

# A STUDY OF THE GPS LONGITUDE VALUES

Bob Mentzer

The attached large table uses longitude values from the MDLPP report that Todd sent to me on 7-11-02. I have converted the longitudes to miles using 53.27582 miles /° longitude obtained from a formula in the Observer's Handbook of the Royal Astronomical Society of Canada (1997) that gives the length of a degree of longitude for any given latitude you plug in. The "Feet Diff" column lists how many feet the distance between the stone and the previous stone differ from 5280 feet.

The miles from PMW start near the exact miles but increase in a fairly regular way reaching 135.432 miles at stone 132 (135 miles from PMW). An increase of .432 miles in 135 miles is  $.432/135 = .0032 \times 5280 = 17$  feet per mile. Todd and others have concluded that M&D's tools measured about 10 feet per mile too long.

As we scan down the difference column the values are in the  $\pm 20$  range until milestone 5 that is off by 657.8 feet. This is suspiciously close to 10 chains (660 feet) and my tentative guess is they messed up the count here. If you subtract the 660 feet from the .432 miles it drops the average from 17 feet to 12 feet per mile.

The numbers then range from -50 to + 65 to milestone 22. The formula I wrote can't handle jumps of more than 1 mile so the jump from stone 8 to 10 shows up as 5300. Subtracting 5280 from this total gives the difference that is spread over the 2 miles. This value of 20 is in the next column.

At stone 22 we find a difference of -1154 followed by an 1178 at stone 23. Now look for a large (100 or more) value followed by a similar value of opposite sign. The second is 166.2 & -128.2 at stone 40. Here is a list:

	Mile		
	Stone	Values	
1.	22	-1154	1178
2.	40	166.2	-128.2
3.	43	-682	758 (over 3 miles)
4.	50	-634	685.1
5.	53	-908	931.2
6.	76	-220	-122 (Followed by 382)
7.	81	-240.8	381.4
8.	109	-159	580 (followed by -350)
9.	124	118	-100.3

The explanation that occurs to me is that these stones have been moved. If there is exactly 5280 feet between stones 1 and 2, and between 2 and 3 and the middle one is moved 200 feet to the west, the new distances will be 5480 feet or +200 feet and 5080 feet or – 200 feet.

## Comparing the stones that seemed to have been moved with Hodgkins report

<b>Mile Stone</b>	<b>Hodgkins Report</b>
1. 21-22-23	-1154 +1178 #23 New Granite monument at fork of road leading north from Conowingo, MD to Pleasant Grove and Grubb Corner PA. This takes the place of original Milestone # 22 which was situated in the bottom of a hollow a little further west and had been washed out and destroyed by the formation of a gully.

CONCLUSION Stone 22 was moved about ¼ mile east.

<b>47</b>	<b>46</b>	<b>45</b>	<b>44</b>	<b>43</b>	<b>42</b>	<b>41</b>	<b>40</b>	<b>39</b>	<b>38</b>
+22	?	?	?	-682	+16	-128	+166	+25	
/-----+758 -----/									

2. 39-40-41 +166 - 128 #42 “Milestone # 40 M&D 1766 in open field just east of road leading from Norrisville MD to Draco PA and where a section of “line road” starts westward. Only the base of this old crown stone remains in the ground, the upper portion of the monument having been broken off and removed. The position was located by the survey and the base was found in place, but owing to the adverse attitude of the owner of the ground, it was not thought expedient to replace the monument in the same position. The base was left in place and the monument next to be mentioned was established to take its place as the visible mark.”

#43. A crown stone brought from Washington Co MD and placed a short distance to the westward of the preceding monument in the intersection of

the two roads mentioned. It is situated in the grassy triangle between the wagon tracks.

Conclusion            Milestone 40 is 166 feet further west than it should be.

3.    42-43-44        ? (maybe +758) -682

#46 “Milestone No. 43 M&D 1766 was in this vicinity but the monument had disappeared and its position was lost. It seems probable that it formerly stood near a road in the bottom of a small valley, but this situation was unfavorable for the preservation of a monument on account of the amount of wash from the hillside and of water seeping through the soil. One of the monuments brought from Washington Co MD was therefore placed on the boundary at the top of the hill next east of the road, where it stands in a fence rail. The place is about northwest of Gorsuchs Mills.”

Hodgkins says they moved milestone 43 east. This agrees with the -682 value. But the needed positive value near 700 is spread over the next 3 stones. In addition Hodgkins says one of these has been moved.

#48 “Milestone No 45 M&D 1766 In heavy woods about a mile northeast of the village of Maryland Line MD. The monument was out of the ground and lying on the steep hillside. It was placed in a better location on the boundary of the rocky ridge just east of where it was found.”

Can't proportion the +758 feet until we know another stone position.

4. 49-50-51        -634 +635            #53 “Marble crown stone replacing the original milestone No 50 of Mason & Dixon which had been washed out of the ground and subsequently removed to Baltimore where it came into the possession of the Maryland Historical Society. The society furnished in exchange for it a duplicate in white marble. Owing to the present unsuitability of the original site which caused the first stone to be washed out, the new monument was placed on the summit of the hill just east of the

intersection of the "line road" with the road that leads north and east toward New Freedom.

Conclusion Milestone 50 was moved east (-634 feet)

5. 52-53-54 -908 +931 Hodgkins finds all 3 stones apparently unmoved.

Conclusion Milestone 53 has probably been moved at some time.

6. 74-75-76-77-78

	out of gr.	Out of gr	O.K.	O.K.	found base	O.K.
80	79	78	77	76	75	74
-- +11 --	-----+71 ----	-----+382 -----	----- -122 ----	---- -254 -----	----- +34 -----	

A confusing mess. Hodgkins says 74 is O.K. The base of 75 was found. I didn't have a GPS value for 75 so I took off topo map. Should be within 50 ft. The distance from 74 to 78 is only 40 feet over 4 miles. Hodgkins say 76 and 77 are O.K. ( -122 + -254 = - 376 vs +382) so by moving 76 west 254 ft and 77 by 382 ft west the fit would be good over this 4 miles. But Hodgkins said 76 and 77 were O.K. and 78 was out of ground with position lost. He said 79 was out of ground and the position was redetermined.

CONCLUSION Your guess is as good as mine.

7. 80-81-82-83 -240 +381 -69 Hodgkins "#83 Milestone No 80 M&D 1766 A crown stone. This monument was found lying on the ground but its former position was plainly indicated by a depression in the

ground near its base. and as this position was found to agree with other neighboring monuments the monument was reset in that place. The location is northeast of Emmitsburg MD and a little west of Muddy Creek. The monument stands in a little open glade between clumps of woods.

#84 “ Milestone No 81 M&D 1767 In an open field nearly north of Emmitsburg MD and west of the Gettysburg road. This monument was lying on the ground, broken. It had to be repaired and its position to be redetermined.

# 85 Milestone No 82 M&D 1767 Close to a stone wall on the west side of a small creek called Flat Run. This monument was out of the ground.

Conclusion Both 81 and 82 out of ground and original position lost.

8. 109-110-111-112-113

<b>113</b>	<b>112</b>	<b>111</b>	<b>110</b>	<b>109</b>	<b>108</b>
-----+88-----	----- -351 -----		(No GPS)	----- -160 ----	
			----- + 580 -----		

Hodgkins- Found 109 & 110 undisturbed.

#115 Milestone No 111 M&D 1767 This monument was found in the dooryard of a farmhouse near the western border of the Cumberland valley. It was much out of line and as the buildings and trees prevented it from being seen from either direction, it was thought advisable to locate it on the open ridge next to the westward. It stands in the line of a fence which crosses the boundary from north to south. Milestones 112 & 113 are undisturbed.

Conclusion Milestone 111 was moved west. Any analysis is too tentative without GPS on 110

9. 123-124-125 +118 -100 Hodgkins finds no problem. MDLPP table lists 125 as tentative.

Conclusion Need recheck of 125.

MDLPP V ALUES 7-11-02

Milestone	Mi f PMW	Feet Diff		
0	PMW			
	3.996952	1		
	5.00081	2	20.4	
	5.997212	3	-19.0	
	6.998786	4	8.3	
	8.123377	5	657.8	
	9.124632	6	6.6	
	10.12723	7	13.7	
	11.12855	8	7.0	
	13.13249	10	5300.8	20
	14.13529	11	14.8	
	15.13756	12	12.0	
	16.13667	13	-4.7	
	17.14133	14	24.6	
	18.14139	15	0.3	
	19.14407	16	14.1	
	20.15622	17	64.2	
	21.15265	18	-18.8	
	22.14365	19	-47.5	
	23.14383	20	1.0	
	24.1467	21	15.2	
	24.92807	22	-1154.4	1
	26.1512	23	1178.1	
	27.14042	24-eccentric	-56.9	
	28.15003	25	50.7	
	29.14965	26	-2.0	
	30.15291	27	17.2	
	32.15639	29	5298.4	18
	34.15913	31	5294.5	14
	35.16289	32	19.8	
	36.16556	33	14.1	
	37.16709	34	8.0	
	38.16913	35	10.8	
	39.17278	36	19.3	
	41.1776	38	5305.4	25
	42.18241	39	25.4	
	43.21389	40	166.2	2
	44.18961	41	-128.2	
	45.19267	42	16.1	

46.06342	43	-682.4		3
49.20703	46	11318.3	758	
50.21124	47	22.2		
51.20094	48	-54.4		
52.21746	49	87.2		
53.09726	50	-634.7		4
54.22701	51	685.1		
55.22796	52	5.0		
56.05598	53	-908.0		5
57.23233	54	931.2		
60.23966	57	10598.7	38	
62.24095	59	5286.8	6	
64.25862	61	5373.3	93	
65.25412	62	-23.7		
67.25954	64	5308.6	28	
69.26322	66	5299.4	19	
71.27126	68	5322.4	42	
74.27682	71	10589.4	29	
75.27929	72	13.0		
76.28276	73	18.3		
77.28415	74	7.4		
79.24251	76-eccentric	5060.1	-220	6
80.21934	77	-122.3		
81.29175	78	382.3		
82.30516	79	70.8		
83.3072	80	10.8		
84.26159	81	-240.8		7
85.33383	82	381.4		
86.32076	83	-69.0		
87.32126	84	2.6		
88.32514	85	20.5		
89.32883	86	19.5		
90.32046	87	-44.2		
91.3349	88	76.2		
92.33734	89	12.9		
93.34101	90	19.4		
94.34321	91	11.6		
95.34751	92	22.7		
96.34957	93	10.9		
97.3541	94	23.9		
98.35587	95	9.4		
100.3628	97	5316.7	36	
102.3542	99	5234.6	-46	
103.3731	100	99.5		
106.3618	103	10500.5	-60	
107.3837	104	115.7		
108.3869	105	17.0		

109.3892	106	12.1		
111.3969	108	5320.3	40	
112.3667	109	-159.4		
114.4766	111	5860.6	580	8
115.4102	112	-350.9		
116.4268	113	88.0		
117.4283	114	7.8		
119.4248	116	5261.3	-19	
121.4036	118	5168.3	-112	
122.4077	119	21.7		
123.407	120	-3.8		
124.4068	121	-0.8		
125.4103	122	18.3		
126.4106	123	1.8		
127.4331	124	118.3		9
128.4141	125-approximate	-100.3		
129.4131	126	-5.3		
132.4181	129	10586.4	26	
135.432	132	10633.4	73	



