boring Log (26), Ing-Yot No.2 Tunnel Adit

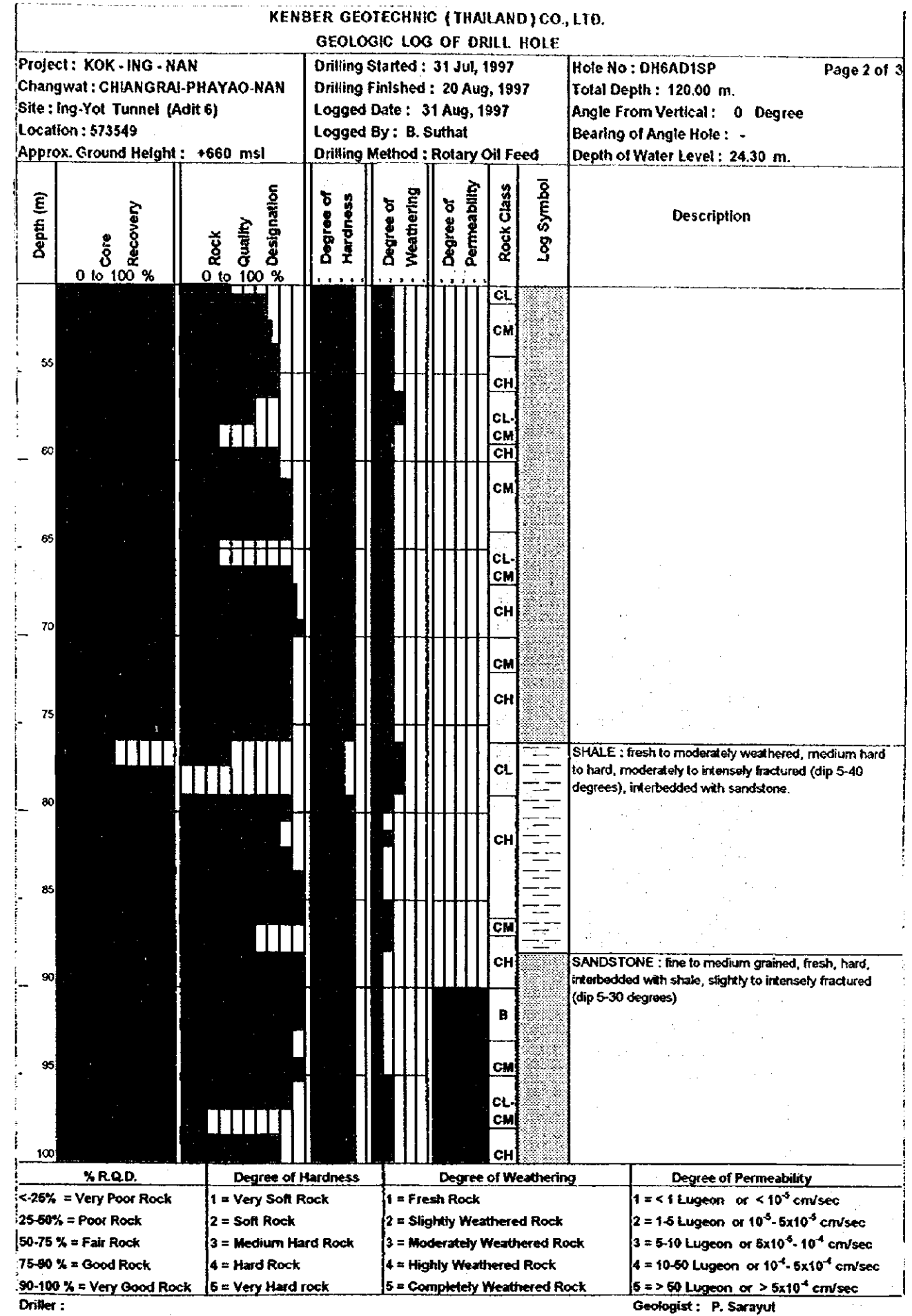
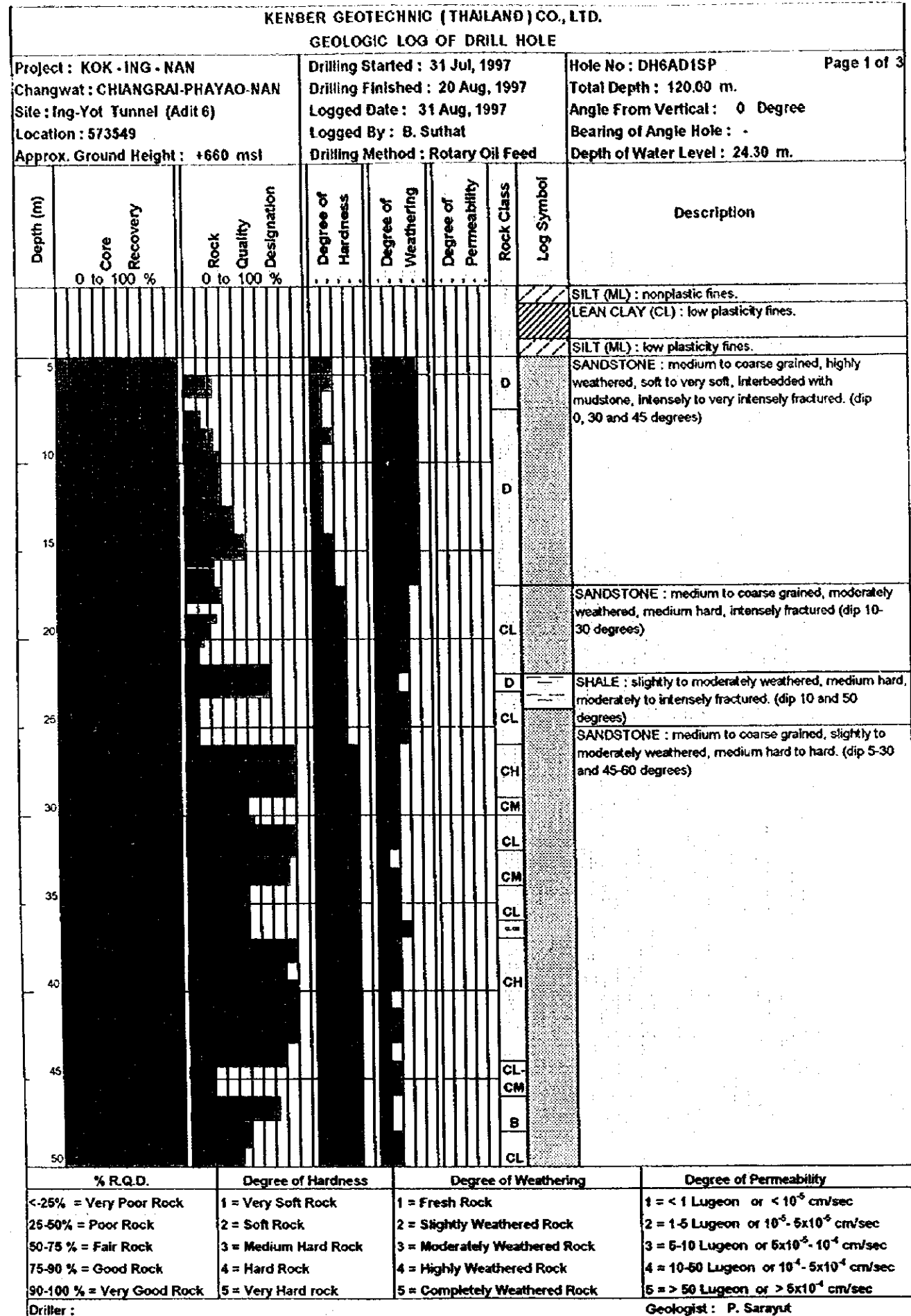


Figure 5.27 Boring Log (27), Ing-Yot No.2 Tunnel Adit

KENBER GEOTECHNIC (THAILAND) CO., LTD.								
GEOLOGIC LOG OF DRILL HOLE								
Project : KOK - ING - NAN		Drilling Started : 31 Jul, 1997		Hole No : DH6AD1SP		Page 3 of 3		
Changwat : CHIANGRAI-PHAYAO-NAN		Drilling Finished : 20 Aug, 1997		Total Depth : 120.00 m.		Angle From Vertical : 0 Degree		
Site : Ing-Yot Tunnel (Adit 6)		Logged Date : 31 Aug, 1997		Bearing of Angle Hole : -		Depth of Water Level : 24.30 m.		
Location : 573549		Logged By : B. Suthat						
Approx. Ground Height : +660 msl		Drilling Method : Rotary Oil Feed						
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description
105						CH D B		
110						CH		SHALE : fresh, hard, slightly to moderately fractured. (dip 15-30 degrees)
115						CM CH B		SANDSTONE : medium to coarse grained, fresh, hard, slightly fractured (dip 10 degrees), interbedded with shale.
120								Bottom of hole
125								
130								
135								
140								
145								
150								

% R.Q.D.	Degree of Hardness	Degree of Weathering	Degree of Permeability
<25% = Very Poor Rock	1 = Very Soft Rock	1 = Fresh Rock	1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec
25-50% = Poor Rock	2 = Soft Rock	2 = Slightly Weathered Rock	2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁵ cm/sec
50-75% = Fair Rock	3 = Medium Hard Rock	3 = Moderately Weathered Rock	3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec
75-90% = Good Rock	4 = Hard Rock	4 = Highly Weathered Rock	4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec
90-100% = Very Good Rock	5 = Very Hard Rock	5 = Completely Weathered Rock	5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec

Driller :

Geologist : P. Sarayut

Figure 5.28 Boring Log (28), Ing-Yot No.2 Tunnel Adit

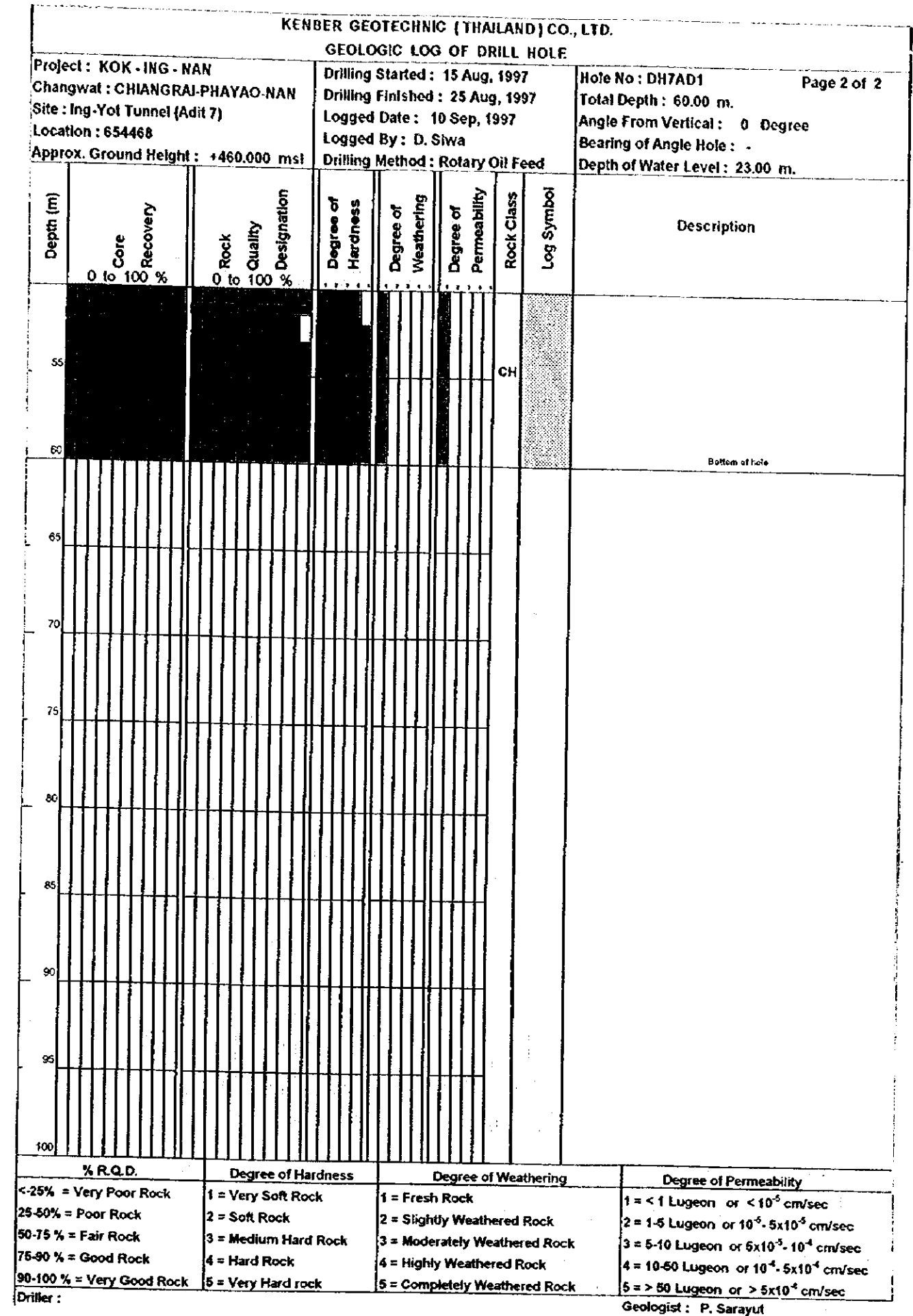
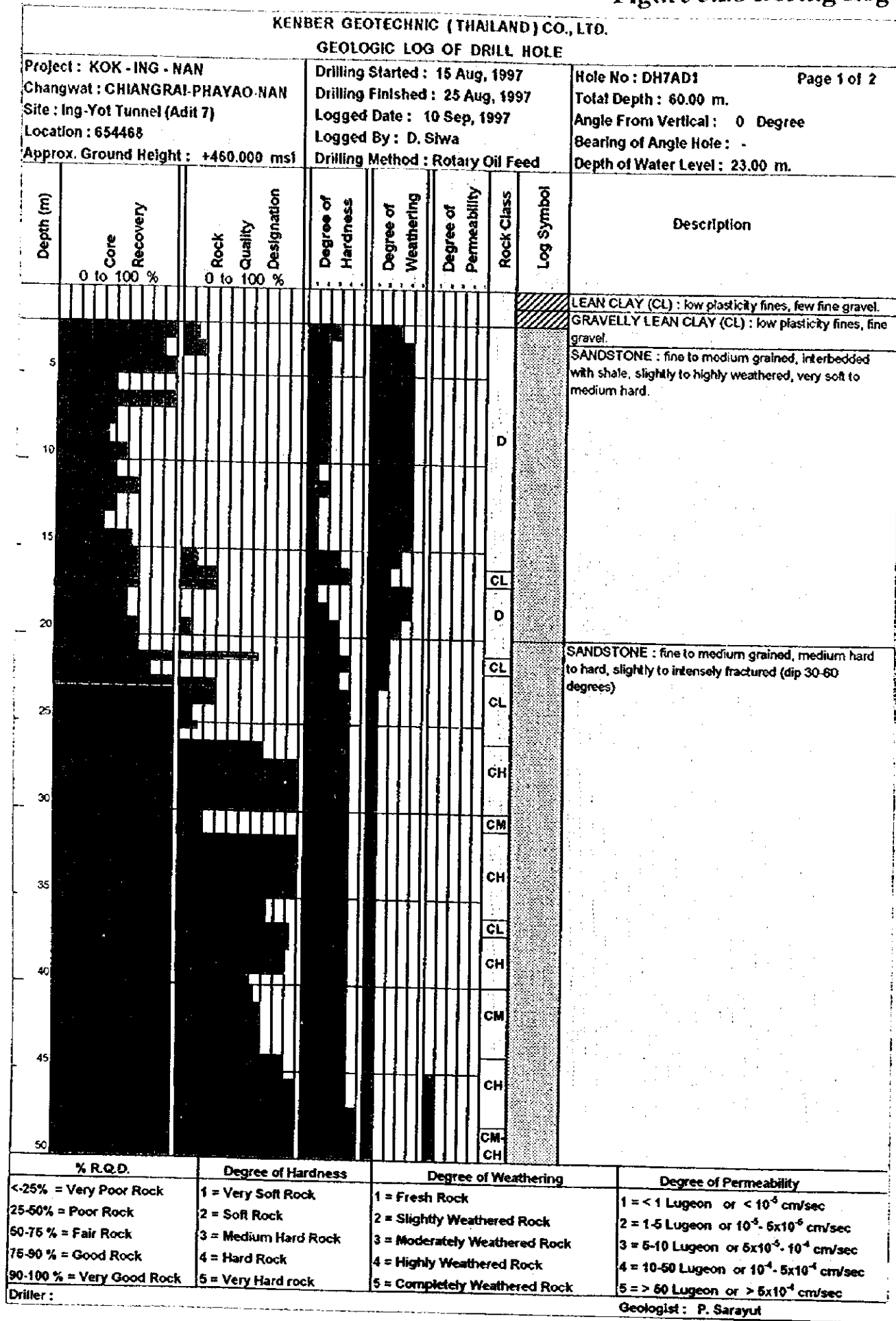


Figure 5.29 Boring Log (29), Ing-Yot No.2 Tunnel

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : PHAYAO Site : Main Route (B) Location : Ban Don Chal Approx. Ground Height : +383.000 msl			Drilling Started : 5 Jun, 1996 Drilling Finished : 11 Jun, 1996 Logged Date : 15 Jun, 1996 Logged By : K. Surake Drilling Method : Rotary Oil Feed			Hole No : DHB-1 Total Depth : 40.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 1.28 m.			Page 1 of 1
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness 1 2 3 4 5	Degree of Weathering 1 2 3 4 5	Degree of Permeability 1 2 3 4 5	Rock Class	Log Symbol	Description	
0								LEAN CLAY (CL) : medium plasticity fines.	
5						CM		SHALE : slightly weathered, moderately to intensely fractured. (dip 30-45 degrees)	
10						CL			
15						CM			
20						CL			
25						CL-CM			
30						CM			
35						CL			
40						CM		Bottom of hole	
45									
50									
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁶ cm/sec			
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁶ - 10 ⁻⁴ cm/sec			
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec			
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller :		Geologist : Surake Kongjai							

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : PHAYAO Site : Main Route (B) Location : Ban Don Chal Approx. Ground Height : +388.000 msl			Drilling Started : 30 April, 1996 Drilling Finished : 3 June, 1996 Logged Date : 10 June, 1996 Logged By : K. Surake Drilling Method : Rotary Oil Feed			Hole No : DHB-2 Total Depth : 45.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 1.25 m.			Page 1 of 1
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness 1 2 3 4 5	Degree of Weathering 1 2 3 4 5	Degree of Permeability 1 2 3 4 5	Rock Class	Log Symbol	Description	
0								LEAN CLAY (CL) : low plasticity fines.	
5								SANDY LEAN CLAY (CL) : low plasticity fines, fine to coarse sand.	
10						CM		SHALE : purplish red, slightly to highly weathered, soft to very soft, moderately fractured. (dip 30-45 degrees)	
15						CL			
20						CM			
25						CL			
30						CM			
35						CL			
40						CM			
45						D		Bottom of hole	
50									
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁶ cm/sec			
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁶ - 10 ⁻⁴ cm/sec			
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec			
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller :		Geologist : Surake Kongjai							

Figure 5.30 Boring Log (30), Ing-Yot No.2 Tunnel

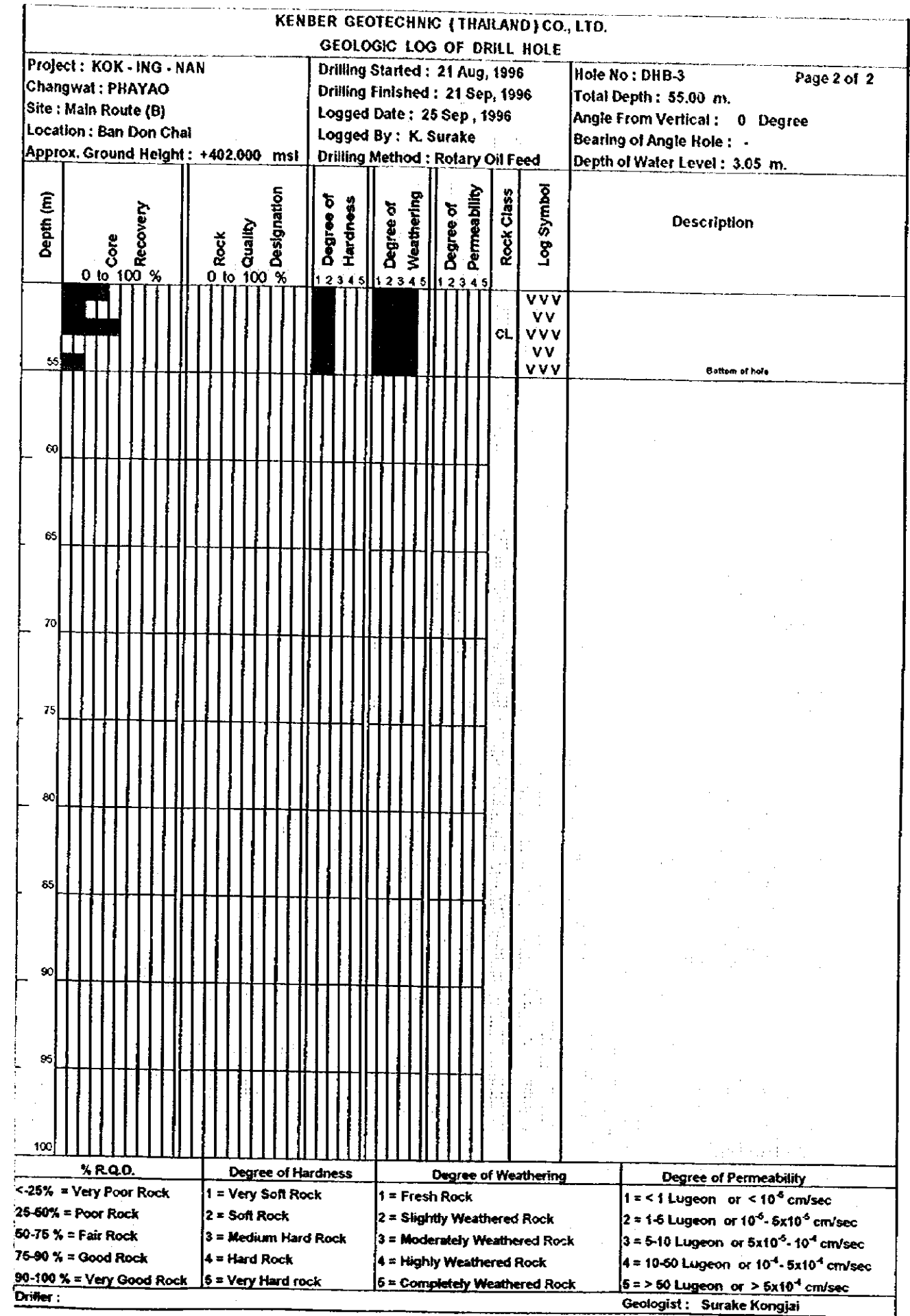
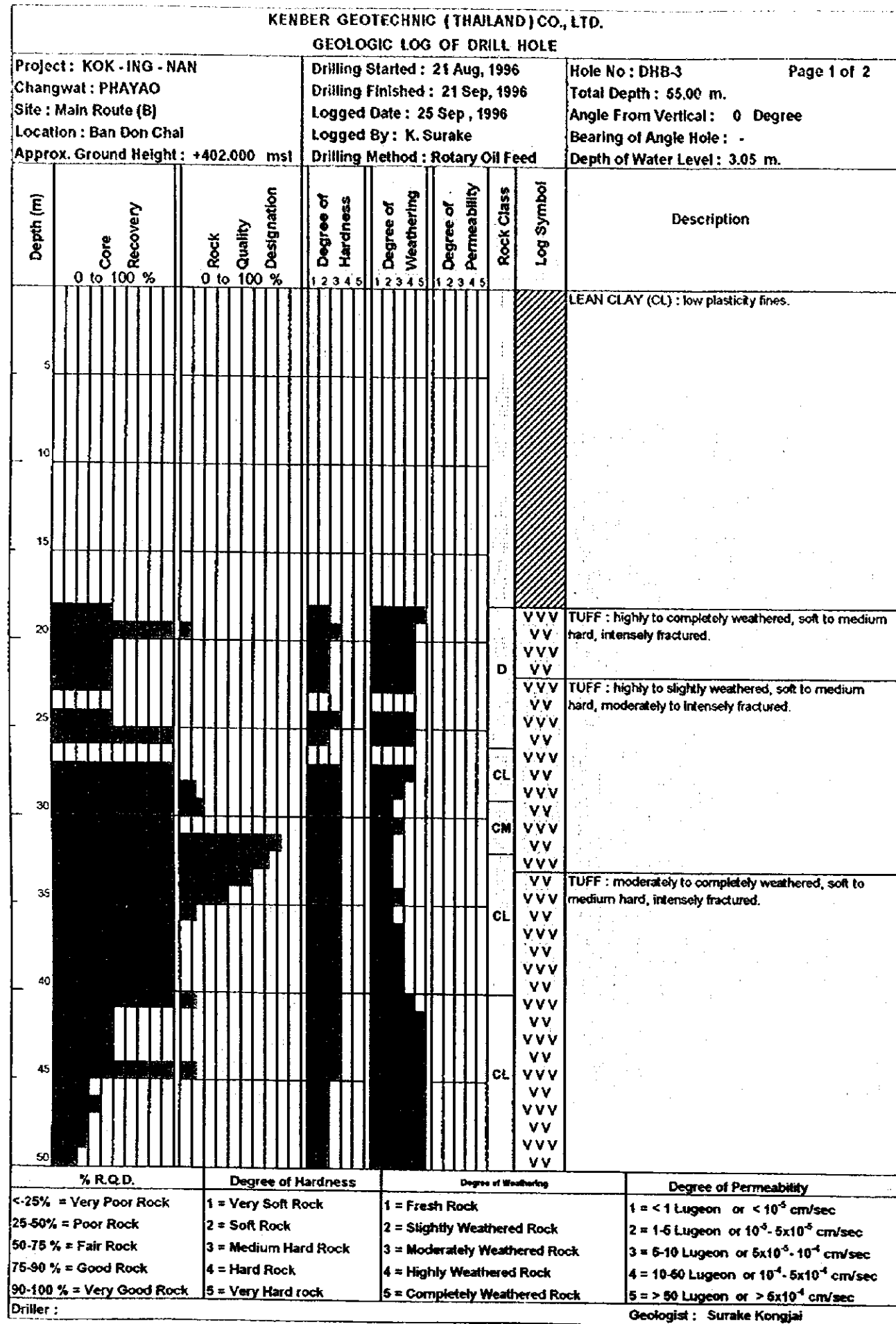


Figure 5.31 Boring Log (31), Ing-Yot No.2 Tunnel

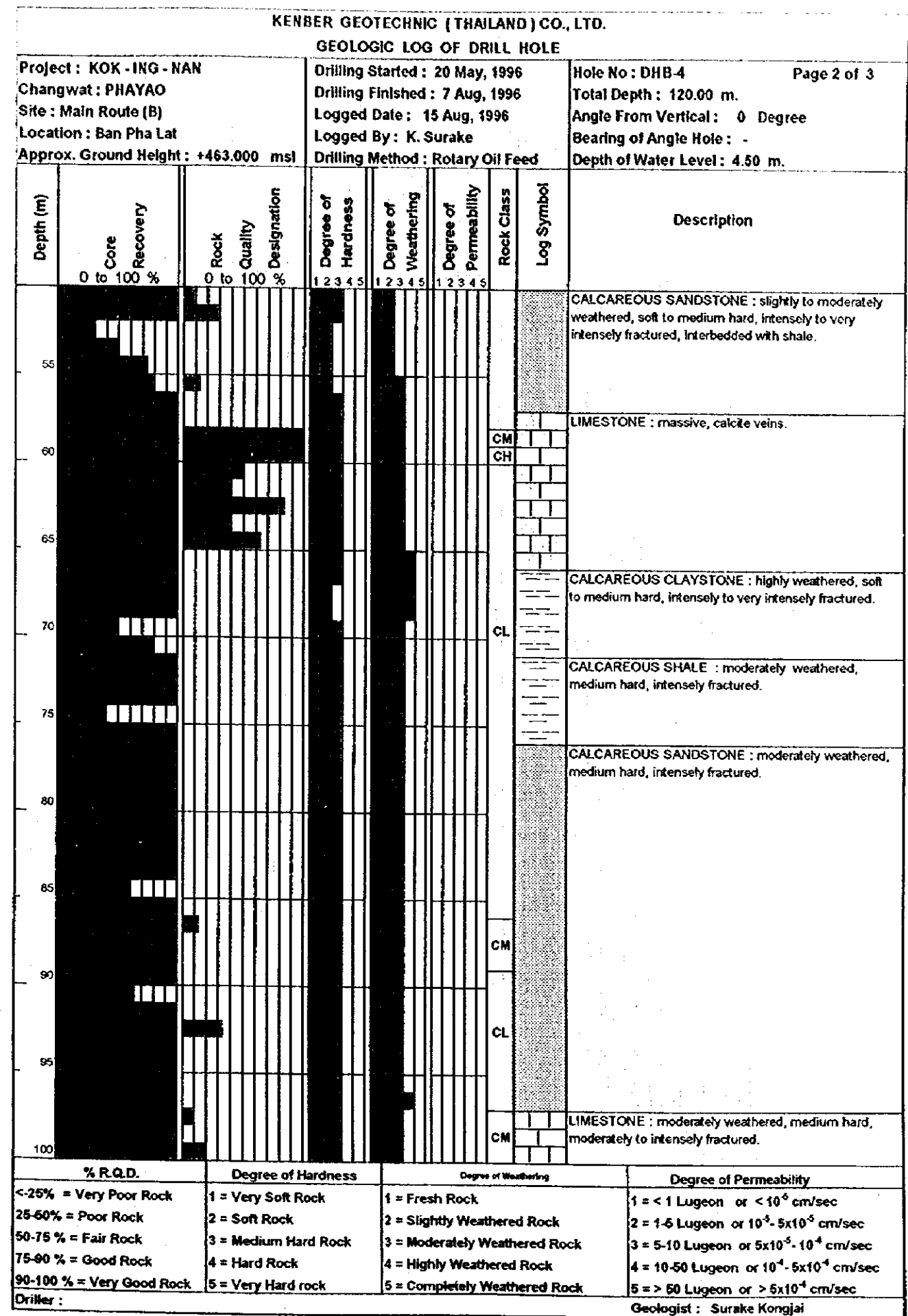
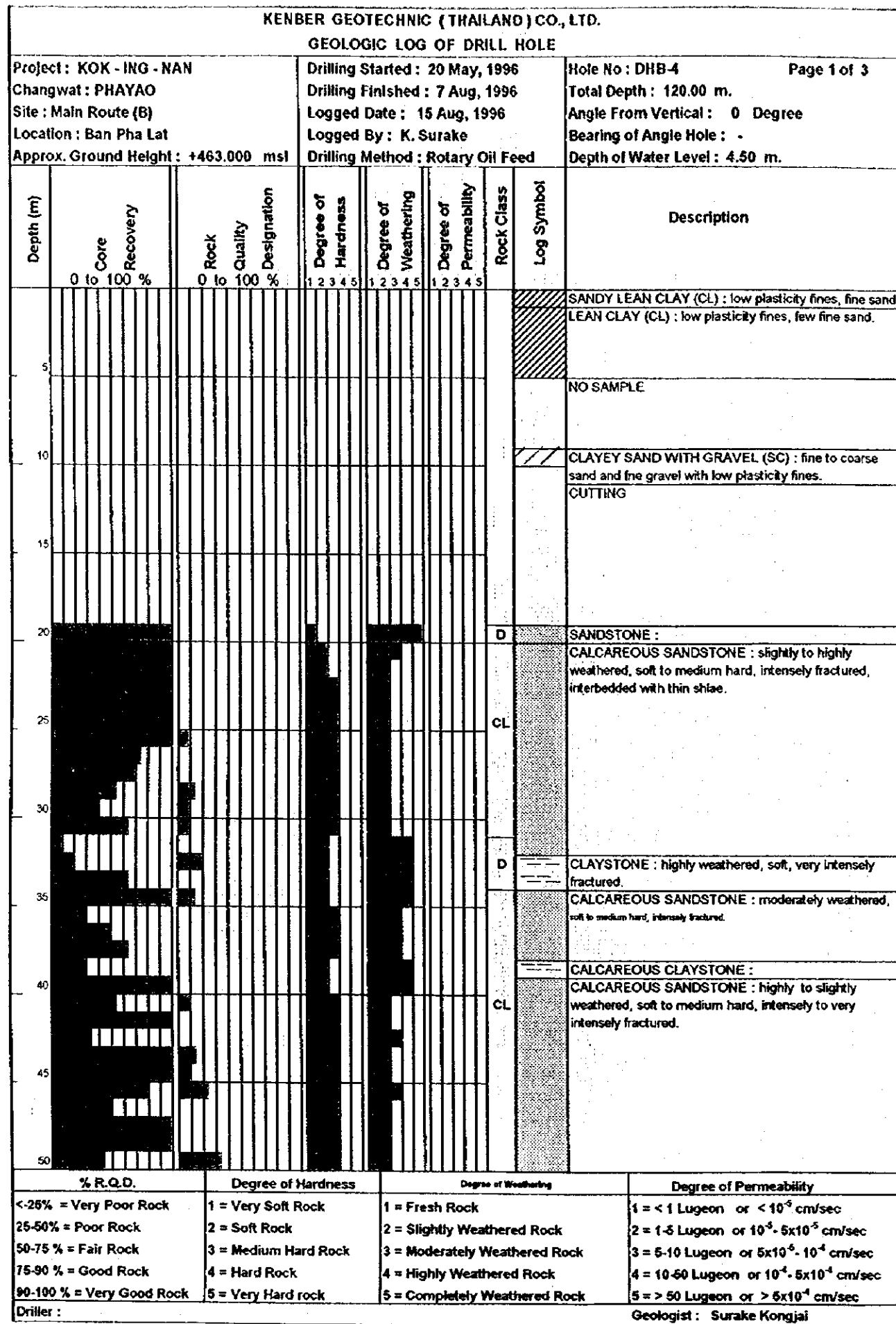


Figure 5.32 Boring Log (32), Ing-Yot No.2 Tunnel

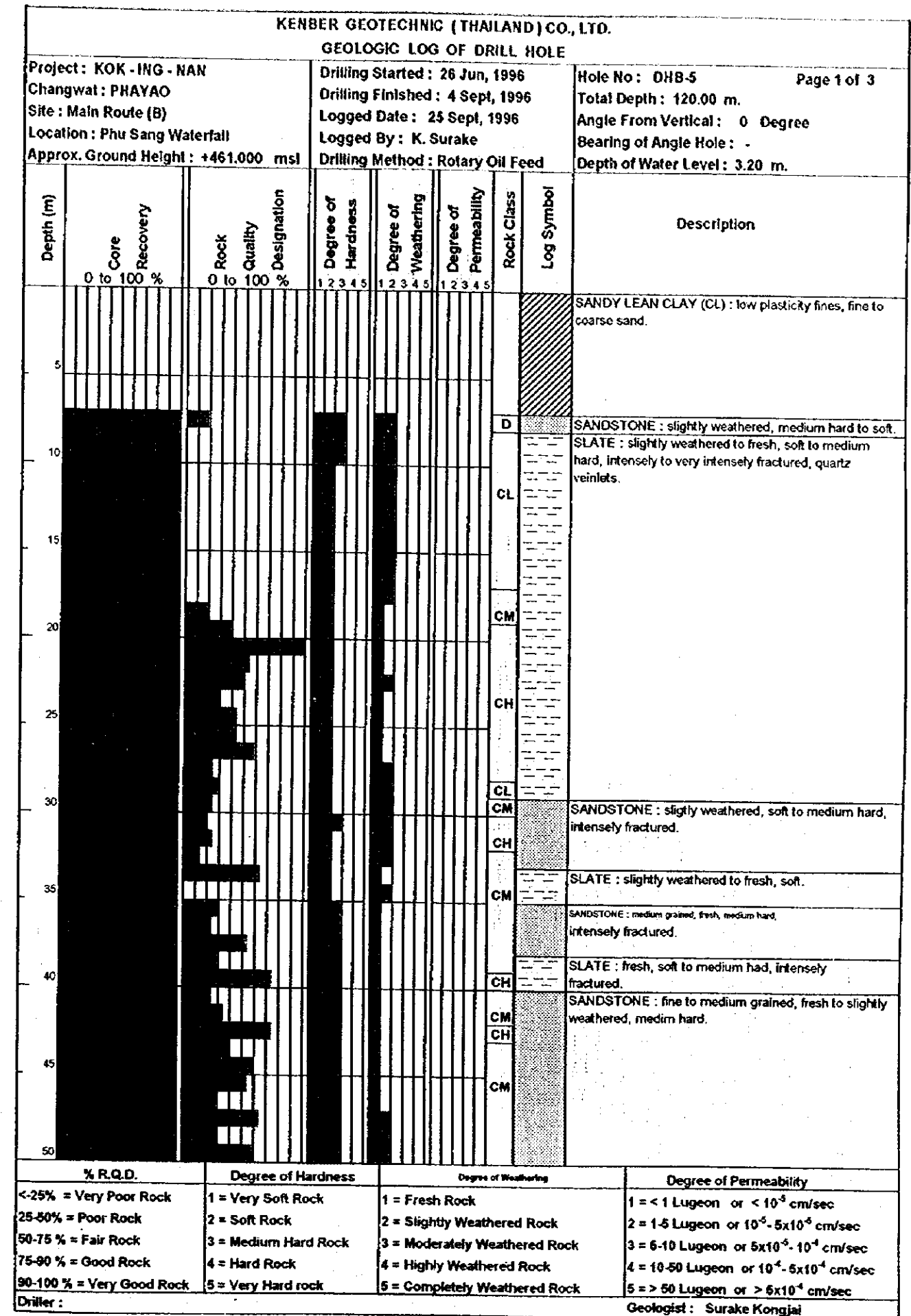
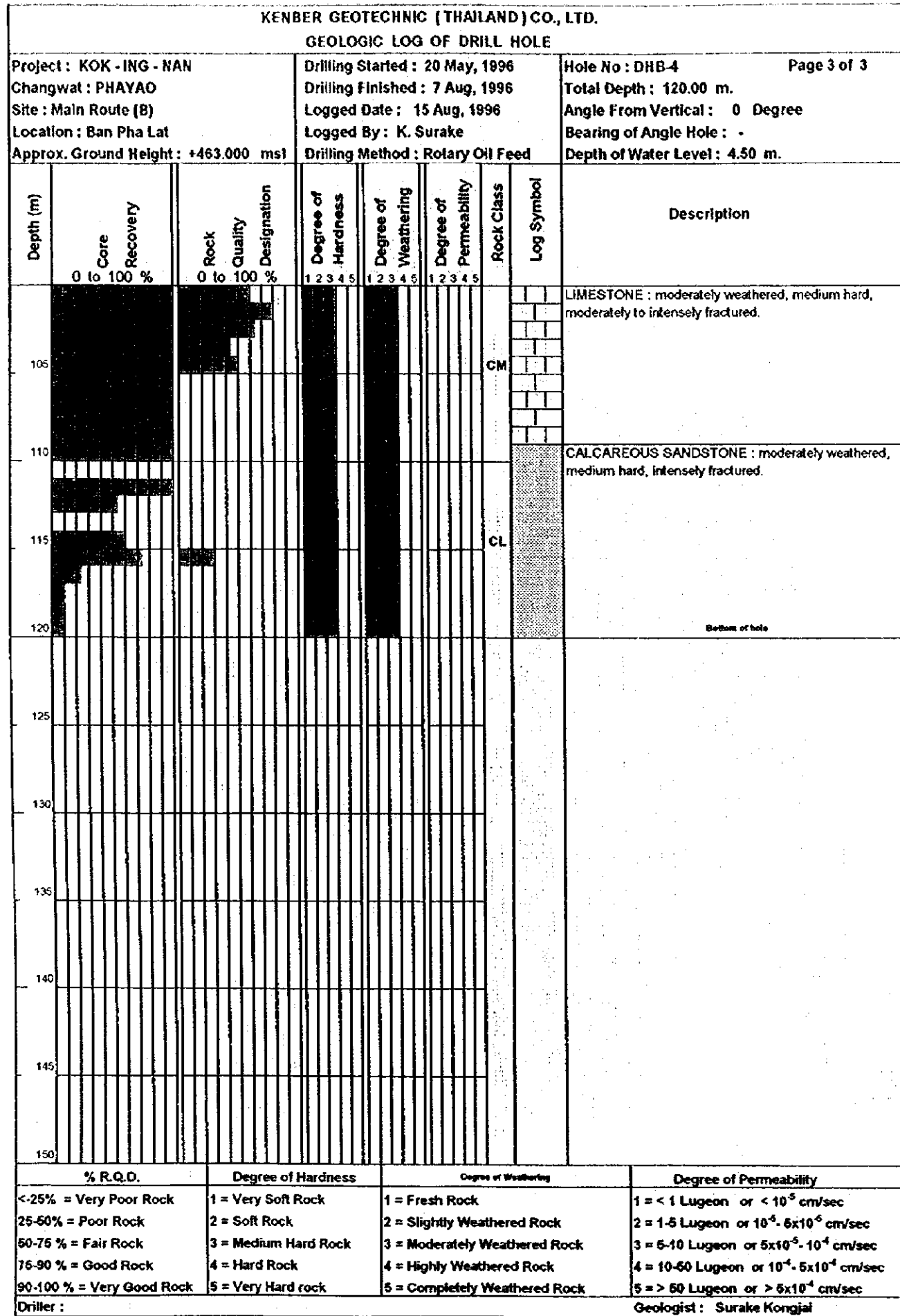


Figure 5.33 Boring Log (33), Ing-Yot No.2 Tunnel

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : PHAYAO Site : Main Route (B) Location : Phu Sang Waterfall Approx. Ground Height : +461.000 msl			Drilling Started : 26 Jun, 1996 Drilling Finished : 4 Sept, 1996 Logged Date : 25 Sept, 1996 Logged By : K. Surake Drilling Method : Rotary Oil Feed			Hole No : DHB-5 Total Depth : 120.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 3.20 m.			
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness 1 2 3 4 5	Degree of Weathering 1 2 3 4 5	Degree of Permeability 1 2 3 4 5	Rock Class	Log Symbol	Description	
55								PHYLLITE : slightly weathered, medium hard.	
60								SANDSTONE : slightly weathered, medium hard to soft, intensely to very intensely fractured, interbedded with slate.	
65						CL		SLATE : slightly weathered, medium hard to soft, intensely to very intensely fractured.	
70								SANDSTONE : fine to medium grained, fresh to slightly weathered, soft to medium hard, intensely fractured, interbedded with thin bed of slate.	
75									
80									
85								SLATE : fresh, medium hard to soft, moderately to intensely fractured.	
90						CM		SANDSTONE : fresh, medium hard to soft, moderately to intensely fractured.	
95									
100						CL		SLATE : slightly weathered, soft, intensely fractured.	
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<-25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ -5x10 ⁻⁵ cm/sec			
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ -10 ⁻⁴ cm/sec			
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ -5x10 ⁻⁴ cm/sec			
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : Surake Kongjai									

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : PHAYAO Site : Main Route (B) Location : Phu Sang Waterfall Approx. Ground Height : +461.000 msl			Drilling Started : 26 Jun, 1996 Drilling Finished : 4 Sept, 1996 Logged Date : 25 Sept, 1996 Logged By : K. Surake Drilling Method : Rotary Oil Feed			Hole No : DHB-5 Total Depth : 120.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 3.20 m.			
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness 1 2 3 4 5	Degree of Weathering 1 2 3 4 5	Degree of Permeability 1 2 3 4 5	Rock Class	Log Symbol	Description	
105								SANDSTONE / SLATE : fine grained, fresh to slightly weathered, medium hard to soft, moderately to intensely fractured.	
110						CL		SANDSTONE : fresh to slightly weathered, medium hard to soft, moderately to intensely fractured.	
115						CM		SLATE : fresh to slightly weathered, soft, moderately to intensely fractured, bed dip 30 degrees.	
120						CH			
Bottom of hole									
125									
130									
135									
140									
145									
150									
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<-25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ -5x10 ⁻⁵ cm/sec			
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ -10 ⁻⁴ cm/sec			
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ -5x10 ⁻⁴ cm/sec			
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : Surake Kongjai									

Figure 5.34 Boring Log (34), Ing-Yot No.2 Tunnel

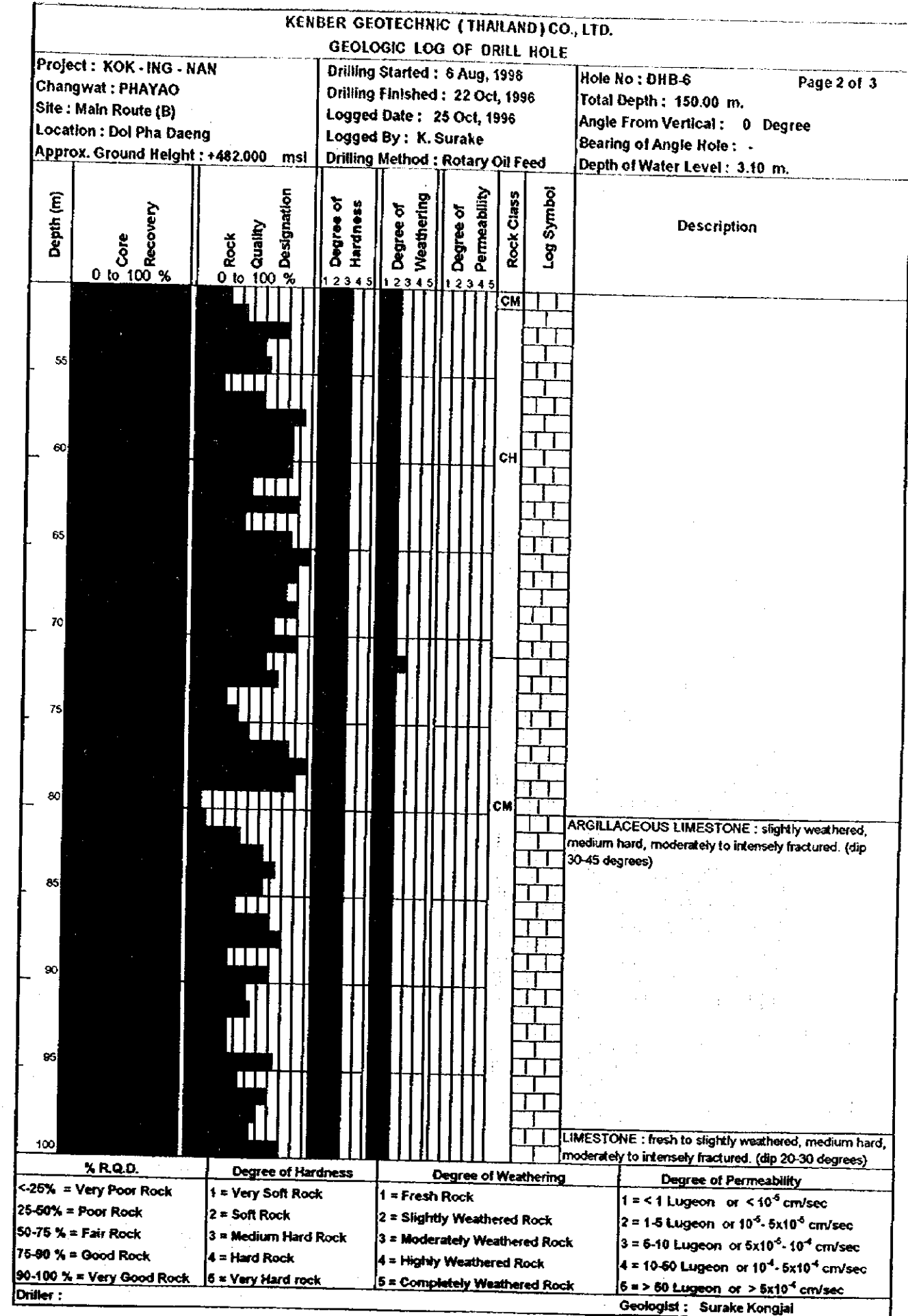
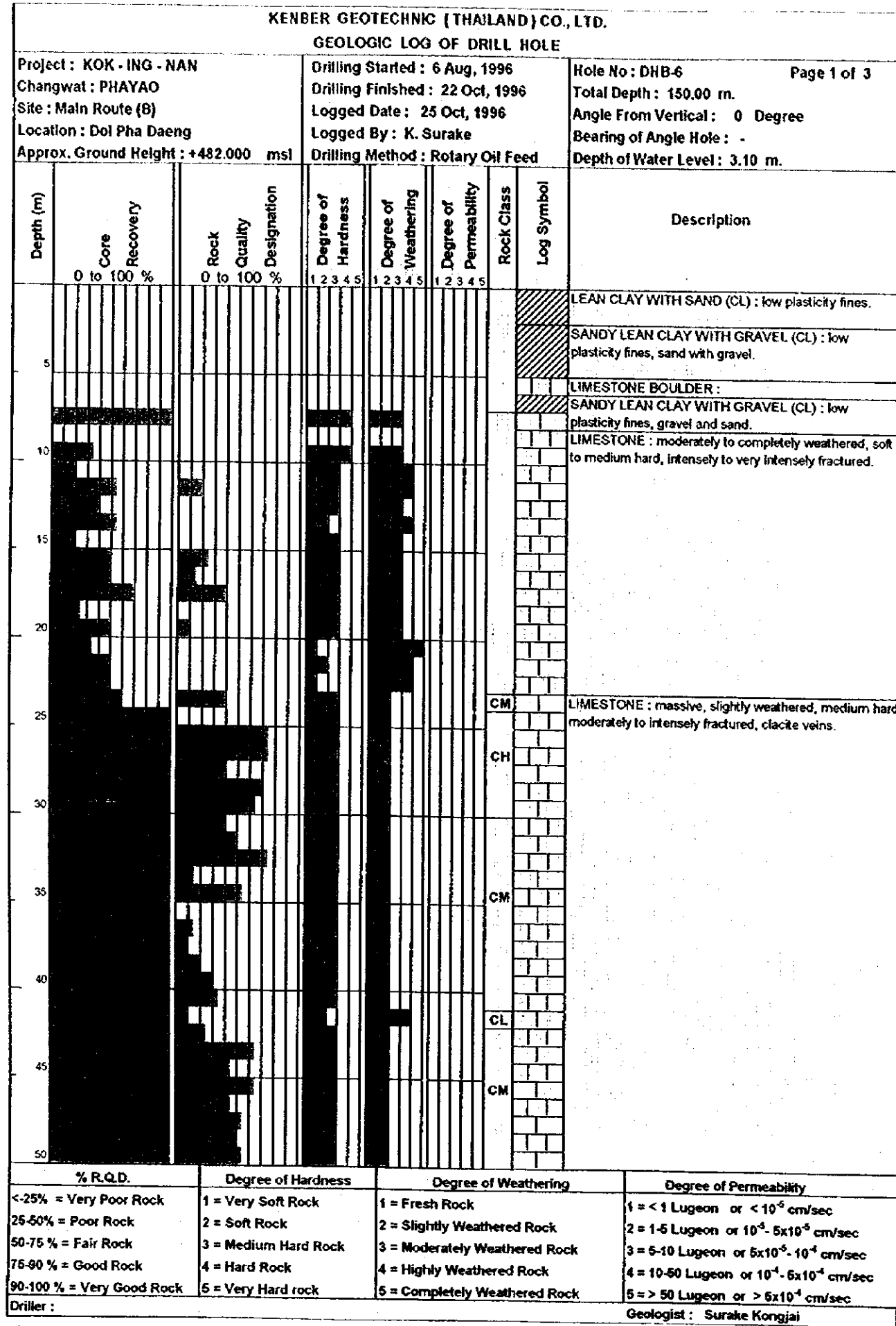


Figure 5.35 Boring Log (35), Ing-Yot No.2 Tunnel

KENBER GEOTECHNIC (THAILAND) CO., LTD.										
GEOLOGIC LOG OF DRILL HOLE										
Project : KOK - ING - NAN				Drilling Started : 6 Aug, 1996			Hole No : DHB-6			Page 3 of 3
Changwat : PHAYAO				Drilling Finished : 22 Oct, 1996			Total Depth : 150.00 m.			
Site : Main Route (B)				Logged Date : 25 Oct, 1996			Angle From Vertical : 0 Degree			
Location : Doi Pha Daeng				Logged By : K. Surake			Bearing of Angle Hole : -			
Approx. Ground Height : +482.000 msl				Drilling Method : Rotary Oil Feed			Depth of Water Level : 3.10 m.			
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness 1 2 3 4 5	Degree of Weathering 1 2 3 4 5	Degree of Permeability 1 2 3 4 5	Rock Class	Log Symbol	Description		
105										
110										
115										
120										
125						CM				
130										
135										
140										
145										
150									Bottom of hole	
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability				
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = <1 Lugeon or < 10 ⁻⁶ cm/sec				
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁶ cm/sec				
50-75 % = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec				
75-90 % = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec				
90-100 % = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec				
Driller :										
Geologist : Surake Kongjai										

Figure 5.36 Boring Log (36), Ing-Yot No.2 Tunnel

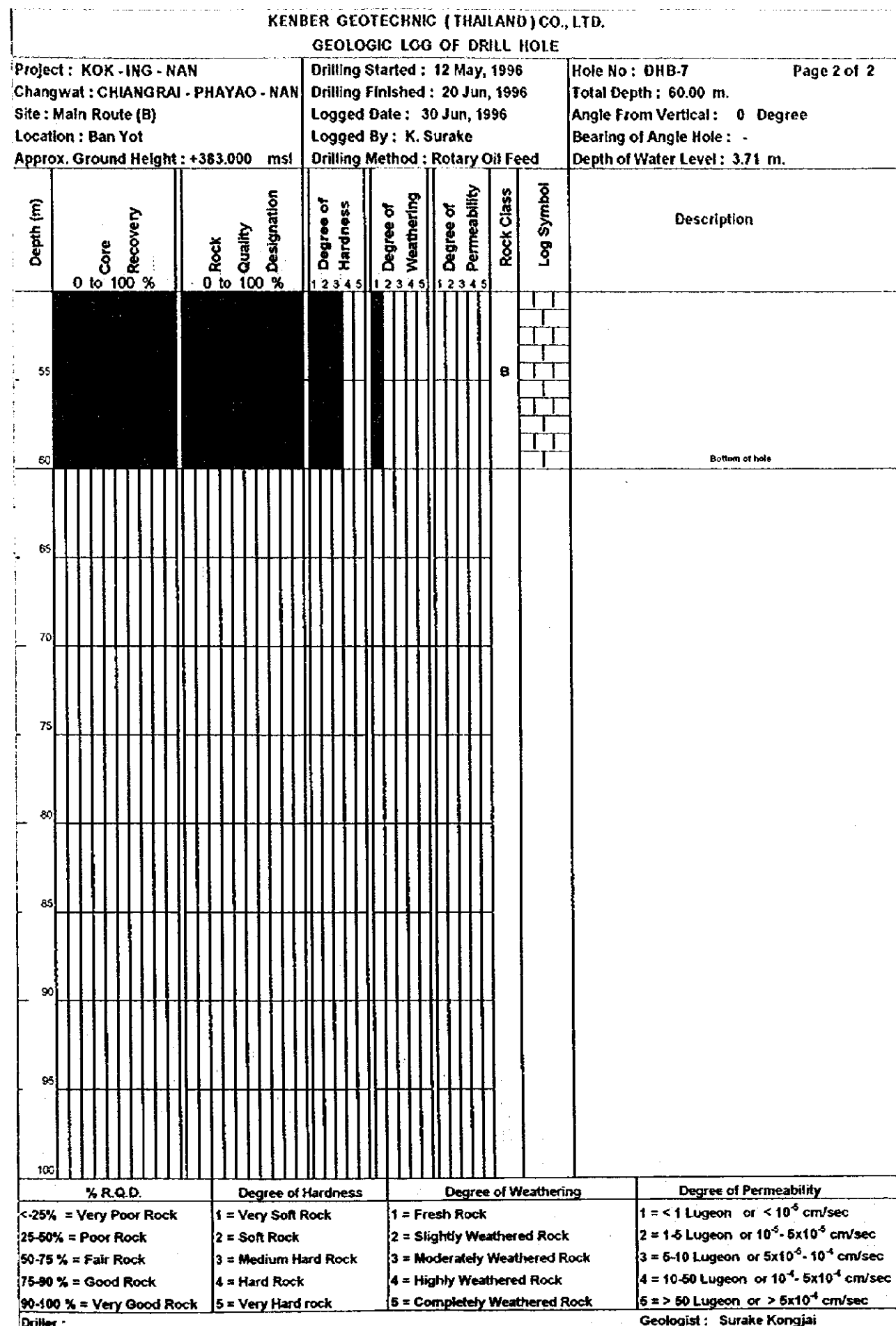
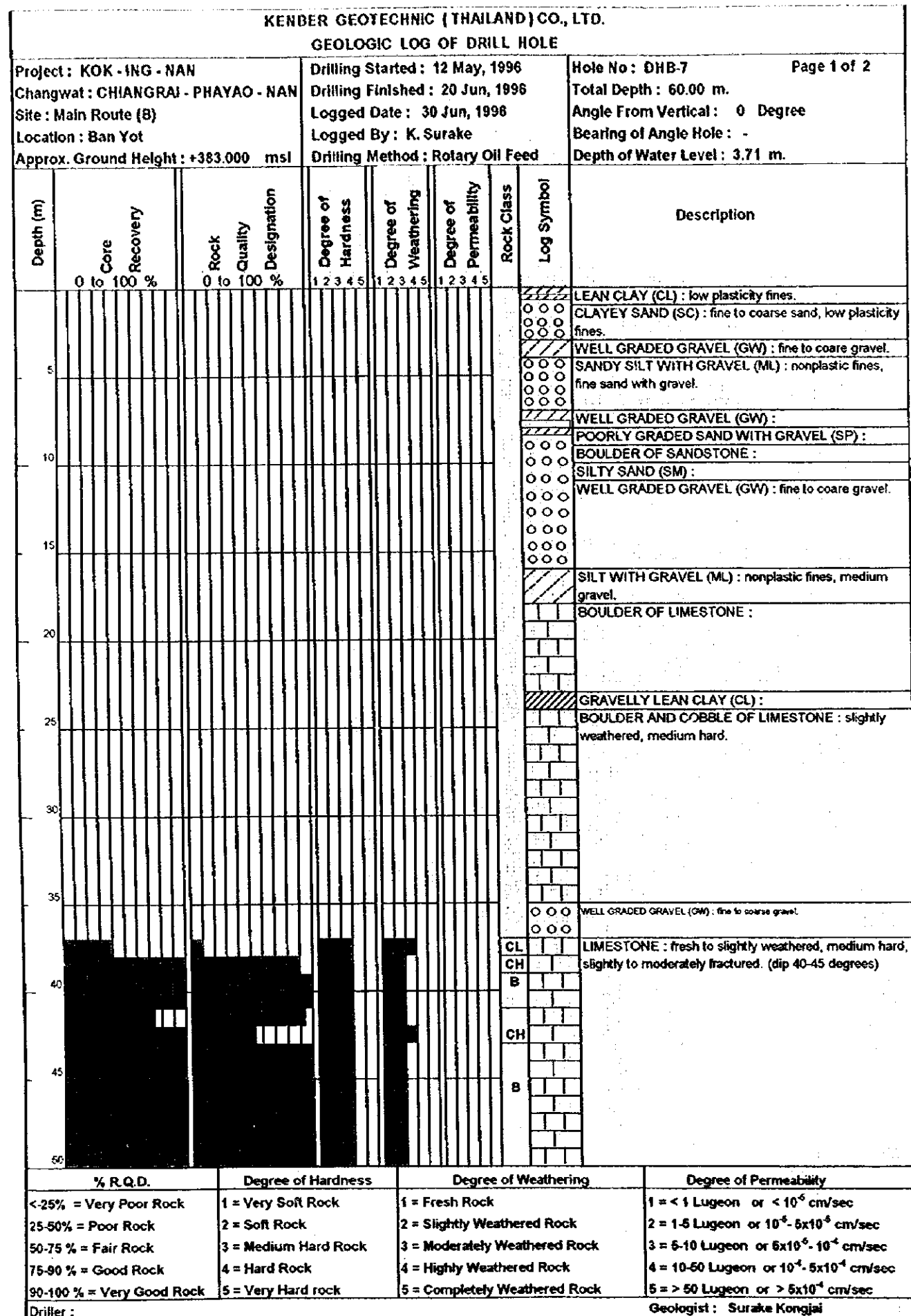


Figure 5.37 Boring Log (37), Ing-Yot No.2 Tunnel

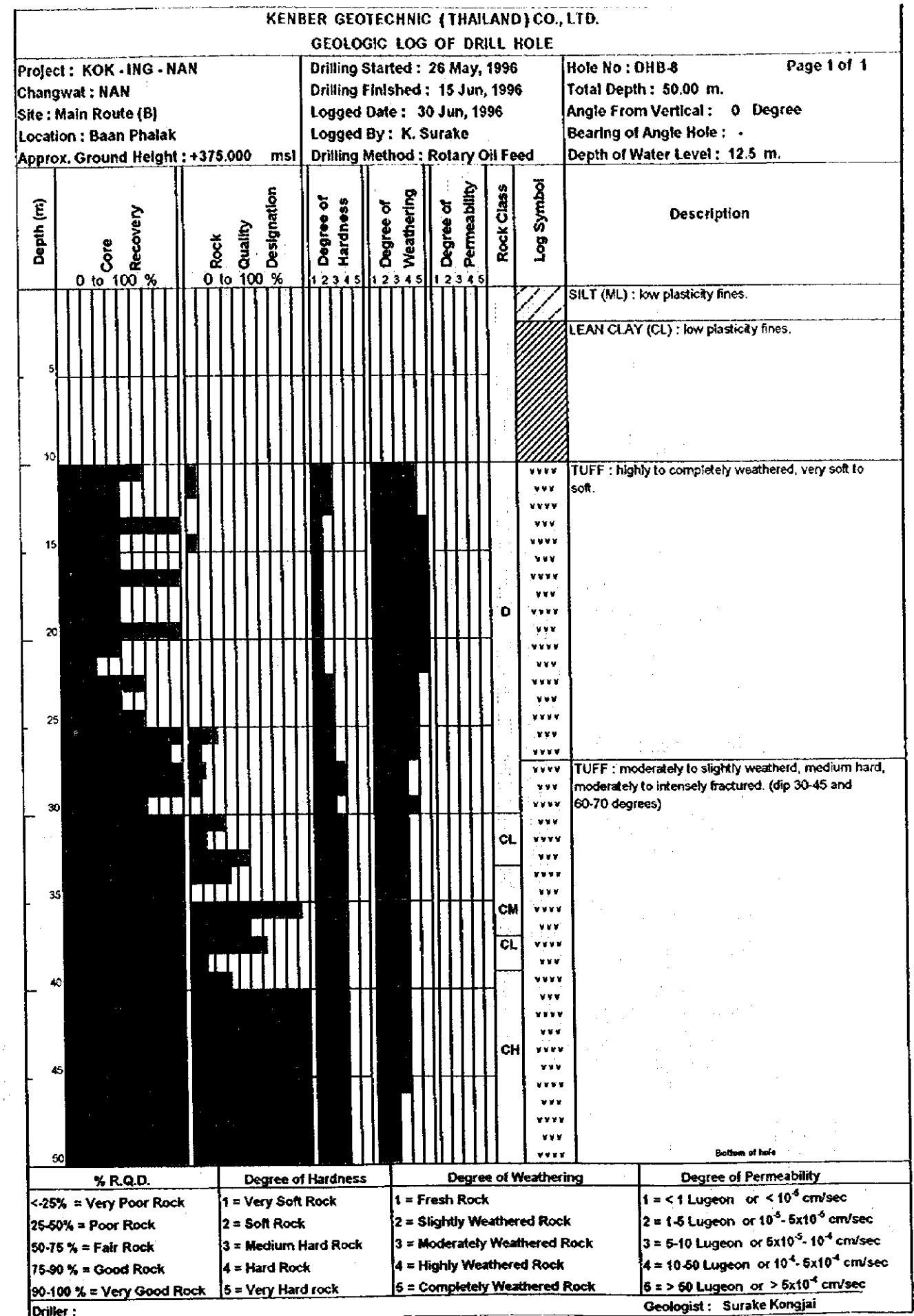


Figure 5.38 Boring Log (38), Ing-Yot No.2 Tunnel

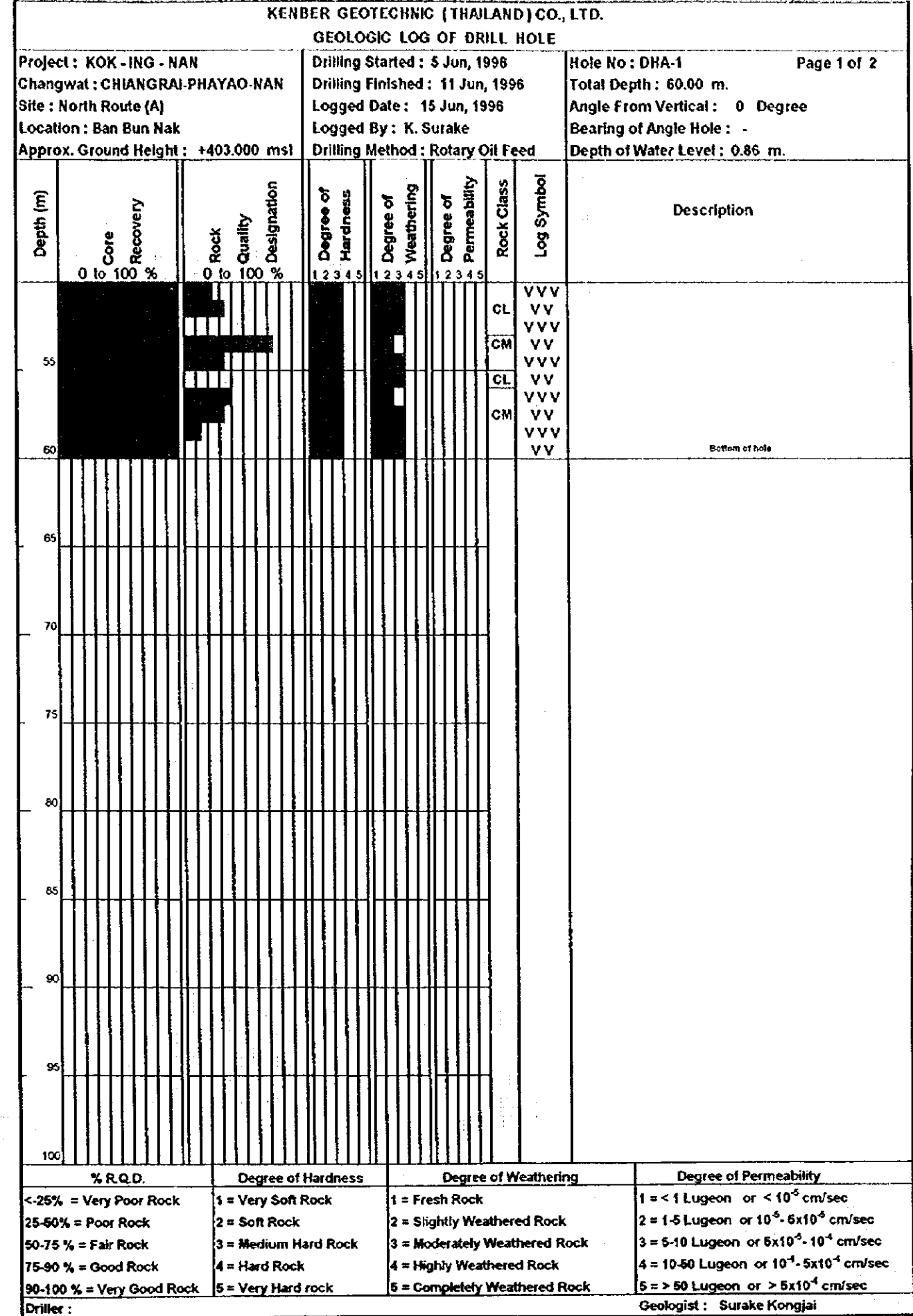
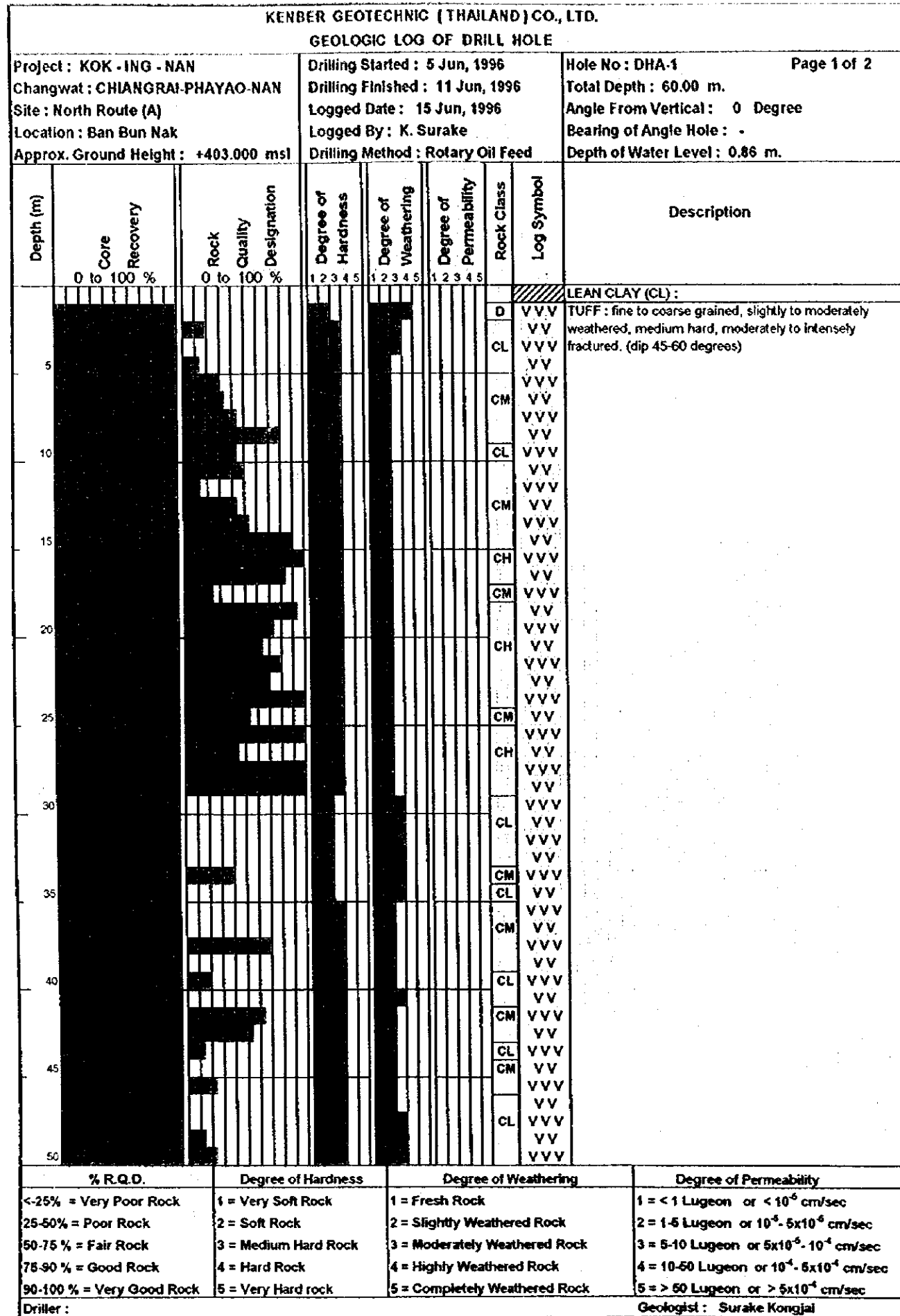


Figure 5.39 Boring Log (39), Ing-Yot No.2 Tunnel

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN			Drilling Started : 21 Jun, 1996		Hole No : DHA-2		Page 1 of 2		
Changwat : CHIANGRAI-PHAYAO-NAN			Drilling Finished : 12 July, 1996		Total Depth : 70.00 m.				
Site : North Route (A)			Logged Date : 15 July, 1996		Angle From Vertical : 0 Degree				
Location : Ban Bun Nak			Logged By : K. Surake		Bearing of Angle Hole : -				
Approx. Ground Height : +412.000 msl			Drilling Method : Rotary Oil Feed		Depth of Water Level : 0.60 m.				
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness 1 2 3 4 5	Degree of Weathering 1 2 3 4 5	Degree of Permeability 1 2 3 4 5	Rock Class	Log Symbol	Description	
								LEAN CLAY (CL):	
								PHYLLITE : completely to highly weathered, soft, intensely to very intensely fractured.	
5									
10									
15									
20								SANDSTONE / PHYLLITE : highly weathered, soft, intensely fractured.	
25								PHYLLITE : SANDSTONE / PHYLLITE : moderately to highly weathered, medium hard to soft, intensely fractured.	
30								ALTERED CLAY : soft to very soft, partly contain quartzite fragments.	
35									
40								PHYLLITE : highly weathered, very soft to soft, intensely to very intensely fractured, bedding plane dip 45-50 degrees.	
45									
50									
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁶ cm/sec			
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec			
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec			
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : Surake Kongjai									

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN			Drilling Started : 21 Jun, 1996		Hole No : DHA-2		Page 2 of 2		
Changwat : CHIANGRAI-PHAYAO-NAN			Drilling Finished : 12 July, 1996		Total Depth : 70.00 m.				
Site : North Route (A)			Logged Date : 15 July, 1996		Angle From Vertical : 0 Degree				
Location : Ban Bun Nak			Logged By : K. Surake		Bearing of Angle Hole : -				
Approx. Ground Height : +412.000 msl			Drilling Method : Rotary Oil Feed		Depth of Water Level : 0.60 m.				
Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness 1 2 3 4 5	Degree of Weathering 1 2 3 4 5	Degree of Permeability 1 2 3 4 5	Rock Class	Log Symbol	Description	
55									PHYLLITE : highly to completely weathered, very soft to soft.
60									
65									
70									Bottom of hole
75									
80									
85									
90									
95									
100									
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁶ cm/sec			
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec			
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec			
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : Surake Kongjai									

Figure 5.40 Boring Log (40), Ing-Yot No.2 Tunnel

