OFFICE MEMORANDUM
MICHIGAN
DEPARTMENT OF STATE HIGHWAYS

June 20, 1974

To: P. J. Serafin
Acting Engineer of Testing

From: L. T. Oehler

Subject: Evaluation of Riding Quality of Sandstone Hot Bituminous Mix. Project No. MB 46061-04845A. Project No. 47 F-15. Research Report No. R-926.

An evaluation of the riding quality resulting from the capping of US 223 between Brooks Highway and Rome Center Rd was performed in response to your request of September 13, 1973.

Since road profile measurements were not obtained before the pavement was resurfaced, no determination can be made of the "before-after" change in riding quality. Also, it is not known whether the existing profile is the result of the resurfacing process and material, or if the existing profile is merely the reflection of what was previously present. Therefore, we are able only to relate those characteristics that exist in the pavement profile after resurfacing.

The Rapid Travel Profilometer was used to obtain two measures of riding quality. One measure is related to the "roughness" of the pavement as formerly obtained by the roughometer. The second measure provides information on the relative amount of vertical energy transmitted to the vehicle as it traverses the pavement. A technique is used whereby this energy is classified according to wavelengths.

The analysis was performed between wavelengths of 200 ft and 2 ft. However, no significant differences were found in the pavement below 8 ft. Therefore, the results are given only between 200 and 8 ft.

For the purposes of comparison, profile measurements were obtained on US 223 between Hawkins Rd and Brooks Highway. The results are attached.

An examination of the graphs obtained in the subject test area reveals some unusual characteristics.

There is a dominant wave pattern occurring in Blends I and II. The length of this repetitive wave is slightly less than 10 ft. It is readily detectable in Blend II mixes 1 and 2. It is interesting to note that the bituminous paver track length is 8 ft - 9 in. It has been learned from previous work that a mis-adjustment of the servo for height control on the paver can produce

periodic waves in the pavement. Using a 30-ft horizontal reference with a wheel at the front and rear, the paver will produce periodic waves of 30, 10, 6, and 2 ft in length into the pavement. Some evidence of the 30-ft wave can also be seen in the graphs.

There also exists an unusual amount of energy at the shorter wavelengths in those sections resurfaced with Blend I, especially mix no. 6. We have no explanation for this result. The following table gives relative roughness values for each of the test sections. The numbers are related to the amount of roughness present in wavelengths between 15 and 2 ft.

TESTING AND RESEARCH DIVISION

L. T. Oehler

Engineer of Research

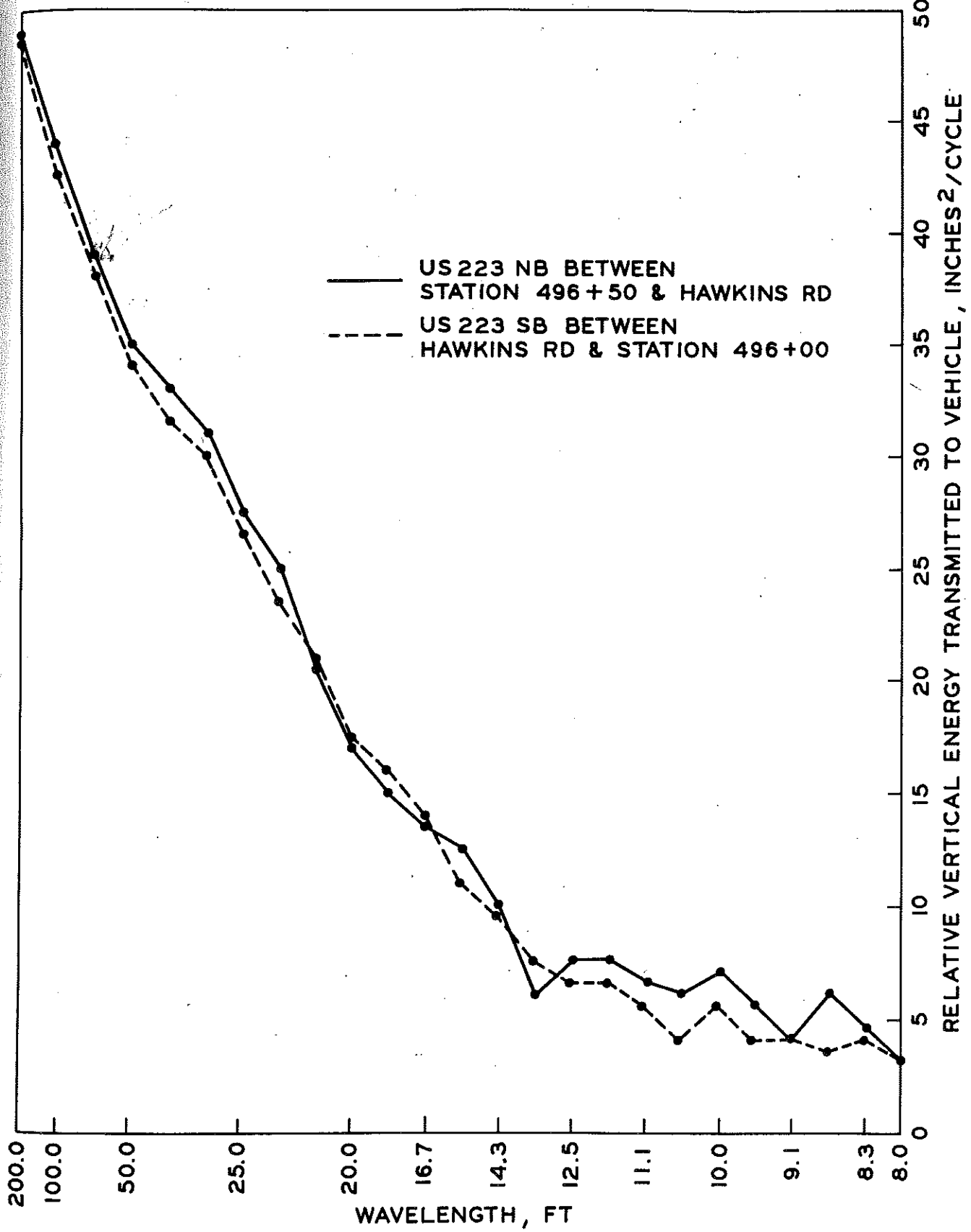
LTO:LED:bf

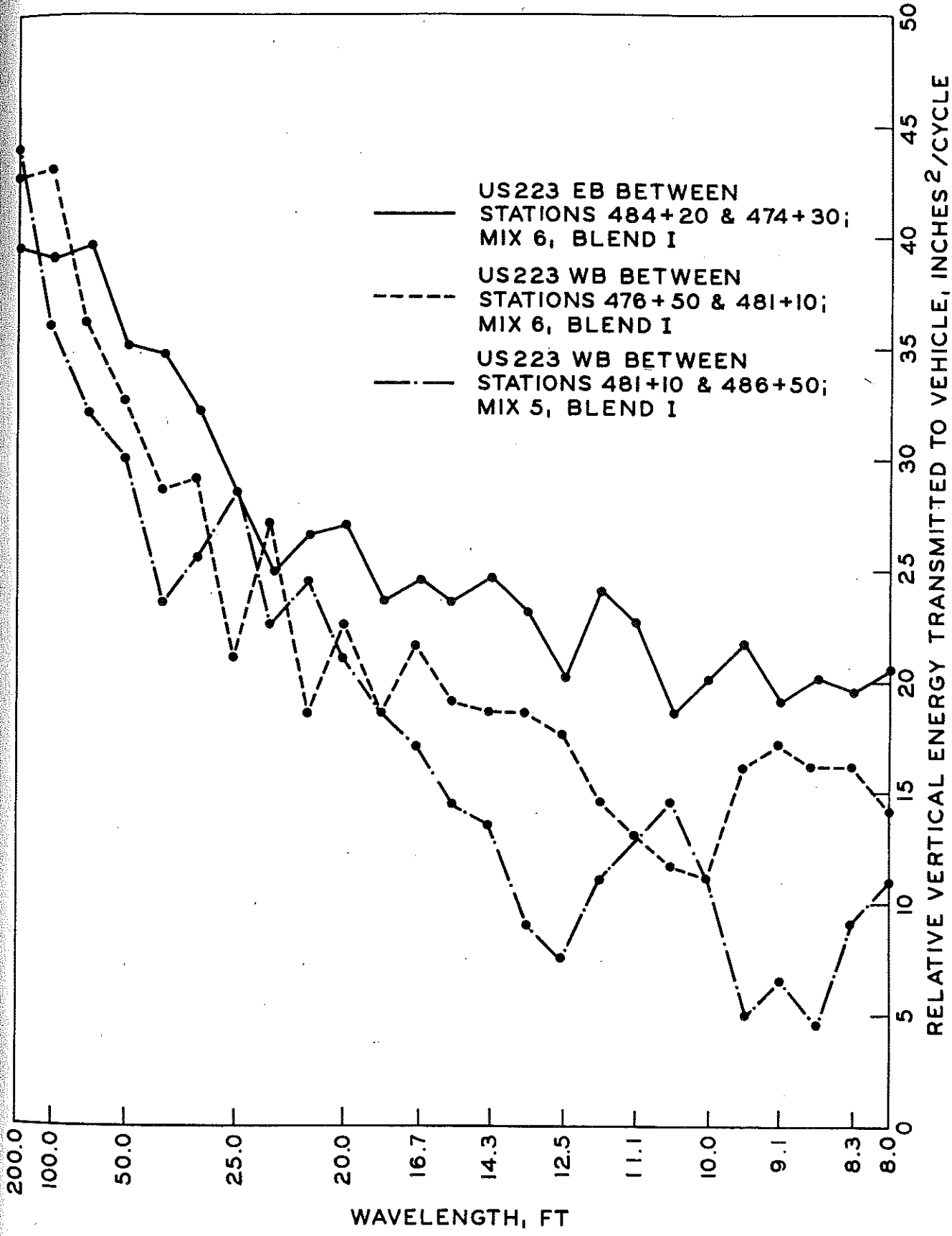
cc: A. P. Chritz
F. Copple

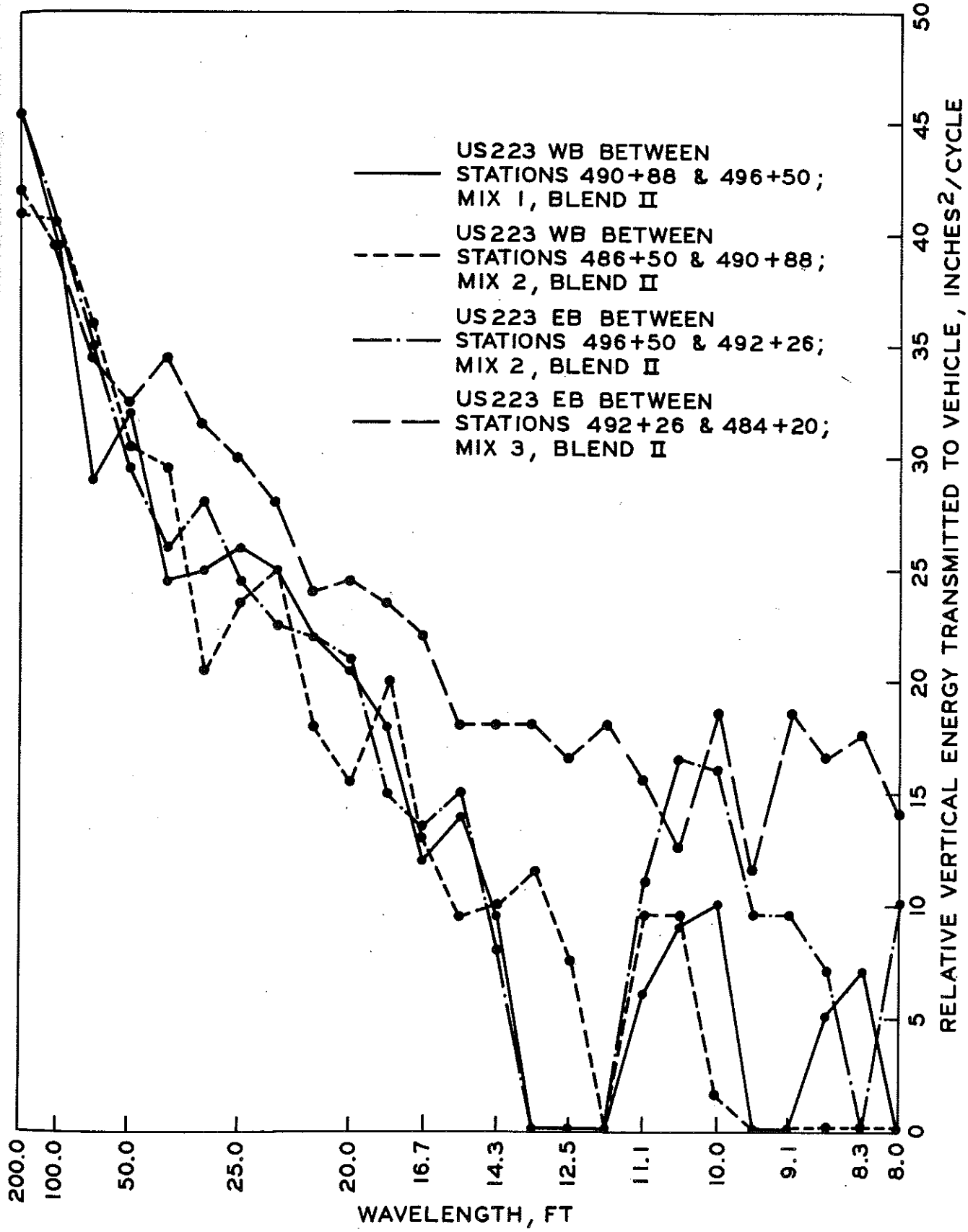
PAVEMENT ROUGHNESS VALUES
ON US 223 BETWEEN
BROOKS HIGHWAY AND ROME CENTER RD

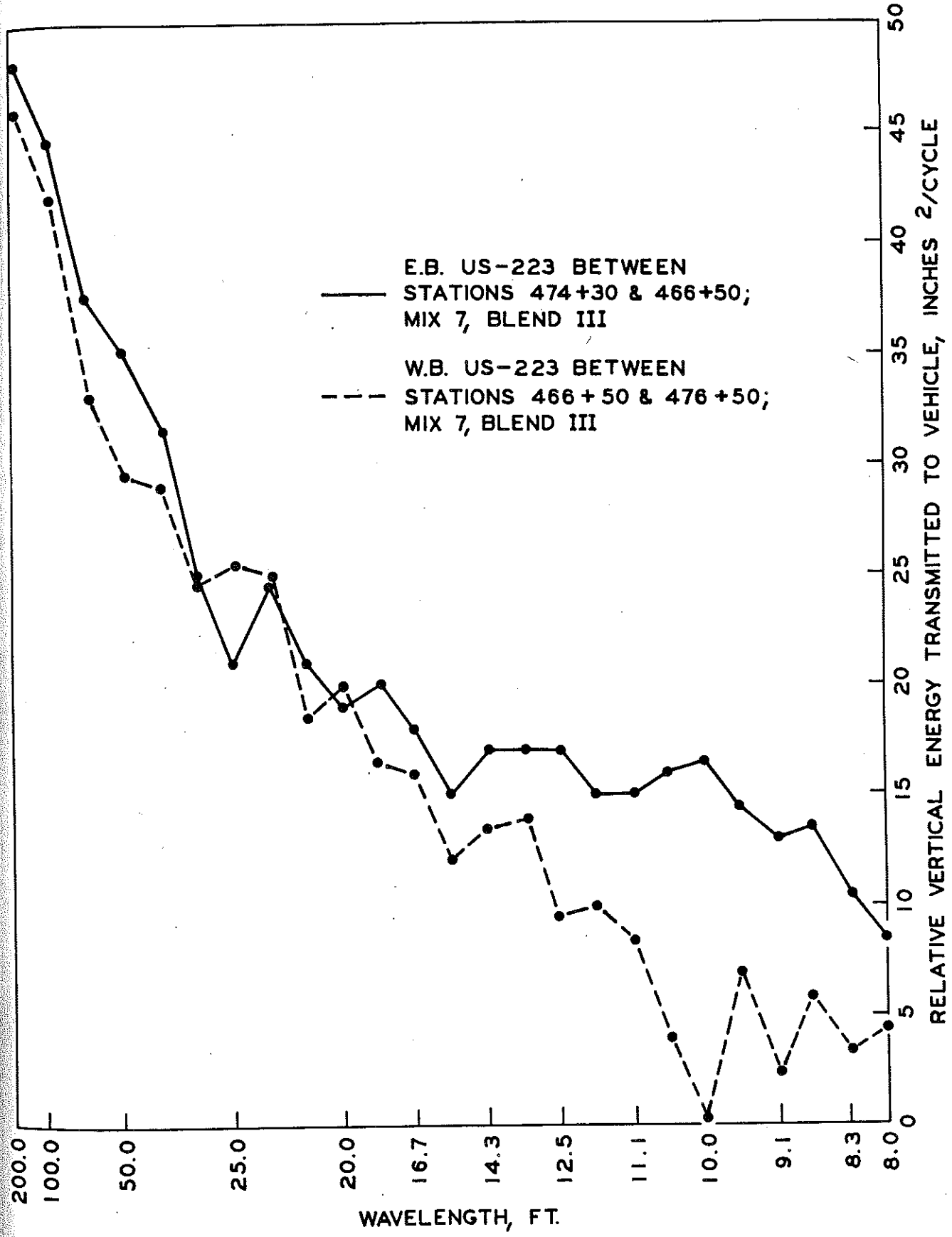
Blend	Direction	Stationing	Mix	Roughness*
I	EB	484+20 -- 474+30	6	334
	WB	476+50 -- 481+10	6	181
	WB	481+10 -- 486+50	5	149
II	EB	496+50 -- 492+26	2	149
	EB	492+26 -- 484+20	3	200
	WB	486+50 -- 490+88	2	143
	WB	490+88 -- 496+50	1	145
III	EB	474+30 -- 466+50	7	136
	WB	466+50 -- 476+50	7	140
IV	EB	466+50 -- 456+40	9	132
	WB	456+50 -- 466+50	9	138
V	EB	456+40 -- 446+50	10	167
	WB	446+50 -- 456+50	10	139
Control	SB	Hawkins Rd to Brooks Highway		196
	NB	Brooks Highway to Hawkins Rd		145

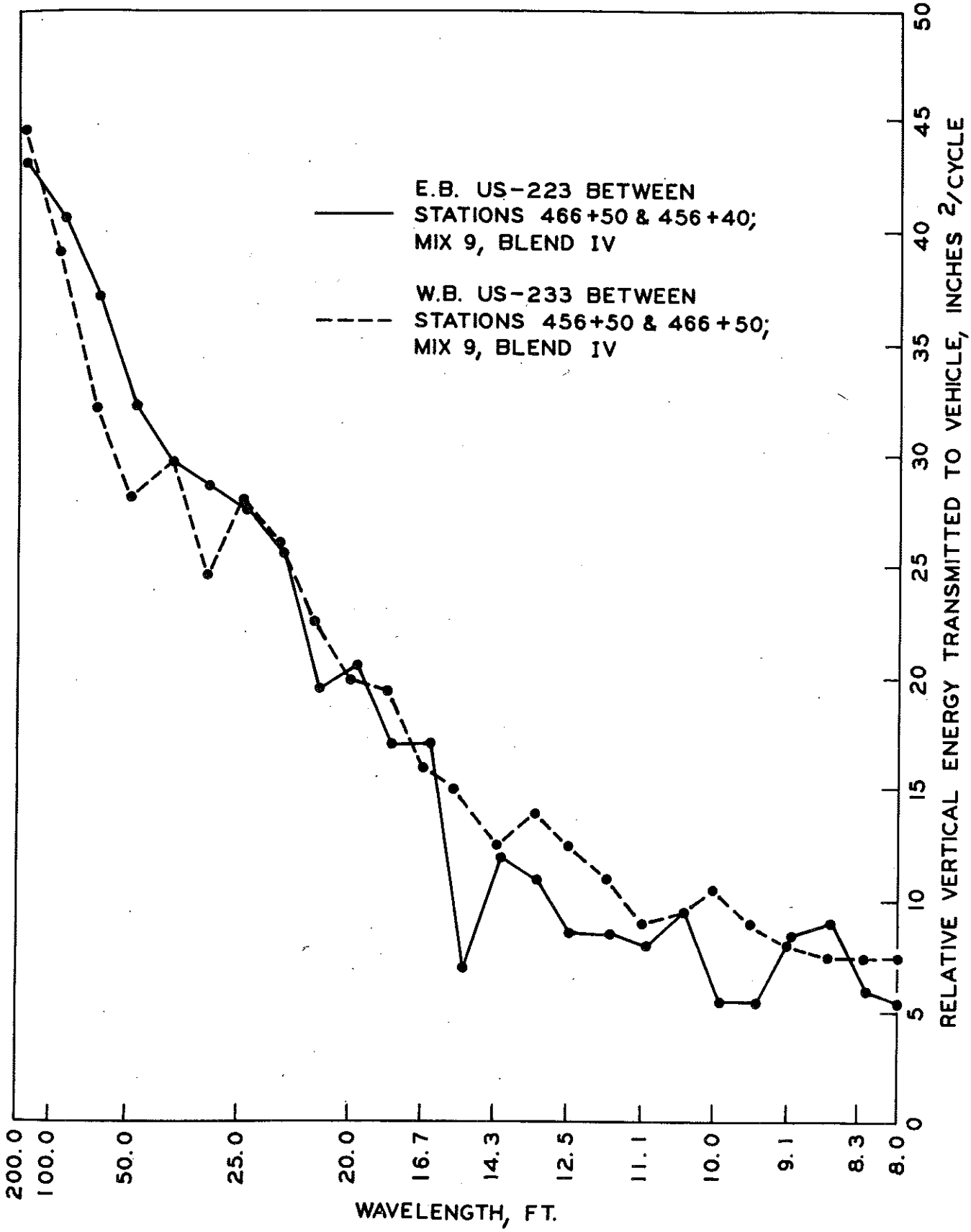
*Roughness values were computed from road profiles and are equivalent to the "roughometer" in./mile unit of measurement. The subjective rating of pavement ride quality is as follows:
Good - less than 130 in./mi, Average - 131 to 174 in./mi, Poor - greater than 175 in./mi.

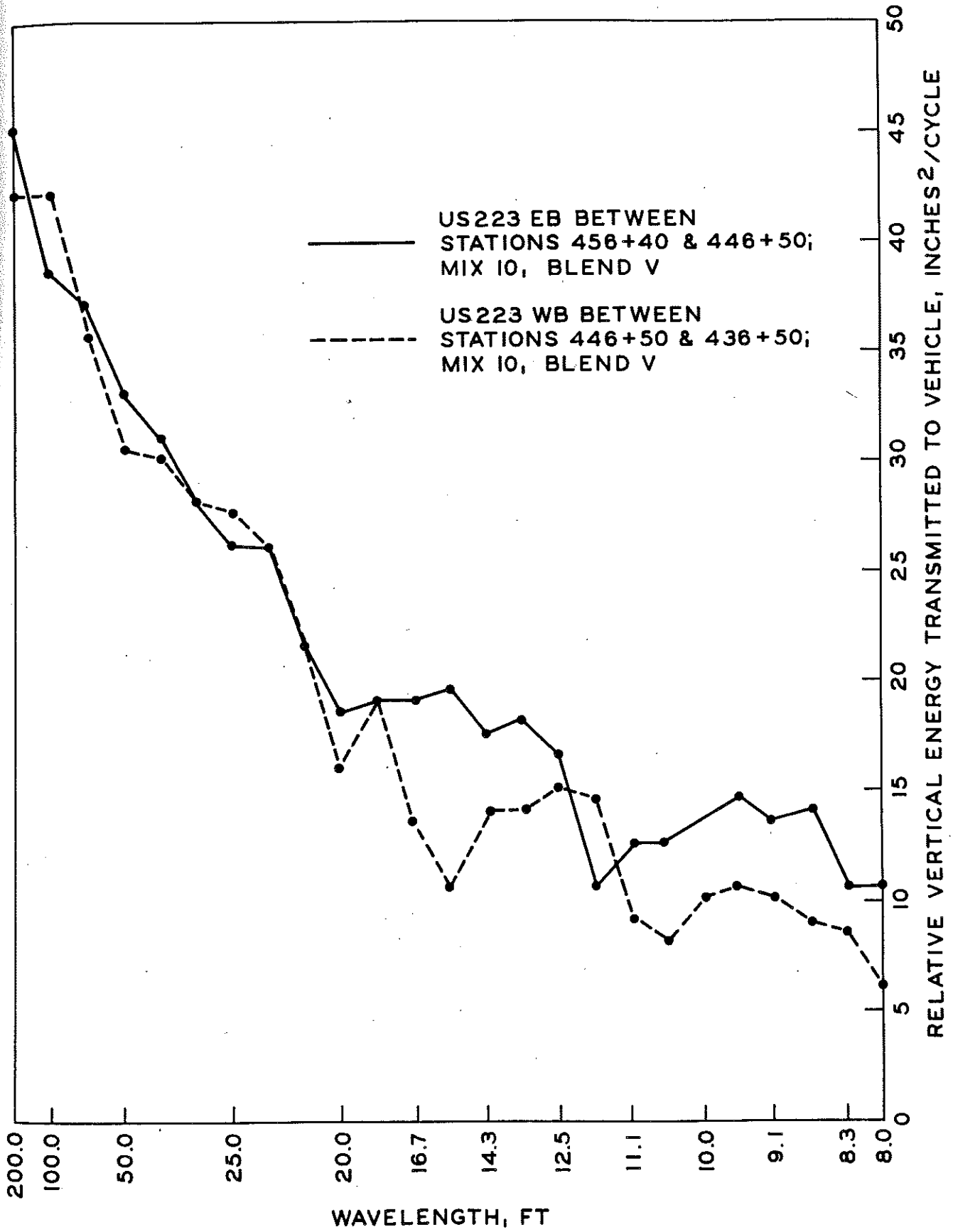

US 223 NB BETWEEN
STATION 496+50 & HAWKINS RD
US 223 SB BETWEEN
HAWKINS RD & STATION 496+00
RELATIVE VERTICAL ENERGY TRANSMITTED TO VEHICLE, INCHES²/CYCLE
0
5
10
15
20
25
30
35
40
45
50
WAVELENGTH, FT
200.0
100.0
50.0
25.0
20.0
16.7
14.3
12.5
11.1
10.0
9.1
8.3
8.0


US223 EB BETWEEN STATIONS 484+20 & 474+30; MIX 6, BLEND I
US223 WB BETWEEN STATIONS 476+50 & 481+10; MIX 6, BLEND I
US223 WB BETWEEN STATIONS 481+10 & 486+50; MIX 5, BLEND I
RELATIVE VERTICAL ENERGY TRANSMITTED TO VEHICLE, INCHES²/CYCLE
0
5
10
15
20
25
30
35
40
45
50
WAVELENGTH, FT
200.0
100.0
50.0
25.0
20.0
16.7
14.3
12.5
11.1
10.0
9.1
8.3
8.0


US223 WB BETWEEN STATIONS 490+88 & 496+50; MIX 1, BLEND II
US223 WB BETWEEN STATIONS 486+50 & 490+88; MIX 2, BLEND II
US223 EB BETWEEN STATIONS 496+50 & 492+26; MIX 2, BLEND II
US223 EB BETWEEN STATIONS 492+26 & 484+20; MIX 3, BLEND II
RELATIVE VERTICAL ENERGY TRANSMITTED TO VEHICLE, INCHES²/CYCLE
0
5
10
15
20
25
30
35
40
45
50
WAVELENGTH, FT
200.0
100.0
50.0
25.0
20.0
16.7
14.3
12.5
11.1
10.0
9.1
8.3
8.0


E.B. US-223 BETWEEN
STATIONS 474+30 & 466+50;
MIX 7, BLEND III
W.B. US-223 BETWEEN
STATIONS 466+50 & 476+50;
MIX 7, BLEND III
RELATIVE VERTICAL ENERGY TRANSMITTED TO VEHICLE, INCHES 2/CYCLE
0
5
10
15
20
25
30
35
40
45
50
WAVELENGTH, FT.
200.0
100.0
50.0
25.0
20.0
16.7
14.3
12.5
11.1
10.0
9.1
8.3
8.0


E.B. US-223 BETWEEN
STATIONS 466+50 & 456+40;
MIX 9, BLEND IV
W.B. US-233 BETWEEN
STATIONS 456+50 & 466+50;
MIX 9, BLEND IV
RELATIVE VERTICAL ENERGY TRANSMITTED TO VEHICLE, INCHES 2/CYCLE
0
5
10
15
20
25
30
35
40
45
50
WAVELENGTH, FT.
200.0
100.0
50.0
25.0
20.0
16.7
14.3
12.5
11.1
10.0
9.1
8.3
8.0


US223 EB BETWEEN STATIONS 456+40 & 446+50; MIX 10, BLEND V
US223 WB BETWEEN STATIONS 446+50 & 436+50; MIX 10, BLEND V
RELATIVE VERTICAL ENERGY TRANSMITTED TO VEHICLE, INCHES2/CYCLE
0
5
10
15
20
25
30
35
40
45
50
WAVELENGTH, FT
200.0
100.0
50.0
25.0
20.0
16.7
14.3
12.5
11.1
10.0
9.1
8.3
8.0