SECTION 86-SOIL STABILIZATION

1924. Stabilization improves the constructional performance of soil. Either by adjusting the grading of the material used of by the use of admixtures.

1925. Stabilized surfaces are commonly used for operational routes as they made the maximum use o local materials and are quickly constructed when sufficient plant is available, but under heavy loads or sustained traffic some surface treatment or superimposed surfacing is normally needed. Stabilized surfaces can be incorporated as bases or sub bases for more permanent roads.

1926. Some soils cannot be stabilized: other can be treated successfully only by particular methods. Methods of soil stabilization are dealt with in RESPB No. 50, Chapter 8. The more important processes are summarized in Table 19.3.

1927. The required thickness of construction depends upon

(a) The intensity of loading.
(b) The stability of the sub grade (see Section 34).
(c) The degree of compaction attainable.

1928. The mixing of soils, or of some stabilizing agent with a soil, is always necessary. The Methods of mixing are:-

a. Mix-in-place.-The material is mixed in situ.

b. Travel mix.- The material is mixed in travelling plant which collects, mixes, and discharges it while moving along the alignment.

c. Central mix.-The material is mixed in central bulk mixer and then brought to the site.

The mix-in place method is generally used for operational work. Construction processes and plant required are summarized in Table 19.4.

TABLE 19.3 - METHODS OF SOIL STABILIZATION

Serial No.	Method	Soils suitable for method	Remarks
(a)	(b)	(c)	(d)
1.	Mechanical stabilization	Gravels sands	Stability achieved by adjusting grading and moisture content before compaction (see RESPB No. 5D Section 28)
2.	Bituminous stabilization: - (a) Material used as binder (b) Material used as waterproofing agent.	Graves sands Sand-clays	Best suited to dry climates using bitumen cut-backs MCT or MC^2 (See RESPB No. 5D Section 28) Use cut-back bitumen RC 1, stable or semi stable emulsion, or soil stabilizing oil (See RESPB No. 5D Section 28)
3.	Soil cement	All soils with clay content less than 30 per cent	See Section 100
4.	Chemical stabilization: - (a) Resin (b) Lime (c) Sodium silicate	Acid cohesive soils Sand-clays	See RESPB No. 5D Section 29. These methods should only be used where specialist laboratory tests confirm suitability. Other chemical methods are being developed.

TABLE 19.4 SOIL STABILIZATION-CONSTRUCTION PROCESSES

Serial No.	Method	Soils suitable for method	Remarks
(a)	(b)	(c)	(d)
1.	Take soil samples for laboratory analysis	-	This preliminary stage essential to get best results
2.	Form sub grade to correct levels and shape	Graders, dozers, scrapers	Form shoulders and cut side drains
3.	(a) Break up natural soil to required depth and pulverize (b) If grading needs adjustment, place and spread imported depth	Disc harrows, rotary hoes, cultivators, or ploughs Graders, dozer, spreader boxes.	Positive depth control required ploughs turn soil towards center line.
4.	Mix the soil or soils thoroughly	Graders, ploughs, harrows, pulvimixers	Intimate mixing is essential. Add any required stabilizing agent at this stage ensuring even dispersal.
5.	Determine, moisture content of dry mix	–	See RESPB No. 5D Section 14
6.	(a) Add water to bring soil to optimum moisture content (b) Re-mix thoroughly to full stabilization depth	Water truck and sprinkler Grader, ploughs, harrows, pulvimixers	OMC can be determining by laboratory test, but field compaction trail results normally suffice. Some allowance should be made for evaporation. Even depth of treatment is most important.

7.	Compact	For mechanical stabilization use sheep foot rollers (see Table 34 for types of roller for various soils)	After using sheep foot rollers light scarifying of surface may be require followed by light rolling with a smooth wheel or pneumatic-tired roller.
8.	Form to final levels and shape	Graders	-
9.	Compact finally	Pneumatic-tired or smooth wheel rollers	Even and high density must be ensured

Note: -Curing may be necessary depending on method used and a priming coat and surfacing may be sizable.

TABLE 19.5 CHARACTERISTICS OF COMMON SOILS

Serial	Nature	Type	Description	Values as construction material	Natural drainage Angle	Angle of repose (Vertical/ horizontal)	CBR range (%)	Remarks
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)
1.	Coarse grained	Gravel and gravelly soils	Well-graded gravels or gravel-sand mixtures, little or no fine material present	Excellent material but requires clayey sand (see Serial 8) as a binder (7 parts to 3 parts of clayey sand)	Excellent	1 in $1^{1/2}$ (33”)	60-80	
2.	Coarse	Gravel and	Poorly-graded	Good but can be	Excellent	1 in $1^{1/2}$ (33”)	25-60	

	grained	gravelly soils	gravels or gravel-sand mixtures, little or no fine material present	improved by mixing with gravel, sand and clay				
3.	Coarse grained	Gravel and gravelly soils	Silty gravels, gravel-sand and silt mixtures	Good but subject to frost action owing to presence of silt	Fair to very poor, depending on amount of silt present	1 in $1^{1/2}$ (33”)	30-50	Silt very unstable particularty when wet
4.	Coarse grained	Gravel and gravelly soils	Clayey gravels, gravel-sand and clay mixtures	Good but can be improved by addition of sands (see Serial 5)	Poor, owing to presence of clay	1 in $1^{1/2}$ (33”)	20-40	Strength depends upon sand and clay content. Clay acts as binder. If clay content is high, soil is weak
5.	Coarse grained	Sand and sandy soils	Well-graded sands or gravelly sands, little or no fine material present	Excellent material but requires sandy clay (see Serial 10)	Excellent	1 in $1^{1/2}$ (33”)(i)	20-40	

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)
6.	Coarse grained	Sand and sandy soils	Poorly-graded sands or gravelly sands, little or no fine material present	Good but can be improved by mixing with good gravel and sandy clay	Excellent	1 in $1^{1/2}$ (33”)(i)	10-30	Lacks mortar to stick particies together
7.	Coarse grained	Sand and sandy soils	Silty sands	Fairly good but subject to frost action owing to presence of silt	Fair to very poor, depending on amount of silt present	1 in $1^{1/2}$ (33”)	10-30	Moisture content critical. If damp and well-compacted, quit good material. If wet, very unstable
8.	Coarse grained	Sand and sandy soils	Clayey sands	Fairly good, depending upon clay content	Poor to very poor, depending upon amount of clay	1 in $1^{1/2}$ (33”)	10-20	Strenght depends upon clay content. If high, soil is weak.