Journal of Multidisciplinary Engineering Science Studies (JMESS)
ISSN: 2458-925X
Vol. 3 Issue 9, September - 2017

Provenance And Engineering Charaterization Of Ireje Stream Sediments, Ado-Ekiti, Nigeria

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***Abstract*—The study was carried out to determine the provenance of Ireje stream sediments in Ado-Ekiti and its gradation for engineering uses. Ireje stream is one of the popular channels of water flow in Ado-Ekiti. Sediment samples were collected at interval of 20m along the stream channel. The samples were washed, dried and subjected to sieve analysis. Histogram /frequency curve of sizes and gradation chart were plotted. The sorting and textural characteristic of the sediments revealed that Ireje sediments must be close to their source. They could have been deposited by high settling velocity since the sediments are majorly sandy and partly of gravel. Such sediments could be recommended for various engineering and sundry other industrial uses.**

Keywords—provenance, sediment, sorting, gradation, sand, gravel, industrial, engineering.

1. INTRODUCTION

Non-point source pollutants come from a number of sources and are washed into our waterways by surface runoff. When land disturbing activities occur, soil particles are transported by surface water movement. Soil particles transported by water are often deposited in streams, lakes, and wetlands. This soil material is called sediment. Sediment is the largest single nonpoint source pollutant and the primary factor in deterioration of surface water quality. Sediments are useful in activities such as road construction and maintenance, timber harvesting, mining, agriculture, residential and other commercial developmental projects. Sediment serves as a vehicle for the transport of many binding contaminants, including nutrients, trace metals, semi-volatile organic compounds, and numerous pesticides (U.S. Environmental Protecton Agency, 2000a). Moreover, sediment has been identified as a medium for the transport and sequestration of organic carbon, playing a potentially important role in understanding sources and sinks in the global carbon budget. (Stallard, 1998)

Ireje stream is one of the popular channels of water flow in Ado-Ekiti. The stream is located along Ado-Ijan road before Erinfun in Ago-Igbira area of Odo- Ado in Ado-Ekiti, Nigeria. Streams are capable of transporting even large boulders if they are waste laden with mud because mud increases the density of the fluid making the rock easier to transport. (Emilanni, 1997). Namblin and Christian (2004) explained that in a stream, sedimentary load is accomplished in varieties of ways such as when mud is carried in suspension. Particles that are too large to remain in suspension are move by sliding, rolling and saltation. Some iron are dissolved in the solution. Increase in discharge due to heavy rainfall or spring, snowmelt can flush out all the loose sand and gravel so that bedrock is eroded by abrasion. Martal *et al* (1998) characterized streams as perennial such as those at the tropical rain forest and other humid areas, intermittent streams whose seasonal varying flow relates to regular monsoonal rain or spring snowmelts to short lived ephemeral streams of the desert areas whose brief flood after local rain rapidly give way to dry sandy and rocky channels. It is customary in aggregate industry to process and stockpile aggregates in several size ranges, designated either as fine or coarse or by the size of the largest sieve retaining an appreciable percentage of the total particles. The supplier with aggregate separated according to size is prepared to supply whatever the market require. The mixture proportion can even be adjusted slightly during a project when condition requires it, (Marotta, 2005). The grains of most sediments are emplaced as solid particles in the fabric of the rock by the movement of fluids under the influence of gravity. They do not form in-situ. Rock thus formed may be said to have a hydrodynamic texture .The study highlighted the determination of the provenance of sediments and its gradation for engineering uses.

2. METHODOLOGY

ASTM (American Standard for Testing and Measurement) 136, sieve or screen analysis of fine and coarse aggregate was used for the analysis of the sediment samples collected. Eight samples of stream sediment were collected at interval of 20m along the ireje stream channel. They were put in cellophane bags and labeled. At the laboratory, 1000 grams of each are weighed on a weighing balance. Fines are removed with a running tap water through a sieve aperture size of 30microns. The left over are then dried in oven for 48 hours. 500grams of the leftover of each of the sample are them made to pass through ascending sieves arrangement of aperture seizes; 9.50mm, 4.75mm, 2.36mm, 1.18mm, 0.425mm, 0.60mm, 0.30mm, 0.15mm and 0.075mm. The entire arrangement was shaken for 10mins with a sieve shaker. The weight of the sample retained by each sieve was recorded. The gradation curve which was plotted as shown in Figure shows the aggregate's relationships.

3. RESULT AND DISCUSSION

The weight of the samples retained by each sieve was recorded and shown in Tables 1-8.

Table 1: Result of sieve analysis of sample 4 from locality 4 at Ireje stream

Volume of sieve aperture(mm)	No of sieve (mm)	Weight of sieve (g)	Weight of sieve + soil	Wt of soil retained (g)	% retained	Cumulative weight %	% passing
-3.5	9.50	499					
-2.0	4.75	548	569	21	5.32	5.32	94.68
-1.0	2.36	492	544	52	13.17	18.49	81.51
0.2	1.18	461	576	115	29.11	47.67	52.33
0.5	0.60	424	576	120	30.38	77.98	22.02
1.0	0.425	402	544	42	10.63	88,61	11.39
1.5	0.30	410	544	30	7.60	96.21	3.79
2.8	0.15	329	340	11	2.79	99.0	1.00
4.0	0.075	314	318	4	1.01	100.00	0.00
				395			

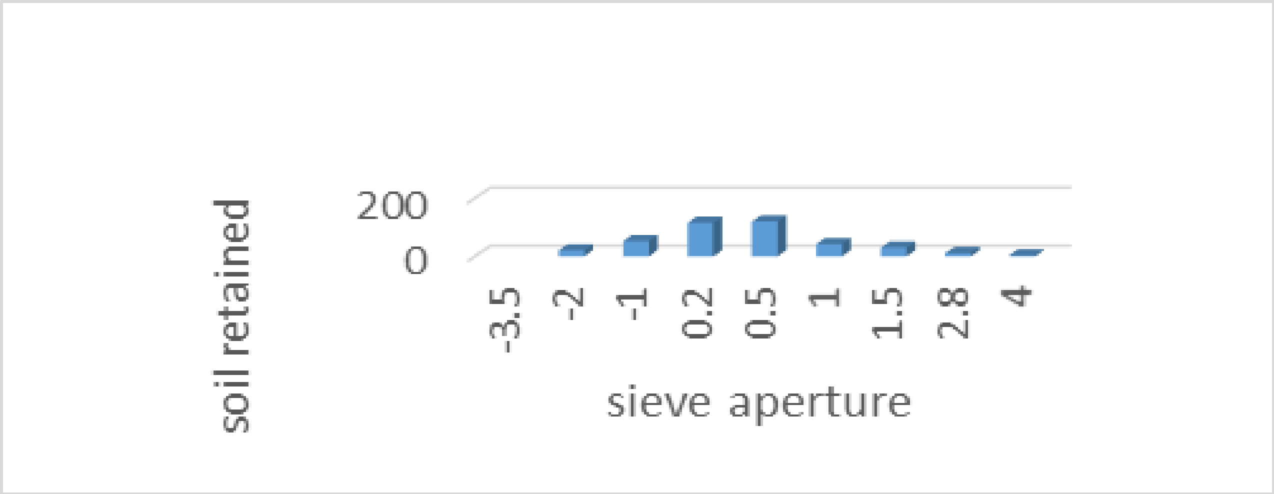

Figure 1a

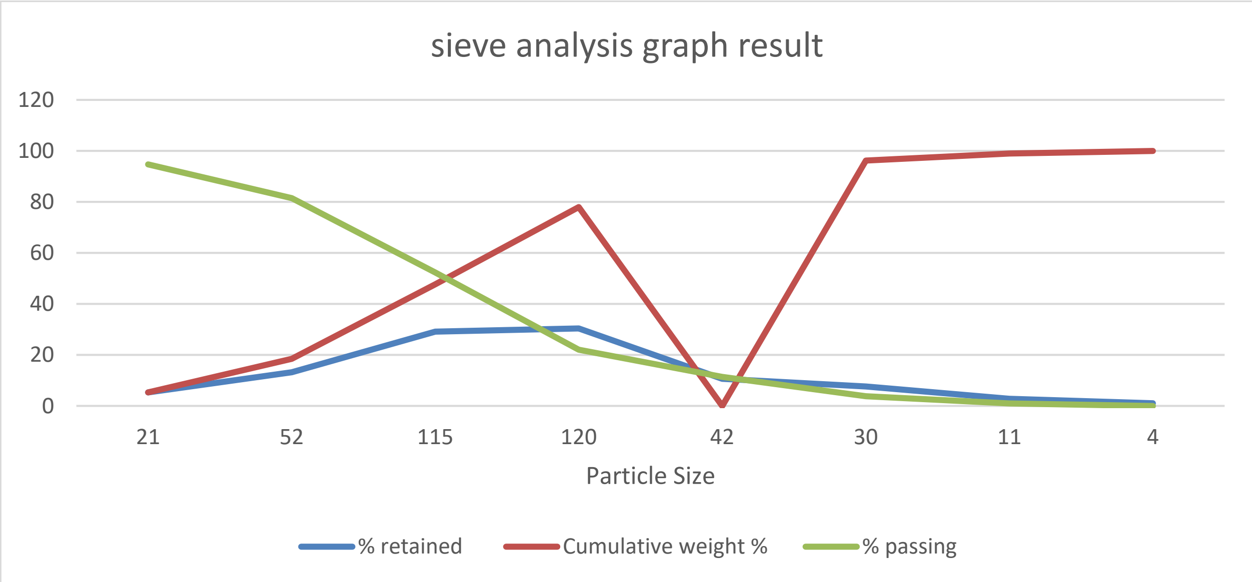

Figure 1b: Graph of sieve analysis Test.

Table 2: Result of sieve analysis of sample 5 from locality 5 at Ireje stream

Volume of sieve aperture(mm)	No of sieve (mm)	Weight of sieve (g)	Weight of sieve + soil	Wt of soil retained (g)	% retained	Cumulative weight %	% passing
-3.5	9.50	499					
-2.0	4.75	548	551	3	1.32	1.32	98.68
-1.0	2.36	492	497	5	2.20	3.52	96.48
0.2	1.18	461	489	28	12.34	3.52	96.48
0.5	0.60	424	518	94	41.41	57.22	42.78
1.0	0.425	402	458	56	24.61	81.94	18.06
1.5	0.30	410	442	32	14.10	96.04	3.96
2.8	0.15	329	330	1	0.44	96.48	3.52
4.0	0.075	314	322	8	0.32	100.00	0.00

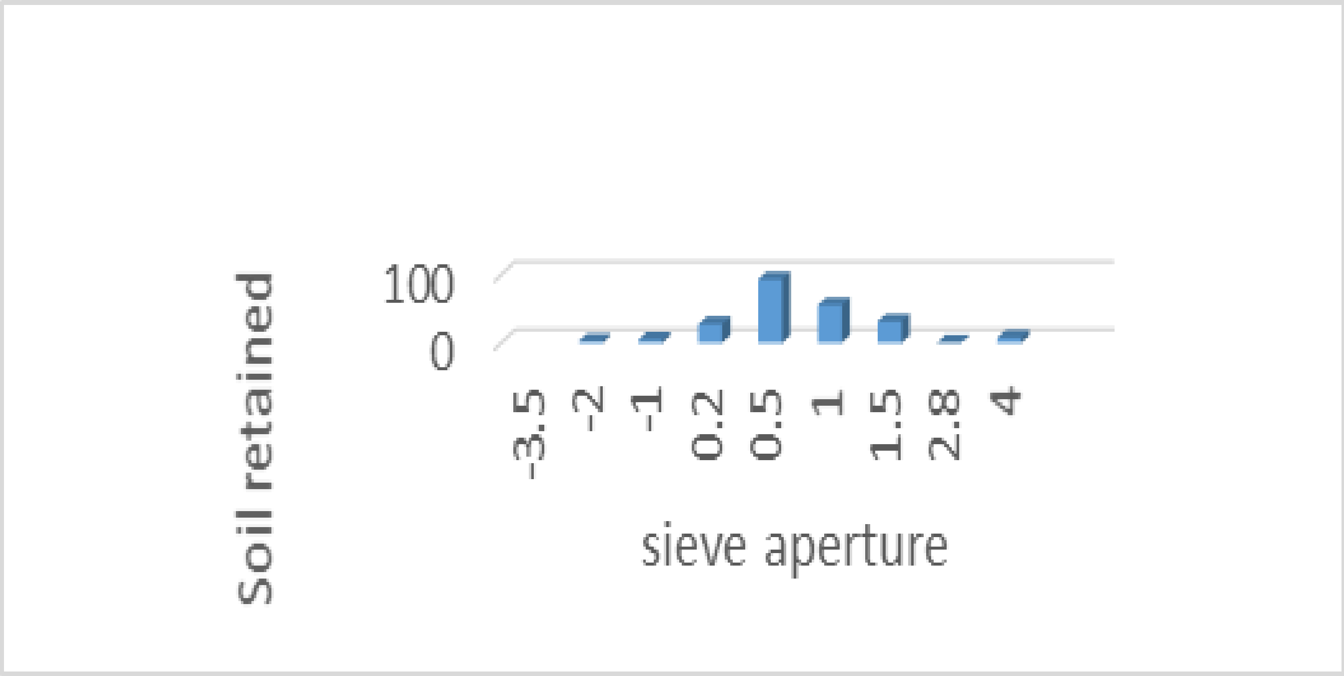

Figure 2a

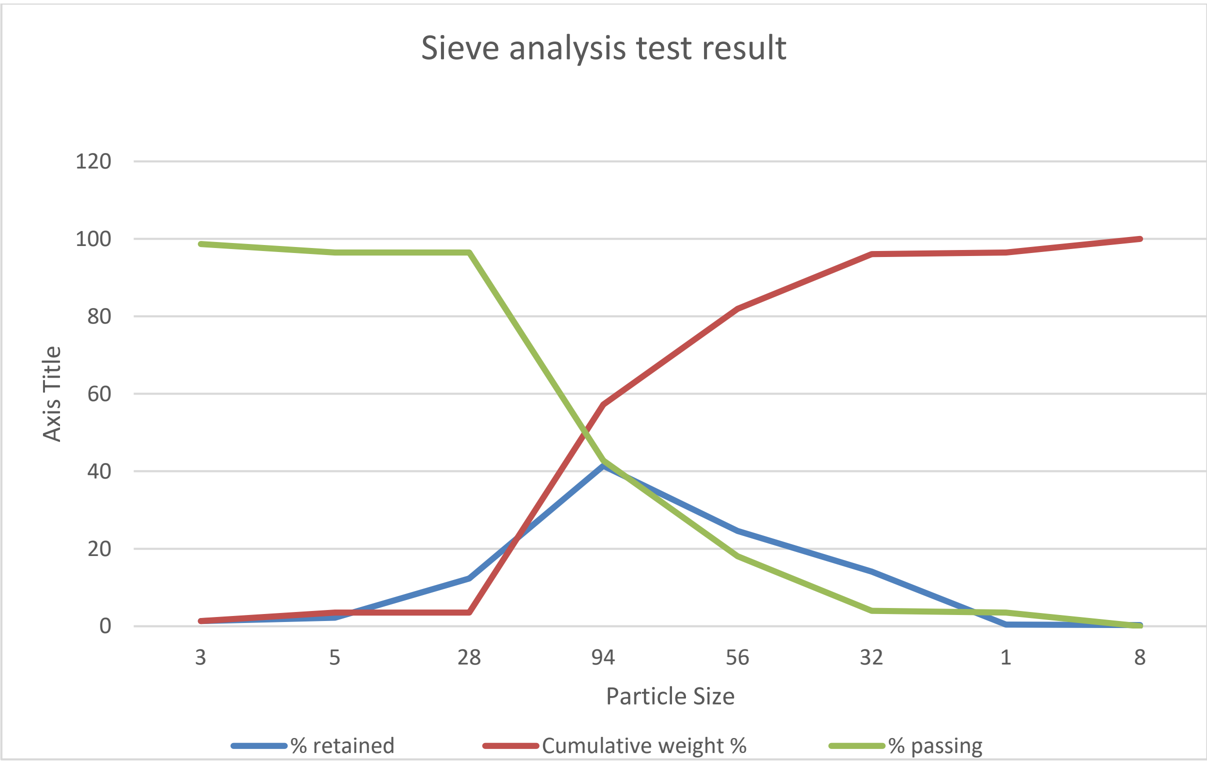

Figure 2b: Graph of sieve analysis Test.

Table 3: Result of sieve analysis of sample 6 from locality 6 at Ireje stream

Volume of sieve aperture(mm)	No of sieve (mm)	Weight of sieve (g)	Weight of sieve + soil	Wt of soil retained (g)	% retained	Cumulative weight %	% passing
-3.5	9.50	499					
-2.0	4.75	548					
-1.0	2.36	492	495	3	1.44	1.44	98.56
0.2	1.18	461	482	21	10.10	11.54	88.46
0.5	0.60	424	517	93	44.71	56.25	43.75
1.0	0.425	402	458	56	26.92	83.17	16.83
1.5	0.30	410	435	35	12.02	95.19	4.81
2.8	0.15	329	335	6	2.89	98.08	1.92
4.0	0.075	314	318	4	1.92	100.00	0.00

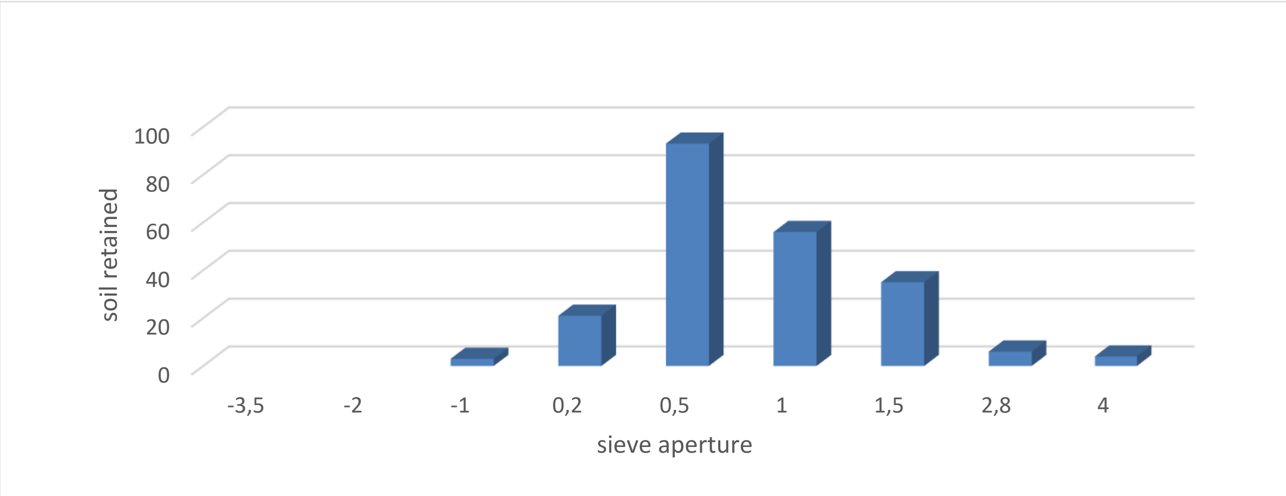

Figure 3a

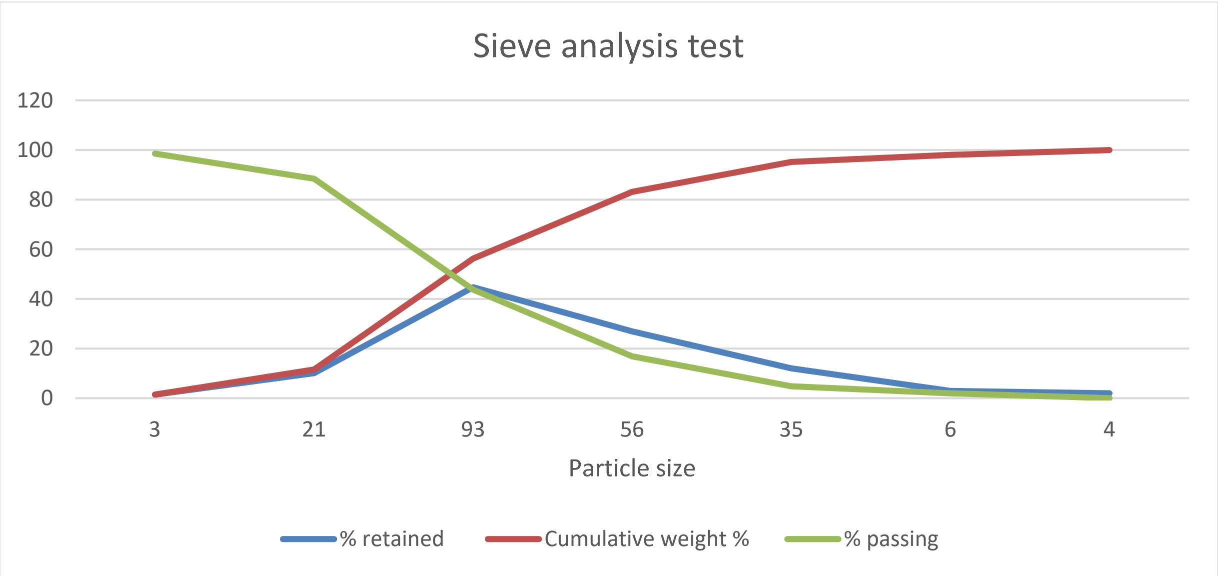

Figure 3b: Graph of sieve analysis Test.

Table 4: Result of sieve analysis of sample 7 from locality 7 at Ireje stream.

Volume of sieve aperture(mm)	No of sieve (mm)	Weight of sieve (g)	Weight of sieve + soil	Wt of soil retained (g)	% retained	Cumulative weight %	% passing
-3.5	9.50	499					
-2.0	4.75	548					
-1.0	2.36	492					
0.2	1.18	461	456	4	1.75	1.75	98.25
0.5	0.60	424	458	34	14.85	16.60	83.40
1.0	0.425	402	471	69	30.13	46.73	53.27
1.5	0.30	410	484	74	32.31	79.04	20.96
2.8	0.15	329	364	35	15.58	94.32	5.68
4.0	0.075	314	327	13	5.68	100.00	0.00
				229			

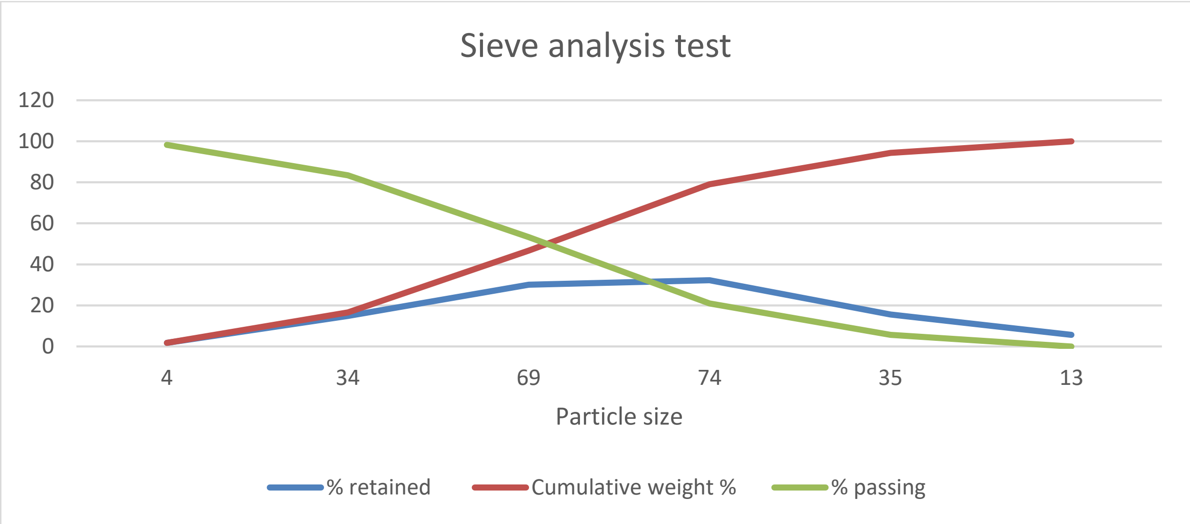

Figure 4: Graph of sieve analysis Test.

Table 5: Result of sieve analysis of sample 8 from locality 8 at Ireje stream.

Volume of sieve aperture(mm)	No of sieve (mm)	Weight of sieve (g)	Weight of sieve + soil	Wt of soil retained (g)	% retained	Cumulative weight %	% passing
-3.5	9.50	499					
-2.0	4.75	548	550	2	0.73	0.75	99.25
-1.0	2.36	492	497	5	1.81	2.54	97.46
0.2	1.18	461	488	27	9.78	12.32	87.68
0.5	0.60	424	512	88	31.88	44.20	55.80
1.0	0.425	402	465	63	22.83	67.03	32.97
1.5	0.30	410	456	46	16.67	83.70	16.30
2.8	0.15	329	350	21	7.61	91.31	8.69
4.0	0.075	314	338	24	8.70	100.00	0.00
				276			

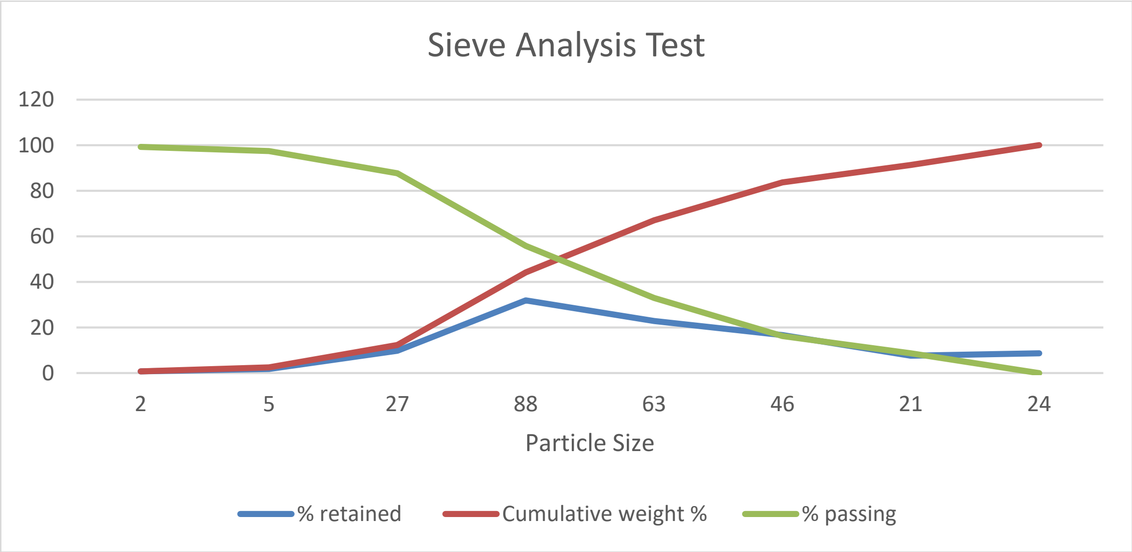

Figure 5: Graph of sieve analysis Test.

The grain size distribution of sediments in locations 1 to 8 are shown in figures 1 to 8

3. ANALYSIS OF RESULTS:

The histogram representation of the sieve analysis for Ireje stream reveals that sieve aperture size 0.5 retained highest percentage of sediments in most of the samples, (Tables 1, 2,3 and 5). In average, 14.36% was retained by sieve of diameter 0.5mm an indication that the Ireje stream sediments are sandy when correlated with Tables of size classification and nomenclature of non-carbonate fragmental deposits (Greensmith, 1978).

Most of the histogram representation of the sediments are unimodal (Figures 2, 3, 4 and 5), this shows that they are well sorted meaning that the grains of Ireje sediments are having approximately uniform sizes. An exception to this in Figure 1 which dips sharply on particle size 42mm.

Majority of the sediments present a steep cumulative curve (Figures 2,3,4 and 5) indicating a perfect sorting found to be characteristic of water-laid deposits of delta forest beds and the gravels of sea beaches (Greensmith, 1978).

4. CONCLUSION :

It has been shown from the study that the sediments are well sorted and originated from a source. The gradation shows that it is majorly sandy and partly gravel hence, it is recommended for mining for appropriate engineering and industrial uses and should be graded where necessary.

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