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U. S. Department of Commerce
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Coast and Geodetic Survey
Robert F. A. Studds, *Director*

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PLANE COORDINATE PROJECTION TABLES
CONNECTICUT

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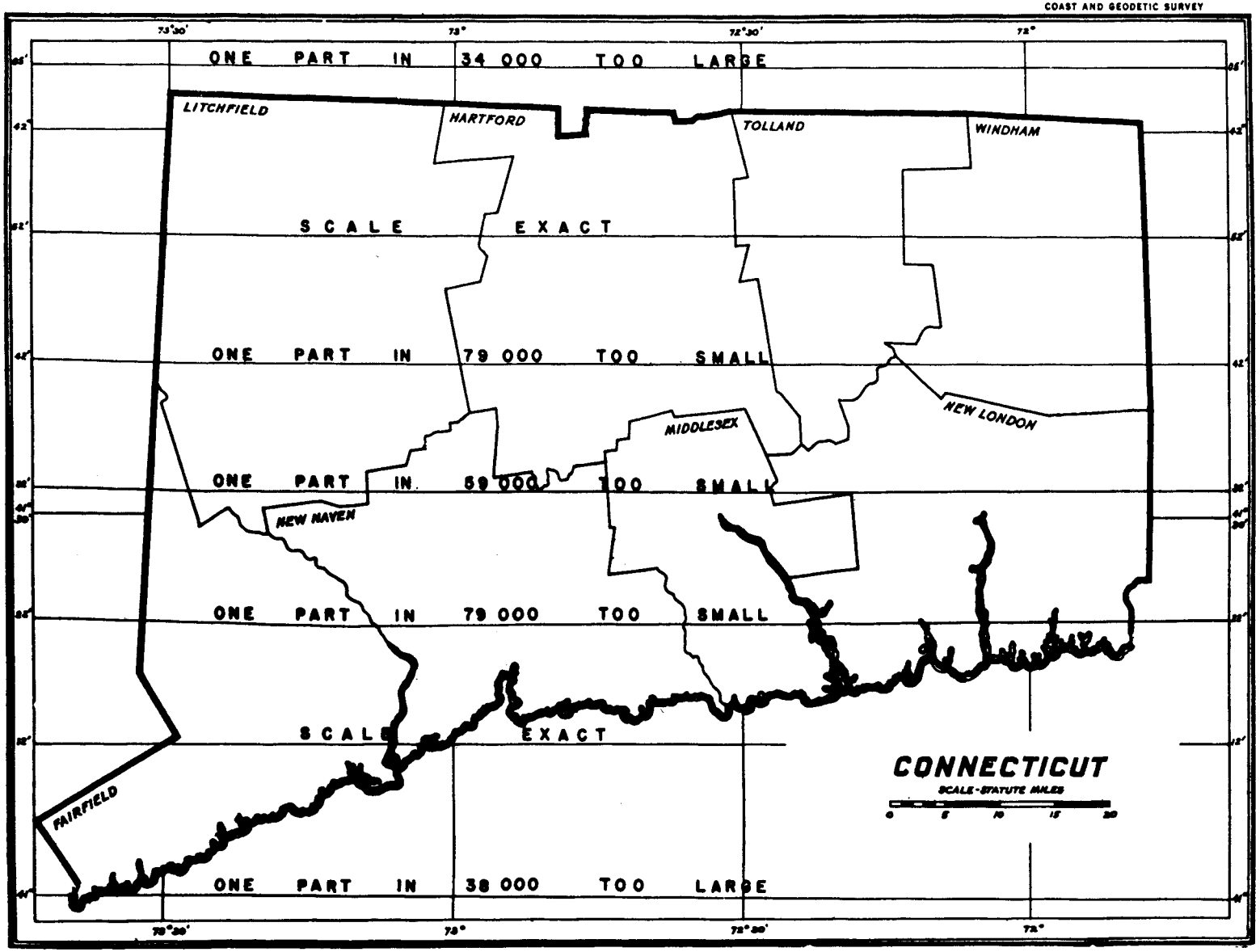
U. S. DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY



Foreword

The plane coordinate system used in this State is based on the Lambert conformal conic projection with two standard parallels for each zone. The tables in this publication are to be used for the conversion of geographic positions to plane coordinates or plane coordinates to geographic positions. The constants of the projection are listed with the tables.

The methods of computation have been designed for machine calculation, using tables of natural trigonometric functions. A table of these functions has been published by the Coast and Geodetic Survey to ten decimal places with ten-second intervals for 0° to 6° in Special Publication No. 246 and is sold for a nominal sum by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

The formulas and sample computations which follow show the general methods for computing either type of coordinates.

Plane Coordinates from Geographic Positions

$$x = R \sin \theta + C$$

$$y = R_b - R \cos \theta$$

Grid azimuth = geodetic azimuth - θ + second term

where

R is the radius for the latitude of the station,

R_b is a constant for a zone,

θ is the mapping angle for the longitude of the station,

and

C is the value of x assigned to the Central Meridian for a zone.

The second term for the reduction of geodetic to grid azimuths may be neglected for most work. However, for lines five miles or more in length, if the same degree of accuracy is desired as is obtained by geographic computations, this term should be evaluated and used.

$$\text{Second term} = \frac{x_2 - x_1}{2\rho_0^2 \sin 1''}\left(y_1 - y_0 + \frac{y_2 - y_1}{3}\right)$$

Geographic Positions from Plane Coordinates

The formulas show the method of computing R and θ from which the latitude and longitude may be obtained.

$$x' = x - C$$

$$\tan\theta = x' \div (R_b - y)$$

$$R = (R_b - y) \div \cos\theta$$

$$\Delta\lambda = \theta \div \ell$$

$$\lambda = \text{Central Meridian} - \Delta\lambda$$

where

R, R_b, θ, and C are the same as previously defined

and

ℓ is a constant for a zone.

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 726 d

PLANE COORDINATES ON LAMBERT PROJECTION

(Condensed form for calculating-machine computation)

$X = R \sin\theta + C$ $\quad$ $Y = R_b - R\cos\theta$ $\quad$ State-Zone Connecticut

$C =$ 600,000.00 $\quad$ $R_b =$ 23,914,389.02 $\quad$ Grid Az. = Geod. Az. − θ

Station	Latitude / Longitude	R / θ	sin θ / cos θ	X / Y
1 Winer, 1932, r. 1942	41 16 55.847	23,750,849.79	+0.00028 76584	606,832.13
	72 43 30.515	+0 00 59.3338	0.99999 99587	163,540.21
	Grid azimuth to azimuth mark		R.M. No. 2	317° 17' 03"
2 Milford 2, 1871, r. 1947	41 13 25.985	23,772,090.04	−0.00313 61901	525,446.21
	73 01 15.609	−0 10 46.8867	0.99999 50822	142,415.89
	Grid azimuth to azimuth mark		R.M. No. 2	124° 46' 04"
3				
	Grid azimuth to azimuth mark			° ' "
4				
	Grid azimuth to azimuth mark			° ' "

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 749 b

GEODETIC POSITIONS FROM LAMBERT COORDINATES

(CALCULATING MACHINE COMPUTATION)

STATE-ZONE Connecticut — $\quad$ $\ell =$ 0.66305 94147

Station Winer, 1932, r. 1942

C	− 600,000.00	R_b	23,914,389.02
X	606,832.13	Y	− 163,540.21
$X' = X - C$	+ 6,832.13	$R_b - Y$	23,750,848.81
$\tan\theta = X' \div (R_b - Y)$	+0.00028 76584	θ	+59.3338
θ	+ 0° 00' 59.3338"	$\Delta\lambda = \theta \div \ell$	+89.485
cos θ	0.99999 99587	Δλ	+0° 01' 29.485"
$R = (R_b - Y) \div \cos\theta$	23,750,849.79	Central Meridian	72° 45' 00.000"
φ	41° 16' 55.847"	$\lambda = C.M. - \Delta\lambda$	72° 43' 30.515"

Station Milford 2, 1871, r. 1947

C	− 600,000.00	R_b	23,914,389.02
X	525,446.21	Y	− 142,415.89
$X' = X - C$	− 74,553.79	$R_b - Y$	23,771,973.13
$\tan\theta = X' \div (R_b - Y)$	−0.00313 62054	θ	−646.8867
θ	−0 10' 46.8867"	$\Delta\lambda = \theta \div \ell$	−975.609
cos θ	0.99999 50822	Δλ	−0° 16' 15.609"
$R = (R_b - Y) \div \cos\theta$	23,772,090.04	Central Meridian	72° 45' 00.000"
φ	41 13 25.985"	$\lambda = C.M. - \Delta\lambda$	73° 01' 15.609"

Constants for Connecticut

C	600,000.00 ft.
Central Meridian	72° 45' 00".000
R_b	23,914,389.02 ft.
y_o	255,155.48 ft.
ℓ	0.66305 94147
$\frac{1}{2\rho_o^2 \sin 1''}$	2.357×10^{-10}
$\log \frac{1}{2\rho_o^2 \sin 1''}$	0.372 3907 - 10
$\log \ell$	9.82155 24459 - 10
log K	7.60257 45968

Table I.

Lat.	R feet	y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
40° 50'	23,914,389.02	0	101.20933	+248.7	1.0000573
51	23,908,316.46	6,072.56	101.20933	+233.6	1.0000538
52	23,902,243.90	12,145,12	101.20917	+218.9	1.0000504
53	23,896,171.35	18,217.67	101.20933	+204.5	1.0000471
54	23,890,098.79	24,290.23	101.20917	+190.4	1.0000438
55	23,884,026.24	30,362.78	101.20917	+176.8	1.0000407
40° 56'	23,877,953.69	36,435.33	101.20917	+163.5	1.0000376
57	23,871,881.14	42,507.88	101.20917	+150.5	1.0000347
58	23,865,808.59	48,580.43	101.20917	+138.0	1.0000318
59	23,859,736.04	54,652.98	101.20917	+125.8	1.0000290
41° 00	23,853,663.49	60,725.53	101.20933	+113.9	1.0000262
41° 01'	23,847,590.93	66,798.09	101.20917	+102.4	1.0000236
02	23,841,518.38	72,870.64	101.20933	+ 91.3	1.0000210
03	23,835,445.82	78,943.20	101.20933	+ 80.5	1.0000185
04	23,829,373.26	85,015.76	101.20950	+ 70.1	1.0000161
05	23,823,300.69	91,088.33	101.20950	+ 60.1	1.0000138
41° 06'	23,817,228.12	97,160.90	101.20950	+ 50.5	1.0000116
07	23,811,155.55	103,233.47	101.20967	+ 41.1	1.0000095
08	23,805,082.97	109,306.05	101.20967	+ 32.2	1.0000074
09	23,799,010.39	115,378.63	101.20983	+ 23.6	1.0000054
10	23,792,937.80	121,451.22	101.21000	+ 15.4	1.0000035
41° 11'	23,786,865.20	127,523.82	101.21000	+ 7.5	1.0000017
12	23,780,792.60	133,596.42	101.21017	0.0	1.0000000
13	23,774,719.99	139,669.03	101.21033	- 7.1	0.9999984
14	23,768,647.37	145,741.65	101.21050	- 13.8	0.9999968
15	23,762,574.74	151,814.28	101.21050	- 20.2	0.9999953
41° 16'	23,756,502.11	157,886.91	101.21083	- 26.3	0.9999939
17	23,750,429.46	163,959.56	101.21100	- 32.0	0.9999926
18	23,744,356.80	170,032.22	101.21117	- 37.3	0.9999914
19	23,738,284.13	176,104.89	101.21117	- 42.2	0.9999903
20	23,732,211.46	182,177.56	101.21167	- 46.8	0.9999892
41° 21'	23,726,138.76	188,250.26	101.21167	- 51.0	0.9999883
22	23,720,066.06	194,322.96	101.21183	- 54.8	0.9999874
23	23,713,993.35	200,395.67	101.21217	- 58.3	0.9999866
24	23,707,920.62	206,468.40	101.21233	- 61.4	0.9999859
25	23,701,847.88	212,541.14	101.21267	- 64.2	0.9999852

Table 1 (Cont'd).

Lat.	R feet	y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
41° 26'	23,695,775.12	218,613.90	101.21283	- 66.6	0.9999847
27	23,689,702.35	224,686.67	101.21317	- 68.6	0.9999842
28	23,683,629.56	230,759.46	101.21333	- 70.3	0.9999838
29	23,677,556.76	236,832.26	101.21367	- 71.6	0.9999835
30	23,671,483.94	242,905.08	101.21400	- 72.5	0.9999833
41° 31'	23,665,411.10	248,977.92	101.21417	- 73.0	0.9999832
32	23,659,338.25	255,050.77	101.21450	- 73.2	0.9999831
33	23,653,265.38	261,123.64	101.21483	- 73.0	0.9999832
34	23,647,192.49	267,196.53	101.21517	- 72.5	0.9999833
35	23,641,119.58	273,269.44	101.21533	- 71.6	0.9999835
41° 36'	23,635,046.66	279,342.36	101.21583	- 70.3	0.9999838
37	23,628,973.71	285,415.31	101.21617	- 68.6	0.9999842
38	23,622,900.74	291,488.28	101.21650	- 66.6	0.9999847
39	23,616,827.75	297,561.27	101.21683	- 64.2	0.9999852
40	23,610,754.74	303,634.28	101.21717	- 61.5	0.9999858
41° 41'	23,604,681.71	309,707.31	101.21750	- 58.4	0.9999866
42	23,598,608.66	315,780.36	101.21800	- 54.9	0.9999874
43	23,592,535.58	321,853.44	101.21833	- 51.0	0.9999883
44	23,586,462.48	327,926.54	101.21883	- 46.8	0.9999892
45	23,580,389.35	333,999.67	101.21917	- 42.2	0.9999903
41° 46'	23,574,316.20	340,072.82	101.21950	- 37.3	0.9999914
47	23,568,243.03	346,145.99	101.22000	- 32.0	0.9999926
48	23,562,169.83	352,219.19	101.22050	- 26.3	0.9999939
49	23,556,096.60	358,292.42	101.22083	- 20.3	0.9999953
50	23,550,023.35	364,365.67	101.22133	- 13.9	0.9999968
41° 51'	23,543,950.07	370,438.95	101.22183	- 7.1	0.9999984
52	23,537,876.76	376,512.26	101.22217	0.0	1.0000000
53	23,531,803.43	382,585.59	101.22283	+ 7.5	1.0000017
54	23,525,730.06	388,658.96	101.22317	+ 15.4	1.0000035
55	23,519,656.67	394,732.35	101.22367	+ 23.7	1.0000055
41° 56'	23,513,583.25	400,805.77	101.22433	+ 32.3	1.0000074
57	23,507,509.79	406,879.23	101.22467	+ 41.3	1.0000095
58	23,501,436.31	412,952.71	101.22533	+ 50.7	1.0000117
59	23,495,362.79	419,026.23	101.22567	+ 60.4	1.0000139
42° 00	23,489,289.25	425,099.77	101.22633	+ 70.5	1.0000162

Table I (Cont'd).

Lat.	R feet	y' y value on central meridian feet	Tabular difference for 1 sec. of lat. feet	Scale in units of 7th place of logs	Scale expressed as a ratio
42° 01'	23,483,215.67	431,173.35	101.22700	+ 81.0	1.0000187
02	23,477,142.05	437,246.97	101.22733	+ 91.8	1.0000211
03	23,471,068.41	443,320.61	101.22800	+103.0	1.0000237
04	23,464,994.73	449,394.29	101.22850	+114.6	1.0000264
05	23,458,921.02	455,468.00	101.22917	+126.5	1.0000291
42° 06'	23,452,847.27	461,541.75	101.22983	+138.8	1.0000320
07	23,446,773.48	467,615.54	101.23033	+151.5	1.0000349
08	23,440,699.66	473,689.36	101.23083	+164.6	1.0000379
09	23,434,625.81	479,763.21	101.23167	+178.0	1.0000410
10	23,428,551.91	485,837.11	101.23217	+191.8	1.0000442
42° 11'	23,422,477.98	491,911.04	101.23283	+206.0	1.0000474
12	23,416,404.01	497,985.01	101.23333	+220.5	1.0000508
13	23,410,330.01	504,059.01	101.23417	+235.4	1.0000542
14	23,404,255.96	510,133.06	101.23483	+250.7	1.0000577
15	23,398,181.87	516,207.15	101.23533	+266.3	1.0000613
42° 16'	23,392,107.75	522,281.27	101.23617	+282.3	1.0000650
17	23,386,033.58	528,355.44	101.23667	+298.7	1.0000688
18	23,379,959.38	534,429.64	101.23750	+315.4	1.0000726
19	23,373,885.13	540,503.89	101.23817	+332.5	1.0000766
20	23,367,810.84	546,578.18		+350.0	1.0000806

LAMBERT PROJECTION FOR CONNECTICUT

Table II.

1" of long. = 0".6630594147 of θ

Long.	θ	Long.	θ	Long.	θ
71° 30'	+0° 49' 43".7674	72° 06'	+0° 25' 51".5590	72° 41'	+0° 02' 39".1343
31	+0 49 03.9838	07	+0 25 11.7755	42	+0 01 59.3507
32	+0 48 24.2002	08	+0 24 31.9919	43	+0 01 19.5671
33	+0 47 44.4167	09	+0 23 52.2083	44	+0 00 39.7836
34	+0 47 04.6331	10	+0 23 12.4248	45	0 00 00.0000
35	+0 46 24.8495				
71° 36'	+0 45 45.0660	72° 11'	+0 22 32.6412	72° 46'	−0 00 39.7836
37	+0 45 05.2824	12	+0 21 52.8576	47	−0 01 19.5671
38	+0 44 25.4988	13	+0 21 13.0741	48	−0 01 59.3507
39	+0 43 45.7153	14	+0 20 33.2905	49	−0 02 39.1343
40	+0 43 05.9317	15	+0 19 53.5069	50	−0 03 18.9178
71° 41'	+0 42 26.1482	72° 16'	+0 19 13.7234	72° 51'	−0 03 58.7014
42	+0 41 46.3646	17	+0 18 33.9398	52	−0 04 38.4850
43	+0 41 06.5810	18	+0 17 54.1562	53	−0 05 18.2685
44	+0 40 26.7975	19	+0 17 14.3727	54	−0 05 58.0521
45	+0 39 47.0139	20	+0 16 34.5891	55	−0 06 37.8356
71° 46'	+0 39 07.2303	72° 21'	+0 15 54.8056	72° 56'	−0 07 17.6192
47	+0 38 27.4468	22	+0 15 15.0220	57	−0 07 57.4028
48	+0 37 47.6632	23	+0 14 35.2384	58	−0 08 37.1863
49	+0 37 07.8796	24	+0 13 55.4549	59	−0 09 16.9699
50	+0 36 28.0961	25	+0 13 15.6713	73° 00	−0 09 56.7535
71° 51'	+0 35 48.3125	72° 26'	+0 12 35.8877	73° 01'	−0 10 36.5370
52	+0 35 08.5289	27	+0 11 56.1042	02	−0 11 16.3206
53	+0 34 28.7454	28	+0 11 16.3206	03	−0 11 56.1042
54	+0 33 48.9618	29	+0 10 36.5370	04	−0 12 35.8877
55	+0 33 09.1782	30	+0 09 56.7535	05	−0 13 15.6713
71° 56'	+0 32 29.3947	72° 31'	+0 09 16.9699	73° 06'	−0 13 55.4549
57	+0 31 49.6111	32	+0 08 37.1863	07	−0 14 35.2384
58	+0 31 09.8275	33	+0 07 57.4028	08	−0 15 15.0220
59	+0 30 30.0440	34	+0 07 17.6192	09	−0 15 54.8056
72° 00	+0 29 50.2604	35	+0 06 37.8356	10	−0 16 34.5891
72° 01'	+0 29 10.4769	72° 36'	+0 05 58.0521	73° 11'	−0 17 14.3727
02	+0 28 30.6933	37	+0 05 18.2685	12	−0 17 54.1562
03	+0 27 50.9097	38	+0 04 38.4850	13	−0 18 33.9398
04	+0 27 11.1262	39	+0 03 58.7014	14	−0 19 13.7234
05	+0 26 31.3426	40	+0 03 18.9178	15	−0 19 53.5069

Table II (Cont'd).

1" of long. = 0".6630594147 of θ

Long.	θ	Long.	θ
73° 16'	-0° 20' 33".2905	73° 51'	-0° 43' 45".7153
17	-0 21 13.0741	52	-0 44 25.4988
18	-0 21 52.8576	53	-0 45 05.2824
19	-0 22 32.6412	54	-0 45 45.0660
20	-0 23 12.4248	55	-0 46 24.8495
73° 21'	-0 23 52.2083	73° 56'	-0 47 04.6331
22	-0 24 31.9919	57	-0 47 44.4167
23	-0 25 11.7755	58	-0 48 24.2002
24	-0 25 51.5590	59	-0 49 03.9838
25	-0 26 31.3426	74° 00	-0 49 43.7674
73° 26'	-0 27 11.1262		
27	-0 27 50.9097		
28	-0 28 30.6933		
29	-0 29 10.4769		
30	-0 29 50.2604		
73° 31'	-0 30 30.0440		
32	-0 31 09.8275		
33	-0 31 49.6111		
34	-0 32 29.3947		
35	-0 33 09.1782		
73° 36'	-0 33 48.9618		
37	-0 34 28.7454		
38	-0 35 08.5289		
39	-0 35 48.3125		
40	-0 36 28.0961		
73° 41'	-0 37 07.8796		
42	-0 37 47.6632		
43	-0 38 27.4468		
44	-0 39 07.2303		
45	-0 39 47.0139		
73° 46'	-0 40 26.7975		
47	-0 41 06.5810		
48	-0 41 46.3646		
49	-0 42 26.1482		
50	-0 43 05.9317		

CORRECTIONS TO NATURAL SCALE RATIOS*
(in units of the 7th decimal place)

For Lambert Projection

Δø' as argument

Δø'	Corr'n (Plus)	Δø'	Corr'n (Plus)
1	0	31	34
2	0	32	36
3	0	33	38
4	1	34	40
5	1	35	43
6	1	36	45
7	2	37	48
8	2	38	51
9	3	39	53
10	4	40	56
11	4	41	59
12	5	42	62
13	6	43	65
14	7	44	68
15	8	45	71
16	9	46	74
17	10	47	77
18	11	48	81
19	13	49	84
20	14	50	88
21	15	51	91
22	17	52	95
23	19	53	98
24	20	54	102
25	22	55	106
26	24	56	110
27	26	57	114
28	27	58	118
29	29	59	122
30	32	60	126

Δø' is the difference in latitude in minutes of the ends of the line.

For Lambert or transverse Mercator Projection

Δy or Δx	Corr'n (Plus)
10,000	0
20,000	0
30,000	1
40,000	2
50,000	2
60,000	3
70,000	5
80,000	6
90,000	8
100,000	10
110,000	11
120,000	14
130,000	16
140,000	19
150,000	21
160,000	24
170,000	27
180,000	31
190,000	34
200,000	38
210,000	42
220,000	46
230,000	50
240,000	55
250,000	59
260,000	64
270,000	69
280,000	74
290,000	80
300,000	86
310,000	91
320,000	97
330,000	103
340,000	110
350,000	116

*Scale ratio interpolated for mean latitude or mean x' of the ends of a line and corrected by the above table is a true mean value accurate to within one in the seventh decimal place.

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