DUNES STABILIZATION USING EMULSION MATERIAL

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Abstract

Bituminous stabilization proper is used with non-cohesive granular material-where the bitumen adds cohesive strength; and with cohesive materials-where the bitumen "waterproofs" the soil thus reducing loss of strength with increase in moisture content. Both effects stem partly from the formation of films around the soil particles, which stick them together and prevent the absorption of water. Direct shear test and C.B.R. were carried on the non-cohesive sample soil, and found that 6% from emulsion material at 3 days curing time was suitable percent to improve the adhesion parameter and for economical coast.

1. Introduction:

Soil stabilization by incorporation of an admixture such as bitumen is becoming the subject of many research projects, as this type of stabilization has important application in the construction of both pavements and buildings. Investigations were under-taken to determine whether or not the proportions of bitumen could be reduced and the stabilization process by this method made more economical.

Mixing bituminous material with soil may either bind the particles together or it may waterproof the soil, thus preserving the bonding action of water films between the particles, or both these effects may occurs together (1).

Stabilization with asphalt is very satisfactory for granular soils, while using asphalt with plastic soil is however sometimes limited due to mixing and construction difficulties, therefore only liquid bitumen materials are suitable for stabilizing cohesive soils (2).

The mechanisms of stabilization with bituminous materials consist of adding cohesive strength and reducing water penetration by the physical presence of the bitumen, no chemical interaction with the soil is necessary to the process. But too much bitumen, causes loss of strength by lubricating particles and preventing interlock (1,3,4).

Bituminous emulsions are generally only suitable for soil stabilization in climates where rapid drying conditions occur, since this is equivalent to adding water to the soil as well as a bituminous binder. In dry conditions, the water in the emulsion may be an advantage since it helps to provide part of the optimum fluids content for compaction.

In hot dry climates the soil is often at low moisture content and there is a correspondingly larger field for the use of fluid stabilizing agents.

The main use of bituminous- stabilizing soil for roads has been in the construction of bases for lightly trafficked surface- dressed roads. For some main roads having concrete or bituminous surfacing, bituminous materials have been used to waterproof the subgrades and thus preserve their stability.

Since bitumen is also used for the stabilization of soil for road construction (2). Particularly in water logged or sandy areas, and also for the preparation of improved mud mortar (1,2), and sun dried bricks, laboratory experiments were

conducted to study the effect of bituminous emulsions on the strength parameters for soil stabilization.

Addition of the bituminous stabilizer reduces the need for water to be added for compaction. And this may be a considerable advantage in very dry condition although the maximum density, will be reduced. because for any compacted density, the higher the bitumen content the less the absorption
and loss of strength on soaking compared to the untreated material. And because beyond a certain level the strength decreases and the material may be impossible to compacted (when the fluid content is such as fill the voids completely preventing particle interlock), the total volatiles content is important (1,6,7).

2. Materials used and Methods of Testing

2.1 Emulsified Asphalt

Emulsified asphalt may be defined as dispersion of asphalt particles, around 3Mm in size in water in the presence of an emulsifying agent and divided in to three categories: anionic cationic and nonionic. The anionic and cationic terms refer to the negative and positive electrical charges respectively imparted to the asphalt particles emulsifying agents. With nonionic emulsions, the bitumen particles are neutral. Emulsions are further classified on the basis of how quickly the asphalt will coalesce(5):-

1. Rapid- Setting (RS).
2. Medium- Setting (MS).
3. Slow- Setting (SS).

The emulsions break down when sprayed or mixed with mental aggregate in a field construction process. The water is removed, and the asphalt remains as a film on the surface of the aggregate.

Asphalt emulsions are steadily replacing cutbacks in many areas because of concerns for energy conservation (it can be used without additional heat), environmental pollution, and economy of construction (5).

Emulsions are especially suited for arid region since the water of emulsions will provide moisture necessary for compaction. The climatic condition such as temperature affects the choice of binder. In heavy warm weather rapid setting tends to set too rapidly and therefore should not be used. In cold weather heavier grades of liquid asphalt are suitable.

Both anionic and cationic emulsions depend upon the evaporation of water for the development of their adhesion and curing characteristics although perhaps the principle advantage of cationic is their ability to give up water faster immediately upon application. The rate at which breaking occurs is dependent upon the atmospheric temperature, relative humidity, wind velocity and the rate and method of emulsion application.

Sand was used for testing and graded as Fig. (1) were testing particle size distribution under ASTM, D421-58.

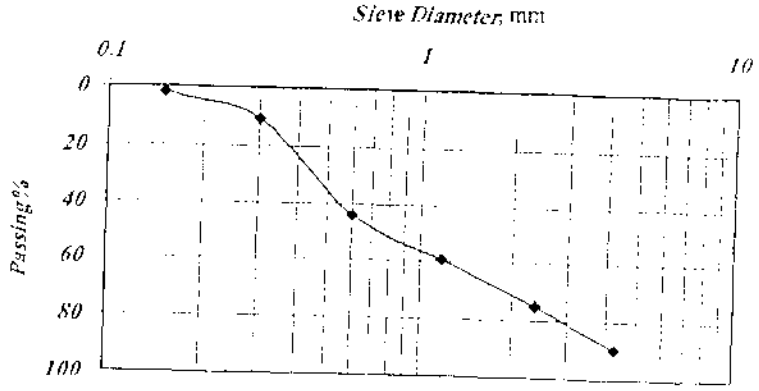


Fig.(1) Sieve Analysis

2.2 Direct Shear Test

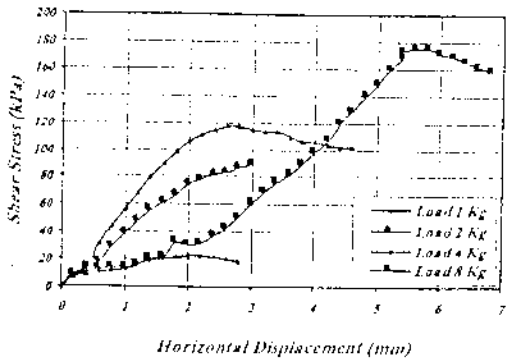
The shear strength and angle of internal friction for samples mixing with percentage of emulsion were test by direct shear under ASTM, D 3080- 72. After curing time (1-day), the samples were tested, and the Figs. (2,3,4,5,6,7) summarization of data of test. From the figures, it would find that increase of percent of emulsion, will increase, of shear strength and decrease in angle of friction.

2.3 California Bearing Ratio C. B. R. Test

The purpose of the test is to get the bearing ratio, which is used in the design of pavements of highways and airports, and also to get penetration due to known load. The results can simulation from the Figs. (7,8,9,10,11,12,13,14). We can see that the suitable test for soil stabilization with emulsion for road construction or dunes stabilization is the C.B.R test. From Table 1; a 6% of emulsion is a suitable percent for strength improvement, thus the unit weight of soil increase with increasing of percent of emulsion until it reach 6% after which it was decreased.

Curing time (Figs. 7, 8 and 9) was more effect on results of samples comparing with other conditions. Dry unit weight in place was increasing with increase curing time for chose percent from emulsion and then will be more near value.

C.B.R. values was increase with increasing curing time, that mean the dry unit weight in place is increase and then the strength of soil will be increase.



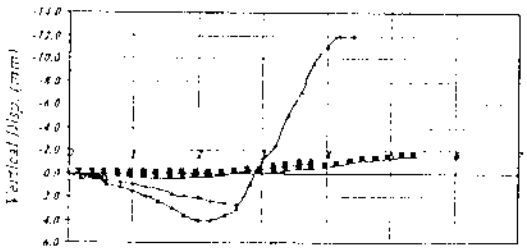
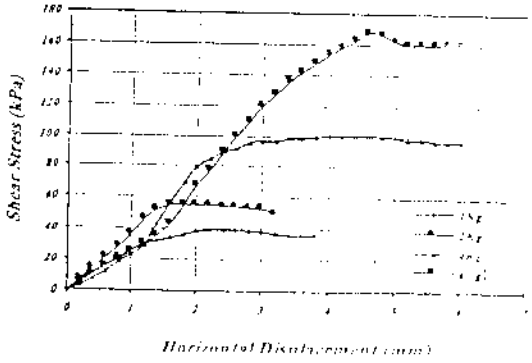


Fig. (2):Direct Shear Test - 2% of Emulsion Mixing



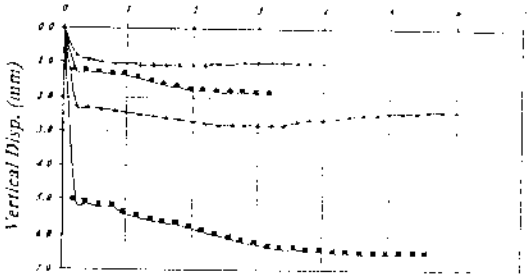
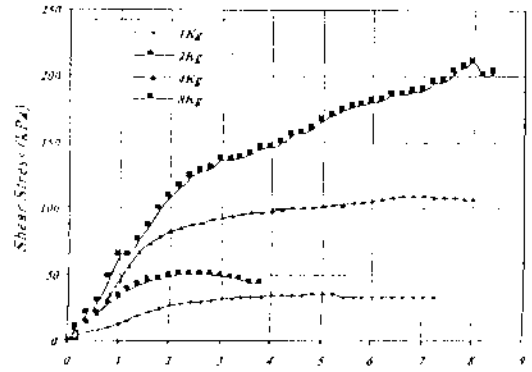


Fig. (3): Direct Shear Test - 4% of Emulsion Mixing



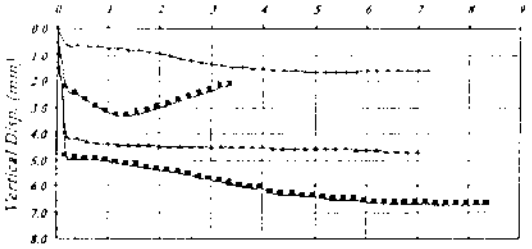


Fig. (4): Direct Shear Test - 6% of Emulsion Mixing

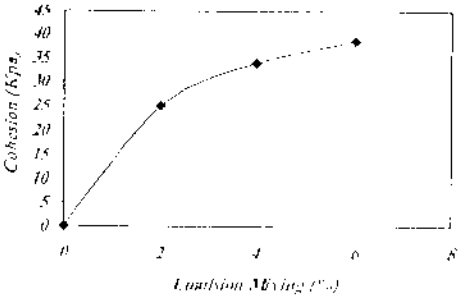


Fig.(5) Relationship between Cohesion Strength and Emulsion Mixing

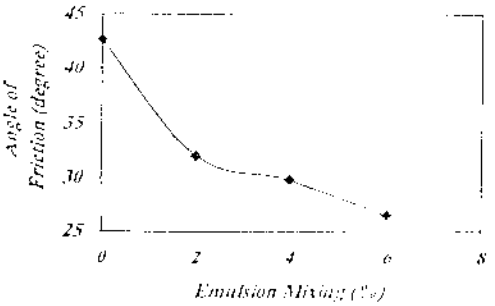


Fig.(6) Relationship between Angle of Friction and

Table -1- Compaction Test Results

Emulsion	*0.02*	*0.04*	*0.06*	*0.08*	*0.1*
W_{gm}	*5936.26*	*5936.26*	*6935*	*7190*	*6725*
V_{cc}	*3249.734*	*3249.734*	*3249.734*	*3249.734*	*3249.734*
γ_{wet}	*1.827*	*1.827*	*2.134*	*2.212*	*2.069*
W_{wet}	*18.07*	*12.08*	*29.29*	*21.02*	*26.45*
W_{dry}	*17.78*	*11.84*	*28.66*	*20.4*	*25.82*
$W_{cont.}$	*6.26*	*6.25*	*12.87*	*9.82*	*12.8*
%O	*2.517*	*4.29*	*3.989*	*5.86*	*4.838*
γ_{dry}	*1.782*	*1.893*	*2.052*	*2.089*	*1.9*

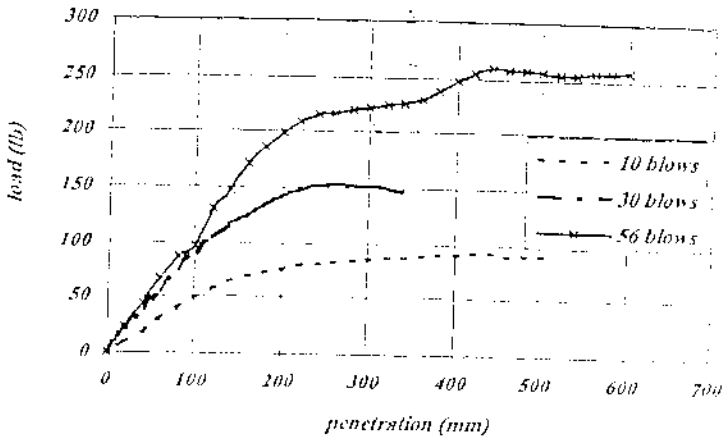


Fig.(7) CBR for One Day

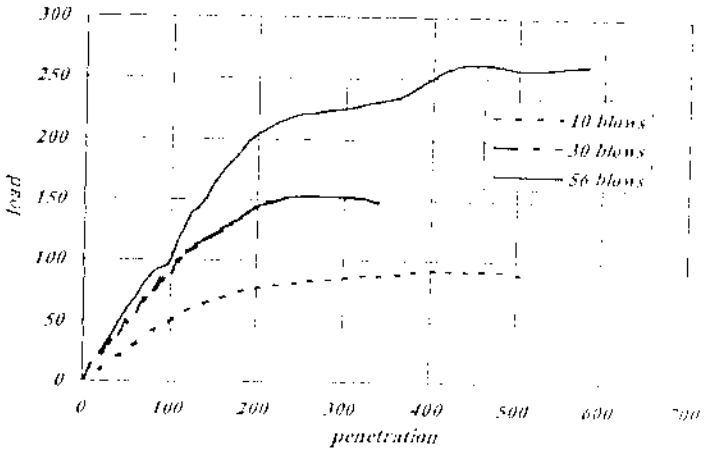


Fig.(8) CBR forThree Days

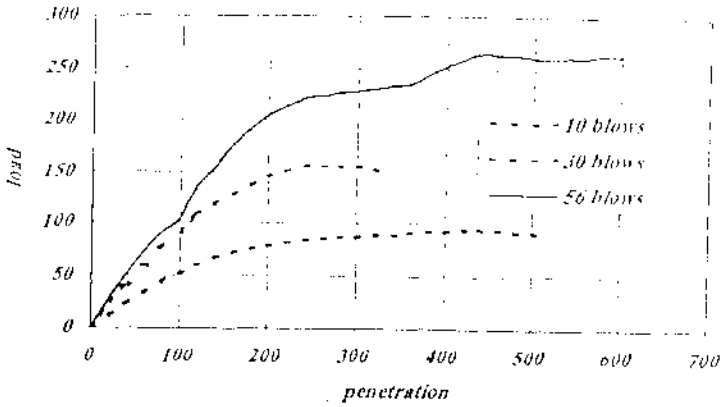


Fig.(9) CBR for Seven Days

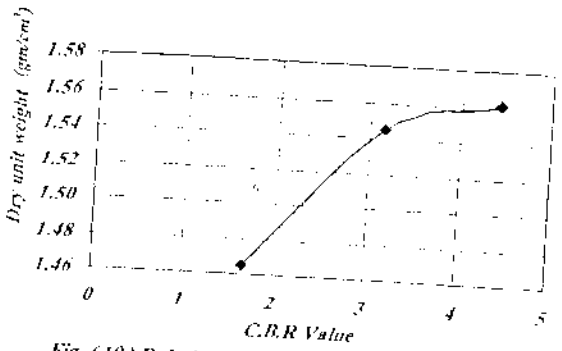


Fig. (10) Relationship between Dry unit weight and C.B.R Value for 1-Day Curing

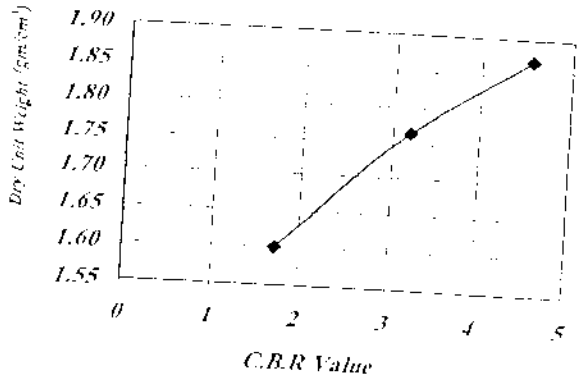


Fig. (11) Relationship between Dry unit weight and C.B.R Value for 3-Day Curing

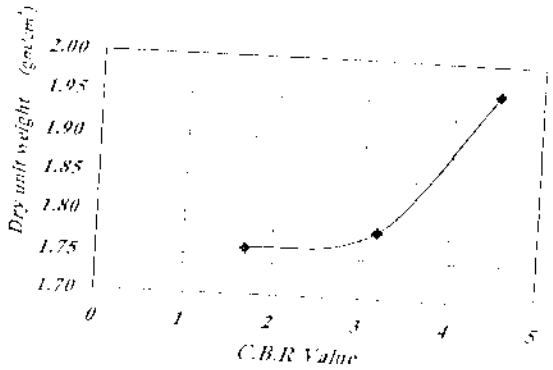


Fig. (12) Relationship between Dry unit weight and C.B.R Value for 7-Day Curing

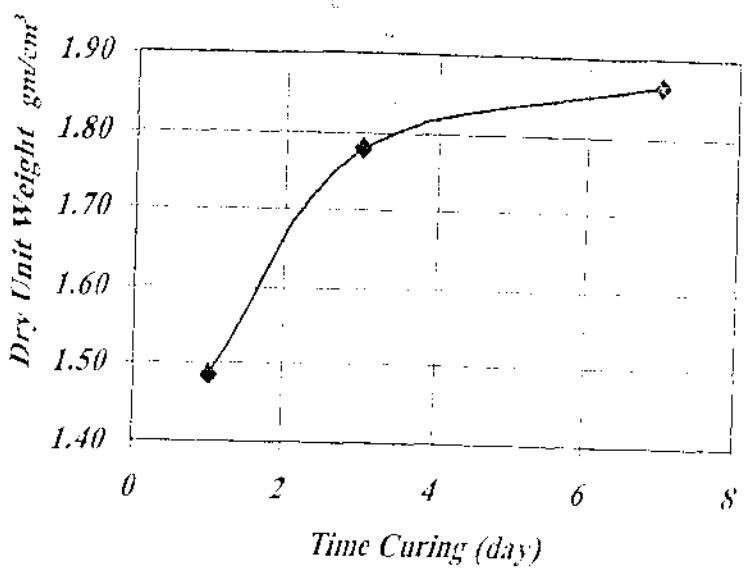


Fig.(13) Relasionship between Time Curing and Dry Unit Weight in Place

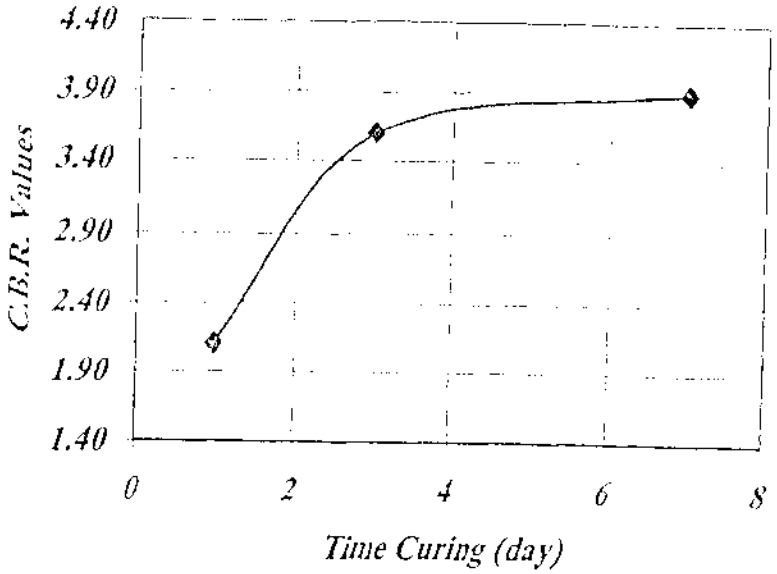


Fig.(14) Relasionship between Time Curing and C.B.R. Values in Place

3. Conclusion and Recommendation

In many cases, a soil needs to be properly treated to improve its strength by reducing its susceptibility to the influence of water and traffic. Any kind of treatment that yields such results is called soil stabilization.

There are many kinds of soil stabilization depending on the properties of the soil and the cost and also site conditions.

In Iraq, the climate is often hot dry and the soil is often at low moisture content so the most preferred type of soil stabilization is stabilizing the soil with Bituminous materials, unlike in temperate climates, the moisture content of cohesive soils is fairly high during most of the year and the addition of further fluids in the form of bituminous materials may cause a loss in strength. The amount of bitumen depends on the type of soil. The addition of the bituminous materials to the soil reduces the need for water to be added for compaction to a certain limit and then increases. Optimum fluid content required for maximum density when bitumen is used is more than that required in the case of water alone.

The decrease in the dry density and the increase in the optimum fluid content may be due to the greater viscosity of the fluid films surrounding the particles.

The amount of bitumen has a direct effect on the strength through increasing the soil's density. The strength of the soil-bitumen mixture made up at the maximum dry densities rises slightly until a certain binder content, after which it decreases progressively until it finally reaches a value lower than that of the untreated soil.

This provides cohesive strength in addition to the frictional resistance of the sand. If excess bitumen is used, this will provide a thick film around the sand grains and the frictional resistance may be lost because it acts as a lubricant.

References

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الخلاصة

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تضمن القص المباشر وفحص تحمل كاليفورنيا قد اجري على نماذج من تربة مفككة وقد وجدت النتائج ان ... ٦% من المادة المستحلبة ولمدة ٣ ايام كفترة انضاج هي النسبة الاقتصادية والتي تؤدي الى ...