TEST RESULTS

ROAD OYL® Resin Modified Emulsion has unique bonding strength for *RESINPAVE*™ pavement construction and base course stabilization. This same bonding power has also made it highly effective as a surface treatment for dust control, erosion control, prime coats, seal coats, tack coats, and other types of application where the emulsion is spray-applied to a consolidated or compacted surface rather than being mechanically mixed with an aggregate material. The performance of this patented Resin Modified Emulsion in mix designs evaluated by Marshall Stability Tests provides clear documentation that ROAD OYL® is a major advance in product technology for pavement construction and for surface treatment applications.

The Marshall Stability Test (ASTM D 1559) has long been a standard procedure used by materials testing laboratories in evaluating mix designs for pavement construction. The Marshall Method is utilized to determine the optimum percentage addition rate of the binder for a paving mixture containing a specific blend of aggregate materials. Marshall

ROAD OYL® Resin Modified Emulsion

Tests with emulsion mixtures also determine the optimum moisture content, or prewet water, required in that aggregate material at the time of mixing with that rate of emulsion. Test results are compared to standard index values for stability and flow rate; "stability" is the maximum load resistance that a test specimen will develop under compression, and "flow value" is the total movement or strain occurring in the specimen during the compression test.

RESINPAVE™

COLD-APPLIED
HIGH STRENGTH
NON-PETROLEUM BASED

The Marshall Method was originally designed to evaluate mix designs for asphalt concrete and other hot mix types of flexible pavement materials. Marshall Design Criteria have been developed thorough extensive research correlation studies for cold mix as well as hot mix materials. A primary focus of this research has been to develop layer-equivalency factors between cold mix and hot mix asphalts. The Marshall Method as modified for use with cold mix asphalt emulsions is also utilized to evaluate mix designs for ROAD OYL® (a cold applied emulsion).

The Marshall Design Criteria supplied by the Asphalt Institute (January 1992 Addendum to Mix Design Methods For Asphalt Concrete And Other Hot-Mix Types, Manual Series No. 2) provide a baseline for comparison with test results obtained with mix designs which utilize the ROAD OYL® Resin Modified Emulsion as the binder.

Flow Values Based upon Asphalt Institute criteria, allowable Flow Values (in units of .01 in) range from:

- 8-14 for the Heavy Traffic classification,
- 8-16 for the Medium Traffic, and to
- 8-18 for the Light Traffic.

A sampling of Marshall Stability test results is provided on back of this page. As you will note, the Flow Values record these tests using ROAD OYL® as the binding agent for a v variety of aggregate combinations, almost all fall within the range of the Asphalt Institute.

Stability The Marshall Design Criteria for Stability pro by the Asphalt Institute also requires minimum values for d traffic classifications starting at:

- 750 pounds for Light Traffic,
- 1200 pounds for Medium Traffic and
- 1800 pounds for Heavy Traffic.

In all three classifications, these minimum values apply for base and surface course pavement m The results from ROAD OYL® test programs on the back of this page incl mix designs utilizing conventional d graded aggregates as well as several standard aggregate materials. Stab throughout these mix designs easi exceed the Asphalt Institute design criteria for Light, M and Heavy Traffic.

Stability translates into resistance to distortion, to displacement, to shearing stresses, to rutting and to sho Stability is a measure of the cohesion and bonding pow the binding agent. The ROAD OYL® multi-purpose resin modified emulsion has tremendous bonding power. Whethe are working with pavements, dust control, erosion control types of applications, ROAD OYL® opens up a whole new of possibilities.

Review of the test report data provided on the next page pr a summary of the effects of changing the three fundamental variables in a paving mix utilizing ROAD OYL® Resin Mo Emulsion as the pavement binder.

- Mix properties vary widely, dependent upon aggregate quality.
- Mix properties are similarly affected by varying additi of the emulsion.
- Mix properties are also significantly affected by prew and its influence upon the total fluids content of the mi

The prewet water consists of the natural water content of th aggregate (the nominal or ambient moisture) plus whatever water might be needed to prepare the aggregate for mixing suit a particular mix design.

The total fluids content of the mixture equals the sum of th emulsion addition rate and the prewet water. Similar to con mix designs w the percentag content of the mixture, or its "slump", has tremendous influence on workability and on the strength of the cured m the total fluids content of an emulsion paving mixture has significant influence on workability and performance.

Total Fluids Content = **Emulsion Addition Rate** + **Prewet Water**

Marshall Stability Test Results

		Sample	EMULSION CONTENT (%)	PREWET WATER (%)	STABILITY (pounds)	FLOW (.01 in)	UNIT WEIGHT (pcf)
1.	Dense Graded Aggregate Caltrans Specification	A	4.0	2.0	5790	12.0	130.7
		B	6.0	2.0	8870	11.0	135.1
		C	8.0	2.0	7010	12.0	136.5
2.	Dense Graded Aggregate New Mexico State Highway & Transportation Department Specification	A	6.0	1.5	7751	11.3	138.0
		B	6.0	2.0	9188	14.0	137.6
		C	6.0	2.5	8516	13.3	143.3
		D	6.0	3.0	8060	11.3	140.2
3.	Dense Graded Aggregate ASTM Specification	A	7.0	1.9	10000+	11.0	141.7
4.	Dense Graded Aggregate New Mexico State Highway & Transportation Department Specification	A	6.0	1.5	8665	10.0	134.4
		B	6.0	3.5	9861	11.0	142.0
5.	Dense Graded Aggregate Illinois State Department of Transportation Specification	A	6.0	1.0	10350	8.5	—
		B	6.0	1.0	10420	8.0	—
		C	6.0	1.0	9920	8.5	—
6.	Dense Graded Aggregate New Mexico State Highway & Transportation Specification	A	4.0	1.0	5000	10.0	—
		B	6.0	1.5	9870	14.0	—
		C	6.0	2.0	9784	19.0	—
		D	6.0	0.0	7000	8.0	—
		E	7.0	1.0	7680	19.0	—
7.	Non-Standard Aggregate* Clayey Granite Ore Landscape Aggregate	A	4.0	—	2566	9.0	144.0
		B	6.0	—	3054	10.0	144.9
		C	8.0	—	2660	12.0	143.5
8.	Non-Standard Aggregate* Decorative Mineral Aggregate and Soil Blend	A	12.4	4.0	9370	8.0	135.3
		B	12.4	4.0	10000+	10.0	139.3
		C	12.4	4.0	10000+	12.0	137.0

The above tests were conducted by a variety of testing laboratories including Agra Earth & Environmental, Inc., the County of Bernalillo's Materials Testing Laboratory in Albuquerque, NM, Law/Crandall, Inc., and Raba-Kistner Consultants, Inc. Mix designs on this page are presented in terms of the percentage of ROAD OYL Resin Modified Emulsion added to the aggregate, calculated by the dry weight of the aggregate material. This system based on percentage emulsion addition rate should not be confused with an alternative mix design terminology which is expressed in terms of residual solids or binder content remaining in the cured pavement material following application of an emulsion binder product.

*Non-Standard Aggregates: The Marshall Method and other pavement mix design methods have been developed to test the performance of binder materials in combination with high quality aggregates which have been standardized as suitable for use in pavement construction. Caution should be exercised as far as reliance on mix design test data alone when using aggregate materials which fail to meet specification for pavement application as predictability of their performance within a pavement mixture has not been previously established.

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