Kamlial Sandstone as Aggregate District Sudhnoti, Plandri from Azad Jammu & Kashmir

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Abstract: ***The project area lies in the Plandri district Sudhnoti of Jammu Kashmir. The area lies between the latitudes N 33^o 45′ 00′′ to N 33^o 49′ 00′ ′ and longitudes 73^o 36′ 35′′E to 73^o 52′6′′E on Geological Survey of Pakistan topoheet no. 43G/10. The area about 72 Km^2 has been mapped at 1:50,000 scale. The Impact value, Los Angeles Abrasion resistance, Specific gravity and Water absorption has been evaluated for kamlial sandstone. The samples collected from Garata Sarsawa, Panjeera, Telyan, Kharran, Jabbri kass, Kand Gora, Parasgali, Garrala, Hollar, Chhechann and Nakar near Pallandri. The data from test results reflect that Impact value of Kamlial Sandstone is 25.2 percent which implies its satisfactory condition. The Mechanical studies show that Abrasion Resistance of Kamlial Sandstones is 41.4 percent which is less than AASHTO (2010) value i.e 50 percent. The Apparent Specific gravity founds 2.1 percent which is less than ASTM standards i.e between 2.6-2.9. And the Water Absorption value comes at 2.24 percent. The data indicate that Kamlial sandstone do not qualify ASTM specification for aggregate.***

Keywords: Kamlial, Sandstone, AASHTO, ASTM

I. INTRODUCTION

The project area is the part of Plandri Azad Kashmir. The research area is situated in Sub-Himalayas of Pakistan. It is delimited by Riasi Fault to the East, Jehlum Strike Slip Fault to the West, Salt Range Thrust to the South and it lies in the south of Hazara Kashmir Syntaxis (Fig. 1.1). The area included Nakar, Chhechhan, Holar, Tallian and Sarsawah. The area is about 79 Sq.km^2 at the height of about 1400 meter from sea level, and lies between longitudes 73°36'35"E to 73°52'6"E and latitudes 33°44'59"N to 33°33'43"N (Figure 1.4) The area lies in the Geological Survey of Pakistan toposheets no.43 $\frac{G}{10}$ and no.43 $\frac{G}{14}$ at 1:50,000 scale. The project area is previously investigated for geology by various geologists like Wadia (1928), Lawrence (1987), Wells and Gingreish (1987).

The main objectives of recent study are:

To evaluate the Siwalik Sandstone of Kamlial Formation as aggregates.

The field work was accomplished in 8 days. The traverses were made across the strike and along the dip. The traverses were made along roads, streams, nalas, and highly exposed rocks in the area. The structural data was collected by GPS, hand Lense, Brunton compass and Geological Hammer.

There are different kinds of sedimentary structures present in the area.

These sedimentary structures are helpful in determining the facing of the stratigraphic units.

Ripple Marks

Fig 1.1 shows the picture of ripple marks from Kamlial Formation in Chhechan area at Coordinates N33 40 984, E73 38 588 collected during Field work.

Rip ups

Fig 1.2 show the picture of Ripups from kamlial formation in Nakkar area at Coordinates N 33 43 642, E 73 42 228 collected during Field work.

Intraformational Conglumerates

Fig 1.3 show the picture of Intraformation conglomerates in kamlial Formation collected from the area of Kand Gora at Coordinates N 33 46 432, E73 42 778.

The samples were mainly collected from Kamlial Formation to know the impact value, abrasion resistance, specific gravity and water absorption of the aggregate to examine its strength to be used for road construction. It was observed that this stone was used in road construction in Plandri and Sarsawah area. The quality of this stone is not qualifying ASTM standard.

AIV (Aggrgate Impact Value) classification for Impact test values is less than 10%, 10-20%, 10-30%, 30-35% show its Exceptionally Strong, Strong , Satisfactory and Weak condition respectively. The Impact value obtained from test is 25.2 percent which reflects its satisfactory condition.

The Mechanical studies show that Abrasion Resistance of Kamlial Sandstones is 41.4 percent which is less than AASHTO (American Association of State Highway and Transportation Officials) value that is 50 percent. There is no standard Los Angles Abrasion value. It can be set by local agencies. The Apparent Specific gravity founds 2.1 percent which is less than ASTM standards that is between 2.6 - 2.9. And the Water Absorption value comes at 2.24 percent. Greater absorption values show its weak condition.

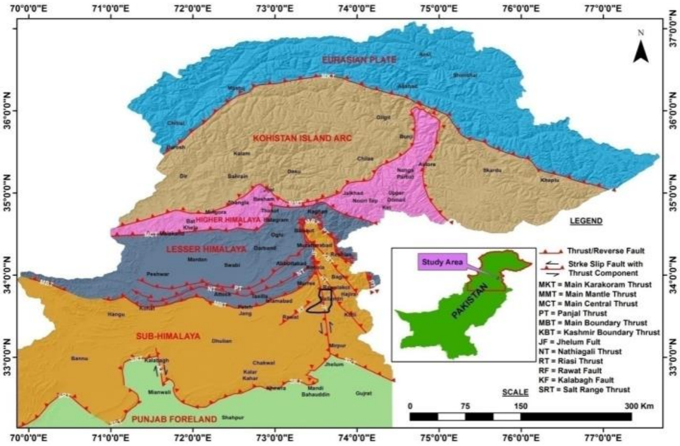

Figure 1.4 Regional Tectonic map of Northern Pakistan and adjoining areas (after Treloar et al. 1991; Searle et al 1999, Khan 1996; and Hussain et al. 2004) Scale 1 : 650,000; Lambert Conformal conic proj-, standard parallels 33º 20′ N and 38º 40′ N (E 70º 00′-- E 77º 30′ / N 37º00′ -- N 32º 08′) Publication date is 1997. The project area is about 79 Sq.Km, lies between the coordinates E 73 36 35 to E 73 52 6 and N 33 44 59 to N 33 33 43 .

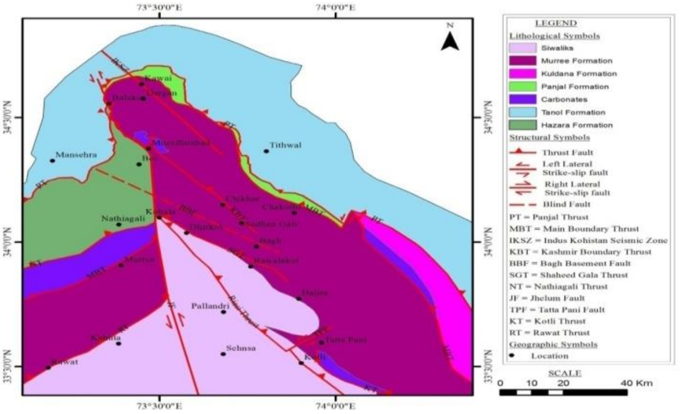

Figure 1.5: Structural and geological map of Hazara Kashmir Syntaxis, after Wadia (1928) (Precambrian to early Paleozoic Orognseis in the Himalayan Kashmir Jour. Geol.,5; vol 1-22, Rustam and Ali (1994) and Rustam et. al. (2016). Tectonic Study of the Sub-himalayas Based on Geophysical Data in Azad Jammu and Kashmir and Northern Pakistan.

1.1 Location and Accessibility

The location marks by GPS, Brunton compass. We mark the various areas like Chhechhan, Kharan, Talyan, Holar, Panjera, and Nakkar. The Kamlial sandstone is accessible by metalled roads man made tracks and unmetalled roads.

1.2 Climate

The climate of the project area is mild to warm during the spring and autumn, Humid temperature during summer and cold to snowy during the winter. The temperature can rise as high as 38 °C during the mid-summer months and drop below −2 °C during the winter months. Snowfall can occur in December and January, while most rainfall occurs during the monsoon season from July to September .

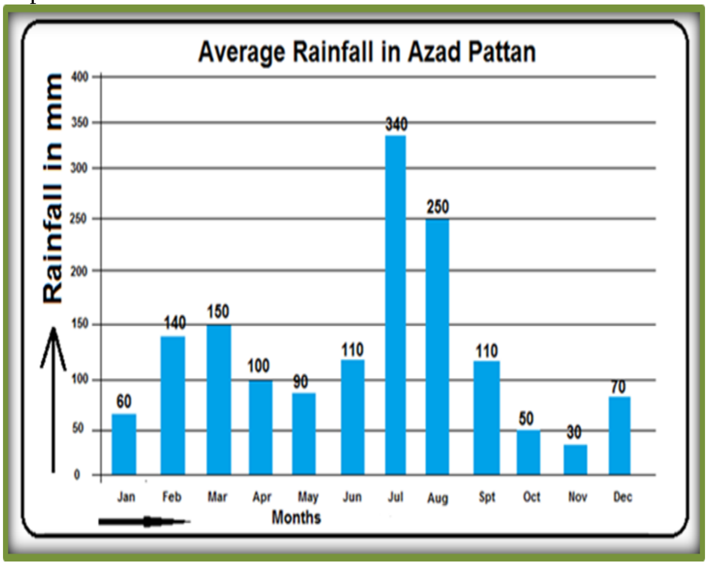

Figure 1.6 show the Average 10 years rainfall data, which has been recorded by Metrological department in Muzaffarabad AJ & K.

1.3 Structure

The project area is situated in Sub-Himalayas of Pakistan. It is delimited by Riasi Fault to the East, Jhelum Fault to the West, Salt Range Thrust to the South and it enters in the south of Hazara Kashmir Syntaxis. The area fall into faults and folds. The area is highly deformed due to Late Tertiary Himalayan orgeney in Fig (1.5).

1.3.1 Faults

The rocks in the project area are highly deformed due to the collision of Indian Plate and Eurasian Plate in the Himalayas. In the study area compression stresses caused by the collisional of Indian and Eurasian plates developed the North West – South East trending faults which are Riasi Fault, Palandri Fault, and Chhechhan Fault. The major faults of the area are Riasi Fault, Palandri Fault, and Chhechhan faults.

1.3.2 Riasi Fault

The Riasi fault is about 45 degree with respect to the Indian shield since Late Eocene / Early Miocene time. The >60 km long Riasi fault system is the south eastern segment of a seismically active regional fault system that extends more than 200 km step wise to the South East from the Balakot –Bagh fault in Pakistan into North West (Fig 1.8).

In study area Riasi Fault is North West – South East trending fault and runs from the Manasa and west of the Mangriot Anticline and to east of the Namb peprian syncline.

The fault is marked on the basis of dislocation, fault gouge, shearing, crushing and bending of streams in the under study area. Bending of streams and dislocation suggest that the hanging wall block moves Upwards and footwall block moves downwards.

1.3.3 Chhechhan Fault

The Chhechhan Fault is major fault passing through the Chhechhan area. The Chhecchan Fault is North West-South East trending fault. The Kamlial Formation is thrusted over the Chingi Formation. The altitude of fault plane is N 41° W / 62° 1.5.2 (Fig 1.8).

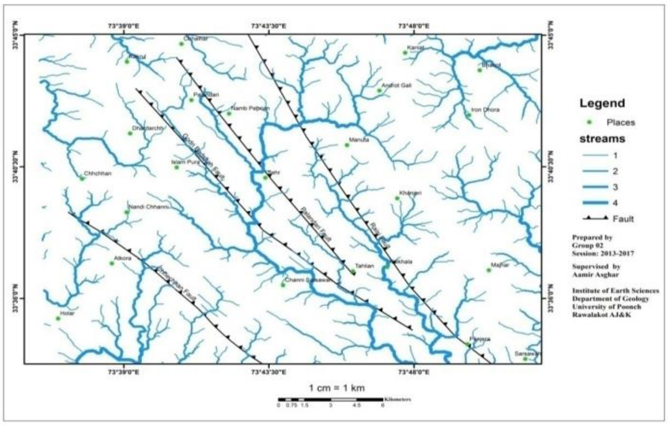

Figure 1.7 Figure shows the Stream Map of Project Area , Prepared on GIS (Geographic Information System) at 1;1000 between Coordinates N33 36 0 – N 33 45 0 and E 73 39 0 – E 73 48 0.

1.3.4 Pallandri Fault

The Palandri Fault is a North West – South East trending and northeast dipping reverse fault. It is an intraformational fault that runs in the Murree Formation. It runs from west of the Namb Peprian Syncline and east of the Palandri Anticline and it passes from Tahlian and Pattan Sher area. In some areas the attitude of fault plane is N60°W / 68°NE. The fault is mark on the basis of dislocation, gouge, tilting of trees, shearing and crushing in the under study area . The north western part of Murree Formation is thrusted over the Kamlial Formation and in southeastern part Kamlial Formation thrusted over Chinji Fig (1.4).

1.3.5 Major folds

The major folds in the project area are, Palandari Anticline, Chhechhan Anticline and Holar Syncline. The Holar Syncline is signifier by the folding of Dhok Pathan Formation and Nagri Formation. The Dhok -Pathan Formation posture in the core whereas the Nagri Formation is on the limbs Fig (1.8).

The Palandri Anticline is a North West to South East trending regional anticline extend from the west of Jehlum River to the east of Azad Pattan area and finally truncate along Palandari Fault. The Palandari Anticline is signifier by the folding of Kamlial Formation and Murree Formation. The Murree Formation posture in the core whereas the Kamlial Formation is on the limb Fig (1.2).

The Chhechhan Anticline is signifier by the folding of Kamlial Formation and Murree Formation. The Murree Formation posture in the core whereas the Kamlial Formation is on the limb Fig (1.).

1.3.6 Cracks

Cracks are also present in Murre Formation near Jabbri kass. These cracks are one per meter. The crackes are filled with quartz , Calcite and clays as secondary material. Cracks are present in Kamlial Formation near Taliyan. These cracks are filled with clay and silty material.

1.3.7 Joints

Joints are present in contact between Muree and Kamlial Formation near Nara Bazaar. These rocks are highly jointed. These joints are filled with cl iterial and calcite veins.

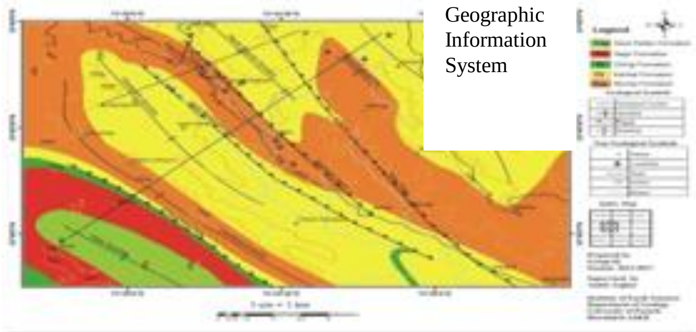

Fig 1.8 Wadia 1931, and Baig, M, S. and Lawrence R.D 1987. At 1:50,000 Precambrian to early Paleozoic Orogensis in the Himalayan, Kashmir Jour. Geol, .5: vol 1-22. Waliullah, Shah Nasir, Ahmed Hussain and Sardar Saed Akhtar. 2004. Geological Map of Palandri District sudhnoti, Geological survey of Pakistan. Structural and Stratigraphic Investigation of Namb Peprian, Chhechhan, Holar and Sarsawah areas Of Sudhnoti and Kotli, Azad Jammu and Kashmir, Pakistan.

1.4 Selection of sample site

The selection of sample site is a technical process during field work. The samples are selected from the area which is easily accessible and best out cropped. The samples were selected to find out the physical and chemical properties of rock. The selection of samples was made on the basis of texture, structure, colour and Weathering conditions.

1.5 Geological description

The project area lies between Jehlum fault on left side and Himalayan Frontal Thrust fault on right side in the core of Hazara Kashmir Syntaxes . The area is mountainous and structurally deformed due to the local and regional faults .

1.6 Kamlial Sandstone

It is coarse grained in texture. Appeared as greenish grey or greenish in color. Kamlial Sandstone has intraformation conglumerates as characteristics feature. It produces dull sound on hammering. Wooden fossils has also been the indication of kamlial Formation Sandstone by Greco, A. (1991).

Table 1.1 The Stratigraphic sequence of Kashmir Basin area Shah A.T (1977).

Formation	Age	Description
Quaternary Alluviam	Recent	Silt, gravel and unconsolidated deposits of clay
…………Unconformity…………		
Mirpur Formation	Pleistocene	Conglomerates having cobbles and pebbles of igneous, metamorphic and sedimentary rocks
…………Unconformity…………		
Soan Formation	Pleocene	Clay, claystone and grey sandstone. Clays are brown, yellowish grey in colour.
DhokPathan Formation	Late Miocene	Dominantly consist of sandstone, siltstone, and clays. Sandstone is grey, fine to medium grained and medium to thick bedded.
Nagri Formation	Late Miocene	Greenish grey sandstone, siltstone and mudstone. Sandstone has massive beds and has medium to coarse grained texture. Sandstone alternates with clay and are 60 percent and 40 percent respectively.
Chingi Formation	Middle to Late Miocene	Red to purple, greenish grey, ash grey sandstone and siltstone and purple and redish brown mudstone. 70 percent clay and 30 percent sandstone.
Kamlial Formation	Early to middle Miocene	Mainly sandstone, clays and intraFormational conglomerates.
Murree Formation	Early Miocene	Mostly clays, shales and sandstone. Sandstone is red purplered in colour and is fine to medium grained
Kuldana Formation	Middle to late Eocene	Variegated shales with subordinate sandstone. Shales are arenaceous
Chorgali Formation	Early Eocene	Mostly Calcareous shales, limestone and dolomitic limestone
Margalla Hill Limestone	Early Eocene	Main nodular fossiliferous limestone with shales
Patala Formation	Late Paleocene	Mainly shales interbedded with marl and limestone
Lockhart Formation	Early Paleocene	Grey to dark grey limestone with subordinate shales
Hangu Formation	Early Paleocene	Mainly Laterite, bauxite and fireclay
…………Unconformity…………		
Muzaffarabad Formation	Chambrian	Mainly Dolomitic limestone with charty dolomite and chert bands
Dogra formation	precambrian	Slates

Table 1.2 Stratigraphic sequence of the project area. (The Stratigraphic sequence of Kashmir Basin area Shah A.T (1977).

Formation	Age	Description

Dhok Pathan Formation	Late Miocene	Dominantly consist of sandstone, siltstone, and clays. Sandstone is grey, fine to medium grained and medium to thick bedded.
Nagri Formation	Late Miocene	Dominantly it consists of greenish grey sandstone, siltstone and mudstone. Sandstone has massive beds and has medium to coarse grained texture. Sandstone alternates with clay and are 60 percent and 40 percent espectively.
Chingi Formation	Middle to Late Miocene	Red to purple, greenish grey, ash grey sandstone and siltstone and purple and redish brown mudstone. 70 percent clay and 30 percent sandstone.
Kamlial Formation	Early to middle Miocene	Mainly sandstone, clays and intra Formational conglomerates.
Murree Formation	Early Miocene	Mostly clays, shales and sandstone. Sandstone is red and purple red in colour and is fine to medium grained

II. FIELD CHARACTERISTICS OF ROCKS

2.1 Murree Formation

The Murree Formation is composed of a sequence of dark red purple clay and sandstone of purple grey and greenish grey color with subordinate intraformational conglomerates. The basal strata of the formation consists of light greenish grey calcareous sandstone and conglomerate with abundant derived larger foraminifers of Eocene age by Pilgrim (1910), Lewis (1937).

In field area there is cyclic deposition of clay and Sandstone. Murree Formation sandstone is fine grained to medium grained Sandstone. Leaching of iron is observed. In Panjeera area at N 33 58 259 E 73 83 188 contact between Kamlial and Murree Formation has been found.

Near Jabbri kass area Murree Formation is highly cracked fractuted, and crushed. These cracks are filled with quartz and clay as a secondry material. Pits are also present which filled with calitic material. Rocks are aslo suffering from physical, chemical and mechanical weathering. Weathering colour is brown to grey while fresh colour isgrey . Tenacity how mettalic sound.

At Coordinates N 33 45 284 - E 73 40 941 an anticline has been found which indicates loacal fault. Fractures are oblique to bedding plane and filled with clay and silty material which cut along stike direction.

In the area, the Murree Formation consists of light greenish grey calcareous cyclic sequence of deposition of sandstone, clay and conglomerates. The Murree Formation exposed in Palandri city, Chhechhan and Sarsawah areas. It has transitional contacts with overlying Kamlial Formation and underlying Kuldana Formation. Early Miocene age has been assigned for Murree Formation by Wadia, (1931).

2.2 Kamilal Formation

Kamlial Formation largely consists of sandstone and inter - bedded clay / mudstone. The sandstone is medium to coarse grained greenish grey color and cross bedded. Minerals in Kamlial Formation are quartz , feldspar, biotite, muscovite, garnet, tourmaline and epidot. Wood and leave prints are also found. In the study area kamlial Formation is well exposed in nakkar, Androt Gali, Dhardarchh and Tahlian. In the area Formation consist of dark brick-red sandstone and intraformational conglomerates . Wood fossils and leaves prints are also present near Tahlian by Pilgrim (1910), Lewis (1937).

The rock bed is mainly exposed as sandstone bed with conglomerates. It consists of nearly equal ratio of sandstone and clays. Moderately cemented, soft and cross-bedded with conglomeratic bed between sandstone beds. It is coarse grained sandstone with granite and granite gneiss by Pilgrim (1910), Lewis (1937).

The rocks are highly cracked, fractured and faulted. Joints are North-South trending and dip at an angle of 45-85 degree. In crakes and joints clayey, silty and calcitic material has been found. DhokPathan and Chinji sandstones are very loose and weather easily. Tenacity of these rocks is low. The rocks break with hammering with dull sound. Upper portion of the rocks is eroded but at places it is stacked with calcareous material. There are some honey combed structures but not common. Rocks are highly folded and cracked along the fold axis striations and load casts have been found in the rocks. The core of the rocks is hard and not break with hammer. At Coordinates N 33 45 33 - E 73 42 511 Murree Formation thrusted over Kamlial Formation as a contact. In the area of Paras gali at N 33 46 941 - E 73 42 424 there is gradational contact between Kamlial Formation and Murree Formation.

Big blocks of 2 and 4 meters have been found on slopes which always fall on the road and block the road for days. Slope are very high at least 50-85 degree. Road cut destabilizes and damage the rocks. The rocks cannot be stabilized due to the nearness of faults which run from the area of study. Earthquake resistance structures should be made to stabilize.

2.3 Dhok -Pathan Formation

Dhok-Pathan Formation consists of sandstone, clays and compact conglomeratic level. Sandstone is light grey, grey and raddish brown. The proportion of sandstone and clay in Dhok -Pathan Formation is equal ratio. Sandstone in Dhok-Pathan Formation is soft with respect to Nagri Formation. The pieces of volcanic, metamorphic and older sedimentary rock is also present in Dh0k-Pathan Formation. The sandstone is composed of feldspar, quartz, mica and red garnet. Epidot, tourmaline and biotite is also present in Dhok-Pathan Formation. It has soft and loose sandstone.

The Dhok-Pathan Formation exposed in Holar and consists of sandstone, clays and compacted conglomerate level. The sandstone in Dhok-Pathan Formation is relatively soft with respect to Nagri Formation. The sandstone is grey, light grey and reddish brown. Flaser bedding is characteristic features of Dhok Pathan Formation.

The lower and upper contact of Dhok-Pathan Formation with Nagri Formation and Soan Formation are gradational. The age of Dhok-Pathan Formation is Early to Middle Pliocene Pascoe (1963).

2.4 Sedimentary Structures

There is different kind of structures present in the area. These Sedimentary structures are helpful in determining the facing of stratigraphic unit. The observed sedimentary structures under study area are cross bedding, Ripple marks, Gradded Bedding, Rip-ups and Spheroidial Weathering.

Cross bedding is the primary sedimentary structure. It is accommodating to recognize the facing of sedimentary strata. Cross bedding well developed in the Kamlial Formation and Dhok-Pathan Formation under study area.

Ripple marks usually form in condition with flowing water, in the part of the Lower Flow Regime. Ripple marks are use to find out the top and bottom of stratigraphic unit (Figure 1.1).

Rip ups are the clasts of shales and clay of underlying rock at the base of overlying sandstone. The rip ups are formed at the bottom of the sandstone beds in the Murre Formation. Rip ups indicate the bottom of the sedimentary strata. (Figure 1.2).

Gradded bedding is a sorting particals according to clast size and shape on a lithified horizontal plane. Gradded bedding is use to identify the top and bottom of a sedimentary strata. Density and gravity forces in downward movement of material.

Chemical weathering transforms the original material in to a substance with a different composition and different physical characteristics. The new substance is typically much softer and more susceptible to agents of erosion than the original material. The rate of chemical weathering is greatly accelerated by the presence of warm temperatures and moisture. Also some minerals are more vulnerable to chemical weathering than others. For example, feldspars more reactive than quartz.

Physical weathering, also called mechanical weathering or disintegration, is the class of processes that causes the disintegration of rocks without chemical change. The primary process in physical weathering is abrasion (the process by which class and other particles are reduced in size). Physical weathering can occur due to temperature, pressure, frost etc.

Mechanical weathering, there also parts of rock which breaks from original rock as a result of water enters in cracks show mechanical weathering of rocks.

III. RESULTS

3.1 Impact value test

It indicates the relative measurement of the aggregate to a sudden shock or an impact. The classification of road aggregate on the basis of impact value reveals that good road aggregate must have an impact value in between 10 to 30% and less than 10 % will give us exceptionally strong having maximum toughness and flexibility. From 10 to 30 % impact value give us satisfactory aggregate class for roads.

This test is done by using Impact test machine consist of hammer of 13.5kg - 14kg weight which is drop from 380mm height into a cup of the diameter 102 mm , in which aggregates are fill upto a height of 50mm .The aggregates which are used are passing from 12.5 mm sieve and retained on 10 mm sieve and their weight in gram should be note as W1.

The aggregates are filled in the cup by three layers and each layer will tamped with 25 blows . Than sample should be subjected to the total of 15 blows in Impact testing machine with one second time interval. Now resulting fraction should teams from 2.36mm sieve and weight the passing fraction as W2. By Using formula that is W2 / W1 * 100 percentage of toughness of aggregates can be determined.

The impact value of some of the Kamlial sandstones are between 10-30 % but some are more higher as 37.57, 32.16, and 42.34 for sample number 2, 8, , and 10 respectively so it could not be used in road construction.

Table 3.1 represents the Aggregates Impact Values after Lab- testing of samples from kamlial Sandstone collected from study area.

S/N	Sample	Coordinates	Total weight (g)	Passing weight (g)	Present value	Average value	ASTM standard value
1	PNKS-01	N 33 58 260 E 73 83 186	600	182	30.33		10-30%
2	TKKS-02	N 33 61 034 E 73 77 983	660	248	37.57		

3	KHKS-03	N 33 38 376 E 73 44 734	400	86	21.5	*25.2%*	
4	KGKS-04	N 33 45 337 E 73 42 511	600	133	22.33		
5	KGKS-05	N 33 46 432 E 73 42 778	600	114	19		
6	GRKS-06	N 33 47 452 E 73 44 031	600	124	20		
7	CHKS-07	N 33 39 164 E 73 37 148	670	70	10.44		
8	NNKS-08	N 33 43 642 E 73 42 228	572	184	32.16		
9	NKS-09	N 33 43 490 E73 42 962	650	104	16		
10	BGKS-10	N 33 44 931 E 73 39 495	392	166	42.34		

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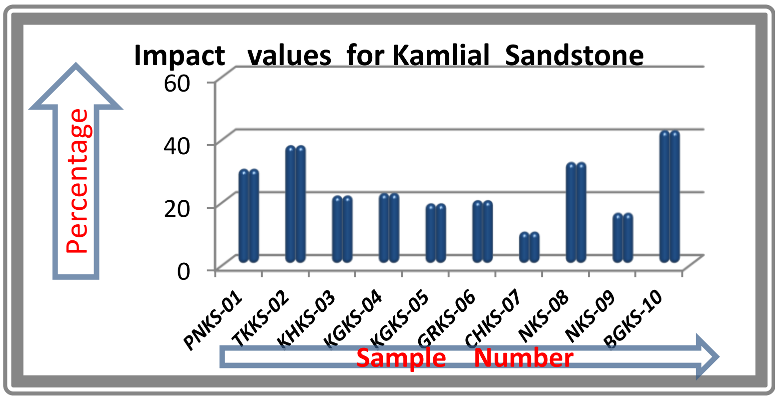

Fig 3.1 shows the Graph for Aggregates impact Values using lab data from Table 3.1.

3.2 Los Angles Abrasion Resistance Test

Los Angeles Abrasion resistance test carried out to indicate crushing, degradation, Disintegration and toughness of aggregates.

Principally; This test produce Abrasive action on aggregates by using standard steel balls in revolving hollow cylinder of Los Angles Abrasion resistance testing machine to determine the Percentage wearing of aggregates. Sample should be prepared by using 20mm, 12.5mm and 10mm Sieves. The machine contain a hollow cylinder closed at one end having a diameter of 700 mm and a length of 500 mm. In this cylinder 5kg of aggregates are filled with the steel balls of size 40mm & weight 390-445kg each. After mixing the cylinder is allowed to rotate with the speed of 30-33 RPM with total of 500-1000 revolutions as selected by category.

Then with the help of formula, Weight of agg pass through 1.7 mm sieve divided by Total Weight of Sample multiply by 100 we can get the percentage value for Los Angles Abrasion resistance of aggregates.

Sieve size(squre hole)		WTing Sample for grade				
Number of Steel balls to b used		12	11	8	6	
Passing (mm)	Retained (mm)	A	B	C	D	G
80	63					
63	50					
50	40					
40	25	1250				5000
25	20	1250				5000
20	12.5	1250	2500			
12.5	10	1250	2500			
10	6.3			2500		
6.3	4.75			2500		
4.75	2.36				5000	

Figure 3.2 Shows the grading table for test of samples for Los Angles Abrasion Resistance test.

Table 3.2 shows Los Angeles Abrasion Resistance Test values after lab-testing of samples of kamlial Sandstone collected from study area.

S/N	Sample	Coordinates	Dry Weight (g)	Retain Weight (g)	Loss Weight (g)	Abrasion Value	A/ V Average value	ASTM standard value

1	PNKS-01	N33 58 260 E73 83186	4982	2720	2262	41	41.4 %	90-120%
2	KGKS-02	N33 45 337 E73 42 511	4996	1590	3406	67		
3	CHKS-03	N33 40 981 E73 38 581	4996	3035	1961	39		
4	NKS-04	N33 43 895 E73 43 195	4992	3502	1490	26		
5	CDKS-05	N33 43 491 E73 42 963	4750	2988	1762	34		

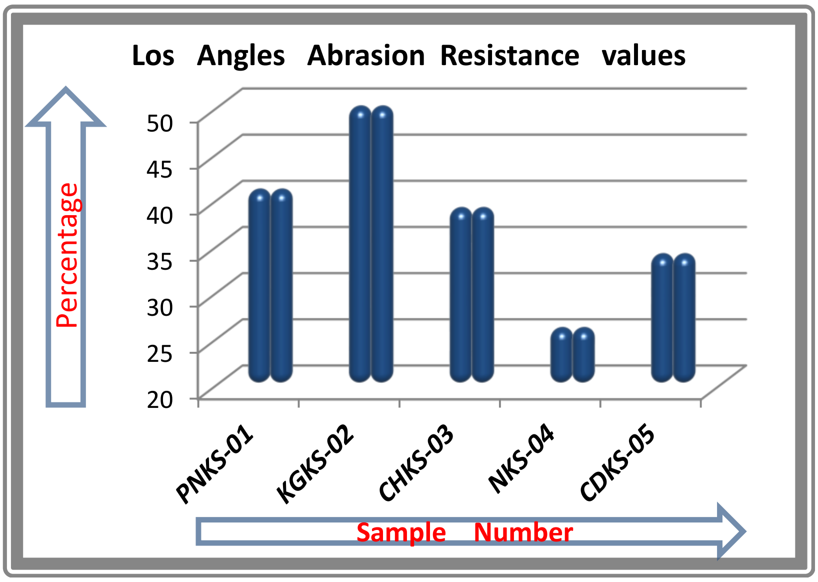

Fig 3.3 shows Graph of Los Angles Abrasion Resistance, values abrasion Values using Lab-Data from Table 3.2.

Specific Gravity Test

Specific Gravity Test for aggregates use to calculate the specific gravity of coarse aggregates by determining the ratio of the weight of a given volume of aggregates to the weight of an equal volume of water. The coarse aggregates specific gravity test measures coarse aggregates weight under three different sample conditions (A) Oven - dry (no water in sample), (B) Saturated surface - dry, (C) Submerged in water (underwater).

Using these three weights and their relationships, a sample's apparent specific gravity and bulk specific gravity as well as absorption can be calculated. 2000g sample choose after passing from 12.5mm Sieve and retained on 4.75 mm Sieve, then after wash and dry place in water and again dry the sample in SSD condition and weight as A , Now Place in underwater and weight as B, Finally placed in an oven at 110 degree centigrade and weight as C.

Apparent Specific gravity can be calculate by (A) divided (A-C) where A is the oven dry weight of the sample B is the Saturated surface dry weight of the sample and C is the Submerged Weight of the sample . Mean or average value for Specific gravity from test results as 2.1 percent.

3.4 Water Absorption Test

Water Absorption test and Specific Gravity test both can be conducted by same method. For Water Absorption values the formula B-A divided by A is used where B is the Saturated surface dry weight of the sample after submerging in water for 24 hours and A is the oven dry weight of the sample . Water Absorption values from test results as 2.24 as an average which is higher than ASTM (American Society of Testing and Material) standard value for water Absorption which is 0.1-1.0 or 0.6 per unit weight.

Table 3.3 shows the values of Specific Gravity values from Lab-Data for kamlial Sandstone collected from study area.

S.N	Sample Name	Coordinates	O. Dry Wt (g)	S.S.D Wt (g)	Wt in Water(g)	App S.G	Mean Value	ASTM
1	TKKS-01	N 33 61 034 E 73 77 983	990	1004	458	1.9	2.1	2.6 - 3.0
2	KHKS-02	N 33 38 376 E 73 44 734	908	1012	532	2.4		
3	KGKS-03	N 33 45 337 E 73 42 511	992	1002	564	2.3		
4	KGKS-04	N 33 46 432 E 73 42 778	958	1076	430	1.8		
5	GRKS-05	N 33 47 452 E 73 44 031	965	1060	440	1.8		
6	CHKS-06	N 33 39 164 E 73 37 148	988	1082	208	1.3		
7	NNKS-07	N 33 43 642 E 73 42 228	952	1122	438	1.8		
8	NKS-08	N 33 43 490 E73 42 962	982	1006	274	1.4		
9	BGKS-09	N 33 44 931 E 73 39 495	988	1028	540	2.2		
10	CDKS-10	N33 43 491 E73 42 963	906	1018	674	3.9		

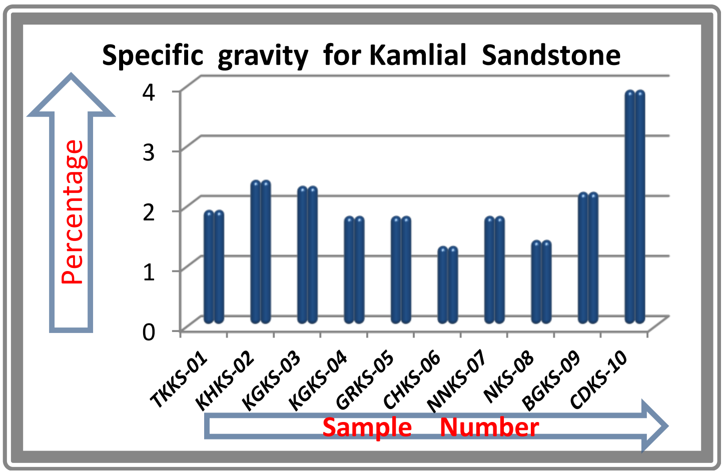

Fig 3.4 shows the Graph of Specific gravity values Using Lab-Data for samples of Kamlial Sandstone collected from study area from Table 3.3.

Table 3.4: Shows the values from Lab- Data for the Water. Absorption Test of Kamlial Sandstone samples collected from study area

S.N	Sample Name	Water Absorption values	Mean values	Standard value for water absorption
1	TKKS-01	2.42	2.24	Less than 0.6 per unit by weight
2	KHKS-02	2.3		
3	KGKS-03	1.7		
4	KGKS-04	2.1		
5	GRKS-05	1.9		
6	CHKS-06	2.3		
7	NNKS-07	2.1		

8	NKS-08	2.33		
9	BGKS-09	2.82		
10	CDKS-10	2.5		

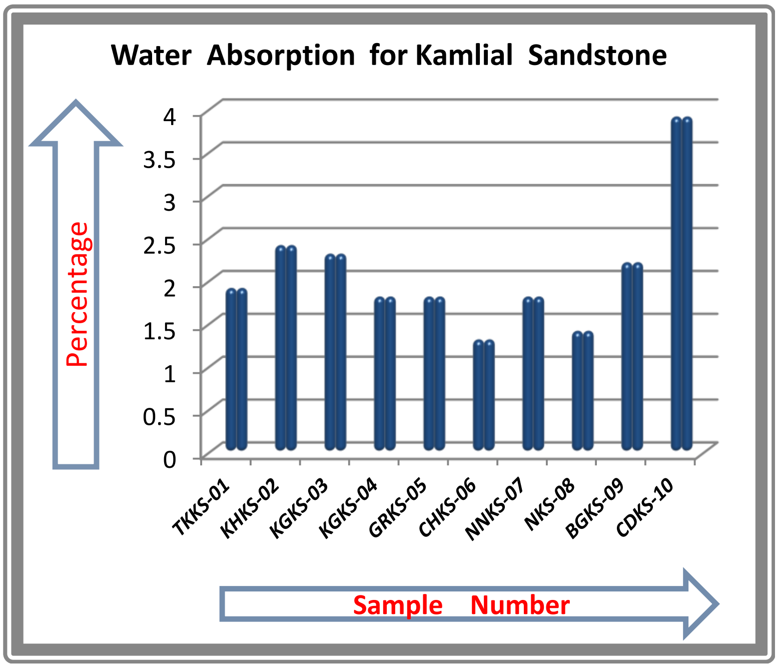

Figure 3.5 shows the graph for Water Absorption values from Lab-Data of the samples of Kamlial sandstone collected from study area.

Table 3.5 shows the Comparison between specific gravity and water absorption values from Lab-Data of samples of Kamlial Sandstone collected from study area.

S.N	Sample Name	App S.G	Water Absorption values
1	TKKS-01	1.9	2.42
2	KHKS-02	2.4	2.3
3	KGKS-03	2.3	1.7
4	KGKS-04	1.8	2.1
5	GRKS-05	1.8	1.9
6	CHKS-06	1.3	2.3
7	NNKS-07	1.8	2.1
8	NKS-08	1.4	2.33
9	BGKS-09	2.2	2.82
10	CDKS-10	3.9	2.5

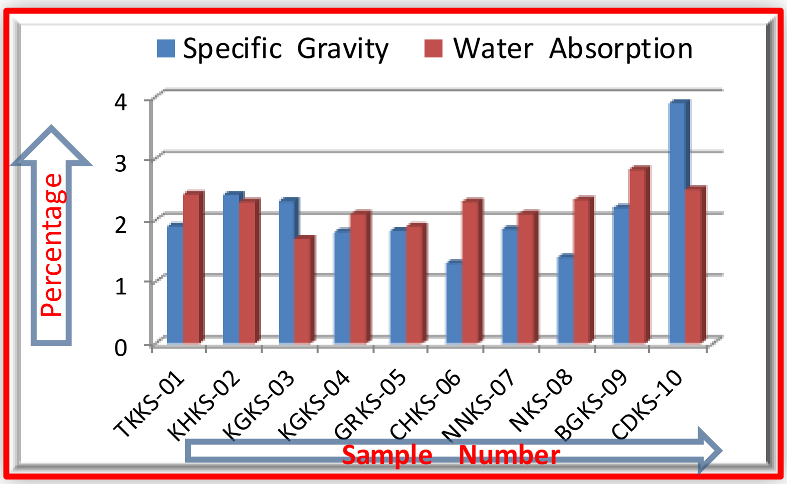

Fig 3.6 shows the Comparison Graph of specific gravity and Water Absorption from Lab-Data of the samples of Kamlial Sandstone.

Table 3.6 shows the comparison between Impact Test Values and Los Angles Abrasion resistance test values from Lab-Data of the samples of Kamlial Sandstone collected from study area.

S/N	Sample	Impact Values	Abrasion Values
1	PNKS-01	30	41
2	KGKS-02	19	67
3	CHKS-03	10.44	39
4	NKS-04	16	26
5	CDKS-05	32.5	34

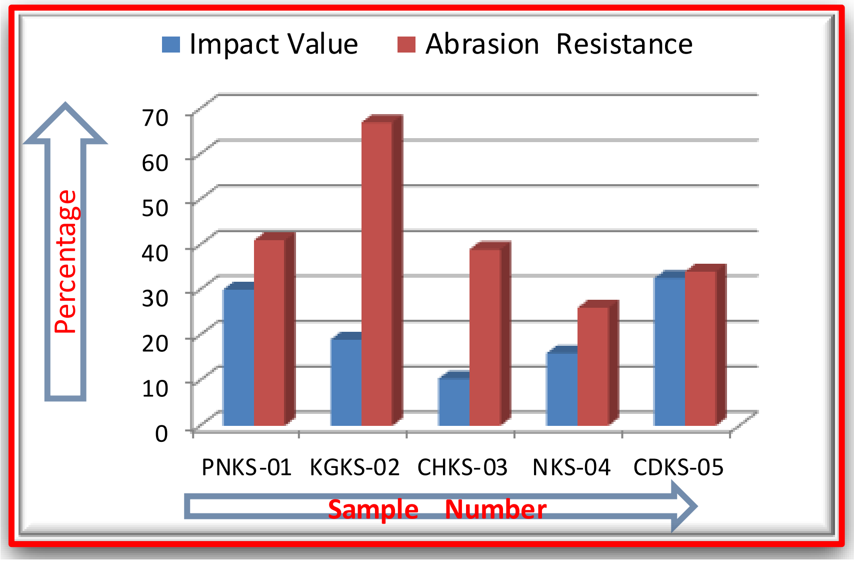

Fig 3.7 represents the Graph showing the relation between Aggregates Impact Values and Los-Angeles Abrasion Resistance values for the samples of kamlial Sandstone collected from Panjeera , Kand Gora, Chhechan and Nakar areas.

DISCUSSION

The Kamlial sandstone is coars grain sandstone with intraformational conglumerates . The kamlial sandstone is very loose. The sample were collected from kamlial Formation to know the , Impact value, specific gravity Water absorption and abrasion resistance of the aggregate to examine its strength to be used in roads construction.

ASTM	Classification
<10%	Exceptionaly Strong
10-20%	Strong
10-30%	Staisfactory
30-35%	Weak

Figure 4.1 Show the ASTM (American Society of Testing and Material) classification for Aggregate Impact values.

The data from the test show that the Kamlial sandstone from study area has Aggregate Impact value of 25.2 % which reflects its Satisfactory condition . The ASTM standard value is 30 %.

The Mechanical studies show that Abrasion Resistance of Kamlial Sandstones Is 41.4 percent which is greater than American Association of State Highway and Transportation Officials (AASHTO) standard value i.e The AASHTO standard value for Abrasion resistance of aggregates is 40 percent that is Abrasion Resistance value should not more than 40% percent.

The Apparent Specific gravity test results as an average of 2.1 percent which is less than ASTM (American Society of Testing and Material) standards that is between 2.6 - 2.9. The low specific gravity implies that clay content in sandstone is higher which degrade the sandstone. The values obtained through experiments show that these sandstone are not good as aggregates.

And the Water Absorption values from test results as a mean value of 2.24 percent , which is significantly greater than from ASTM standard value i.e 0.1-1.0 or 0.6 per unit weight.

The values obtained from aggregate tests do not qualifying ASTM abrasion, impact, and absorption values good. Should take action to avoid to use the Kamlial sandstone as aggregate.

CONCLUSION

The physical, mineralogical, mechanical and textural charcteristics were determined to know the grade of aggregates.

The mechanical investigations of Kamlial Sandstone are determined by the properties like Impact value, Los angeles abrasion resistance, Specific gravity and Water Absorption. This investigation indicates that the some samples of Kamlial Sandstone has aggregate Impact value in satisfactory condition while some samples of Kamlial Sandstone as Aggregate Impact value in weak condition whereas Specific gravity , Water Absorption and Abrasion resistance values do not qualify ASTM standard for aggregates and cannot be used for important structures .

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