SECTION D-4

ASPHALT PAVING
(Methodology for Districts)

CES NUMBER AND DESCRIPTION

46870 A612. P340. E230. 26D30.
Road Construction. Asphalt Paving. Petro-Evap. Cutback Asphalt.

46888 A612. P340. E230. 26D31.
Road Construction. Asphalt Paving. Petro-Evap. Road Oil.

46896 A612. P340. E230. 26D32.
Road Construction. Asphalt Paving. Petro-Evap. Paving Asphalt.

46904 A612. P340. E230. 26D33.
Road Construction. Asphalt Paving. Petro-Evap. Emulsified Asphalt

DESCRIPTION

The volatile organic gas emissions for these CES categories result from the evaporation of volatile petroleum distillates (diluents). These categories collectively pertain to the use of various forms of asphalt for construction and maintenance of roads, streets, parking lots, shopping center grounds, driveways, industrial pavements, etc.

Cutback asphalt refers to asphalt cements liquified with petroleum solvents; specification types include Medium Cure (MC), which is cut back with a kerosene-range distillate, and Rapid Cure (RC), which is thinned with naptha or gasoline. Road oils refer to liquified asphalts of the Slow Cure (SC) type, which is either distilled to specifications at the refinery or thinned with residual oil. The amount of solvent used in the cutback asphalt or road oil determines its viscosity or grade. Paving asphalt refers to asphalt cements heated to a liquid form (290°F) and transported to the site for application. Emulsified asphalt refers to asphalts liquified with water containing an emulsifying agent. There are two kinds of emulsified asphalt systems produced; anionic, and cationic. The anionic types are those systems in which the dispersed asphalt bears a negative charge. The cationic systems are those in which the dispersed asphalt bears a positive charge.

Solvent contents for each cutback and road oil grade are obtained by multiplying the tonnage of each grade of RC, MC and SC asphalt by the weight percent of petroleum distillate (solvent) as reported by the manufacturers. The solvent content is then multiplied by the percentage of solvent evaporated to obtain emissions for each grade. The percentage of diluent to evaporate is dependent on the cure type. The evaporating percentages are: Slow Cure (SC)-25 percent; Medium Cure (MC)-70 percent; Rapid Cure (RC)-80 percent.[1] Emissions evolved from paving asphalts are approximately 0.002 pounds per ton of mix or 0.04 pounds per ton of asphalt cement.[2] Emissions from emulsion asphalts are calculated by multiplying the percent by volume of distillate in the emulsion by the volume of the emulsion. Emulsified asphalts contain an average of 40 percent by volume of water and emulsifying agent.

COLLECTION OF DATA

The amount of asphalt used for road construction may be obtained by contacting city and county public works departments, the local Caltrans District, paving contractors, asphalt batch plants, and refineries. Due to the difficulty of obtaining accurate asphalt usage figures, it is recommended that a best estimate of asphalt usage be made by surveying all organizations involved in road construction, road repair, and asphalt production. Care must be taken not to duplicate any of the usage figures received, i.e. a refinery reports its total sales of asphalt and a construction company reports its total usage of asphalt, some of which may have been purchased from the refinery. Survey sheets sent to these agencies may request the number of construction days per year, miles of new, reconstructed, overlayed, and repaired roads, and the types and quantities of asphalt used. Attached is a sample survey sheet. The amount of asphalt used can be calculated by multiplying the width (24' to 60'), by the depth (2" to 8"), by the length of the road surface to obtain the volume of asphalt used. The average density of asphalt mix, 144 lbs/cu.ft., is then multiplied by the volume to obtain pounds of asphalt mix used. The amount of asphalt mix multiplied by its percent by weight asphalt can be used with the emission factors to calculate emissions. Asphalt mixes contain 5-6% by weight asphalt for cutback asphalts and road oils, and 8-14% by weight asphalt for emulsified asphalts. A sample calculation is attached.

SUMMARY OF ASSUMPTIONS

1. The use of rapid cure cutback asphalt is almost non-existent in California.

2. The percentage of diluent which evaporates from SC, MC and RC asphalts is 25 percent, 70 percent, and 80 percent respectively.

3. Emulsified asphalts contain 40 percent by volume of emulsion.[5]

4. The density of asphalt mix is 144 lbs/cu.ft. for all grades. (From a telephone conversation with Caltrans and county public works department)

TEMPORAL VARIATIONS

Annual variation in road construction and maintenance operations is dependent on the local climate. Generally, most activity is in the late spring, all of summer, and early fall; however, some areas may require winter maintenance. It may be assumed for a typical county that emissions in the winter are slightly lower than during the rest of the year.

Although road construction and maintenance operations most often occur during daylight hours, Monday through Friday, emissions may be considered to be uniform throughout each day of the week, because the evaporation of volatile organics from the asphalt products is nearly a continuous process for months after application.

SAMPLE CALCULATIONS

1. Cutback Asphalt and Road Oil

Emissions from usage of MC-800 in Fresno County in 1979:

TOG Emissions

= (quantity of MC-800 used) x (TOG emission factor)
= (1,700 tons/year) x (241 lbs of emissions/ton of asphalt)
= 409,700 lbs/year
= 204.9 tons/year

2. Paving Asphalt

Emissions from usage of paving asphalt in Fresno County in 1979:

TOG Emissions

= (quantity of paving asphalt used) x (TOG emission factor)
= (266,281 tons/year) x (0.04 lb of emissions/ton of asphalt)
= 10,651 lbs/year
= 5.3 tons/year

3. Emulsified Asphalt

a) Emissions from usage of anionic (RS-1, RS-2) asphalt in Fresno County in 1979:

TOG Emissions

= (quantity of anionic asphalt used) x (TOG emission factor)
= (779 tons/year) x (40 lb of emissions/ton of asphalt)
= 31,160 lbs/year
= 15.6 tons/year

b) Emissions from usage of cationic (CRS-1, CRS-2) asphalt in Fresno County in 1979:

TOG Emissions

= (quantity of cationic asphalt used) x (TOG emission factor)
= (178 tons/year) x (24 lb of emissions/ton of asphalt)
= 4272 lbs/year
= 2.1 tons/year

ASSESSMENT OF METHOD AND OTHER COMMENTS

Although the emission factors are relatively accurate, the accuracy of the emissions by county is uncertain, because no actual usage data for asphalt are available for any county or region of the state.

REFERENCES

1. U.S. Environmental Protection Agency, Control of Volatile Organic Compounds From Use of Cutback Asphalt, EPA-450/2-77-037, December, 1977.

2. California Air Resources Board, Consideration of a Model Rule for Control of Volatile Organic Compound Emissions from Cutback Asphalt Paving Materials, May, 1979, pp. 16, 22, 28, 35-37.

3. Documentation - 1979 Area Source Emission Inventory, CARB, Sacramento, California, July, 1981.

4. Chevron Asphalt Company, Paving Handbook, 1973.

5. Institute of Transportation Studies, University of California, Design and Control of Asphalt Mixes, May, 1978, pp. 30-35.

PREPARER AND DATE

Michael Tollstrup, Fresno County Air Pollution Control District, February, 1982.

APPENDIX

TABULATION OF EMISSION FACTORS

Type of Asphalt		TOG Emission Factor (Pounds of Emissions/Ton of Asphalt)
Cutback Asphalts:		
	RC-70	544
	RC-250	384
	RC-800	288
	RC-3000	160
	MC-70	463
	MC-250	315
	MC-800	241
	MC-3000	132
Road Oils:		
	SC-70	160
	SC-250	118
	SC-800	69
	SC-3000	32
Paving Asphalt:		0.04
Emulsified Asphalts:		
Anionic;	RS-1, RS-2	40
	MS-2h	120
	SS-1, SS-1h	0
Cationic;	CRS-1, CRS-2	24
	CMS-2s	160
	CMS-2, CMS-2h	96
	CSS-1, CSS-1h	0

Sources: (2), (4), (5)

Specifications for each grade of asphalt are attached.

ROAD CONSTRUCTION

Department Name: _____

Address: _____ Telephone: _____

Construction Days Per Year: _____ days

Season: (circle one) Fall Winter Spring Summer

		USAGE				
Road Work Description	Type of Asphalt Used	Amount of Asphalt (tons)	OR	Length of Road (miles)	Width (ft.)	Thickness (inches)

Other Comments:

Amount of Paint Used on Roads: _____ Gal/Yr., Type: _____

Thinners Used: _____ Gal/Yr.,

Contact Person: _____ Date: _____

TABLE 5 — UNIFORM PACIFIC COAST SPECIFICATIONS[1] PAVING ASPHALT VISCOSITY GRADED AT 60°C (140°F) ON RTFC RESIDUE

Specification Designation	AASHTO Test Method	Viscosity Grade				
		AR-1000	AR-2000	AR-4000	AR-8000	AR-16000
Tests on Residue from RTFC Procedure-Ca. Method 346E*						
Absolute Viscosity at 60°C (140°F) poise	T-202	750-1,250	1,500-2,500	3,000-5,000	6,000-10,000	12,000-20,000
Kinematic Viscosity at 135°C (275°F) cs, min.	T-201	140	200	275	400	550
Penetration at 25°C (77°F) 100g/5sec, min.	T-49	65	40	25	20	20
Percent of original penetration at 25°C (77°F) min.	***	—	40	45	50	52
Ductility at 25°C (77°F) cm, min.	T-51	100**	100**	75	75	75
TEST ON ORIGINAL ASPHALT Flash point, C.O.C., deg. F, min.	T-48	400	425	440	450	460
Solubility in Trichlorethylene percent, min.	T-44	99	99	99	99	99

* TFO may be used but RTFC shall be the referee method.

** If the ductility at 25°C (77°F) is less than 100 cm., the material will be acceptable if its ductility at 15.6°C (60°F) is more than 100 cm.

*** Original penetration as well as penetration after RTFC loss will be determined by AASHTO Test Method T-49.

[1] AASHTO M226 Table III.

Reference 5

Table 10 Average Weights and Volumes of Asphalts

Grade	Gallons Per Ton @ 60°F	Barrels Per Ton @ 60°F	Pounds Per Gallon @ 60°F	Pounds Per Barrel @ 60°F
PAVING ASPHALTS				
AC-40, AR-16,000, 40- 50 pen.	235	5.60	8.51	357
AC-20, AR- 8,000, 60- 70 pen.	235	5.60	8.51	357
AC-10, AR- 4,000, 85-100 pen.	235	5.60	8.51	357
AC- 5, AR- 2,000, 120-150 pen.	237	5.64	8.44	355
AC2½, AR- 1,000, 200-300 pen.	239	5.70	8.36	353
LIQUID ASPHALTS				
30	254	6.10	7.80	328
70	253	6.03	7.90	332
250	249	5.93	8.03	337
800	245	5.83	8.16	343
3000	241	5.74	8.30	349
EMULSIFIED ASPHALTS				
All Grades	241	5.73	8.3	349

NOTE: The above weights and volumes are average values. For specific information, contact our nearest District Office.

Reference 4

Table 9 Bitumuls Anionic Emulsified Asphalt* — Product Specifications

Bitumuls Type				Rapid Setting				Coarse Aggregate Mixing		Dense Aggregate Mixing		Quick-Set Slurry Seal	
Bitumuls Grade Designation				RS-1		RS-2		CM-h		DM-h		QS-h	
ASTM Grade Designation (Closest)				(RS-1)		(RS-2)		(MS-2h)		(SS-1h)		(None)	
Test Method	AASHO	ASTM	Chevron	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Test on Emulsion (a)													
Viscosity, Saybolt Furol at 77°F (25°C) sec.	T-59	D 244	–	–	100	–	–	–	–	–	100	–	100
Viscosity, Saybolt Furol at 122°F (50°C) sec.	T-59	D 244	–	–	–	100	400	–	500	–	–	–	–
Storage Stability Test, 1 day, per cent	–	D 244	–	–	1.0	–	1.0	–	1.0	–	1.0	–	1.0
Demulsibility, 35 ml. 0.02 N $CaCl_2$ per cent	T-59	D 244	–	60	–	60	–	–	–	–	–	–	–
Aggregate Coating – Water Resistance Test													
Dry Standard Reference Aggregate, per cent coated, minimum	–	–	C-5	–	–	–	–	80	–	–	–	–	–
Wet Standard Reference Aggregate, per cent coated, minimum	–	–	C-5	–	–	–	–	60	–	–	–	–	–
Cement Mixing Test, per cent	T-59	D 244	–	–	–	–	–	–	–	–	2.0	–	–
Sieve Test, per cent	T-59	D 244	–	–	0.10	–	0.10	–	0.10	–	0.10	–	0.10
Particle Charge Test (b)	T-59	D 244	–	Negative		Negative		Negative		Negative		Negative	
pH (b)	T-200	E 70	–	–	–	–	–	–	–	7.3	–	–	–
Dehydration, ratio	–	–	B-15	–	–	–	–	–	–	0.5	–	–	–
Adhesion	–	–	S-4	–	–	–	–	–	–	Pass	–	–	–
Slurry Seal Tests (Standard Reference Aggregate)													
Mixing, seconds	–	–	P-7	–	–	–	–	–	–	–	–	60	–
Setting, minutes	–	–	P-8	–	–	–	–	–	–	–	–	–	60
Water Resistance, after 30 minute cure	–	–	P-14	–	–	–	–	–	–	–	–	Pass	
Residue by Distillation, per cent	T-59	D 244		55	–	63	–	60	–	57	–	57	–
Oil Distillate, by volume of emulsion, per cent	T-59	D 244		–	5	–	5	5	15	–	–	–	–
Tests on Residue from Distillation Test													
Penetration at 77°F (25°C), 100 gm, 5 sec.	T-49	–	–	100	200	100	200	40	100	40	100	40	100
Ductility at 77°F (25°C) cm.	T-51	D 113	–	40	–	40	–	40	–	40	–	40	–
Viscosity at 140°F, poises	T-202	D 2171	–	600	–	600	–	–	–	–	–	–	–
Solubility in Trichloroethylene, per cent	T-44	D 2042	–	97	–	97	–	97	–	97	–	97	–

a) All tests shall be performed within 30 days from the date of emulsified asphalt shipment.
b) Must meet pH Test if inconclusive Particle Charge Test.
* These specification requirements may vary in different locations dependent on local construction practices, aggregates, and climatic conditions. Please check with your nearest Chevron Asphalt Company District Office for grades available in your area.

Reference 4

TABLE 9 — UNIFORM PACIFIC COAST SPECIFICATIONS FOR CATIONIC EMULSIFIED ASPHALT

TYPE			RAPID SETTING				MEDIUM SETTING						SLOW SETTING			
GRADE	AASHTO Test Method	ASTM Test Method	CRS-1 Min.	CRS-1 Max.	CRS-2 Min.	CRS-2 Max.	CMS-2s Min.	CMS-2s Max.	CMS-2 Min.	CMS-2 Max.	CMS-2h Min.	CMS-2h Max.	CSS-1 Min.	CSS-1 Max.	CSS-1h Min.	CSS-1h Max.
Tests on Emulsions:																
Viscosity SSF @ 25°C (77°F) sec.	T72	D88	—	—	—	—	—	—	—	—	—	—	20	100	20	100
Viscosity SSF @ 50°C (122°F) sec.	T72	D88	20	100	100	400	50	450	50	450	50	450	—	—	—	—
Settlement 5 days, %[1]			—	5	—	5	—	5	—	5	—	5	—	5	—	5
Storage Stability Test 1 day[2]			—	1	—	1	—	1	—	1	—	1	—	1	—	1
Demulsibility 35 ml. 0.8% sodium dioctyl sulfosuccinate, %[3]			40	—	40	—	—	—	—	—	—	—	—	—	—	—
Coating ability & water resistance:																
Coating, dry aggregate			—	—	—	—	Good	—	Good	—	Good	—	—	—	—	—
Coating, after spraying			—	—	—	—	Fair	—	Fair	—	Fair	—	—	—	—	—
Coating, wet aggregate			—	—	—	—	Fair	—	Fair	—	Fair	—	—	—	—	—
Coating, after spraying			—	—	—	—	Fair	—	Fair	—	Fair	—	—	—	—	—
Particle charge test			Positive		Positive		Positive		Positive		Positive		Positive[5]		Positive[5]	
Sieve Test, %			—	0.10	—	0.10	—	0.10	—	0.10	—	0.10	—	0.10	—	0.10
Cement Mixing Test, %			—	—	—	—	—	—	—	—	—	—	—	2.0	—	2.0
Distillation:																
Oil Distillate by vol. of emulsion %		D244	—	3	—	3	—	20	—	12	—	12	—	—	—	—
Residue, %			60	—	65	—	60	—	65	—	65	—	57	—	57	—
Tests on residue from distillation test:				(4)		(4)										
Penetration, 25°C (77°F)	T49	D5	100	250	100	250	100	250	100	250	40	90	100	250	40	90
Ductility, 25°C (77°F) 5 cm/min., cm.	T51	D113	40	—	40	—	40	—	40	—	40	—	40	—	40	—
Solubility in trichloroethylene, %	T44	D2042	97.5	—	97.5	—	97.5	—	97.5	—	97.5	—	97.5	—	97.5	—

[1] The test requirement for settlement may be waived when the emulsified asphalt is used in less than 5 days time, or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.
[2] The 24 hour (1 day) storage stability test may be used instead of the 5 day settlement test.
[3] The demulsibility test shall be made within 30 days from date of shipment.
[4] A harder base asphalt meeting current paving asphalt specifications may be specified with the provision that the test requirements on the Residue from Distillation be waived.
[5] Must meet a pH requirement of 6.7 maximum (ASTM E-70) if the Particle Charge Test result is inconclusive.

Reference 5

TABLE 6 — UNIFORM PACIFIC COAST SPECIFICATIONS FOR SLOW-CURING (SC) CUTBACK ASPHALTS

Characteristics	AASHTO Test Method	ASTM Test Method	GRADES							
			SC-70		SC-250		SC-800		SC-3000	
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Kinematic Viscosity at 60°C (140°F) cs.	T201	D2170	70	140	250	500	800	1600	3000	6000
Flash Point (Cleveland Open Cup), °F.	T48	D92	150	—	175	—	200	—	225	—
Distillation: Total Distillate to 360°C (680°F) % by volume	T78	D402	10	30	4	20	2	12	—	5
Kinematic Viscosity of Distillation Residue at 60°C (140°F) Stokes.[1]	T201	D2170	4	70	8	85	20	140	40	350
Asphalt Residue of 100 Penetration, %	T56	D243	50	—	60	—	70	—	80	—
Ductility of 100 Penetration Asphalt Residue at 25°C (77°F) cms.	T51	D113	100	—	100	—	100	—	100	—
Solubility in Trichloroethylene, %	T44	D2042	99.5	—	99.5	—	99.5	—	99.5	—
Water, %	T55	D95	—	0.5	—	0.5	—	0.5	—	0.5

NOTE: When the Heptane-Xylene Equivalent Test is specified by the consumer, a negative test with 35 percent xylene after 1 hour will be required, AASHTO Method T 102.

[1] Recommended by User Agencies at Seventh Pacific Coast Conference on Asphalt Specifications, May 1967, for adoption by Pacific Coast States on January 1, 1968.

Reference 5

TABLE 7 — UNIFORM PACIFIC COAST SPECIFICATIONS FOR MEDIUM-CURING (MC) CUTBACK ASPHALTS

Characteristics	AASHTO Test Method	ASTM Test Method	GRADES							
			MC-70		MC-250		MC-800		MC-3000	
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Kinematic Viscosity at 60°C (140°F) cs.	T201	D2170	70	140	250	500	800	1600	3000	6000
Flash Point (Open Tag.), °F.[1]	T79	D1310	100	—	150	—	150	—	150	—
Distillation: Distillate (per cent of total distillate) to 360°C (680°F)										
to 225°C (437°F)	T78	D402	—	20	—	10	—	—	—	—
to 260°C (500°F)			20	60	15	55	—	35	—	15
to 316°C (600°F)			65	90	60	87	45	80	15	75
Residue from distillation to 360°C (680°F) volume per cent by difference			88	—	67	—	75	—	80	—
Tests on Residue from Distillation: Penetration, 25°C (77°F) 100g., 5 sec.	T49	D5	120	250	120	250	120	250	120	250
Ductility, 25°C (77°F) cms.[2]	T51	D113	100	—	100	—	100	—	100	—
Solubility in Trichloroethylene, %	T44	D2042	99.5	—	99.5	—	99.5	—	99.5	—
Water, %	T55	D95	—	0.2	—	0.2	—	0.2	—	0.2

GENERAL REQUIREMENT — The material shall not foam when heated to application temperature recommended by The Asphalt Institute.

NOTE: When the Heptane-Xylene Equivalent Test is specified by the consumer, a negative test with 35 percent xylene after 1 hour will be required, AASHTO Method T 102.

[1] Flash Point by Cleveland Open Cup may be used for products having a flash point greater than 79°C (175°F).

[2] If penetration of residue is more than 200 and its ductility at 25°C (77°F) is less than 100, the material will be acceptable if its ductility at 15.6°C (60°F) is 100+.

Reference 5

Table 5 ASTM Specifications For Liquid Asphalt, Rapid-Curing Type (D-2028)

Requirements For Liquid Asphalt (Rapid-Curing Type)

Designation	RC-70		RC-250		RC-800		RC-3000	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Kinematic viscosity at 140°F (60°C), cSt	70	140	250	500	800	1600	3000	6000
Flash point (Tag open-cup), deg. F (deg. C)			80+(27+)		80+(27+)		80+(27+)	—
Distillation Test:								
Distillate, per cent by volume of total distillate to 680°F (360°C):								
to 374°F (190°C)	10							
to 437°F (225°C)	50		35		15			
to 500°F (260°C)	70		60		45		25	
to 600°F (316°C)	85		80		75		70	
Residue from distillation to 680°F (360°C), per cent volume by difference	55		65		75		80	
Tests on residue from distillation:								
Penetration at 77°F (25°C), 100 g, 5 sec	80	120	80	120	80	120	80	120
Ductility at 77°F (25°C), cm	100		100		100		100	
Solubility in trichloroethylene, per cent	99.0		99.0		99.0		99.0	
Water, per cent		0.2		0.2		0.2		0.2

NOTE 1. — If the ductility at 77°F (25°C) is less than 100, the material will be acceptable if its ductility at 60°F (15.5°C) is more than 100.

Reference 4

EMISSION FACTOR COMPUTATIONS

Type of Asphalt	% Solvent Evaporated		% Petroleum Distillate in Asphalt	Emission Factor (lb HC/ton)
Cutback Asphalts:				
RC-70	.80	x	.34	x 2000 lb/ton = 544
RC-250	.80	x	.24	x 2000 lb/ton = 384
RC-800	.80	x	.18	x 2000 lb/ton = 288
RC-3000	.80	x	.10	x 2000 lb/ton = 160
MC-70	.70	x	.33	x 2000 lb/ton = 463
MC-250	.70	x	.22	x 2000 lb/ton = 315
MC-800	.70	x	.17	x 2000 lb/ton = 241
MC-3000	.70	x	.09	x 2000 lb/ton = 132
Road Oils:				
SC-70	.25	x	.32	x 2000 lb/ton = 160
SC-250	.25	x	.24	x 2000 lb/ton = 118
SC-800	.25	x	.14	x 2000 lb/ton = 69
SC-3000	.25	x	.06	x 2000 lb/ton = 32

Paving Asphalt: Emission factor obtained directly from reference No. 2. Page 16.

Type of Asphalt	% Emulsion in Mix		% Distillate in Emulsion		Emission Factor (lb HC/ton)
Emulsified Asphalts:					
Anionic; RS-1, RS-2	.40	x	.05	x	2000 lb/ton = 40
MS-2h	.40	x	.15	x	2000 lb/ton = 120
SS-1, SS-1h	.40	x	0	x	2000 lb/ton = 0
Cationic; CRS-1, CRS-2	.40	x	.03	x	2000 lb/ton = 24
CMS-2s	.40	x	.20	x	2000 lb/ton = 160
CMS-2, CMS-2h	.40	x	.12	x	2000 lb/ton = 96
CSS-1, CSS-1h	.40	x	0	x	2000 lb/ton = 0

SAMPLE ASPHALT USAGE CALCULATION

MC-70 asphalt used
Length: 0.5 mile
Width: 24 feet
Thickness: 4 inches

Calculations:

Volume of asphalt: (0.5 mile)(5,280 ft/mile)(24 ft)(4/12 ft)
= 21,120 ft^3

Asphalt mix usage: (21,120 ft^3)(144 lb/ft^3) ÷ 2000 lb/ton
= 1520.6 tons of asphalt mix

Asphalt usage: (1520.6 tons of asphalt mix)(% asphalt)
% asphalt: 5-6% for cutback asphalts and road oils
8-14% for emulsified asphalts
(1520.6 tons of asphalt mix)(5.5% asphalt)
= 83.6 tons of asphalt

Emission Factor for MC-70: 463 lb HC/ton of asphalt

Total Emissions: (83.6 tons of asphalt)(463 lb HC/ton of asphalt)
= 19.4