SECTION 96 - PREMIX

2222. Construction procedure is summarized in table 22.9. The three alternative processes shown can be applied as follows:

a. Normal hot process. Tar macadam, bitumen macadam, rolled asphalt, fine cold sphalt.

b. Gold aggregate process (hot binder)- Tar macadam, bitumen macadam.

c. Cold aggregate process (cold binder)- Emulsion macadam only.

2223. Construction methods. Premix can be laid cither in a single course, or in two courses (occasionally three). Single course construction is quick and economical. In two course works comparatively coarse material is laid and compacted to form a base course, which is then covered with material of finer texture. Type and thickness of construction depend on type and volume of traffic and on the condition of the base. Normal practice is as follows:

a. Tar macadam, bitumen macadam (see tables 22.10, 22.11 and 22.12): Single course (2 ro 3 ins thick) – for light traffic in densities. Two-course construction – superimposed on pitched or hardcore bases for roads carrying heavy traffic, predominantly pneumatic tyred.

b. Rolled asphalt (see table 22.10 and 22.15): Suitable for all types of traffic, including a large percentage of tracked vehicles. Single course – suitable for strong, stable bases that are accurately shaped. Two-course construction-used when necessary to strengthen the base, or if the surface of the base I badly shaped.

c. Fine cold asphalt (see tables 22.10 and 22.14)- Used only as a thin wearing surface on stable bases. Not suitable for tracked vehicles.

d. Emulsion macadam (see tables 22.10 and 22.13)- Similar to hot binder macadam's, although not considered so durable.

2224. Recommended methods for different thicknesses of construction are given in table 61.

2225 Mix design- Poor military work, the details given in tables 22.11 and 66 will be found adequate.

TABLE 22.9 PREMIX SUMMARY OF CONSTRUCTION PROCEDURE

Serial no	Stage of construction	Normal hot process	Cold process (hot binder)	Cold process (cold binder)
1.	Preparation of site	Foundation must be stable and well drained and be correctly shaped. Sub grade, sub-bade and base should be compacted by rollers at least equal in weight to that to be used in final stages. All potholes and weak patches must be made good and loose material and oil patches must be cleaned off. Lateral support (preferably kerbs or haunch stones) must be provided to contain the premix material		
		A dry surface is essential		A damp surface is desirable
2.	Preparation of materials	Ideally, aggregate should be dried and screened into single sizes and separately stored. Sizes are then drawn in correct proportions by weight and the combined dried aggregate is heated to specified temperature. Binder of specified type and grade hated to prescribe temperature.	Aggregate should be screened and graded as in column (c), but neither drying nor heating is necessary. A coating agent should be added to the aggregate and Both a lux and a coating agent to the blinder. Binder should be heated to about 20°F above the normal temperature for untreated binder of similar grade	Aggregate mist be properly graded. But no filler is required. No heating is required; and fluxes and reagents are not needed

3.	Mixing	Appropriate quantities of aggregate and binder, at correct temperature, are mixed in a mixer until aggregate is completely coated (about 1 ½ minutes). Filler is then added and mixing continue for about 1 minute	Aggregate is first mixed with 1 to 2 per cent hydrated lime or Portland cement. when thoroughly mixed, introduce binder treated with flux and coating agent, heated to prescribed temperature, and mix till aggregate is thoroughly coated	Mixing must be done quickly to avoid breaking of emulsion in mixer. Graded aggregate in natural condition is put into mixer and appropriate quantity of cold emulsion is added. Mix just long enough to coat the emulsion, and empty mixer at once
4.	placing and compaction	(a) Mechanical speeding-High rate of output and delivery required, Material tipped direct into hopper of the machine, which itself provides some initial compaction (b) Hand placing material tipped alongside alignment, preferably on dump plates, and spread by heated shovels (not forks). Level blocks help to maintain even thickness. (c) Compaction: - By smooth wheel roller (6 to 10 tons) wheels should be kept wit roller must not stand on unset material		Spreading is normally done by hand, using unheated forks, rakes, and shovels, it should be completed within 10 to 15 minutes of mixing, compaction must be limited to one or two passes of roller, and traffic should preferably be kept off for 24 hours

TABLE 22.10 PREMIX RECOMMENDED CONSTRUCTION METHODS

Serial no	Range of total compacted thickness (ins)	Number of course	Average thickness of compacted course or course	Normal size of aggregate*
(a)	(b)	(c)	(d)	(f)
1.	Tramacadam- 2 to 3	One	2 to 3	1 ½ in
2.	3 to 4	Two	Base course 2 ¼ to 3 ¼ Wearing course ¾ to 1 ,, ,, 1 to 1 ½	1 ½ or 2 in 3/8 or ½ in ½ or ¾ in
3.	4 min	three	Base course 2 ½ min Intermediate 1 ½ min Wearing course ¾ to 1 ½	2 in 1 ½ in 3/8, ½ , or ¾ in
4.	Bitumen macadam- 2 to 3	One	2 to 3	1 ½ in
5.	2 ½ to 5	Two	Base course 2 ½ to 3 ¼ ,, ,, 2 to 3 Wearing course ½ to ¾ ,, ,, 1 to 1 ½	2 in 1 ½ in 3/8 in ½ in ¾ in

6.	Emulsion macadam- 2 to 3	One	2 to 3	1 ½ in
7.	2 ½ to 4	Two	Base course 2 to 3 Wearing course 3/8 to ¾ ,, ,, ¾ to 1	1 ½ in ¼ in ½ in
8.	Fine cold asphalt- ½ to 1	One	Wearing course ½ to 1	¾ in
9.	Rolled asphalt- 1 ½ to 1	One		Recommended stone content
			1 ½ 2 to 2 ½ 3	25-45 percent 30-60 ,, 40-60 ,,
10.	2 ½ to 4 ¼	Two	Base Course 1 ½ to 3 Wearing course 1 to 1 ½	55-75 percent 0-50 percent

* For actual aggregate grading and composition of mixtures see tables 22.11, 22.12, 22.13, 22.14 and 22.15.

TABLE 22.11 AGGREGATE GRADINGS AND BINDER CONTENTS FOR TARMACADAM AND BITUMEN MACADAM

Serial no	aggregate grading (sieve size to BS 410)	Single course construction 2" to 3" thick	Two- course construction				
			Base course 3 ½ to 2" thick		Wearing course 1 ½ to ¼ " thick		
		1 ½ nominal size	2" nominal size	1 ½" nominal size	¾" nominal size	½" nominal size	3/8" nominal size
		Percentage passing	Percentage passing	Percentage passing	Percentage passing	Percentage passing	Percentage passing
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1.	2 ½" BS		100				
2.	2 " BS	100	90-100	100			
3.	1 ½ "	90-100	35-65	90-100			
4.	1" BS	50-80	20-40	50-80	100		
5.	¾" BS				90-100	100	
6.	½ " BS	30-50	5-20	5-30	40-70	90-100	100
7.	3/8" BS						85-100
8.	¼ " BS	20-30			10-20	25-45	30-60
9.	1/8 " BS	20-30			0-10	5-15	10-20

10.	No 200 (filler)	0-5	0-5	0-5	0-5	0-5	0-5
	Binder content-						
11.	Tar- percentage by weight of mixed materials	4 ¼ , 5 ¼	3 – 4 ½	3 ¾ - 4 ¾	4 ¾ -5 ¾	5 ¼ - 6 ¼	5 ¾ - 6 ¾
12.	Tar. Quantity in gals per ton of aggregate	8 ½ - 10 ½	7-9	7 ½ - 9 ½	9 ½ - 11 ¾	10 ½ - 12 ¾	11 ¾ - 14
13.	Bitumen. Percentage by weight of mixed materials	3-4 ½	2 ¼ - 3 ½	2 ¾ - 4 ¼	3 ¾ - 5	4- 5 ¼	4 ¼ -6
14.	Bitumen. Quantity in gals per ton of aggregate	7 ¼ -11	5 ½ - 8 ½	6 ½ - 10 ½	9- 12 ½	9¾ - 13	10 ½ - 15

Note: Mixing temperature:

a.	Using straight bitumen:	b.	Using cut back bitumen's;	c.	Using road tar:
d.	Binder: 225 F to 325 F	e.	Binder: 150 F to 250 F	f.	Binder: 140 F to 220 F
g.	Aggregate: 150 F to 250F	h.	Aggregate: 120 F to 160F	l.	Aggregate: 120 F to 160F

TABLE 22.12 RECOMMENDED AND VISCOSITIES OF BINDERS FOR THE PRODUCTION OF TARMACADAM AND BITUMEN MACADAM TO AGGREGATE GRADINGS SHOWN IN TABLE 22.11

Serial No	Climatic conditions	condition of material when laid (i)	Recommended type and viscosity of binder (ii)				Straight run bitumen PEN at 25 c
			Road tar		Cut back bitumen (iii)		
			Type A c EVT	Type B c EVT	UK grades	Us grade	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1.	Temperate-Summer	Cold	34-38	34-38	80/120 sec at 40c 500/700 sec at 25c	RC 5 MC 5	
2.	ditto	Warm		37-41	160/240 sec at 40c 750/1125 sec at 25c	RC 5 MC 5	150/300
3.	Temperate-Winter	Cold	24-34	27-34	40/60 sec at 40c 200/400 sec at 25c	RC 5 MC 5	
4.	ditto	Warm	34-37	37-37	80/120 sec at 40c 500/700 sec at 25c	RC 5 MC 5	150/500

5.	Tropical and sub tropical	Cold	Not recommended	150/200 sec at 25 c	RC 3 and 4 MC 4 and 5	
6.	ditto	Warm	Not recommended	200/700 sec at 25 c	RC 4 and 5 MC 4 and 5	100/300

TABLE 22.13 AGGREGATE GRADING AND BINDER CONTENT FOR EMULSION MACADAM

Serial No	Aggregate grading (sieve size to BS 410)	Single course construction 2" to 3" thick	Percentage construction		
			Two-course constriction		
			Base course 2" to 3"	Wearing course 3/8" to 1' thick	
		1½" normal size	1½" normal size	½" normal size	¼ " normal size
(a)	(b)	(c)	(d)	(e)	(f)
1.	2 in	100	100		
2.	1 ½ in	90-100	-0-100		
3.	1 in	50-80	50-80		
4.	¾ in			100	

5.	½ in	30-50	5-30	90-100	
6.	3/8 in				100
7.	¼ in	20-30		20-45	90-100
8.	1/8 in			5-15	5-15
9.	No 200	0-5	0-5	0-5	0-5
10.	Binder content- Quantity in gals of emulsion per ton of aggregate	12-16	10-14	16-20	18-22
11.	Recommended type of emulsion	Simi stable class 2A or 2B	Simi stable class 2A or 2B	Simi stable class 2A or 2B	stable class 3

TABLE 22.14 AGGREGATE GRADING AND BINDER CONTENT FOR FINE COLD ASPHALT

Serial No	Aggregate grading (sieve size to BS 410)	Percentage Passing
(a)	(b)	(c)
1.	¼ ins	100
2.	No 7	75-100
3.	No 25	35-60
4.	No 100	15-30
5.	No 200	5-15
6.	Binder content- Percentage by weight of mixed materials	4.5-7.5
7.	Quantity in gals per ton of aggregate	11.0-18.5

Notes:

a. Mixing Temperatures-Binder– Max 300 F
Aggregate - Max 2400 F

b. The binder used may range from a medium viscosity cut back bitumen to a soft straight-run bitumen. As a general guide 400/500 PEN straight-run is normally suitable under most climatic conditions when the material is to be laid warm. A special cut back known as FB 1 with a viscosity range of 120/140 seconds at 40 c, is available for viscosity range of 120/140 seconds at 40 c, is available for use in the UK when the material is to be laid cold or stored.

TABLE 22.15 ROLLED ASPHALT- COMPOSITION OF MIXTURES

Ser No	Climatic condition	Stone content	Soluble bitumen		Aggregate passing N0. 200 BS sieve (filler)		Aggregate retained N0. 200 but passing No 7 BS sieve (filler)		Aggregate passing 3 in 16 BS sieve		Construction method	Rmks	Recommended binder straight run bitumen PEN at 25 c
			Min	Max	Min	Max	Min	Max	Min	Max			
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)	(m)	(n)	(p)
1.	Dry moderate climates. Tropical and subtropical areas	0	9.8	10.8	12.0	14.0	75.2	75.2	-	-	Wearing course	Not suitable for tracked vehicles	40/60
2.	Ditto	25	7.8	8.8	8.6	10.6	55.6	58.6	-	-	Single or wearing course	ditto	40/60

3.	Ditto	40	6.6	7.6	6.4	8.4	44.0	47.0	-	-	ditto	Suitable for all types of heavy traffic	30/40
4.	Ditto	50	5.8	6.8	5.1	7.1	36.1	39.1	-	-	ditto	ditto	30/40
5.	wet moderate climates and areas with extreme of weather, eg high rainfall	0	11.8	12.8	16.0	18.0	69.2	72.2	-	-	Wearing course	Not suitable for tracked vehicles	60/80
6.	Ditto	25	9.8	10.7	12.5	14.5	49.8	52.7	-	-	Single or wearing course	ditto	60/80
7.	Ditto	40	8.5	9.4	10.4	12.4	38.2	41.1	-	-	ditto	Suitable for all types of heavy traffic	30/40

8.	Ditto	50	7.7	8.6	9.1	11.1	30.3	33.2	-	-	ditto	ditto	30/40
9.	All conditions	55	6.0	7.0	-	-	-	-	38.0	39.0	Base course	Suitable for serial No 1 to 8	40 to 80 (see Note 5)
10.	Ditto	75	4.5	5.5	-	-	-	-	19.5	20.5	ditto	ditto	ditto

Note: a. Mixing temperatures- Binder - Max 350 F
Aggregate - 300 to 400 F

b. Temperature of laying of all compositions should not be less than 250F

c. The largest size of stone must not be more than half nor less than a third of the final thickness of the compacted course.

d. In mixes containing less than 45 per cent stone, single size stone may be used. In mixes containing more than 45 per cent stone, the stone must be well graded.

e. The sand used should be clean and well graded.

f. 40/60 PEN should be used if a base course is constructed in conjunction with serials no 1 to 4.
60/80 PEN should be used in conjunction with serials no 5 to 8.

2226. Filler (see Section 84):- For coated macadam the inclusion of filler, within the limits shown in the respective tables, improves results, For rolled asphalt and fine cold asphalt the filler content is an essential part of the mixture.

2227. Coating agents and fluxes:- In the cold aggregate (hot binder) process, the addition of hydrated lime or Portland cement to the aggregate improves the adhesion of the binder, Two per cent of CPB or Adhesion T,. and 10 per cent of creosote oil, may also be added to the binder, or alternatively heated SRO may be used as both coating agent and flux.