Transportation Engineering Laboratory (TEL)

Department of Civil Engineering (CED)

UNIVERSITY OF ENGINEERING & TECHNOLOGY (UET)

LAHORE – 54890 (PAKISTAN)

Phone: 092-42-9929202 Cable: UNIVENGTECH Fax: 092-42-9922566

Ref.---------- Date:----------

The Executive Engineer,
Highway Division, Narowal.

Subject: **Testing of Water Bound Macadam (Base Course "New")**
Rehabilitation/Widening/Reconstruction of Road from Zafarwal to Kingra (Length = 8.00 km) in District Narowal

Dear Sir,

It is with reference to your letter No. 1862/CB dated 06-11-2024.
Please find below the results for the tests conducted on the WBM sealed samples provided to this laboratory on 04-12-2024 through your representative.

Sample # 1

1. **Sieve Analysis (ASTM C-136)**

Sieve Size	3"	2 ½"	2"	1 ½"	1"	¾"	½"	3/8"	#4
%age Passing	100	68.91	15.64	0.49	0	0	0	0	0

2. **Specific Gravity & Water Absorption (ASTM C-127)**

Specific Gravity (oven dried condition)	2.69
Specific Gravity (saturated surface dry condition)	2.71
Apparent Specific Gravity	2.74
Water Absorption (%)	0.68

3. **Sodium Sulphate Soundness (ASTM C-88)**

Sieve Size	Weight of Fraction Before Test (gm)	Weight of Fraction After Test (gm)	Percentage Passing Designated Sieve After Test	Weighted Percentage Loss
2" + 1 ½"	5009.9	4989.2	0.41	0.28
	Total = 0.28%			

4. **Los Angeles Abrasion Value Test (ASTM C-131/535)**

Grading Used	**Los Angeles Abrasion Value (%)**
1	21.56

5. **Flakiness & Elongation Index (BS 812: Part 105)**

Sieve Size		Individual Flakiness Index (%)	Weighted Flakiness Index (%)	Individual Elongation Index (%)	Weighted Elongation Index (%)
Passing (in.)	Retained (in.)				
3	2 ½	3.97	1.23	6.14	1.91
2 ½	2	7.26	3.87	10.46	5.57
2	1 ½	0	0	7.36	1.11
1 ½	1	0	0	57.04	0.28
		Flakiness Index = 5.10%		**Elongation Index = 8.87%**	

Sample # 2

1. **Sieve Analysis (ASTM C-136)**

Sieve Size	3”	2 ½”	2”	1 ½”	1”	¾”	½”	3/8”	#4
%age Passing	100	50.31	40.27	0.72	0	0	0	0	0

2. **Specific Gravity & Water Absorption (ASTM C-127)**

Specific Gravity (oven dried condition)	2.68
Specific Gravity (saturated surface dry condition)	2.70
Apparent Specific Gravity	2.73
Water Absorption (%)	0.75

3. **Sodium Sulphate Soundness (ASTM C-88)**

Sieve Size	Weight of Fraction Before Test (gm)	Weight of Fraction After Test (gm)	Percentage Passing Designated Sieve After Test	Weighted Percentage Loss
2” + 1 ½”	5010.4	4988.9	0.43	0.21
	Total = 0.21%			

4. **Los Angeles Abrasion Value Test (ASTM C-131/535)**

Grading Used	Los Angeles Abrasion Value (%)
1	22.66

5. **Flakiness & Elongation Index (BS 812: Part 105)**

Sieve Size		Individual Flakiness Index (%)	Weighted Flakiness Index (%)	Individual Elongation Index (%)	Weighted Elongation Index (%)
Passing (in.)	Retained (in.)				
3	2 ½	3.06	1.52	6.09	3.03
2 ½	2	56.42	5.67	63.93	6.42
2	1 ½	3.30	1.31	7.51	2.97
1 ½	1	0	0	21.56	0.16
		Flakiness Index = 8.50%		**Elongation Index = 12.58%**	

Sample # 3

1. **Sieve Analysis (ASTM C-136)**

Sieve Size	3”	2 ½”	2”	1 ½”	1”	¾”	½”	3/8”	#4
%age Passing	100	86.09	64.30	3.65	0	0	0	0	0

2. **Specific Gravity & Water Absorption (ASTM C-127)**

Specific Gravity (oven dried condition)	2.68
Specific Gravity (saturated surface dry condition)	2.70
Apparent Specific Gravity	2.73
Water Absorption (%)	0.69

3. **Sodium Sulphate Soundness (ASTM C-88)**

Sieve Size	Weight of Fraction Before Test (gm)	Weight of Fraction After Test (gm)	Percentage Passing Designated Sieve After Test	Weighted Percentage Loss
2” + 1 ½”	5004.3	4983.3	0.42	0.35
	Total = 0.35%			

4. **Los Angeles Abrasion Value Test (ASTM C-131/535)**

Grading Used	**Los Angeles Abrasion Value (%)**
1	22.62

5. **Flakiness & Elongation Index (BS 812: Part 105)**

Sieve Size		**Individual Flakiness Index (%)**	**Weighted Flakiness Index (%)**	**Individual Elongation Index (%)**	**Weighted Elongation Index (%)**
Passing (in.)	**Retained (in.)**				
3	2 ½	48.77	6.78	51.82	7.21
2 ½	2	67.47	14.70	78.53	17.11
2	1 ½	2.57	1.56	4.92	2.99
1 ½	1	0	0	27.61	1.00
		Flakiness Index = 23.04%		**Elongation Index = 28.31%**	

If you have further query, please do not hesitate to contact the undersigned.

Best Regards,

Director
Transportation Engineering Laboratory

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LAHORE – 54890 (PAKISTAN)

Phone: 092-42-9929202 Cable: UNIVENGTECH Fax: 092-42-9922566

Ref.---------- Date:----------

The Executive Engineer,
Highway Division,
Narowal.

Subject: **Testing of Various Construction Materials**
Rehabilitation/Widening/Reconstruction of Road from Zafarwal to Kingra (Length = 8.00 km) in District Narowal

Dear Sir,

It is with reference to your letter No. 1864/CB dated 07-11-2024.
Please find below the results for the tests conducted on the sealed material samples provided to this laboratory on 04-12-2024 through your representative.

Sand

1. **Sieve Analysis (ASTM C-136)**

Sieve Size	3/8"	#4	#8	#16	#30	#50	#100	#200
%age Passing	100	99.95	99.39	98.82	96.31	49.86	5.28	1.62

2. **Fineness Modulus (ASTM C-142)**

Fineness Modulus (%)	1.50

3. **Specific Gravity & Water Absorption (ASTM C-128)**

Specific Gravity (OD)	2.65
Specific Gravity (SSD)	2.67
Apparent Specific Gravity	2.70
Water Absorption (%)	0.74

Sub-base (Re-use)

Sieve Analysis (ASTM C-136)

Sieve Size	1 ½"	1"	¾"	½"	3/8"	#4
%age Passing	100	83.67	69.02	49.65	44.82	39.86

Coarse Aggregate

Los Angeles Abrasion Value Test (ASTM C-131/535)

Grading Used	Los Angeles Abrasion Value (%)
B	14.21

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Ref.---------- Date:----------

The Executive Engineer,
Highway Division,
Narowal.

Subject: **Testing of Various Construction Materials**
Rehabilitation/Widening/Reconstruction of Road from Zafarwal to Kingra (Length = 8.00 km) in District Narowal

Dear Sir,

It is with reference to your letter No. 1888/CB dated 14-11-2024.
Please find below the results for the tests conducted on the sealed material samples provided to this laboratory on 04-12-2024 through your representative.

Sand

1. **Sieve Analysis (ASTM C-136)**

Sieve Size	3/8"	#4	#8	#16	#30	#50	#100	#200
%age Passing	100	99.90	99.23	98.49	96.13	49.09	4.76	1.47

2. **Fineness Modulus (ASTM C-142)**

Fineness Modulus (%)	1.52

3. **Specific Gravity & Water Absorption (ASTM C-128)**

Specific Gravity (OD)	2.65
Specific Gravity (SSD)	2.67
Apparent Specific Gravity	2.71
Water Absorption (%)	0.76

Sub-base (Re-use)

Sieve Analysis (ASTM C-136)

Sieve Size	2"	1 ½"	1"	¾"	½"	3/8"	#4
%age Passing	100	97.97	77.34	59.59	53.58	50.26	44.91

Coarse Aggregate

Los Angeles Abrasion Value Test (ASTM C-131/535)

Grading Used	Los Angeles Abrasion Value (%)
B	15.86

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Ref.---------- Date:----------

The Executive Engineer,
Highway Division,
Narowal.

Subject: **Testing of Various Construction Materials**
Rehabilitation/Widening/Reconstruction of Road from Zafarwal to Kingra (Length = 8.00 km) in District Narowal

Dear Sir,

It is with reference to your letter No. 1892/CB dated 16-11-2024.
Please find below the results for the tests conducted on the sealed material samples provided to this laboratory on 04-12-2024 through your representative.

Sand

1. **Sieve Analysis (ASTM C-136)**

Sieve Size	3/8"	#4	#8	#16	#30	#50	#100	#200
%age Passing	100	99.93	99.28	98.69	96.30	50.11	5.26	1.67

2. **Fineness Modulus (ASTM C-142)**

Fineness Modulus (%)	1.50

3. **Specific Gravity & Water Absorption (ASTM C-128)**

Specific Gravity (OD)	2.65
Specific Gravity (SSD)	2.67
Apparent Specific Gravity	2.69
Water Absorption (%)	0.70

Sub-base (Re-use)

Sieve Analysis (ASTM C-136)

Sieve Size	2"	1 ½"	1"	¾"	½"	3/8"	#4
%age Passing	100	97.57	78.90	61.77	56.34	52.77	48.11

Coarse Aggregate

Los Angeles Abrasion Value Test (ASTM C-131/535)

Grading Used	Los Angeles Abrasion Value (%)
B	15.51

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Ref.---------- Date:----------

The Executive Engineer,
Highway Division,
Narowal.

Subject: **Testing of Various Construction Materials**
Rehabilitation/Widening/Reconstruction of Road from Zafarwal to Kingra (Length = 8.00 km) in District Narowal

Dear Sir,

It is with reference to your letter No. 1938/CB dated 22-11-2024.
Please find below the results for the tests conducted on the sealed material samples provided to this laboratory on 04-12-2024 through your representative.

Sand

1. **Sieve Analysis (ASTM C-136)**

Sieve Size	3/8"	#4	#8	#16	#30	#50	#100	#200
%age Passing	100	99.91	99.27	98.67	96.29	51.42	5.57	1.70

2. **Fineness Modulus (ASTM C-142)**

Fineness Modulus (%)	1.49

3. **Specific Gravity & Water Absorption (ASTM C-128)**

Specific Gravity (OD)	2.66
Specific Gravity (SSD)	2.68
Apparent Specific Gravity	2.71
Water Absorption (%)	0.80

Sub-base (Re-use)

Sieve Analysis (ASTM C-136)

Sieve Size	2"	1 ½"	1"	¾"	½"	3/8"	#4
%age Passing	100	100	81.34	64.82	57.13	52.64	48.37

Coarse Aggregate

Los Angeles Abrasion Value Test (ASTM C-131/535)

Grading Used	Los Angeles Abrasion Value (%)
B	16.05

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The Executive Engineer,
Highway Division,
Narowal.

Subject: **Testing of Various Construction Materials**
Rehabilitation/Widening/Reconstruction of Road from Zafarwal to Kingra (Length = 8.00 km) in District Narowal

Dear Sir,

It is with reference to your letter No. 1939/CB dated 22-11-2024.
Please find below the results for the tests conducted on the sealed material samples provided to this laboratory on 04-12-2024 through your representative.

Sand

1. **Sieve Analysis (ASTM C-136)**

Sieve Size	3/8"	#4	#8	#16	#30	#50	#100	#200
%age Passing	100	99.94	99.39	98.85	96.36	51.05	5.83	1.56

2. **Fineness Modulus (ASTM C-142)**

Fineness Modulus (%)	1.49

3. **Specific Gravity & Water Absorption (ASTM C-128)**

Specific Gravity (OD)	2.66
Specific Gravity (SSD)	2.68
Apparent Specific Gravity	2.71
Water Absorption (%)	0.77

Sub-base (Re-use)

Sieve Analysis (ASTM C-136)

Sieve Size	2"	1 ½"	1"	¾"	½"	3/8"	#4
%age Passing	100	97.72	73.85	51.90	25.61	12.67	2.65

Coarse Aggregate

Los Angeles Abrasion Value Test (ASTM C-131/535)

Grading Used	Los Angeles Abrasion Value (%)
B	15.51

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The Executive Engineer,
Highway Division,
Narowal.

Subject: **Testing of Various Construction Materials**
Rehabilitation/Widening/Reconstruction of Road from Zafarwal to Kingra (Length = 8.00 km) in District Narowal

Dear Sir,

It is with reference to your letter No. 1953/CB dated 26-11-2024.
Please find below the results for the tests conducted on the sealed material samples provided to this laboratory on 04-12-2024 through your representative.

Sand

1. **Sieve Analysis (ASTM C-136)**

Sieve Size	3/8"	#4	#8	#16	#30	#50	#100	#200
%age Passing	100	99.91	99.24	98.66	96.23	51.21	5.83	1.67

2. **Fineness Modulus (ASTM C-142)**

Fineness Modulus (%)	1.49

3. **Specific Gravity & Water Absorption (ASTM C-128)**

Specific Gravity (OD)	2.65
Specific Gravity (SSD)	2.67
Apparent Specific Gravity	2.70
Water Absorption (%)	0.71

Sub-base (Re-use)

Sieve Analysis (ASTM C-136)

Sieve Size	2"	1 ½"	1"	¾"	½"	3/8"	#4
%age Passing	100	100	79.70	61.77	55.40	52.19	46.11

Coarse Aggregate

Los Angeles Abrasion Value Test (ASTM C-131/535)

Grading Used	Los Angeles Abrasion Value (%)
B	16.21

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Best Regards,

Director
Transportation Engineering Laboratory

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