

Suitability of Some Tigris Flood Plain Deposits as Impervious Fill Type "A" Class CL for Lining

Duraïd B. Deikran

Kirkuk University, College of Science, Applied geology Department

Abstract:

This paper evaluates the suitability of using some flood plain deposit between Samara and Tikrit as impervious blanket to prevent the leakage of water.

The scope of work includes: engineering geological evaluation of the study area, picking and testing samples and the final decision to accept or reject the sampled area according to well-known standards.

Introduction

The economical aspect was behind this study. Extracting, powdering, mixing and moisten the crude material near the outcrop area, besides the in-situ testing, cost a lot money especially when the outcrop area is far from project area, as it was. On the contrary the flood plain deposits don't need the former activities except digging and testing the material and thus, it has relatively low cost.

The sampled area is located within the Upper Mesopotamian Zone of the Unstable Shelf Area according to Buday and Jassim, (1987). It is located (13) Km. NW of Samarra city, near Baghdad-Mosul highway, within Tigris River flood plain deposit, (Figure 1A & 1B)

Generally Tigris flood plain forms narrow strip along Tigris River otherwise the vast area surrounding Tigris River between Baiji and Samarra area falls within Al-Fatha alluvial fan, Jassim, 1979. The flood plain deposit consists of coarse and fine clastics i.e. sand, silt and clay but the near by area toward the course of the river is covered by coarse sand and gravel on the surface. Barwary and Slewa, 1991 distinguished, in addition to the mentioned units, slope sediments and valley and depression fill deposits, (Figure 1B).

Field observation shows that Al-Fatha alluvial fan consists, depth wise, of 0.5-3.0 meters of high gypsiferous fine clastics, maximally reaches 5.0 meters in some localities, mantled by scattered gravel on the surface. The mentioned fine clastics is followed by conglomerate of variable thickness, (3- 15) meters thick, composed of igneous and sedimentary grains of coarse sand, granule and cobbles. It is packed by sand and gypsiferous fine clastics as cementing material. In some domestic water wells the Miocene and Pliocene sediments (Injana and Mukdadiya Formations) are exposed at the base.

The high gypsum content makes the /target/ (fill type “A” class CL) impossible within the mentioned fan because it mismatches with standard. Consequently, the idea of studying flood plain deposits as (Target) comes from the fact that the flood plain deposits, in general, have different varieties of clastic sediments i.e. clay, silt sand, and occasionally gravel with insignificant percent of gypsum.

There are rare related studies to the present work, for instance Artin and Hafidh (1998) studied the possibility of some localities which fits with the /target/ in Baiji area (to the north of the sampled area). The result was: none of the tested samples were accepted for the mentioned /target/. The only solution was to mix and add certain component or components which are deficient in the excavated sediments followed by permanent quality control for prepared stacks.

As far as the author knowledge, few attempts were found to be restricted to bed rock but none of them touch flood plain deposits in the study area.

The aim of the present paper is to assess the possibility of using some of Tigris flood plain deposits Fill Type "A" Class CL for Lining

The present study shows that it is not possible to use the sampled area of the Tigris flood plain deposits, in the studied area, as impervious fill because most of the samples mismatch the standards unless other samples have to be tested.

Finally the studied samples were tested at the laboratories of *General Company of Geological Surveying and Mining*

Scope and Steps of work

Usually, in such type of work, the results of various tests and analysis are compared with international standards (U.S.C.S.) by the way of plotting the numerical results on standard curves. For chemical analysis the numerical results are directly compared with standards. The standards include:

1-A.S.T.M. standards concerning Atterberg limits and as follows;

Liquid limit =25-45

Plastic limits=10-25

2-U.S. Bureau of soil classification and as follow:

A-Weight percentage of clay= (14-34) the ideal is 24%

B-Weight percentage of silt= (18-38) the ideal is 28%

C-Weight percentage of sand= (33-53) the ideal is 43%

D-Weight percentage of gravel=5%

3-BS 1377 Standard for chemical analyses: Percentage of gypsum do not exceed 5%

The scope and step by step procedures can be summarized as follow:

1-Field work: Nine Channel samples were collected from hand dug pits of 1-3 meters in depth and 2 meters as an average depending on water table depth. Each sample was numbered and put in nylon bag.

2-Laboratory works: This includes the following tests and analyses

A-Grain size analysis aimed at determining weight percentages of different soil components. This test is used to draw and compare the grading curve of each sample with the standard grading curve of fill type A. It includes sieve analysis for coarse grain material (gravel, sand) and hydrometer test for fine grained materials (silt and clay)

B-The Atterberg limits test includes: the determination of: liquid limit, plastic limit and plasticity index. The mentioned tests are used to determine type of the studied soil (Unified soil classification system=USCS)

C-Chemical analysis was carried out to determine for gypsum percent.

3-Desk study: It involved the following steps:

A-The results of the mentioned tests and analyses were plotted or compared with standard diagrams and standards values respectively.

B-Plotting the results of Atterberg limits on plasticity chart to classify the fine soil according to Unified soil classification system.

C-Plotting the results of grain size analysis on semi-log paper to get the soil grading curves and comparing them with standard grading curves of fill type A.

D-Comparing the result of chemical analysis (soluble gypsum %) with standard value

Results and Discussion

1-The studied samples lie above line A, ($PI = (0.73(LL\% - 20))$), and within the domain of CL type of soil, (Figure 2). Hence, all samples are of CL type.

2-There is two samples where liquid limit larger than 45% (the maximum limit of the standard), these are sample number (1 & 6), (Table 1 & Figure 2)

3-All samples have plastic limit within the range of the standard 10%-25% (Table 1).

4-Eight samples have weight percentage of clay higher than the standard (14-34)%, these are (1,2,3,4,5,6,7,8), (Table 1).

5-There is four samples (1, 4, 5, 6,) have weight percentage of silt higher than the standard (18-38) % (Table 1).

6-Eight samples have weight percentages of sand less than the standard (33-53) % (Table1).

7-No gravel was recognized in the studied samples.

8-All samples have gypsum percentage less than the standard 5%.

9-The grain size distribution curves (Figure 3) shows that none of curves matches the standard curve

Conclusions

1-For plasticity chart two samples mismatches the standard. For grain size distribution curves all samples fail to be within the standard.

2-Accordingly, the sampled area cannot be used for this type of deposit unless more samples should be tested.

3-The studied samples have low content of gypsum which is conformable with standards.

References:

ASTM standards, 1969, Bituminous material for highway construction, water proofing and roofing, soils and skid resistance, part 2

Barwary, A.M. and Slewa, N.A., 1991, The Geology of Samarra Quadrangle, sheet NI-38-6, GM-14 scale 1:250000, unpub.rep. No. 2316, Geosurv. Lib., Baghdad.

Buday, T. and Jassim, S.Z., 1987, The Regional Geology of Iraq vol.2, Tectonism, Magnetism & Metamorphism, Kassab, I.I.M, & Abbas, M.J.(edit.), GEOSURV. Pub., Baghdad, 351p.

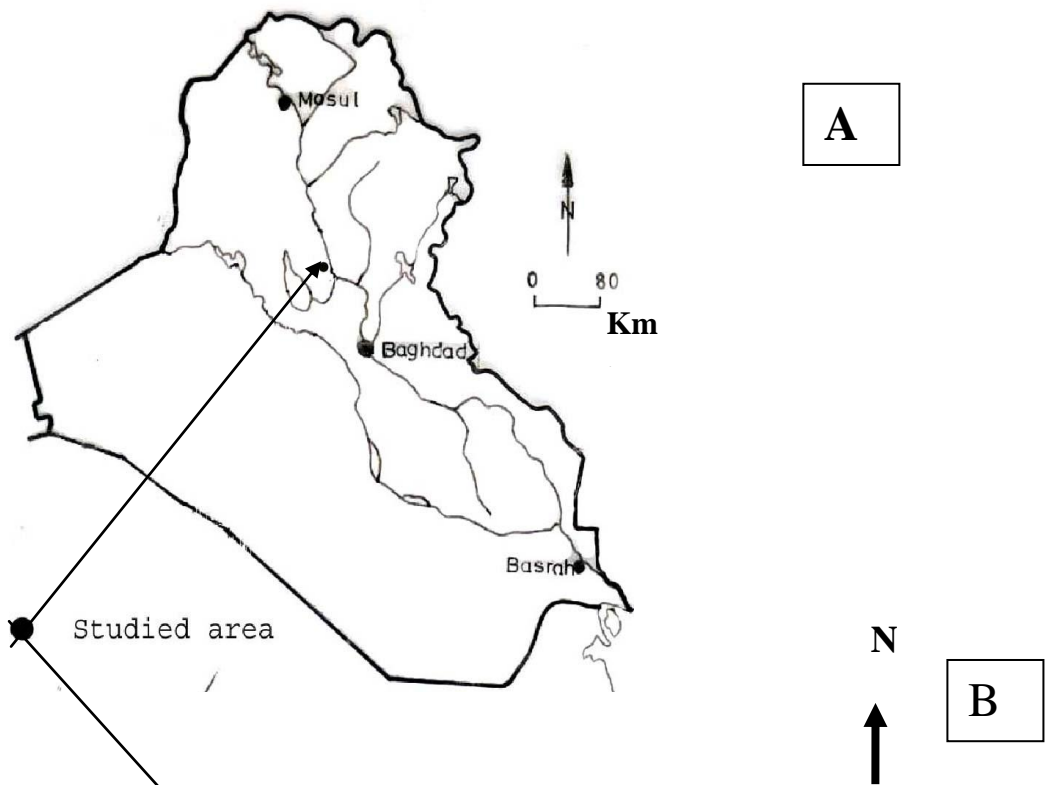
BS 1377-3:1990, Method of test for soil for civil engineering purpose, chemical and electro-chemical.

Jassim, S. Z., 1979, Early Pleistocene gravel fan of the Tigris River from Al-Fatha to Baghdad, Jour. Geol. Soc. of Iraq: 14:25-34.

US bureau of reclamation 1960, Design of small dams, US government printing office.

Singh, B. and Prakash, S., 1976, Soil Mechanics and Foundation Engineering, 4th edition, Roorkee press, Roorkee (u.p), India, 564p

آرتين، أ. و حافظ، ش.ك، ١٩٩٨، التحري عن الترب الصالحة لتبطين احواض معمل ا سمدة
بيجي. مكتبة الشركة العامه للمسح الجيولوجي والتعدين بغداد.



Scale: 1:350000

Legend

- Q f **Flood plain deposits**
- Q vdf **Valley & depression fill deposits**
- Q s **Slope Sediment deposits**
- Q alf **Al-Fatha alluvial fan deposits**
- Paved road**
- Town and city**
- The study area**

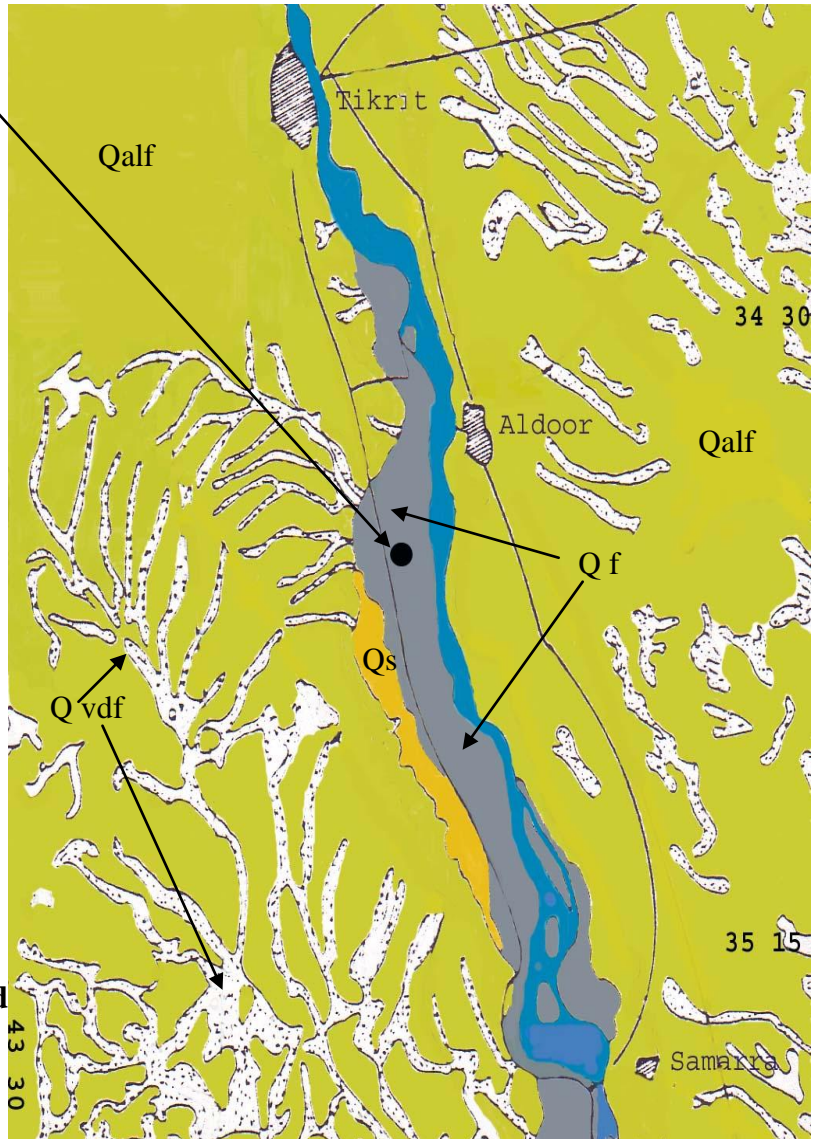


Figure 1: Location and geology of studied area, A) location map, B) Geologic map of the studied area and its surrounding, from Barwary and Slewa, 1991

Table 1: The results of the Atterberg limits, grain size and chemical analyses

Sample Number	Atterberg limits				Grain size analyse			Chemical composition
	Soil type (USCS)	Liquid limit %.	Plastic Limit%	Plasticity Index %	Weight % Of clay	Weight % Of Silt	Weight % Of Sand	gypsum %
1	CL	46.34	24.92	21.42	49	46	05	0.65
2	CL	28.00	17.60	10.40	40	36	24	0.54
3	CL	27.11	16.50	10.61	35	37	28	3.98
4	CL	37.11	23.48	13.63	51	39	10	2.04
5	CL	33.64	20.59	13.05	42	43	15	2.26
6	CL	46.78	23.23	23.55	48	47	05	0.27
7	CL	28.01	16.90	11.11	41	27	32	0.60
8	CL	31.28	18.31	12.97	39	31	30	0.65
9	CL	28.75	17.90	10.85	34	33	33	0.39

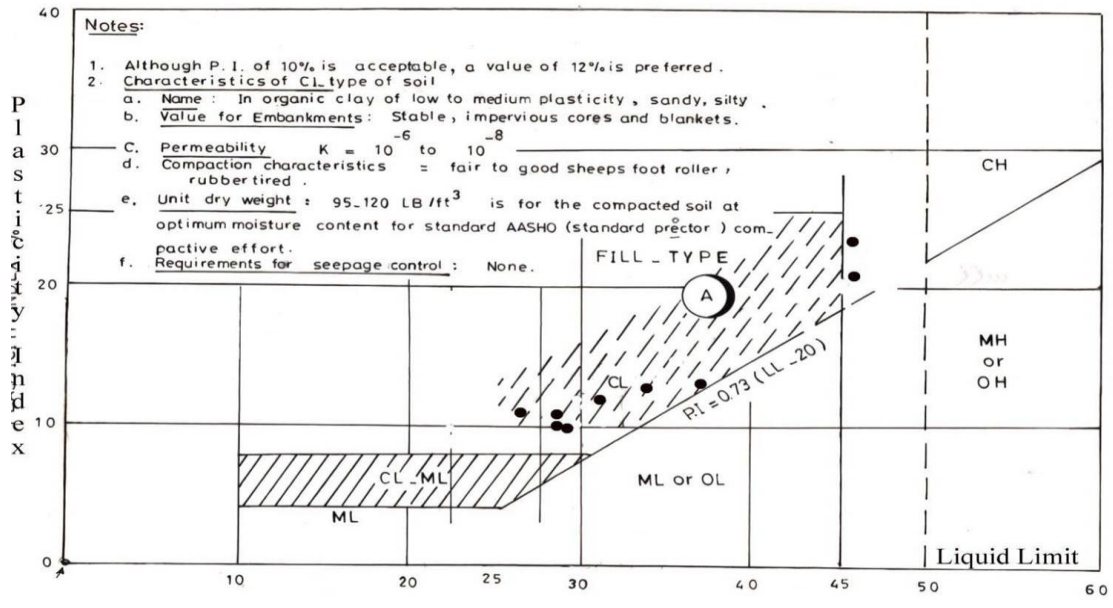


Figure 2: Location of samples on plasticity chart, two samples lies out of fill type A region.

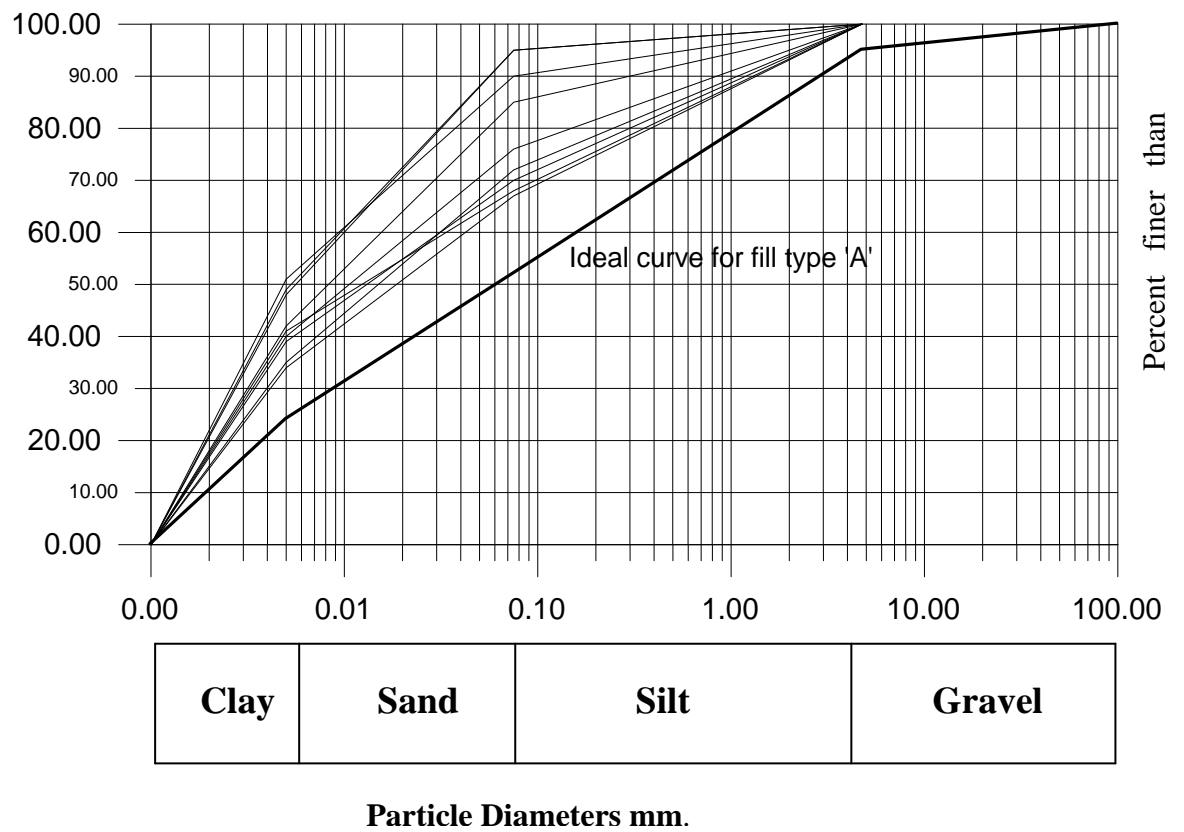


Figure 3: Grain size distribution curves of the studied samples, original graph is from Prakash, 1976.

المستخلص:

هذا البحث يقيم ملائمة استعمال بعضا من ترسبات السهل الفيضي بين سامراء وتكريت كبطانه غير نفيذه لمنع نزوح الماء. محتوى البحث يتضمن تقييم منطقة الدراسة من الناحية الجيولوجيه الهندسيه و التقاط وفحص النماذج و القرار النهائي لقبول او رفض منطقة الدراسة استنادا الى المواصفات القياسيه.