CLIENT:	**Japan International Cooperation Agency**
PROJECT:	Study on wastewater management in Skopje in Republic of Macedinia
SCOPE OF WORKS:	Geomechanical investigations and laboratory tests
ASSOCIATES:	Keti Dolnenec – Vckova, grad.civ.eng. Igor Krstev , grad.civ.eng. Slobodanka Dimova, civ.tech. Dragi Arsovski, civ.tech.
DRILL RIGS:	GDR 500, GAK 300

In compliance with our Rules for Contents and Technical Control of Investment and Technical Documentation, internal control was performed by :

1. Cekorova Rusa, grad.civ.eng.
2. Markovski Vido, grad.civ.eng.

Manager :
Dusko Spirovski, grad.civ.eng.

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-1 **Ground level:** 239.45 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
– 0.60	0.60	**ML**			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 23 cm
– 2.50	1.90	**SFs**			*Silty sand with gravel, compacted, light brown colour;*	2.00m 30 / e = 20 cm
				-4.6 UWL		3.00m 30 / e = 7 cm
						4.00m 30 / e = 8 cm
						5.00m 30 / e = 8 cm
						6.00m 30 / e = 8 cm
						7.00m 30 / e = 8 cm
						8.00m 30 / e = 8 cm
	12.50	**GW**			*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=8,0 cm, compacted, gray colour;*	9.00 m 30 / e = 8 cm
						10.00 m 30 / e = 8 cm
						11.00 m 30 / e = 8 cm
						12.00 m 30 / e = 8 cm
						13.00 m 30 / e = 8 cm
						14.00 m 30 / e = 8 cm
– 15.00						15.00 m 30 / e = 8 cm

Skopje, 2008 god.

Appendix No. 3.1

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-2 **Ground level:** 237.4 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
– 0.50	0.50	**ML**			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 18 cm
– 1.00	0.50	**SFs**			*Silty sand with gravel, compacted, light brown colour;*	2.00 m 30 / e = 16 cm
	11.0	**GW**		-7.0 UWL	*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=8,0 cm, compacted gray colour;*	3.00 m 30 / e = 19 cm 4.00 m 30 / e = 17 cm 5.00 m 30 / e = 16 cm 6.00 m 30 / e = 17 cm 7.00 m 30 / e = 21 cm 8.00 m 30 / e = 24 cm 9.00 m 30 / e = 22 cm 10.00 m 30 / e = 21 cm 11.00 m 30 / e = 20 cm
– 12.0						12.00 m 30 / e = 20 cm

Skopje, 2008 god.

Appendix No. 3.2

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-3 **Ground level:** 233.82 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
– 0.80	0.80	**ML**			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 23 cm
				-4.2 UWL		2.00 m 30 / e = 20 cm
						3.00 m 30 / e = 18 cm
						4.00 m 30 / e = 17 cm
						5.00 m 30 / e = 23 cm
						6.00 m 30 / e = 21 cm
						7.00 m 30 / e = 19 cm
	17.2	**GW**			*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=12,0 cm, compacted gray colour;*	8.00 m 30 / e = 18 cm
						9.00 m 30 / e = 21 cm
						10.00 m 30 / e = 23 cm
						11.00 m 30 / e = 20 cm
						12.00 m 30 / e = 21 cm
						13.00 m 30 / e = 22 cm
						14.00 m 30 / e = 24 cm
						15.00 m 30 / e = 24 cm
						16.00 m 30 / e = 23 cm
						17.00 m 30 / e = 20 cm
– 18.0						18.00 m 30 / e = 18 cm

Skopje, 2008 god.

Appendix No. 3.3

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-4 **Ground level:** 235.9 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
	2.50	ML			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 20cm; 2.00m 30 / e =16 cm
–2.30						
	1.70	SFs			*Silty sand with gravel, compacted, light brown colour;*	3.00m 30 / e = 7 cm; 4.00m 30 / e = 8 cm
–4.00				-5.7 UWL		
	12.00	GW			*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=8,0 cm, compacted gray colour;*	5.00m 30 / e = 8 cm; 6.00m 30 / e = 8 cm; 7.00m 30 / e = 8 cm; 8.00m 30 / e = 8 cm; 9.00m 30 / e = 8 cm; 10.00m 30 / e = 7 cm; 11.00m 30 / e = 9 cm; 12.00m 30 / e = 8 cm; 13.00 m 30 / e = 8 cm; 14.00 m 30 / e = 7 cm; 15.00 m 30 / e = 7 cm; 16.00 m 30 / e = 8 cm
–16.00						

Skopje, 2008 god.

Appendix No. 3.4

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-5 **Ground level:** 234.31 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
	2.90	ML			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 26 cm 2.00 m 30 / e = 30cm 3.00 m 30 / e = 17cm
2.90				-4.4 UWL		4.00 m 30 / e = 20 cm 5.00 m 30 / e = 8 cm 6.00 m 30 / e = 10 cm 7.00 m 30 / e = 15 cm 8.00 m 30 / e = 9 cm 9.00 m 30 / e = 10 cm 10.00 m 30 / e = 13 cm 11.00 m 30 / e = 12 cm 12.00 m 30 / e = 10 cm 13.00 m 30 / e = 8 cm 14.00 m 30 / e = 7 cm 15.00 m 30 / e = 9 cm 16.00 m 30 / e = 8 cm 17.00 m 30 / e = 9 cm 18.00 m 30 / e = 8 cm 19.00 m 30 / e = 7 cm
	16.10	GW			*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=10,0 cm, compacted gray colour;*	
19.00						

Skopje, 2008 god.

Appendix No. 3.5

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-6 **Ground level:** 234.34 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
– 1.20	1.20	**ML**			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 30 cm
				-5.0 UWL		2.00 m 30 / e = 25 cm
						3.00 m 30 / e = 23 cm
						4.00 m 30 / e = 19 cm
						5.00 m 30 / e = 22 cm
						6.00 m 30 / e = 23 cm
						7.00 m 30 / e = 20 cm
						8.00 m 30 / e = 22 cm
	15.80	**GW**			*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=8,0 cm, compacted gray colour;*	9.00 m 30 / e = 22 cm
						11.00 m 30 / e = 21 cm
						11.00 m 30 / e = 20 cm
						12.00 m 30 / e = 21 cm
						13.00 m 30 / e = 20 cm
						14.00 m 30 / e = 23 cm
						15.00 m 30 / e = 22 cm
						16.00 m 30 / e = 25 cm
– 17.0						17.00 m 30 / e = 23 cm

Skopje, 2008 god.

Appendix No. 3.6

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-7 **Ground level:** 232.61 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
-1.00	1.00	ML			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 20 cm
-3.50	2.50	SFs		-3.8 UWL	*Silty sand with gravel, compacted, light brown colour;*	2.00 m 30 / e = 17 cm 3.00 m 30 / e = 15 cm
-16.00	12.50	GW			*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=5,0 cm, compacted gray colour;*	4.00 m 30 / e = 19 cm 5.00 m 30 / e = 7cm 6.00 m 30 / e = 9 cm 7.00 m 30 / e = 10 cm 8.00 m 30 / e = 6 cm 9.00 m 30 / e = 8 cm 10.00 m 30 / e = 11cm 11.00 m 30 / e = 13 cm 12.00 m 30 / e = 9 cm 13.00 m 30 / e = 8cm 14.00 m 30 / e = 9 cm 15.00 m 30 / e = 7 cm 16.00 m 30 / e = 9 cm

Skopje, 2008 god.

Appendix No. 3.7

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-8 **Ground level:** 233.22 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
– 0.80	0.80	ML			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 15 cm 2.00 m 30 / e = 13 cm 3.00 m 30 / e = 10 cm 4.00 m 30 / e = 20 cm 5.00 m 30 / e = 22 cm 6.00 m 30 / e = 21 cm 7.00 m 30 / e = 21 cm 8.00 m 30 / e = 19 cm 9.00 m 30 / e = 22 cm 10.00 m 30 / e = 24 cm 11.00 m 30 / e = 26 cm 12.00 m 30 / e = 22 cm 13.00 m 30 / e = 21 cm 14.00 m 30 / e = 20 cm 15.00 m 30 / e = 20 cm 16.00 m 30 / e = 22 cm 17.00 m 30 / e = 24 cm
	16.20	GW		-3.9 UWL	*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=8,0 cm,compacted gray colour;*	
– 17.0						

Skopje, 2008 god.

Appendix No. 3.8

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-9 **Ground level:** 233.18 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
	3.00	ML			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 22 cm 2.00 m 30 / e = 18 cm 3.00 m 30 / e = 16 cm
-3.00				-4.2		
	1.00	SFs		UWL	*Silty sand with gravel, compacted, light brown colour;*	4.00 m 30 / e = 19 cm
-4.00						5.00 m 30 / e = 11 cm 6.00 m 30 / e = 9 cm 7.00 m 30 / e = 8 cm 8.00 m 30 / e = 11 cm 9.00 m 30 / e = 10 cm 10.00 m 30 / e = 12 cm 11.00 m 30 / e = 20 cm 12.00 m 30 / e = 15 cm 13.00 m 30 / e = 18 cm 14.00 m 30 / e = 19 cm 15.00 m 30 / e = 17 cm
	11.00	GW			*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=5,0 cm, compacted gray colour;*	
-15.00						

Skopje, 2008 god.

Appendix No. 3.9

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-10 **Ground level:** 232.38 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
– 1.20	1.20	ML			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 23 cm
– 2.80	1.60	SFs			*Silty sand with gravel, compacted, light brown colour;*	2.00 m 30 / e = 20 cm
– 3.30	0.50	OI		-3.5 UWL	*Mud with gray - blue colour;*	3.00 m 30 / e = 28 cm
	13.70	GW			*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=10,0 cm, compacted, gray colour;*	4.00 m 30 / e = 19 cm 5.00 m 30 / e = 21 cm 6.00 m 30 / e = 25 cm 7.00 m 30 / e = 22 cm 8.00 m 30 / e = 22 cm 9.00 m 30 / e = 22 cm 10.00 m 30 / e = 19 cm 11.00 m 30 / e = 18 cm 12.00 m 30 / e = 19 cm 13.00 m 30 / e = 19 cm 14.00 m 30 / e = 20 cm 15.00 m 30 / e = 21 cm 16.00 m 30 / e = 18 cm 17.00 m 30 / e = 17 cm
– 17.0						

Skopje, 2008 god.

Appendix No. 3.10

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-11 **Ground level:** 233.74 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
1.20	1.20	ML			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 25 cm
2.20	1.00	SFs			*Silty sand with gravel, compacted, light brown colour;*	2.00 m 30 / e = 18cm
				-3.8 UWL		3.00 m 30 / e = 14cm
						4.00 m 30 / e = 17cm
						5.00 m 30 / e = 15cm
						6.00 m 30 / e =20 cm
						7.00 m 30 / e = 22 cm
						8.00 m 30 / e = 20cm
						9.00 m 30 / e = 17 cm
						10.00 m 30 / e = 19 cm
	17.80	GW			*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=8,0 cm, compacted gray colour;*	11.00 m 30 / e = 16 cm
						12.00 m 30 / e = 15 cm
						13.00 m 30 / e = 14 cm
						14.00 m 30 / e =18 cm
						15.00 m 30 / e = 16 cm
						16.00 m 30 / e = 19 cm
						17.00 m 30 / e =18cm
						18.00 m 30 / e = 15 cm
						19.00 m 30 / e = 17 cm
20.00						20.00 m 30 / e = 18 cm

Skopje, 2008 god.

Appendix No. 3.11

DGR "GEOTEHNIKA"
DOO - Skopje

GEOTECHNICS PROFILE

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-12 **Ground level:** 232.24 m **Scale:** 1:100

Depth [m]	Thickness [m]	Mark	Symbol		Description of material	SPT test
1	2	3	4	5	6	7
0.00						
– 1.20	1.20	ML			*Sandy and clayly silt,low placticity light brown colour;*	1.00m 30 / e = 22 cm
				-3.5 UWL		2.00 m 30 / e = 20 cm
						3.00 m 30 / e = 19 cm
						4.00 m 30 / e = 25 cm
						5.00 m 30 / e = 24 cm
						6.00 m 30 / e = 27 cm
						7.00 m 30 / e = 29 cm
						8.00 m 30 / e = 30 cm
						9.00 m 30 / e = 27 cm
	16.80	GW			*Silty and sandy gravel, locally clayly gravel, rarely with blocks, well size distribution, with fine and softy grains surface d_{max}=8,0 cm, compacted , gray colour;*	10.00 m 30 / e = 25 cm
						11.00 m 30 / e = 24 cm
						12.00 m 30 / e = 25 cm
						13.00 m 30 / e = 25 cm
						14.00 m 30 / e = 20 cm
						15.00 m 30 / e = 21 cm
						16.00 m 30 / e = 21 cm
						17.00 m 30 / e = 19 cm
– 18.0						18.00 m 30 / e = 17 cm

Skopje, 2008 god.

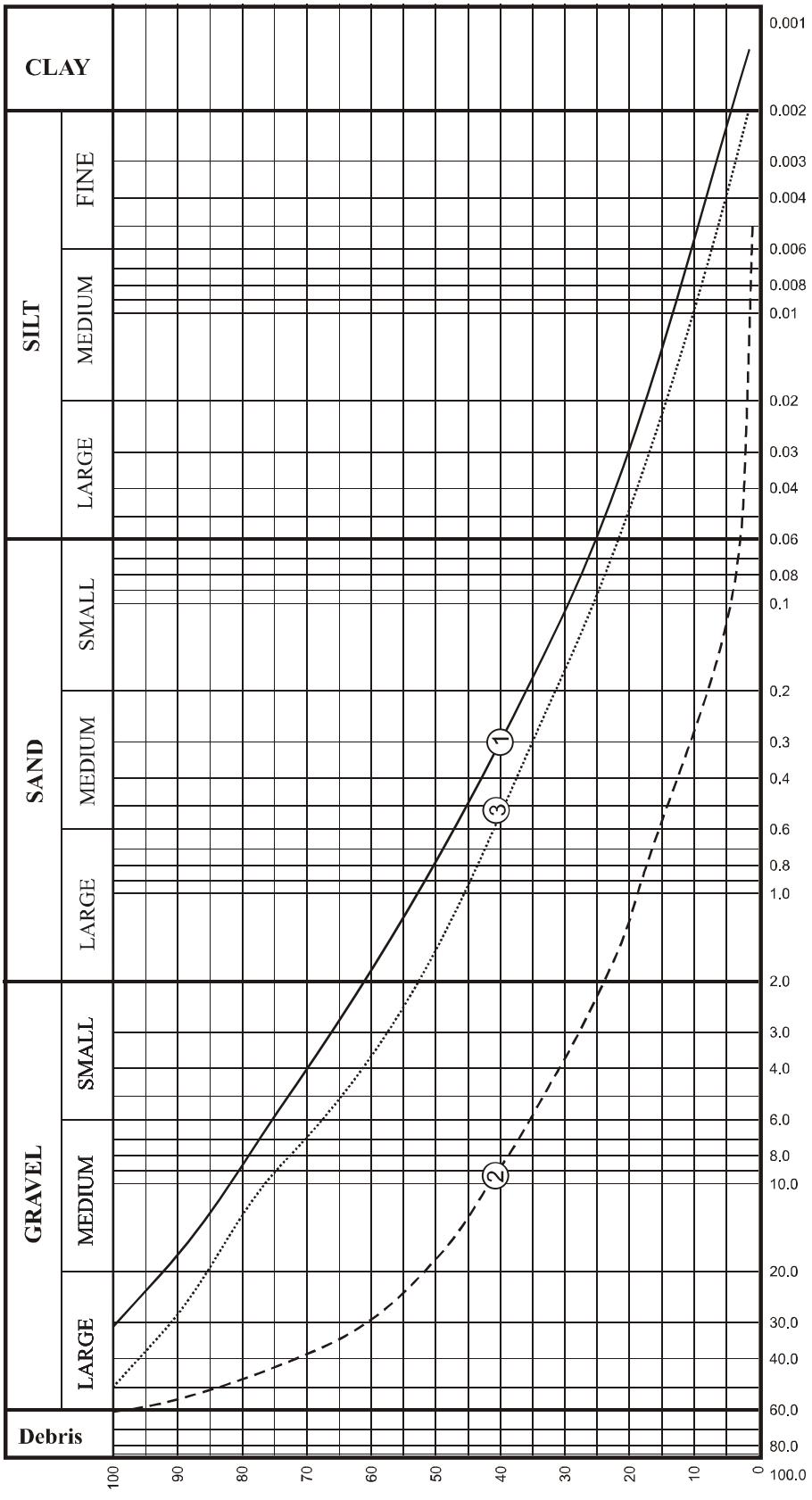
Appendix No. 3.12

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B - 1



USBR (m/s)

K = $3.47*10^{-4}$
K = $4.28*10^{-3}$
K = $4.88*10^{-4}$

LEGEND

① 3.0 - 4.0
② 8.0 - 9.0
③ 11.0 - 12.0

Skopje, 2008.

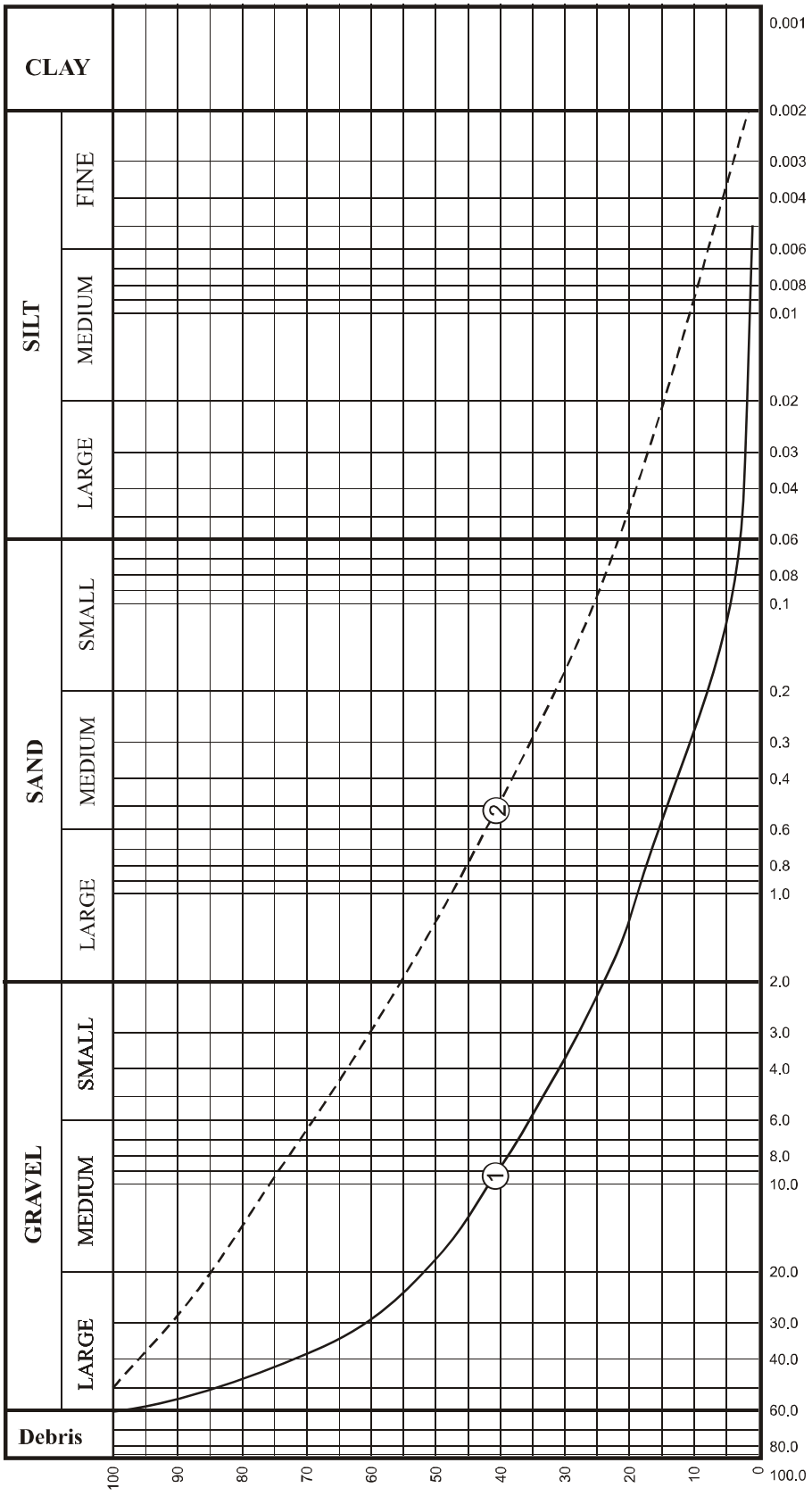
Appendix No. 4.1

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B - 2



USBR (m/s)

$K = 4.28*10^{-3}$

$K = 4.88*10^{-4}$

LEGEND

① 5.0 - 6.0

② 8.0 - 9.0

Skopje, 2008.

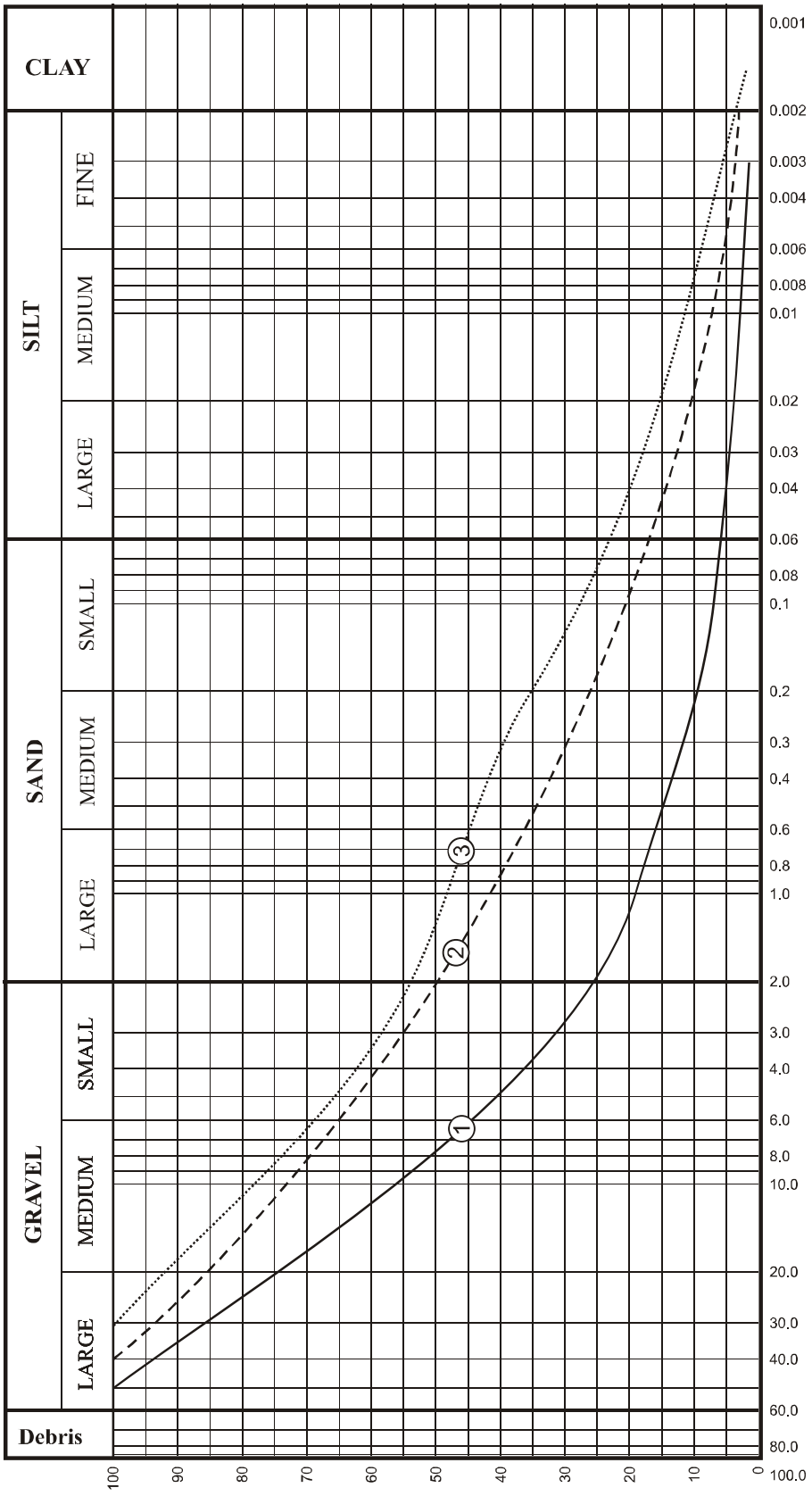
Appendix No. 4.2

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B - 3



USBR (m/s)

K = $4.06*10^{-3}$
K = $6.95*10^{-4}$
K = $4.21*10^{-4}$

LEGEND

① 2.0 - 3.0
② 4.0 - 5.0
③ 11.0 - 12.0

Skopje, 2008.

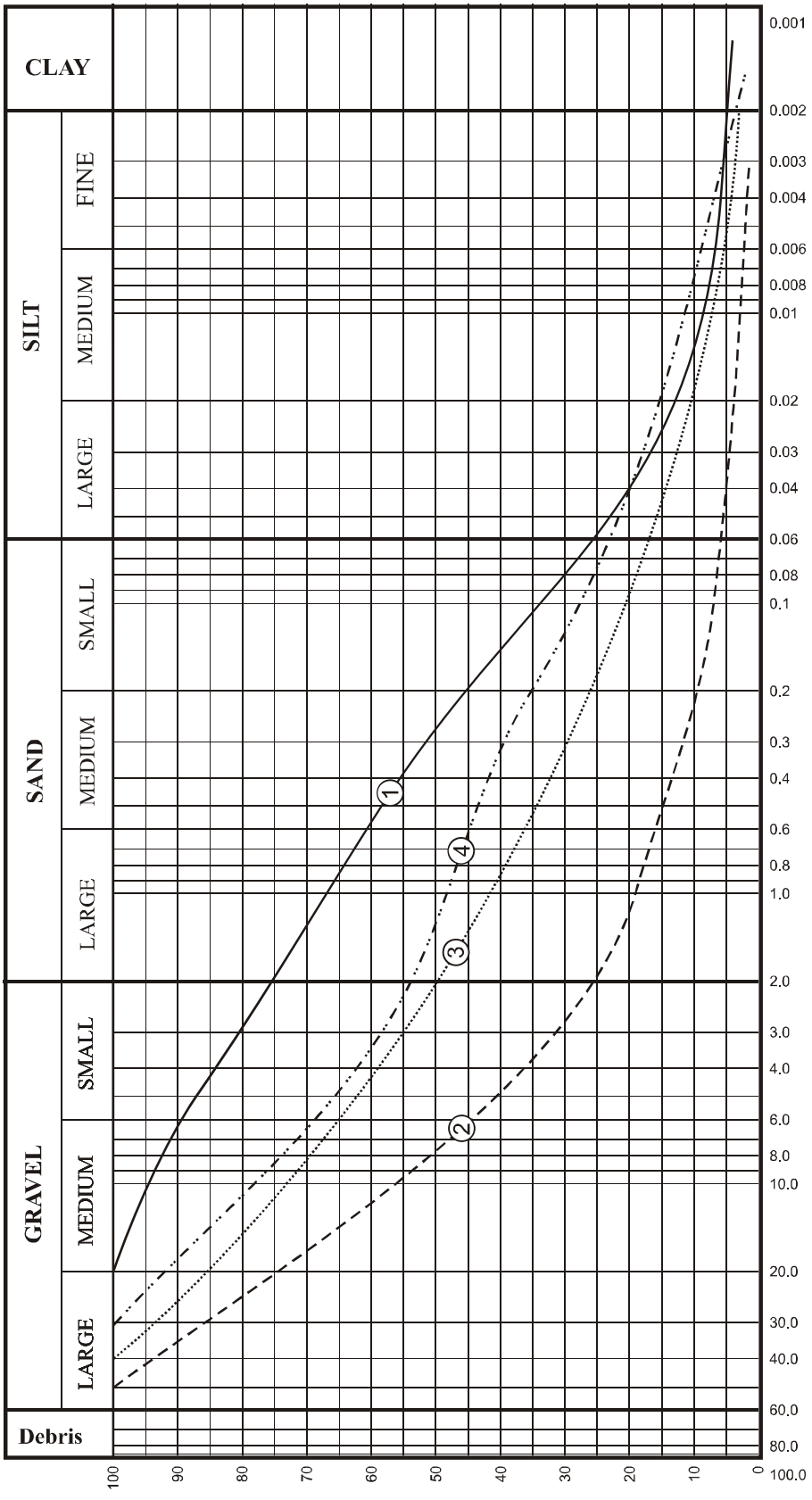
Appendix No. 4.3

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B - 4



USBR (m/s)

$K = 4.28*10^{-3}$

$K = 6.95*10^{-4}$

$K = 4.21*10^{-4}$

LEGEND

① 2.3 - 4.0
② 4.0 - 5.0
③ 7.0 - 8.0
④ 10.0 - 11.0

Skopje, 2008.

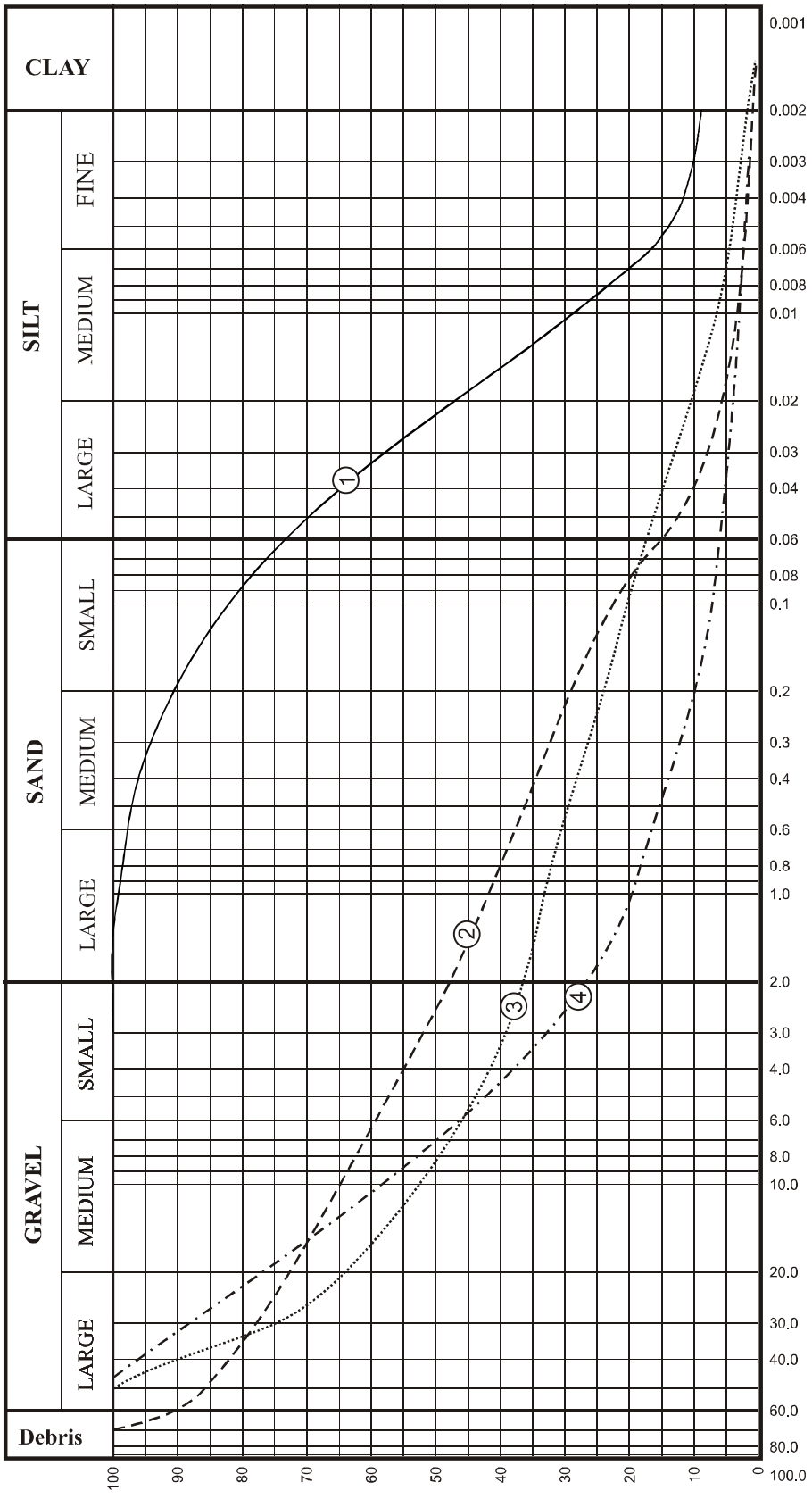
Appendix No. 4.4

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B -5



USBR (m/s)

K = $6.68*10^{-4}$
K = $7.33*10^{-4}$
K = $3.95*10^{-3}$

LEGEND

① 1.2 - 1.5
② 5.0 - 6.0
③ 8.2 - 8.5
④ 14.5 - 14.8

Skopje, 2008.

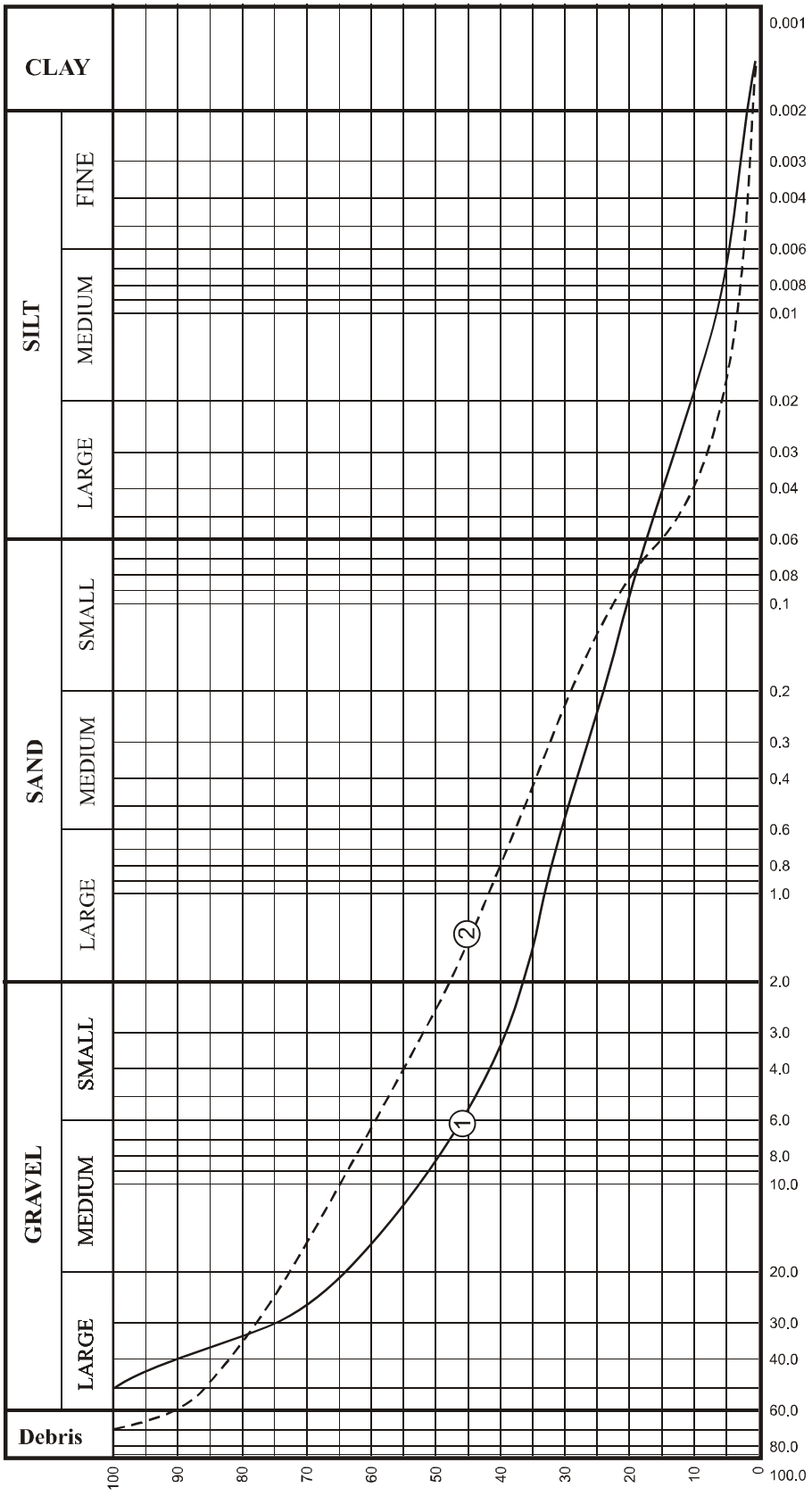
Appendix No. 4.5

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B - 6



USBR (m/s)

K = $7.23*10^{-4}$

K = $6.68*10^{-4}$

LEGEND

① 3.0 - 4.0

② 9.0 - 10.0

Skopje, 2008.

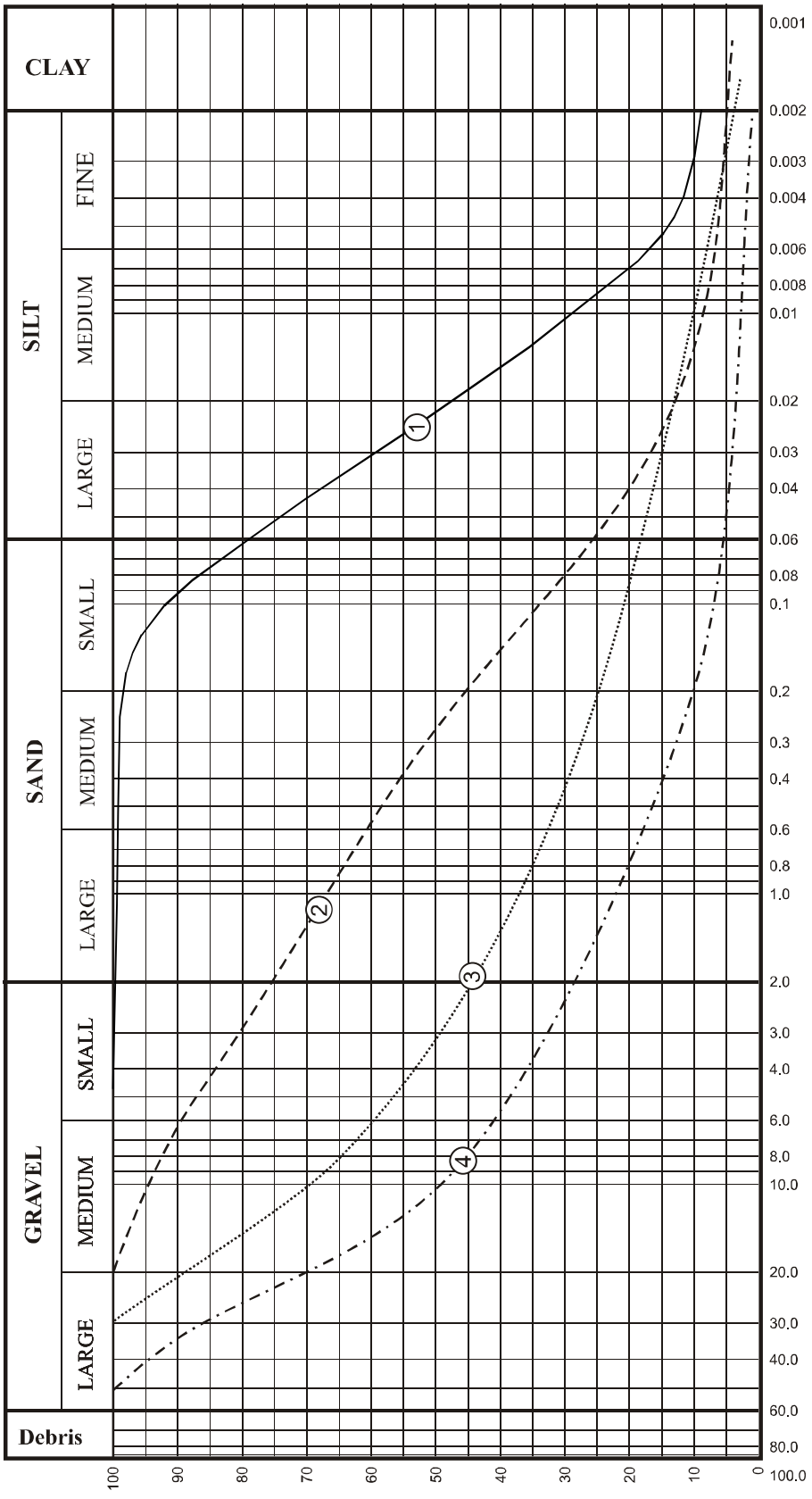
Appendix No. 4.6

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B - 7



USBR (m/s)

$K = 7.23*10^{-4}$

$K = 3.02*10^{-3}$

LEGEND

① 0.3 - 0.5
② 1.4 - 1.7
③ 5.5 - 5.9
④ 10.2 - 10.6

Skopje, 2008.

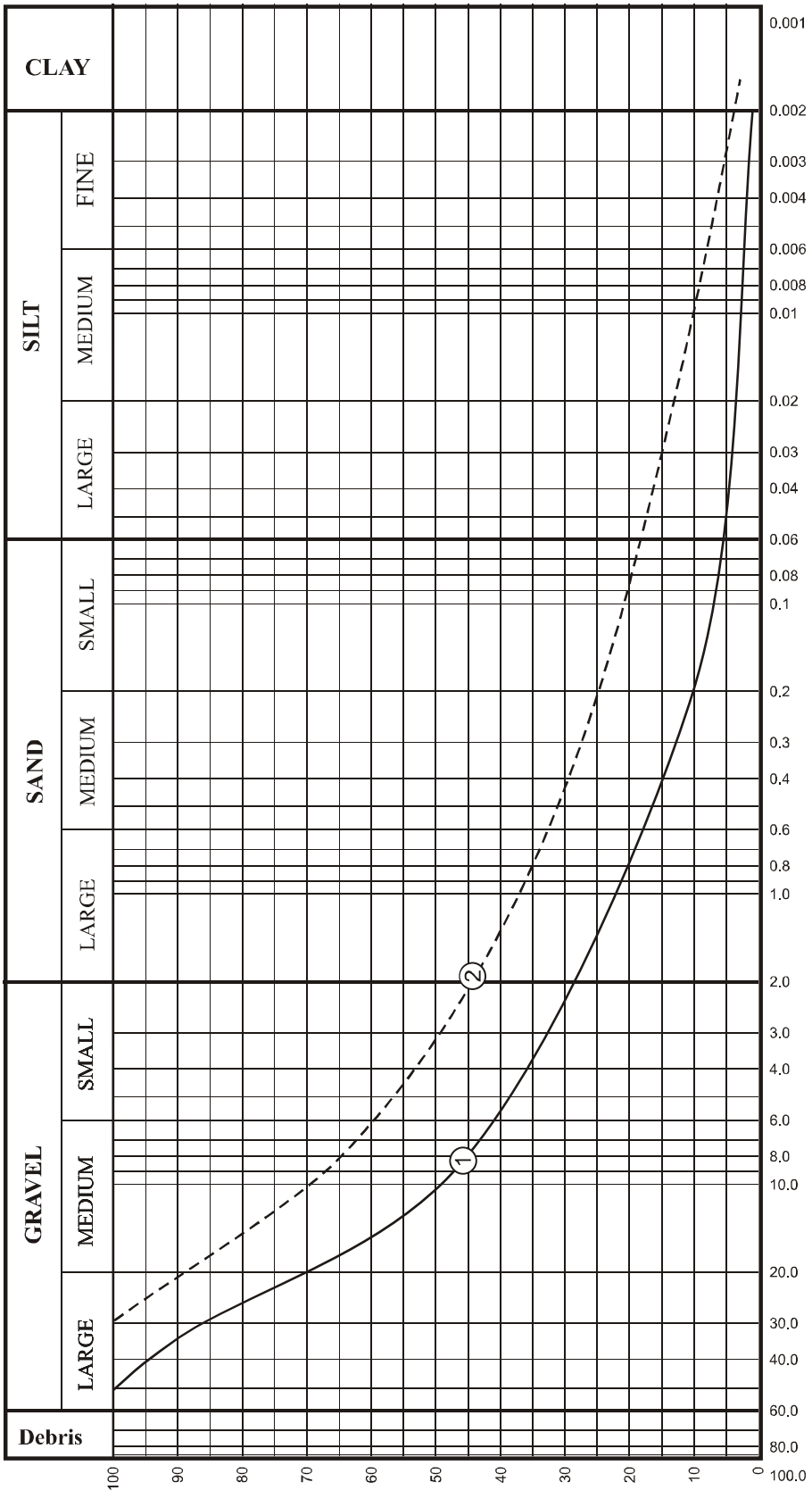
Appendix No. 4.7

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B - 8



USBR (m/s)

$K = 2.97*10^{-3}$

$K = 7.23*10^{-4}$

LEGEND

① 2.0 - 3.0

② 6.0 - 7.0

Skopje, 2008.

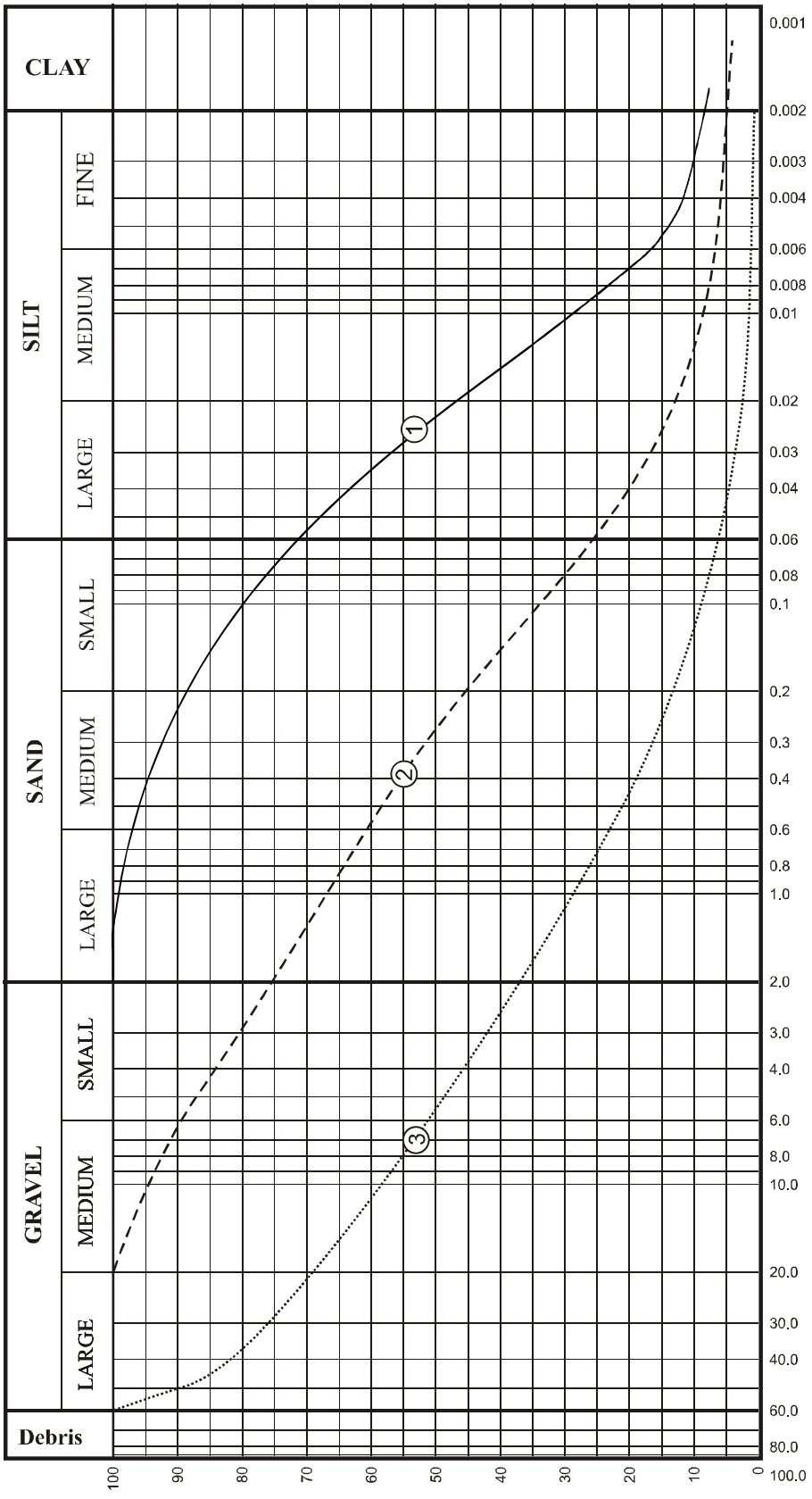
Appendix No. 4.8

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B - 9



USBR (m/s)

$K = 2.26*10^{-3}$

LEGEND

① 1.3 - 1.7
② 3.5 - 4.0
③ 7.1 - 7.5

Skopje, 2008.

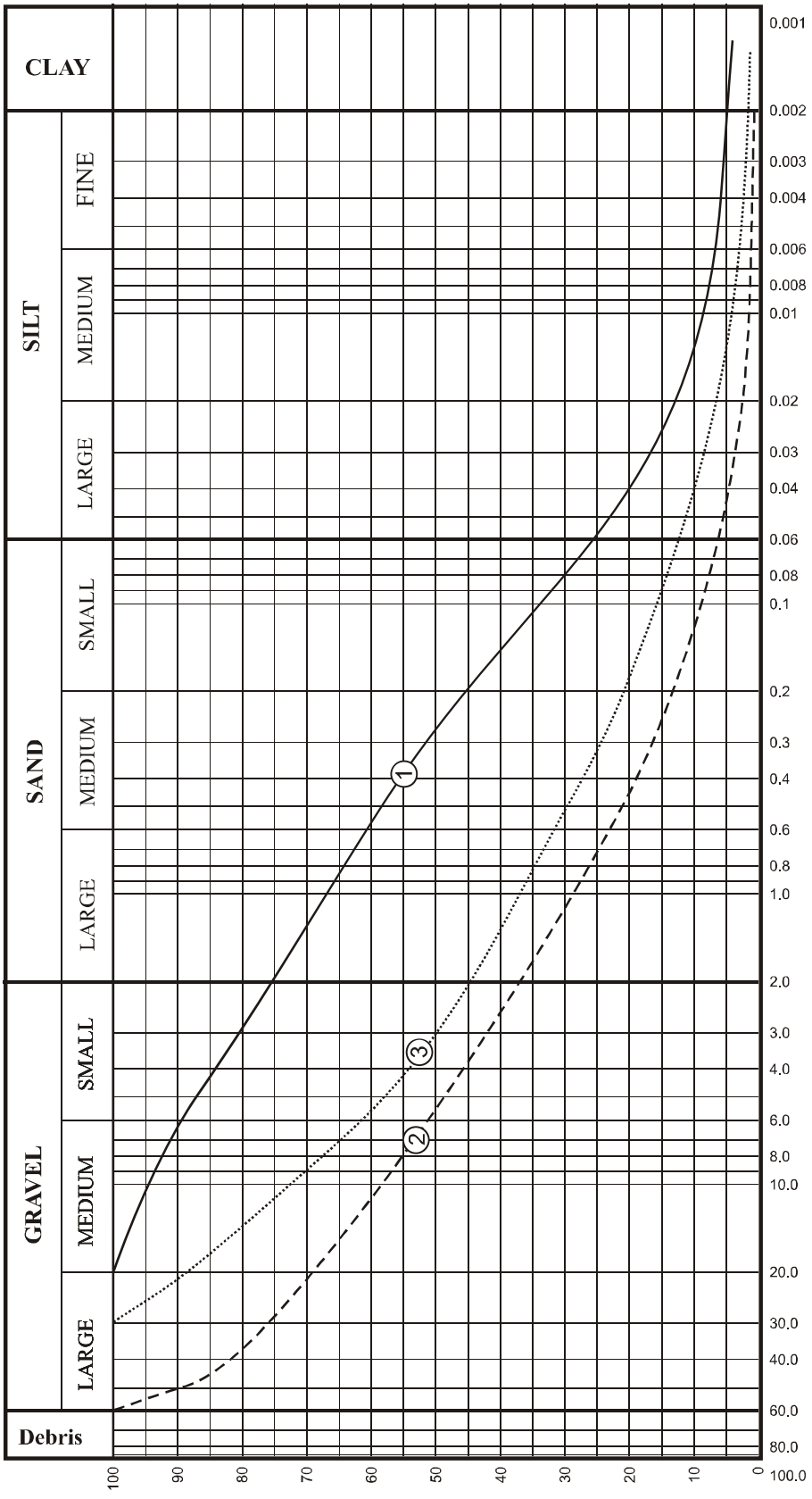
Appendix No. 4.9

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B - 10



USBR (m/s)

$K = 2.11*10^{-3}$

$K = 1.14*10^{-3}$

LEGEND

① 1.0 - 2.0
② 5.0 - 6.0
③ 10.0 -11.0

Skopje, 2008.

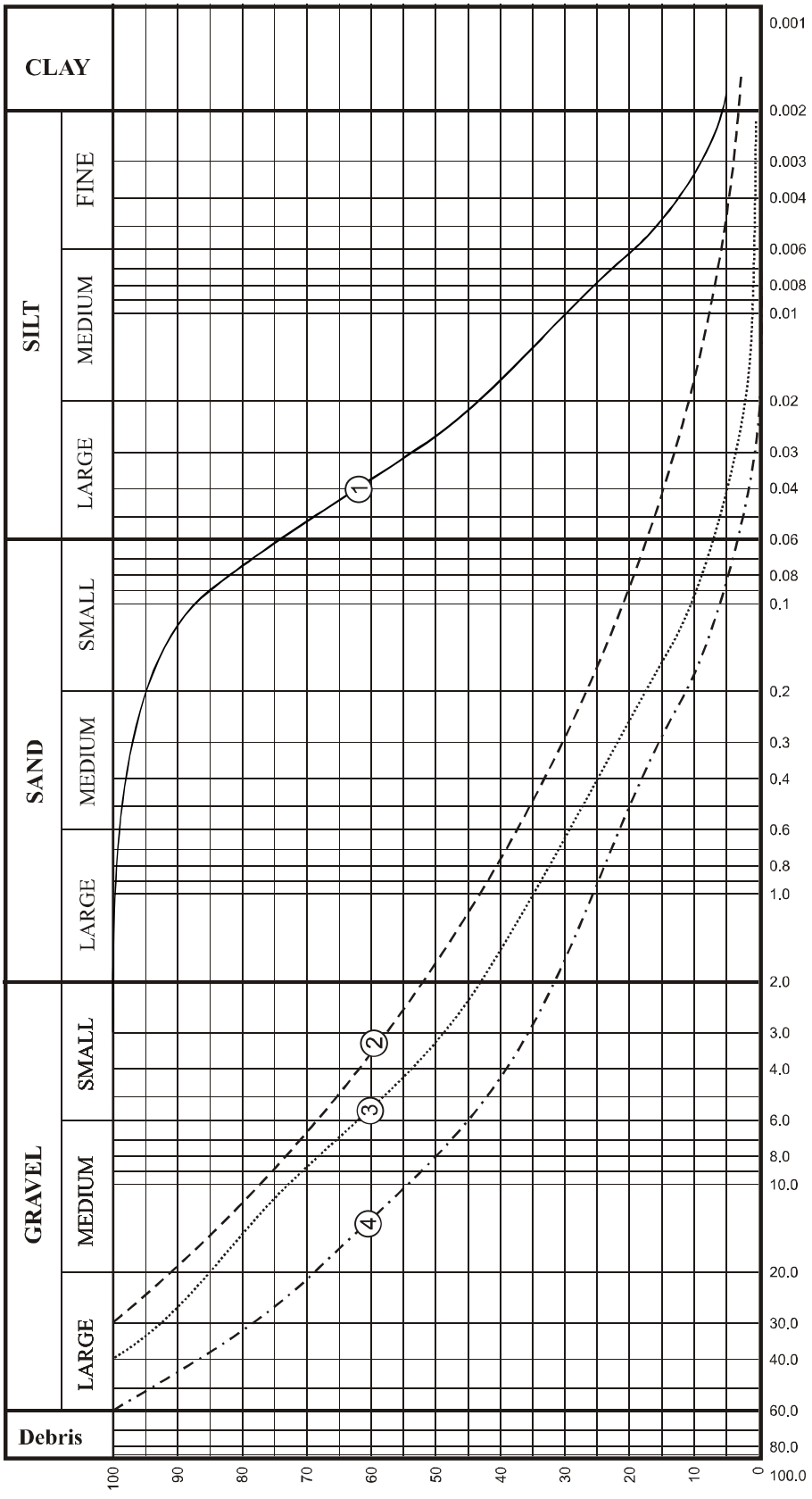
Appendix No. 4.10

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B - 11



USBR (m/s)

$K = 1.42*10^{-3}$

$K = 2.26*10^{-3}$

LEGEND

① 0.5 - 0.8
② 3.2 - 3.6
③ 5.4 - 5.8
④ 11.4 - 11.8

Skopje, 2008.

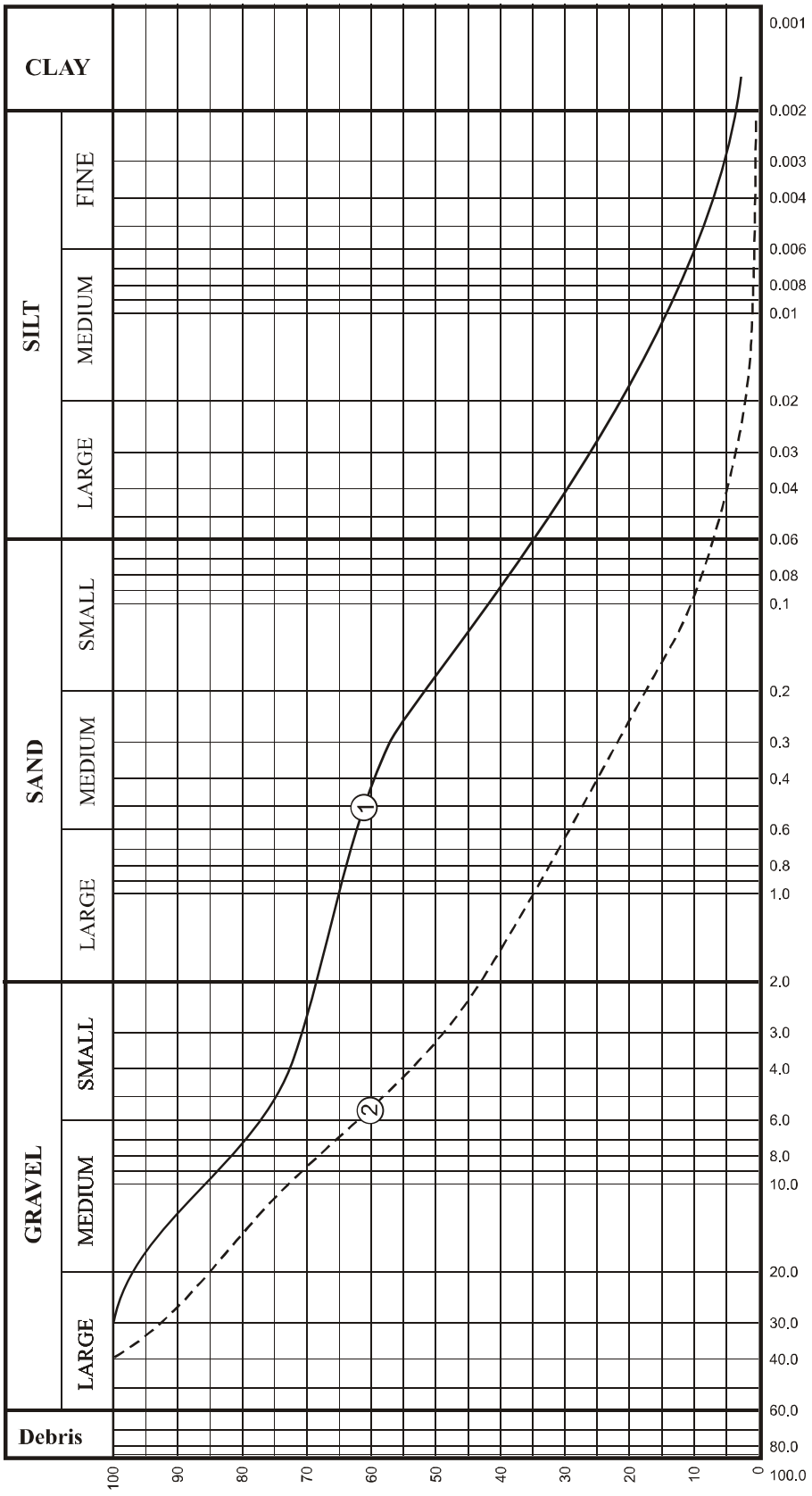
Appendix No. 4.11

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF SIZE DISTRIBUTION

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

BOREHOLE
B - 12



USBR (m/s)

$K = 1.43*10^{-3}$

LEGEND

① 1.0 - 2.0
② 4.0 - 5.0

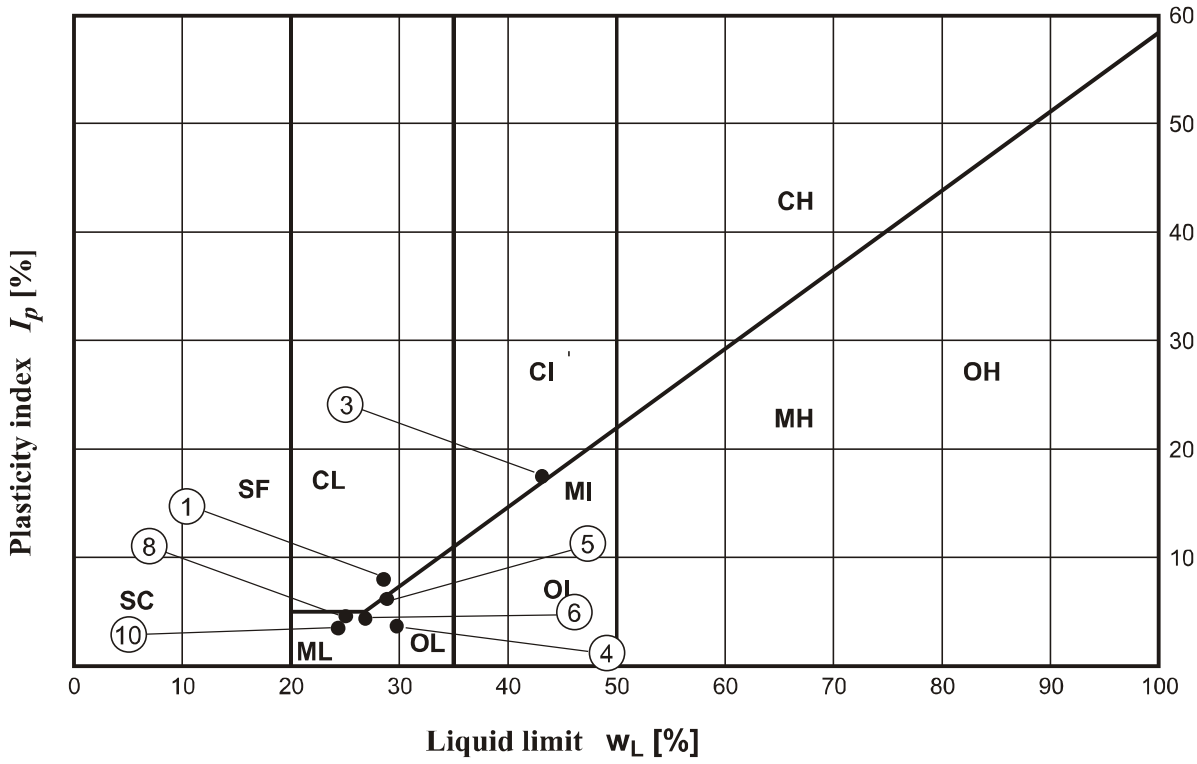
Skopje, 2008.

Appendix No. 4.12

DGR "GEOTEHNIKA"
DOO - Skopje

DIAGRAM OF PLASTICITY

Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA



No	Borehole	Depth	W_l	W_P	I_p	Symbol
1.	B - 1	3.0 - 4.0	28.4	20.2	8.2	CL
2.	B - 3	11.0 - 12.0		SANDY		
3.	B - 4	2.0 - 3.0	43.0	25.4	17.7	CI
4.	B - 5	1.2 - 1.5	29.6	25.7	3.9	ML
5.	B - 5	2.2 - 2.5	28.7	22.3	6.4	ML
6.	B - 7	0.7 - 1.0	26.7	22.1	4.6	ML
7.	B - 8	6.0 - 7.0		SANDY		
8.	B - 9	1.3 - 1.4	24.9	20.1	4.8	ML
9.	B - 10	1.0 - 2.0		SANDY		
10.	B - 12	1.0 - 2.0	24.2	20.49	3.71	ML

Skopje, 2008.

Appendix No. 5

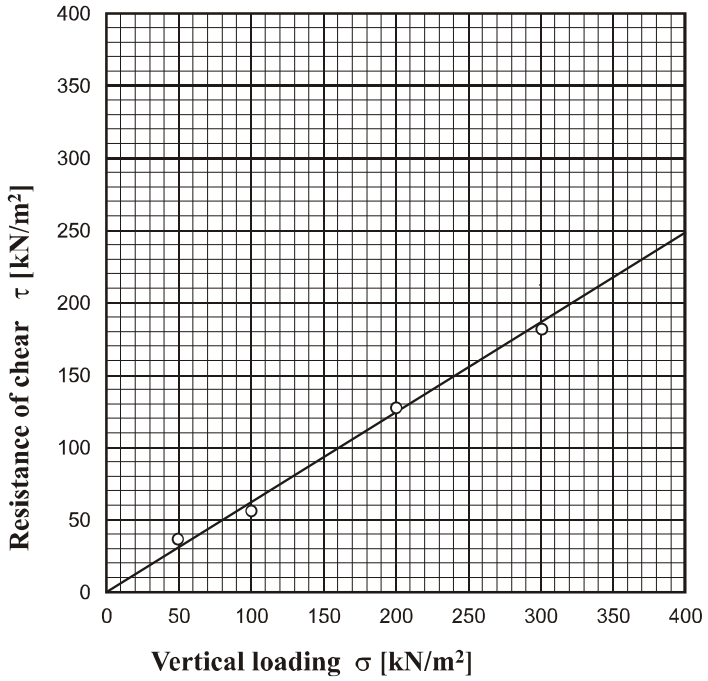
DGR "GEOTEHNIKA"
DOO - Skopje

CHART OF SHEAR STRENGTH

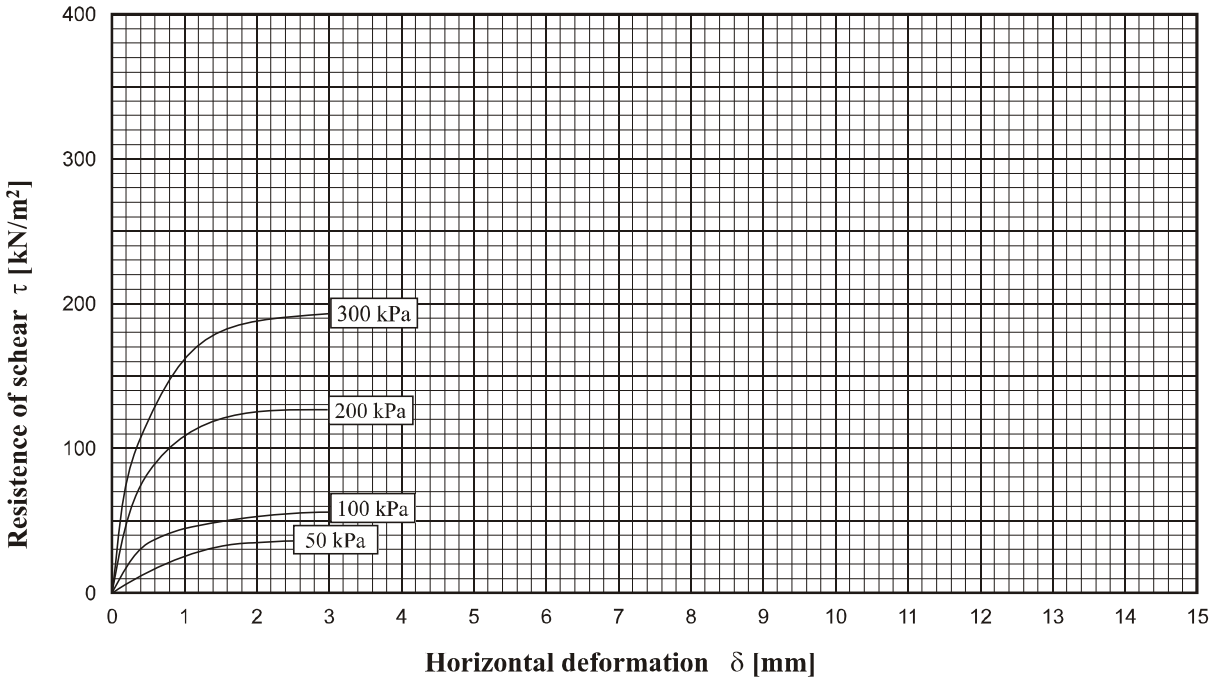
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: **B-1** **Depht:** 8.0 - 9.0 m

SAMPLE		
Dimension	6×6×1,9	[cm]
Moisture content before test	8.05	[%]
Moisture content after test	11.90	[%]
Bulk density	19.47	[kN/m³]
Dry density	18.02	[kN/m³]
Consolidation	**24**	[h]
tg φ	0.617	
Frictional angle – φ	**31.7**	[°]
Cohesion – *c*	**0.0**	[kPa]



SHEAR



Skopje, 2008.

Appendix No. **6.1**

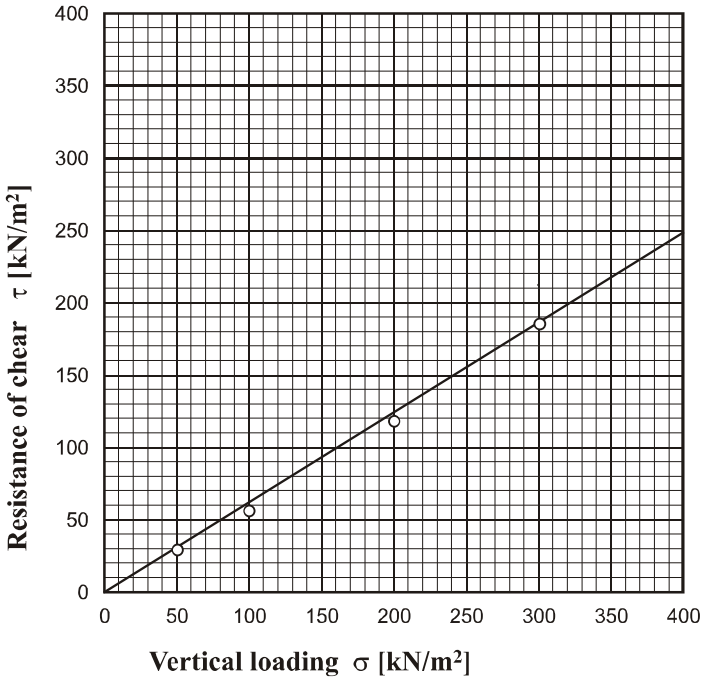
DGR "GEOTEHNIKA"
DOO - Skopje

CHART OF SHEAR STRENGTH

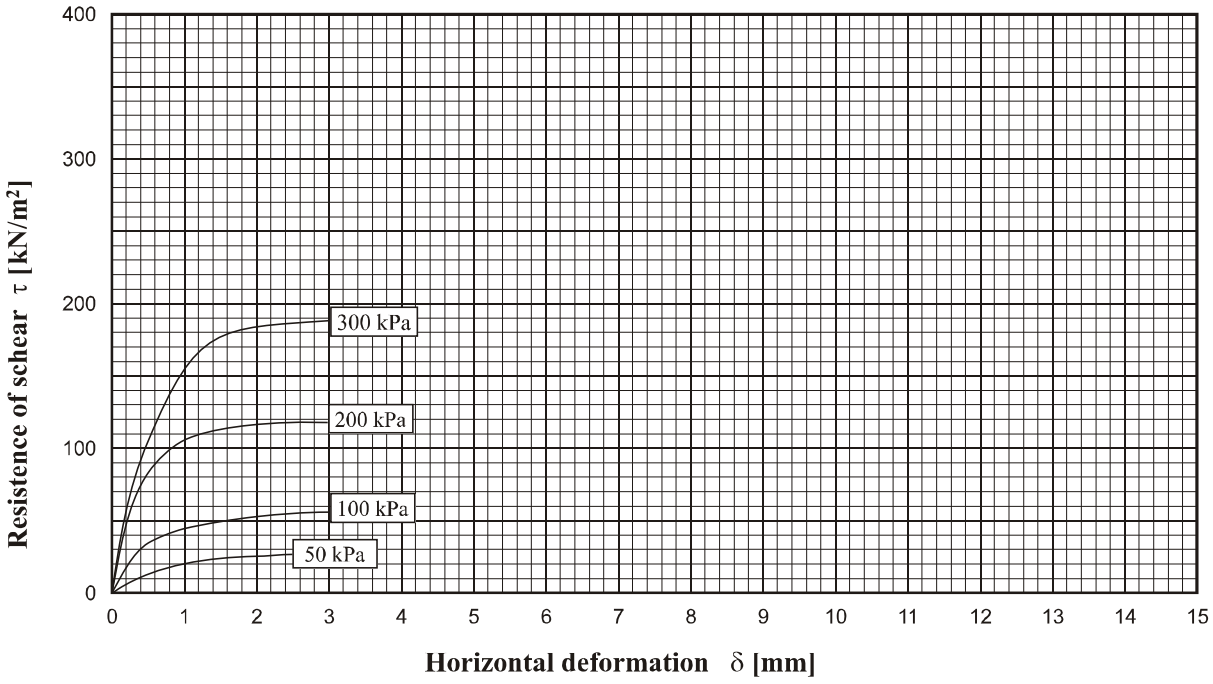
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-3 **Depht:** 11.0 - 12.0 m

SAMPLE		
Dimension	6×6×1,9	[cm]
Moisture content before test	8.60	[%]
Moisture content after test	12.30	[%]
Bulk density	21.46	[kN/m³]
Dry density	19.65	[kN/m³]
Consolidation	24	[h]
tg φ	0.637	
Frictional angle – φ	**32.5**	[°]
Cohesion – *c*	**0.0**	[kPa]



SHEAR



Skopje, 2008. Appendix No. **6.2**

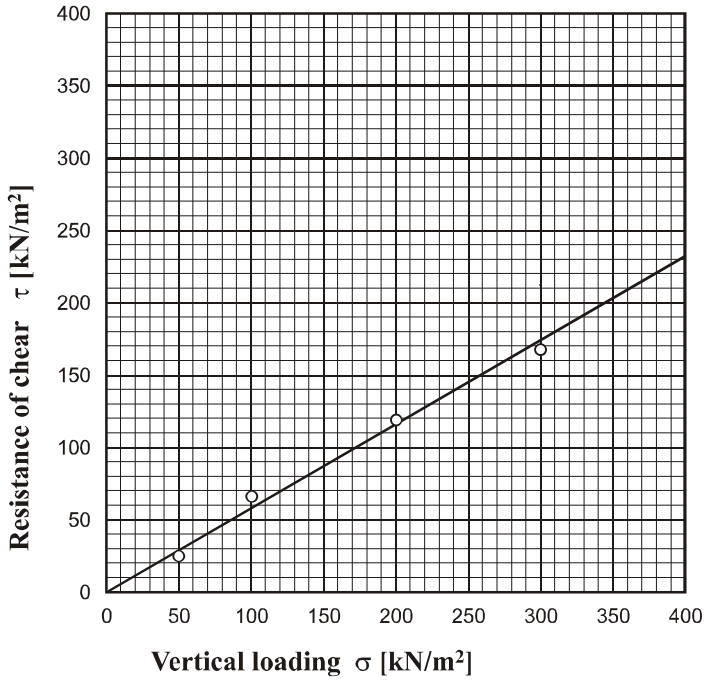
DGR "GEOTEHNIKA"
DOO - Skopje

CHART OF SHEAR STRENGTH

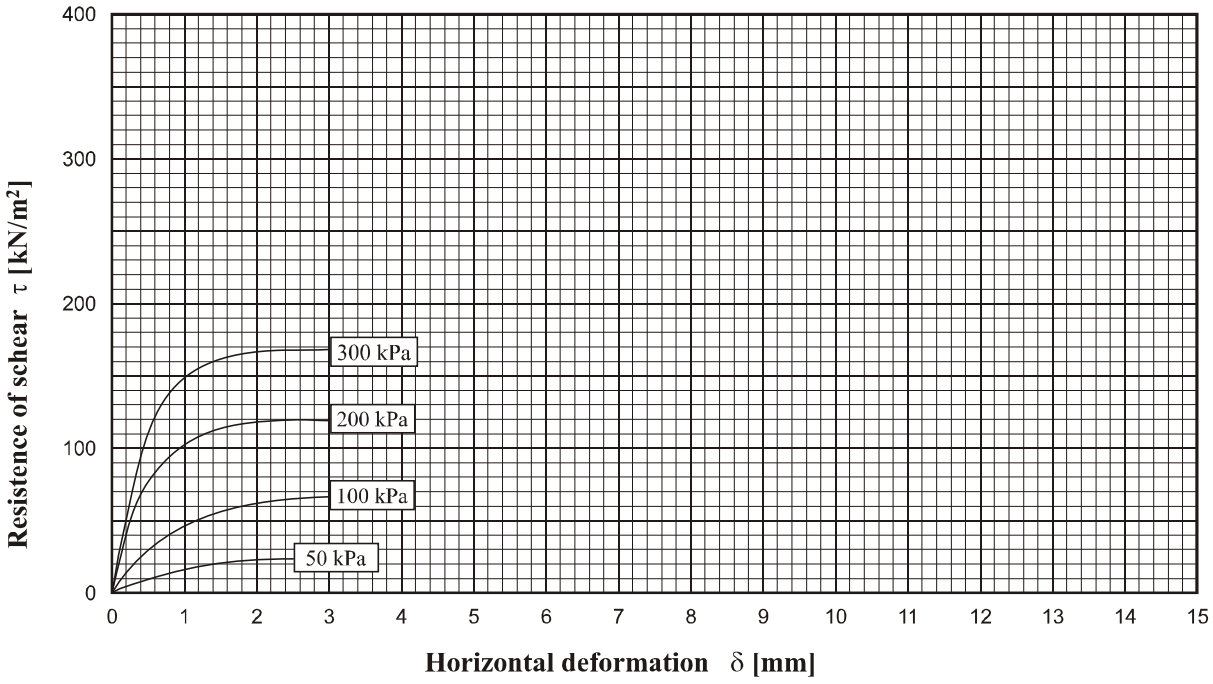
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-4 **Depht:** 4.0 - 5.0 m

SAMPLE		
Dimension	6×6×1,9	[cm]
Moisture content before test	8.75	[%]
Moisture content after test	12.50	[%]
Bulk density	21.0	[kN/m³]
Dry density	19.31	[kN/m³]
Consolidation	24	[h]
tg φ	0.589	
Frictional angle – φ	**30.0**	[°]
Cohesion – *c*	**0.0**	[kPa]



SHEAR



Skopje, 2008. Appendix No. **6.3**

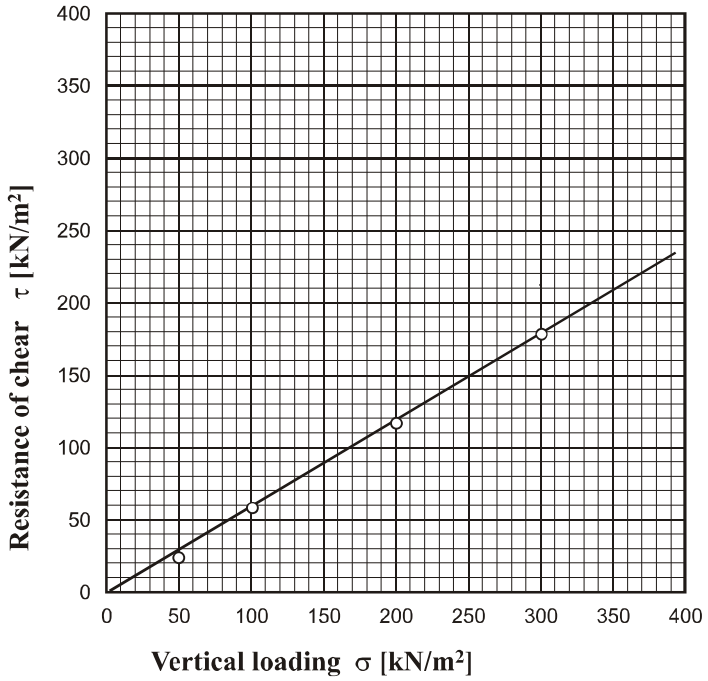
DGR "GEOTEHNIKA"
DOO - Skopje

CHART OF SHEAR STRENGTH

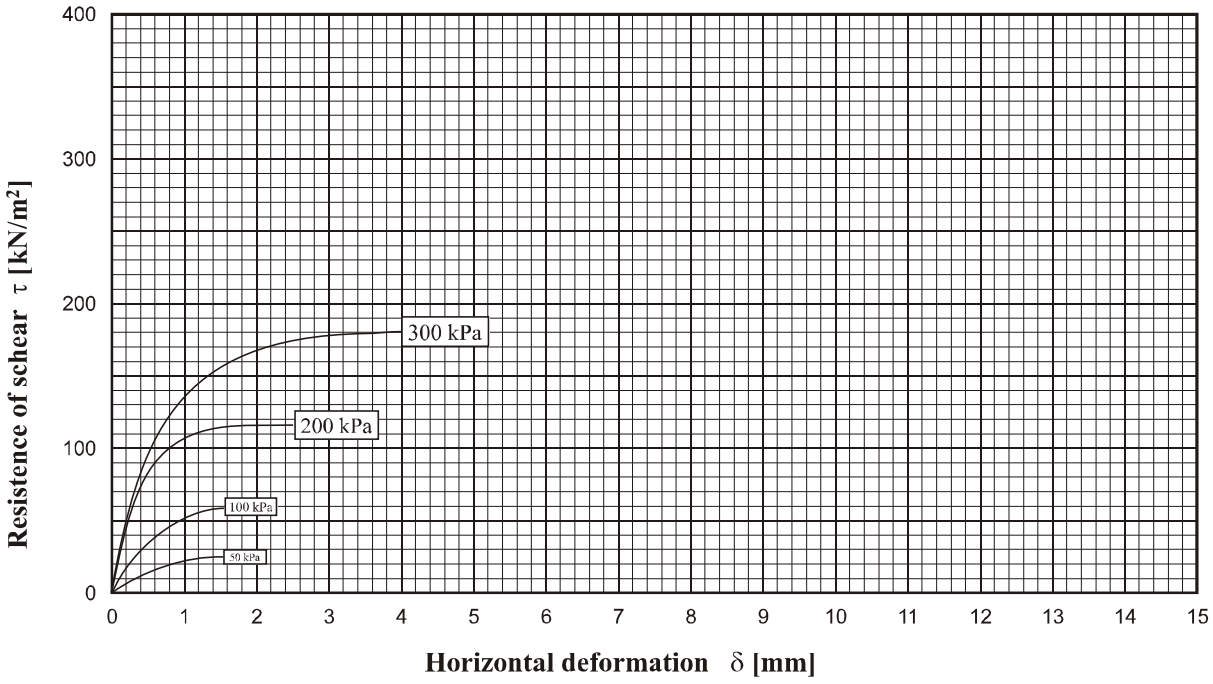
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-5 **Depht:** 5.0 -6.0 m

SAMPLE		
Dimension	6×6×1,9	[cm]
Moisture content before test	9.20	[%]
Moisture content after test	12.90	[%]
Bulk density	21.85	[kN/m³]
Dry density	20.0	[kN/m³]
Consolidation	24	[h]
tg φ	0.600	
Frictional angle – φ	**31.0**	[°]
Cohesion – *c*	**0.0**	[kPa]



SHEAR



Skopje, 2008.

Appendix No. **6.4**

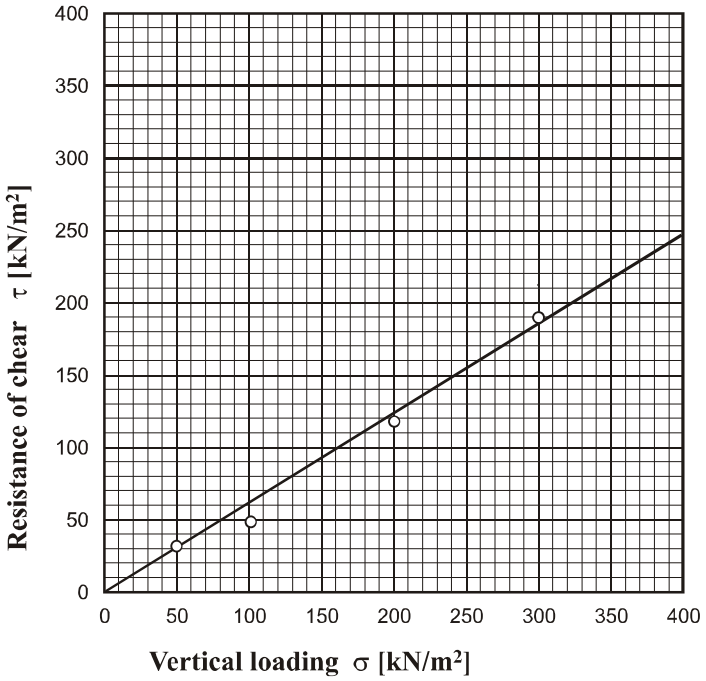
DGR "GEOTEHNIKA"
DOO - Skopje

CHART OF SHEAR STRENGTH

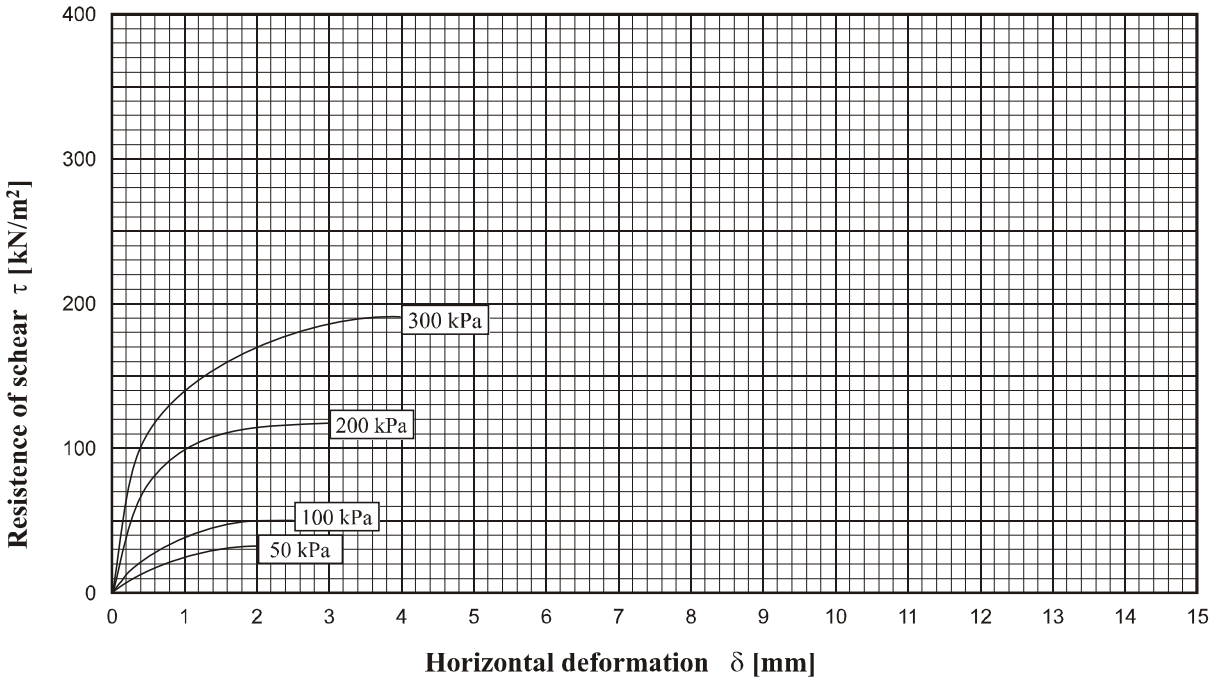
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-7 **Depht:** 5.5 - 5.9 m

SAMPLE		
Dimension	6×6×1,9	[cm]
Moisture content before test	12.2	[%]
Moisture content after test	17.5	[%]
Bulk density	22.0	[kN/m³]
Dry density	19.60	[kN/m³]
Consolidation	24	[h]
tg φ	0.610	
Frictional angle – φ	**31.4**	[°]
Cohesion – *c*	**0.0**	[kPa]



SHEAR



Skopje, 2008.

Appendix No. **6.5**

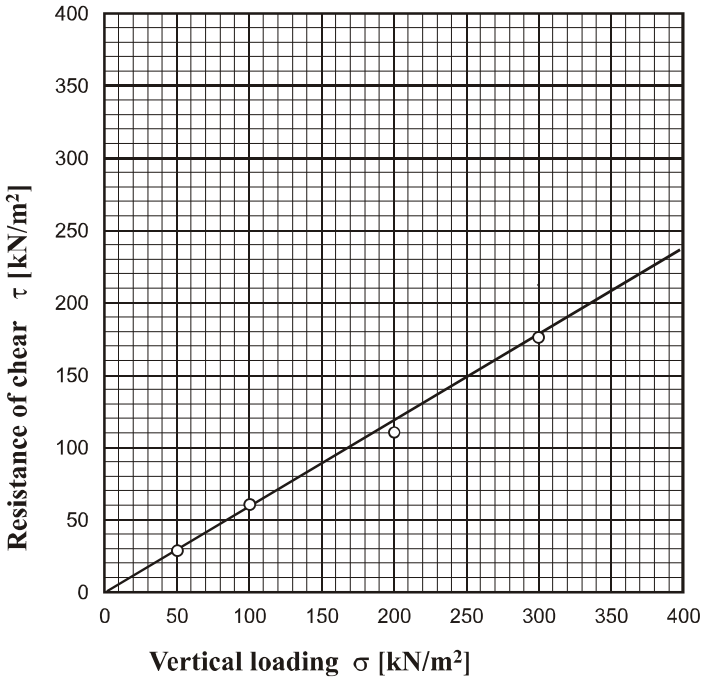
DGR "GEOTEHNIKA"
DOO - Skopje

CHART OF SHEAR STRENGTH

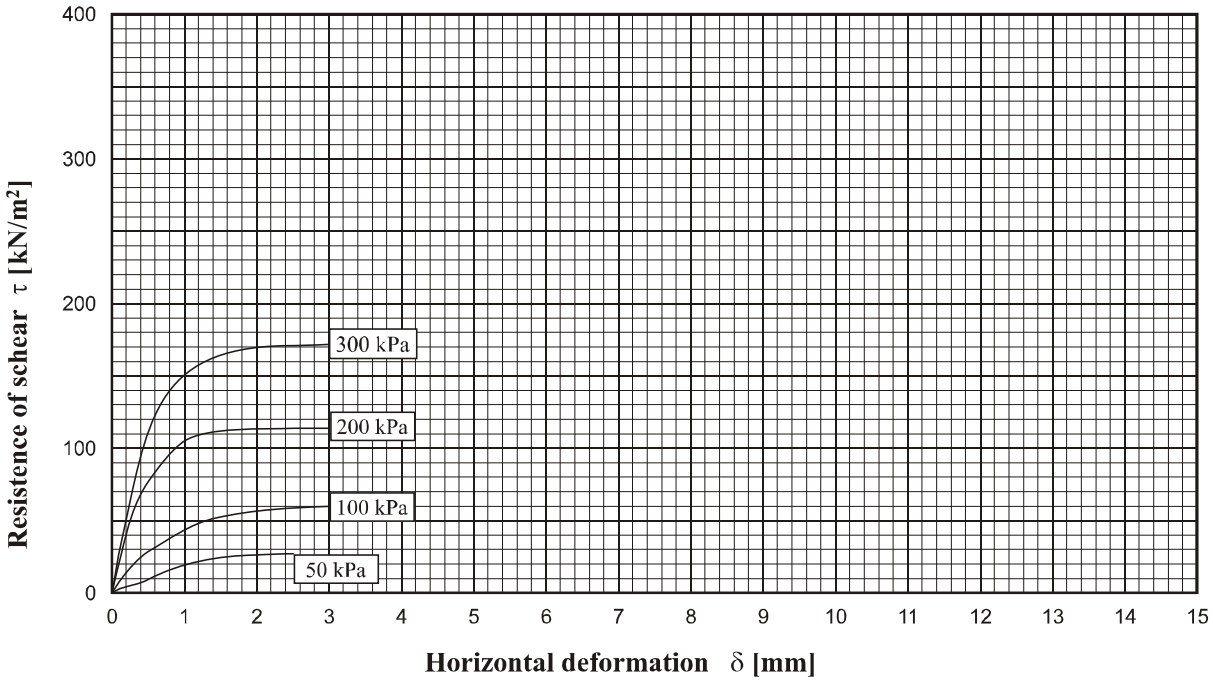
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: **B-8** **Depht:** 6.0 - 7.0 m

SAMPLE		
Dimension	6×6×1,9	[cm]
Moisture content before test	8.90	[%]
Moisture content after test	13.50	[%]
Bulk density	21.55	[kN/m³]
Dry density	19.78	[kN/m³]
Consolidation	24	[h]
tg φ	0.589	
Frictional angle – φ	**30.5**	[°]
Cohesion – *c*	**0.0**	[kPa]



SHEAR



Skopje, 2008.

Appendix No. **6.6**

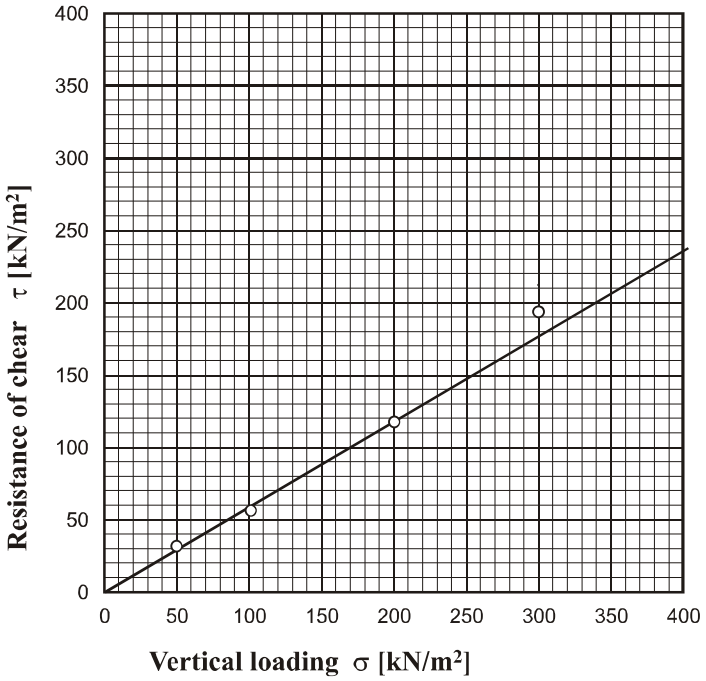
DGR "GEOTEHNIKA"
DOO - Skopje

CHART OF SHEAR STRENGTH

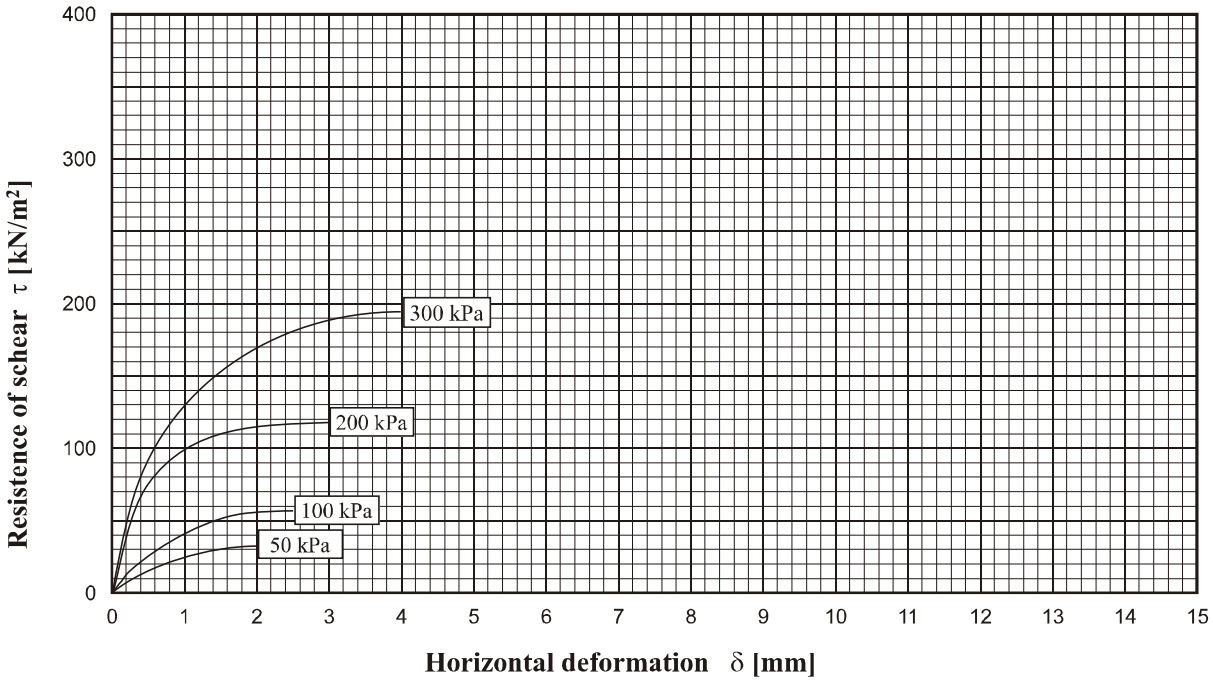
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: **B-9** **Depht:** 7.1 - 7.5 m

SAMPLE		
Dimension	6×6×1,9	[cm]
Moisture content before test	9.20	[%]
Moisture content after test	14.85	[%]
Bulk density	19.97	[kN/m³]
Dry density	18.28	[kN/m³]
Consolidation	24	[h]
tg φ	0.586	
Frictional angle – φ	**30.4**	[°]
Cohesion – *c*	**0.0**	[kPa]



SHEAR



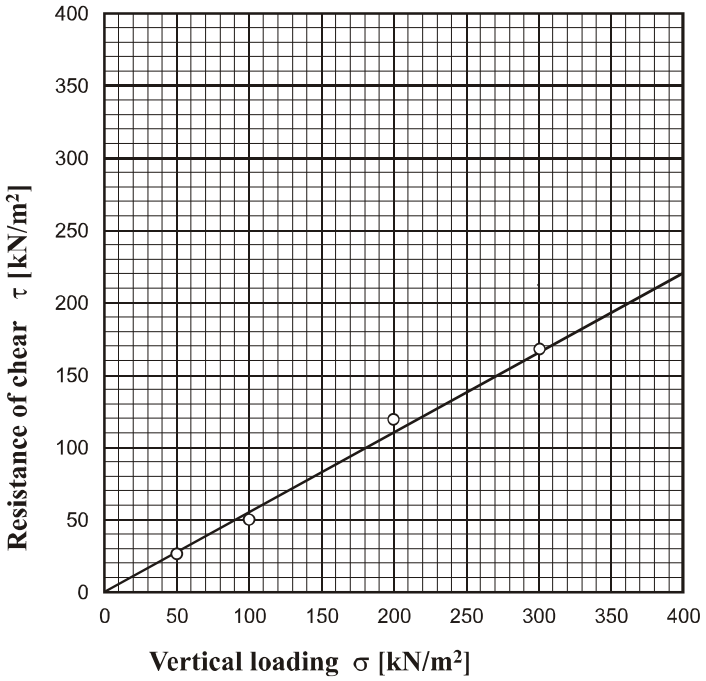
DGR "GEOTEHNIKA"
DOO - Skopje

CHART OF SHEAR STRENGTH

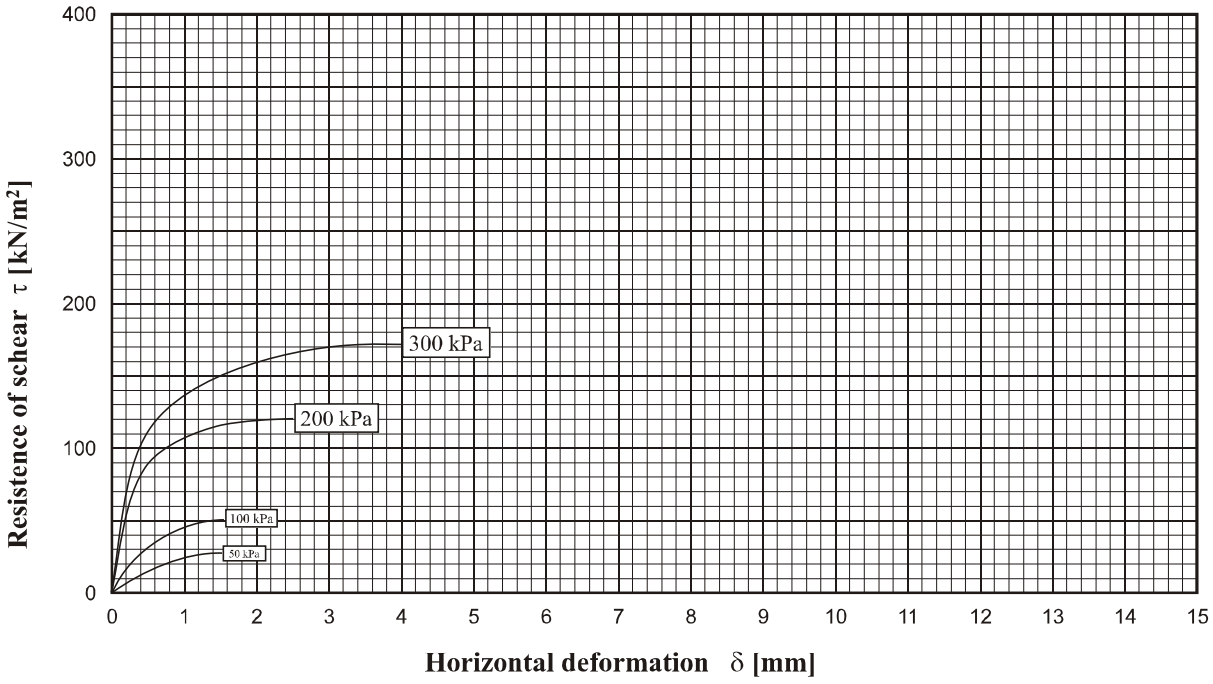
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: **B-10** **Depht:** 1.0 - 2.0 m

SAMPLE		
Dimension	6×6×1,9	[cm]
Moisture content before test	24.60	[%]
Moisture content after test	26.80	[%]
Bulk density	16.49	[kN/m³]
Dry density	13.23	[kN/m³]
Consolidation	24	[h]
tg φ	0.543	
Frictional angle – φ	**28.5**	[°]
Cohesion – *c*	**0.0**	[kPa]



SHEAR



Skopje, 2008.

Appendix No. **6.8**

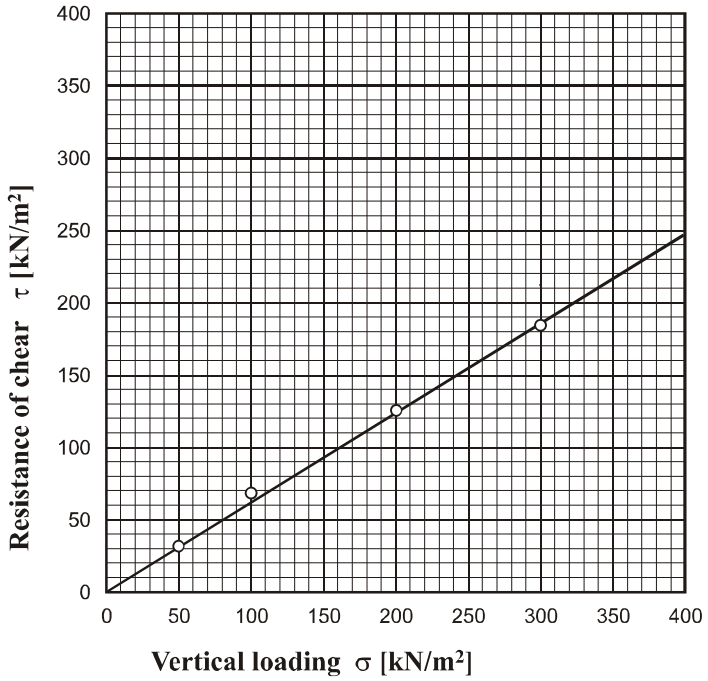
DGR "GEOTEHNIKA"
DOO - Skopje

CHART OF SHEAR STRENGTH

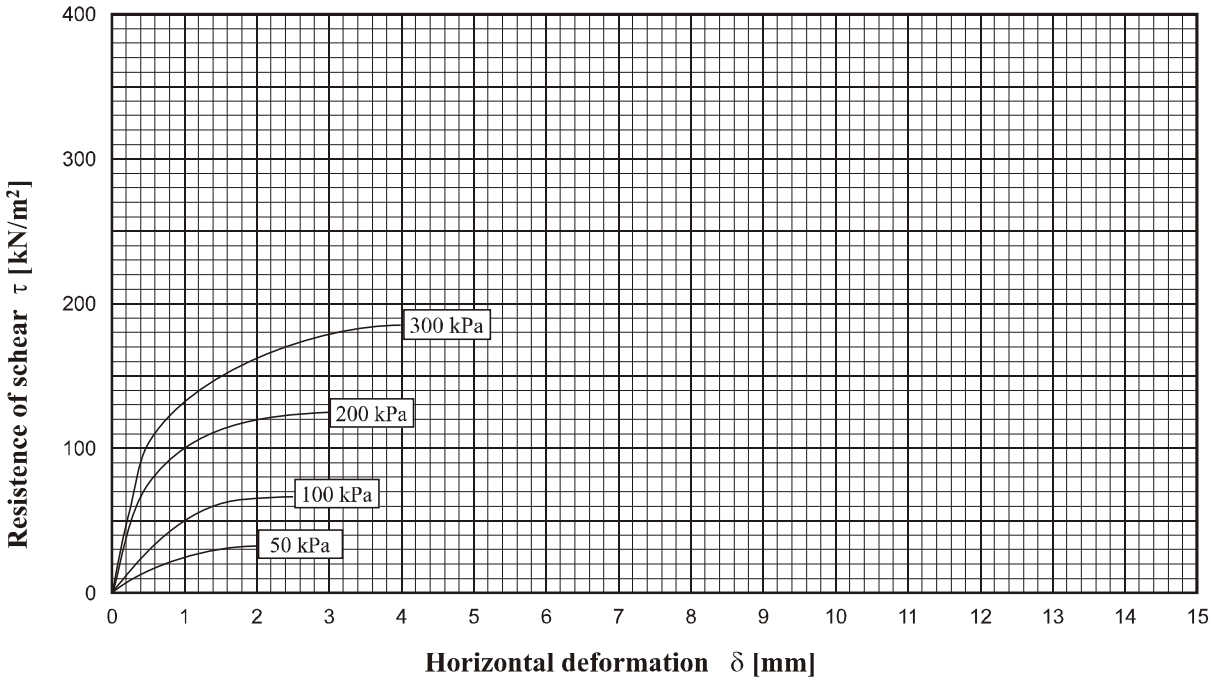
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-11 **Depht:** 5.4 - 5.8 m

SAMPLE		
Dimension	6×6×1,9	[cm]
Moisture content before test	12.9	[%]
Moisture content after test	17.7	[%]
Bulk density	19.16	[kN/m³]
Dry density	16.97	[kN/m³]
Consolidation	24	[h]
tg φ	0.617	
Frictional angle – φ	**31.7**	[°]
Cohesion – *c*	**0.0**	[kPa]



SHEAR



Skopje, 2008.

Appendix No. **6.9**

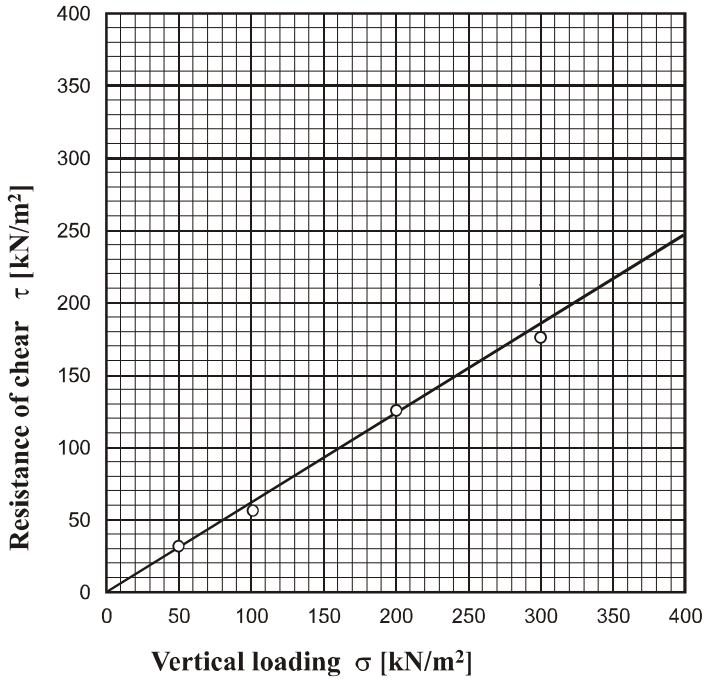
DGR "GEOTEHNIKA"
DOO - Skopje

CHART OF SHEAR STRENGTH

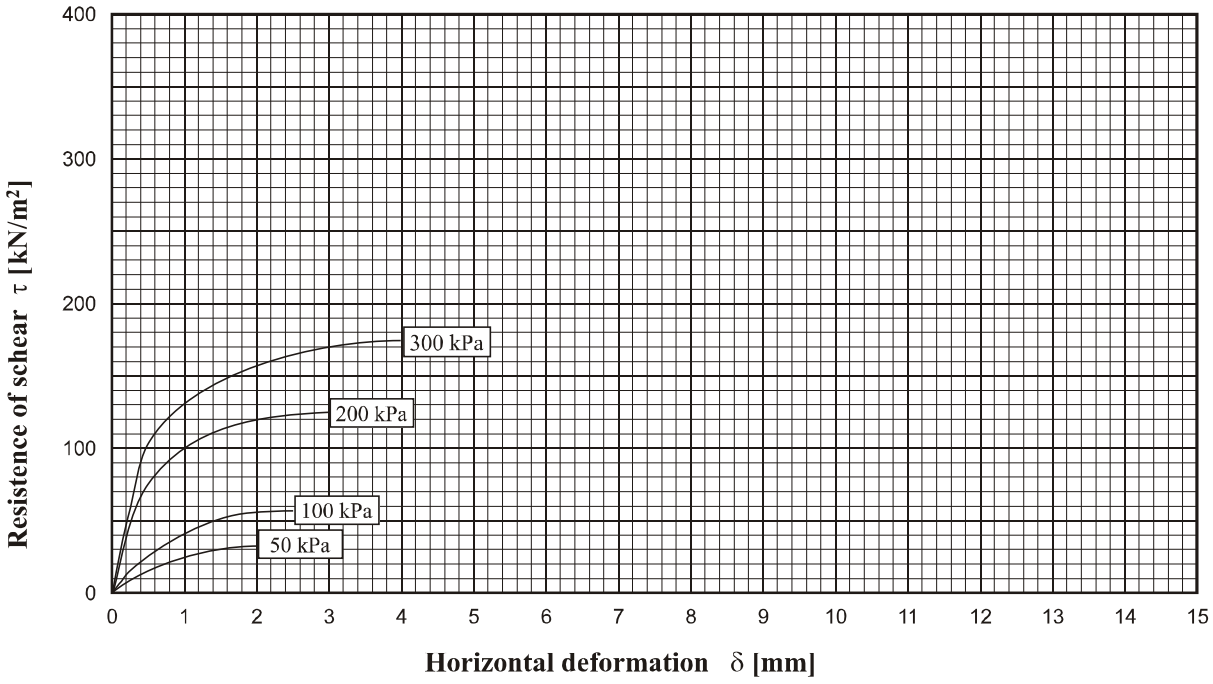
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: **B-12** **Depht:** 1.0 - 2.0 m

SAMPLE		
Dimension	6×6×1,9	[cm]
Moisture content before test	12.0	[%]
Moisture content after test	17.0	[%]
Bulk density	19.16	[kN/m^3]
Dry density	17.10	[kN/m^3]
Consolidation	24	[h]
tg φ	0.605	
Frictional angle – φ	**31.2**	[°]
Cohesion – *c*	**0.0**	[kPa]



SHEAR



Skopje, 2008.

Appendix No. **6.10**