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*Sinclair Weeks, Secretary*

**Coast and Geodetic Survey**

*Robert F. A. Studds, Director*

**Special Publication No. 317**

**PLANE COORDINATE PROJECTION TABLES  
NEW HAMPSHIRE**



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# **National Oceanic and Atmospheric Administration**

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**NEW HAMPSHIRE**

SCALE - STATUTE MILES  
0 10 20 30 40

TOO SMALL

SCALE EXACT

ONE PART IN

30 000

SCALE

EXACT

32.4 MI.

CHESTER

SULLIVAN

SCALE

EXACT

CENTRAL

MERIDIAN

HILLSBORO

MERRIMACK

ONE

PART

IN

30 000

COOS

ROCKINGHAM

STRATFORD

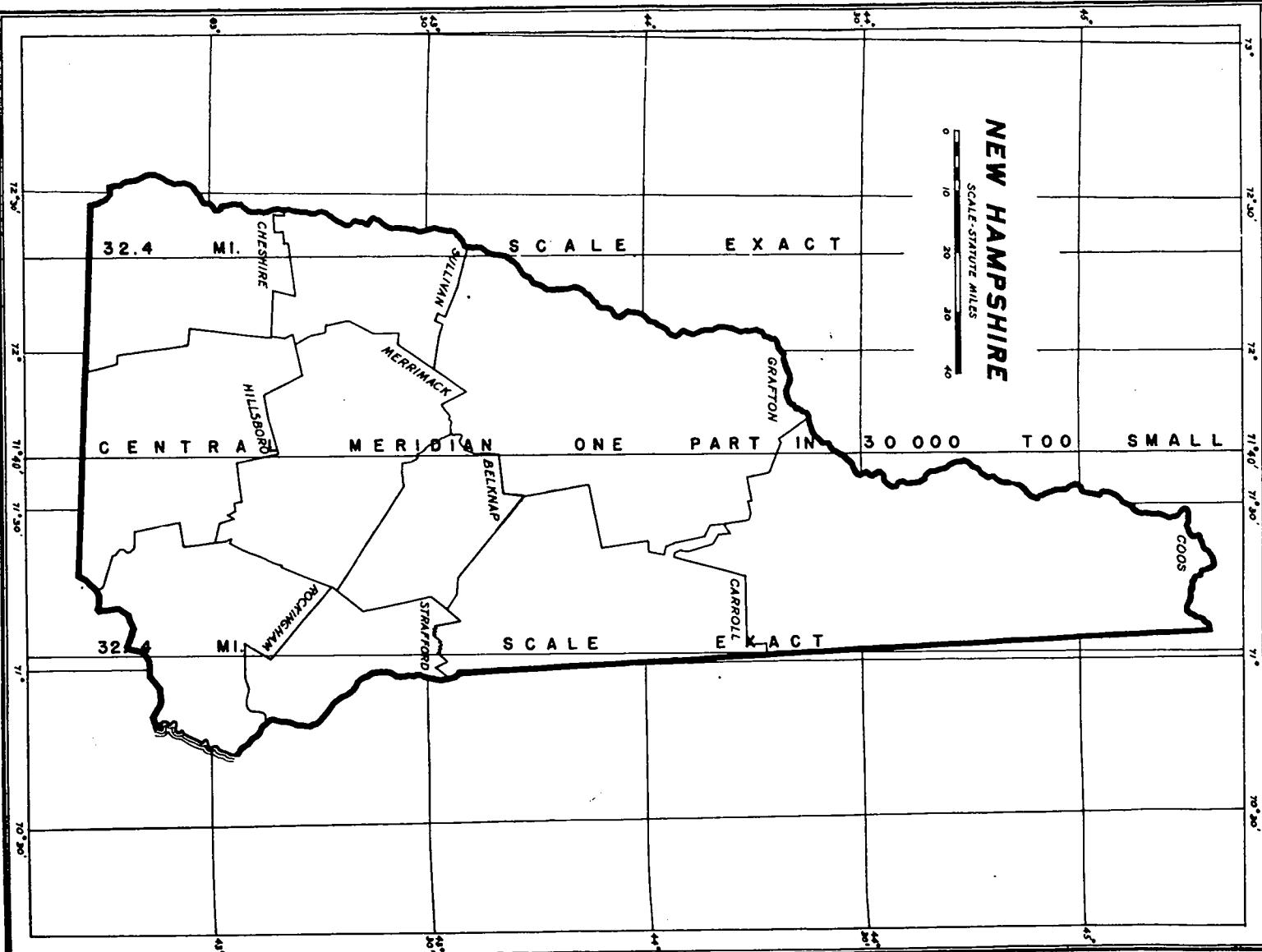
SCALE

EXACT

32.4 MI.

BELKNAP

CARROLL



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## Foreword

The plane coordinate system used in this State is based on the transverse Mercator projection using a reduced scale for the central meridian of the 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. All of the functions that are required are given in this publication.

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

### Plane coordinates from geographic positions

$$x = x' + 500,000$$

$$x' = H \cdot \Delta \lambda'' \pm a$$

$$y = y_0 + v \left( \frac{\Delta \lambda''}{100} \right)^2 \pm c$$

Grid azimuth = geodetic azimuth -  $\Delta \alpha$  - second term

$$\Delta \alpha'' = \Delta \lambda'' \sin \phi + g$$

where

$y_0$ ,  $H$ ,  $V$ , and  $a$  are based on the latitude  
of the geographic position,

and

$b$ ,  $c$ , and  $g$  are based on  $\Delta \lambda''$ .

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

and

$\Delta\alpha''$  is the convergence of the meridian at the station with respect to the Central Meridian.

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.

$$\text{Second term} = \frac{(y_2 - y_1) (2x'_1 + x'_2)}{(6\rho_o^2 \sin l'') g}$$

#### Geographic positions from plane coordinates

$$P(x'/10,000)^2 + d = V(\Delta\lambda''/100)^2 + c$$

$$y_o = y - P(x'/10,000)^2 - d$$

Obtain the latitude from the table of  $y_o$ .

Use latitude to obtain H from the table.

$$x' = x - 500,000$$

$$\text{approximate } \Delta\lambda'' = x' \div H.$$

Determine a from latitude and b from approximate  $\Delta\lambda$   
then

$$\Delta\lambda'' = (x' + a b) \div H$$

$$\Delta\alpha'' = Mx' - e$$

M is based on the y, and e on the x and y of the plane coordinates.

PLANE COORDINATES ON TRANSVERSE MERCATOR PROJECTION  
(Condensed form for calculating-machine computation)

State New Hampshire Zone — Central meridian  $71^{\circ} 40' 00.000$

Station	<i>Durham, 1943</i>	<i>Childs, 1942</i>			
$\phi$	$43^{\circ} 08' 15.006$	$42^{\circ} 51' 25.984$			
$\lambda$	$70^{\circ} 56' 11.287$	$72^{\circ} 32' 32.197$			
$\Delta\lambda = \text{Central mer.} - \lambda$	$+ 0^{\circ} 43' 48.713$	$- 0^{\circ} 52' 32.197$			
$\Delta\lambda''$	$+ 2,628.713$	$- 3,152.197$			
$\left(\frac{\Delta\lambda''}{100}\right)^2$	691.013	993.635			
$H$	74.145 908	74.483 716			
$V$	1.229 158	1.228 296			
$a$	-0.737	+1.107	-0.851	+1.082	
$x = H \cdot \Delta\lambda \pm ab$	+194,907.50	-234,786.43			
$V \left(\frac{\Delta\lambda''}{100}\right)^2 \pm c$	849.25	1,220.34			
Tabular $y$	232,336.56	130,184.27			
$x$	694,907.50	265,213.57			
$y$	233,185.81	131,404.61			
$\Delta\alpha''$	+1,797.45	-2,144.14			
$\Delta\alpha$	$+ 0^{\circ} 29' 57''$	$- 0^{\circ} 35' 44.1''$			
Geod. Az. to Az. Mk.	93 09 39	30 31 15.7			
Grid Az. to Az. Mk.	92 39 42	31 07 00			

$$x = x' + 500,000$$

$$y = \text{Tab. } y + V \left( \frac{\Delta\lambda''}{100} \right)^2 \pm c$$

$$\Delta\alpha'' = \Delta\lambda'' \sin \phi + g$$

$$\text{Grid Az.} = \text{Geod. Az.} - \Delta\alpha$$

$$H \text{ and } V = \text{Tab. } H \text{ and Tab. } V$$

When  $ab$  is  $\begin{cases} - & \text{decrease} \\ + & \text{increase} \end{cases}$   $H \cdot \Delta\lambda$  numerically.

$g$  increases  $\Delta\lambda'' \cdot \sin \phi$  numerically.

**GEODETIC POSITIONS FROM TRANSVERSE MERCATOR COORDINATES**  
(CALCULATING MACHINE COMPUTATION)

STATE - ZONE New Hampshire

Station Durham, 1943

X	694,907.50	Y	233,185.81
C	- 500,000.00	$P(\frac{X}{10,000})^2 + d$	- 849.25
X'	+ 194,907.50	$Y_o$	232,336.56
P	2.23547	Approx. $\Delta\lambda = X' \div H$	+ 2,629"
d	+ 0.02	$\Delta\lambda = (X' + ab) \div H$	+ 2,628."713
H	74.145 908	$\Delta\lambda$	+ 0° 43' 48."713
a   b	-0.737   +1.107	Central Meridian	71 40 00.000
φ	43° 08' 15.006	$\lambda = C.M. - \Delta\lambda$	70° 56' 11."287

Station Childs, 1942

X	265,213.57	Y	131,404.61
C	- 500,000.00	$P(\frac{X}{10,000})^2 + d$	- 1,220.34
X'	- 234,786.43	$Y_o$	130,184.27
P	2.21376	Approx. $\Delta\lambda = X' \div H$	- 3,152"
d	+ 0.01	$\Delta\lambda = (X' + ab) \div H$	- 3,152."197
H	74.483 716	$\Delta\lambda$	- 0° 52' 32."197
a   b	-0.851   +1.082	Central Meridian	71 40 00.000
φ	42° 51' 25.984	$\lambda = C.M. - \Delta\lambda$	72° 32' 32."197

Station

X	.	Y	
C	-	$P(\frac{X}{10,000})^2 + d$	-
X'		$Y_o$	"
P		Approx. $\Delta\lambda = X' \div H$	"
d		$\Delta\lambda = (X' + ab) \div H$	"
H		$\Delta\lambda$	° 1 "
a   b	.	Central Meridian	° 1 "
φ	° 1 "	$\lambda = C.M. - \Delta\lambda$	° 1 "

Station

X	.	Y	
C	-	$P(\frac{X}{10,000})^2 + d$	-
X'		$Y_o$	"
P		Approx. $\Delta\lambda = X' \div H$	"
d		$\Delta\lambda = (X' + ab) \div H$	"
H		$\Delta\lambda$	° 1 "
a   b	.	Central Meridian	° 1 "
φ	° 1 "	$\lambda = C.M. - \Delta\lambda$	° 1 "

When  $ab$  is  $\frac{+}{-}$ , decrease  $X'$  numerically  
 $\frac{-}{+}$ , increase

**Constants for New Hampshire**

Central Meridian	71° 40' 00.000
log R	-144.8
Scale reduction (Central Meridian)	1 : 30,000
$\log \left( \frac{1}{2} \right) g$	4.580 6202 -20
$\log \left( \frac{1}{2} \sin 1'' \right) g$	9.895 0453 -20
$\left( \frac{1}{2} \sin 1'' \right) g$	$0.7853 \times 10^{-10}$



TRANSVERSE MERCATOR PROJECTION  
NEW HAMPSHIRE

Lat.	y <sub>o</sub> feet	Δy <sub>o</sub> per second	H	ΔH per second	V	ΔV per second	a
42 30	0.00	101.230 17	74.911 651	331.68	1.227 025	1.07	1.000
42 31	6 073.81	101.230 50	74.891 750	331.80	1.227 089	1.05	- .993
42 32	12 147.64	101.230 67	74.871 842	331.88	1.227 152	1.05	- .986
42 33	18 221.48	101.231 00	74.851 929	332.00	1.227 215	1.03	- .979
42 34	24 295.34	101.231 33	74.832 009	332.12	1.227 277	1.03	- .972
42 35	30 369.22	101.231 67	74.812 082	332.22	1.227 339	1.02	- .965
42 36	36 443.12	101.232 00	74.792 149	332.32	1.227 400	1.02	- .958
42 37	42 517.04	101.232 17	74.772 210	332.43	1.227 461	1.02	- .951
42 38	48 590.97	101.232 50	74.752 264	332.53	1.227 522	1.00	- .944
42 39	54 664.92	101.232 83	74.732 312	332.63	1.227 582	1.00	- .937
42 40	60 738.89	101.233 17	74.712 354	332.75	1.227 642	.98	- .930
42 41	66 812.88	101.233 50	74.692 389	332.85	1.227 701	.98	- .923
42 42	72 886.89	101.233 67	74.672 418	332.95	1.227 760	.98	- .916
42 43	78 960.91	101.234 00	74.652 441	333.07	1.227 819	.97	- .909
42 44	85 1034.95	101.234 33	74.632 457	333.17	1.227 877	.97	- .902
42 45	91 109.01	101.234 67	74.612 467	333.28	1.227 935	.95	- .896
42 46	97 183.09	101.234 83	74.592 470	333.38	1.227 992	.95	- .889
42 47	103 257.18	101.235 33	74.572 467	333.48	1.228 049	.93	- .882
42 48	109 331.30	101.235 50	74.552 458	333.58	1.228 105	.93	- .875
42 49	115 405.43	101.235 83	74.532 443	333.70	1.228 161	.93	- .868
42 50	121 479.58	101.236 00	74.512 421	333.80	1.228 217	.92	- .861
42 51	127 553.74	101.236 50	74.493 393	333.92	1.228 272	.92	- .854
42 52	133 627.93	101.236 67	74.472 358	334.02	1.228 327	.90	- .847
42 53	139 702.13	101.237 00	74.452 317	334.12	1.228 381	.90	- .841
42 54	145 776.35	101.237 33	74.432 270	334.23	1.228 435	.90	- .834
42 55	151 850.59	101.237 67	74.412 216	334.32	1.228 489	.88	- .827
42 56	157 924.85	101.237 83	74.392 157	334.45	1.228 542	.88	- .820
42 57	163 999.12	101.238 33	74.372 090	334.53	1.228 595	.87	- .813
42 58	170 073.42	101.238 50	74.352 018	334.65	1.228 647	.87	- .807
42 59	176 147.73	101.238 83	74.331 939	334.75	1.228 699	.85	- .800
43 00	182 222.06		74.311 854		1.228 750		- .793

TRANSVERSE MERCATOR PROJECTION  
NEW HAMPSHIRE

Lat.	y. feet	$\Delta y$ . per second	H	$\Delta H$ per second	V	$\Delta V$ per second	a
43 00	182 222.06	101.239 00	74.311 854	334.85	1.228 750	.85	-.793
43 01	188 296.40	101.239 50	74.291 763	334.97	1.228 801	.83	-.786
43 02	194 370.77	101.239 67	74.271 665	335.07	1.228 851	.85	-.780
43 03	200 445.15	101.240 00	74.251 561	335.17	1.228 902	.82	-.773
43 04	206 519.55	101.240 33	74.231 451	335.28	1.228 951	.83	-.766
43 05	212 593.97	101.240 50	74.211 334	335.38	1.229 001	.82	-.760
43 06	218 668.40	101.241 00	74.191 211	335.48	1.229 050	.80	-.753
43 07	224 742.86	101.241 17	74.171 082	335.60	1.229 098	.80	-.746
43 08	230 817.33	101.241 50	74.150 946	335.70	1.229 146	.80	-.739
43 09	236 891.82	101.241 83	74.130 804	335.80	1.229 194	.78	-.733
43 10	242 966.33	101.242 17	74.110 656	335.92	1.229 241	.78	-.726
43 11	249 040.86	101.242 33	74.090 501	336.02	1.229 288	.77	-.719
43 12	255 115.40	101.242 67	74.070 340	336.12	1.229 334	.78	-.713
43 13	261 189.96	101.243 00	74.050 173	336.23	1.229 381	.75	-.706
43 14	267 264.54	101.243 33	74.029 999	336.32	1.229 426	.75	-.700
43 15	273 339.14	101.243 67	74.009 820	336.45	1.229 471	.75	-.693
43 16	279 413.76	101.243 83	73.989 633	336.53	1.229 516	.75	-.686
43 17	285 488.39	101.244 17	73.969 441	336.65	1.229 561	.72	-.680
43 18	291 563.04	101.244 50	73.949 242	336.75	1.229 604	.73	-.673
43 19	297 637.71	101.244 83	73.929 037	336.85	1.229 648	.72	-.667
43 20	303 712.40	101.245 17	73.908 826	336.97	1.229 691	.72	-.660
43 21	309 787.11	101.245 33	73.888 608	337.05	1.229 734	.70	-.653
43 22	315 861.83	101.245 67	73.868 385	337.17	1.229 776	.70	-.647
43 23	321 936.57	101.246 00	73.848 155	337.28	1.229 818	.68	-.640
43 24	328 011.33	101.246 33	73.827 918	337.37	1.229 859	.68	-.634
43 25	334 086.11	101.246 67	73.807 676	337.48	1.229 900	.67	-.627
43 26	340 160.91	101.246 83	73.787 427	337.60	1.229 940	.67	-.620
43 27	346 235.72	101.247 17	73.767 171	337.68	1.229 980	.67	-.614
43 28	352 310.55	101.247 50	73.746 910	337.80	1.230 020	.65	-.607
43 29	358 385.40	101.247 83	73.726 642	337.90	1.230 059	.65	-.601
43 30	364 460.27	101.248 00	73.706 368	338.00	1.230 098	.63	-.594
43 31	370 535.15	101.248 50	73.686 088	338.12	1.230 136	.63	-.588
43 32	376 610.06	101.248 67	73.665 801	338.22	1.230 174	.63	-.581
43 33	382 684.98	101.249 00	73.645 508	338.32	1.230 212	.62	-.575
43 34	388 759.92	101.249 33	73.625 209	338.43	1.230 249	.62	-.568
43 35	394 834.88	101.249 50	73.604 903	338.52	1.230 286	.60	-.562
43 36	400 909.85	101.249 83	73.584 592	338.63	1.230 322	.60	-.555
43 37	406 984.84	101.250 17	73.564 274	338.75	1.230 358	.58	-.549
43 38	413 059.85	101.250 50	73.543 949	338.83	1.230 393	.58	-.542
43 39	419 134.88	101.250 83	73.523 619	338.95	1.230 428	.58	-.536
43 40	425 209.93	101.251 17	73.503 282	339.05	1.230 463	.57	-.529
43 41	431 285.00	101.251 33	73.482 939	339.17	1.230 497	.57	-.523
43 42	437 360.08	101.251 67	73.462 589	339.25	1.230 531	.57	-.516
43 43	443 435.18	101.252 00	73.442 234	339.37	1.230 565	.55	-.510
43 44	449 510.30	101.252 33	73.421 872	339.47	1.230 598	.53	-.503
43 45	455 585.44	101.252 67	73.401 504	339.57	1.230 630	.53	-.497
43 46	461 660.60	101.252 83	73.381 130	339.68	1.230 662	.53	-.491
43 47	467 735.77	101.253 17	73.360 749	339.78	1.230 694	.53	-.484
43 48	473 810.96	101.253 50	73.340 362	339.88	1.230 726	.50	-.478
43 49	479 886.17	101.253 83	73.319 969	339.98	1.230 756	.52	-.471
43 50	485 961.40	101.254 00	73.299 570	340.08	1.230 787	.50	-.465
43 51	492 036.64	101.254 33	73.279 165	340.20	1.230 817	.50	-.459
43 52	498 111.90	101.254 67	73.258 753	340.30	1.230 847	.48	-.452
43 53	504 187.18	101.255 00	73.238 335	340.40	1.230 876	.48	-.446
43 54	510 262.48	101.255 33	73.217 911	340.52	1.230 905	.47	-.440
43 55	516 337.80	101.255 67	73.197 480	340.60	1.230 933	.47	-.434
43 56	522 413.14	101.255 83	73.177 044	340.72	1.230 961	.47	-.427
43 57	528 488.49	101.256 17	73.156 601	340.82	1.230 989	.45	-.421
43 58	534 563.86	101.256 50	73.136 152	340.92	1.231 016	.45	-.415
43 59	540 639.25	101.256 83	73.115 697	341.03	1.231 043	.43	-.408
44 00	546 714.66		73.095 235		1.231 069		-.402

TRANSVERSE MERCATOR PROJECTION  
NEW HAMPSHIRE

Lat.	y <sub>o</sub> feet	Δy <sub>o</sub> per second	H	ΔH per second	V	ΔV per second	a
44 0 0	546 714.66	101.257 00	73.095 235	341.13	1.231 069	.43	.402
44 0 1	552 790.08	101.257 33	73.074 767	341.23	1.231 095	.43	.396
44 0 2	558 865.52	101.257 67	73.054 293	341.33	1.231 121	.42	.390
44 0 3	564 940.98	101.258 00	73.033 813	341.45	1.231 146	.42	.383
44 0 4	571 016.46	101.258 33	73.013 326	341.53	1.231 171	.40	.377
44 0 5	577 091.96	101.258 67	72.992 834	341.65	1.231 195	.40	.371
44 0 6	583 167.48	101.258 83	72.972 335	341.75	1.231 219	.38	.365
44 0 7	589 243.01	101.259 17	72.951 830	341.87	1.231 242	.38	.359
44 0 8	595 318.56	101.259 50	72.931 318	341.95	1.231 265	.38	.352
44 0 9	601 394.13	101.259 83	72.910 801	342.07	1.231 288	.37	.346
44 1 0	607 469.72	101.260 17	72.890 277	342.17	1.231 310	.37	.340
44 1 1	613 545.33	101.260 33	72.869 747	342.27	1.231 332	.35	.334
44 1 2	619 620.95	101.260 67	72.849 211	342.37	1.231 353	.35	.328
44 1 3	625 702.59	101.261 00	72.828 669	342.48	1.231 374	.33	.321
44 1 4	631 772.25	101.261 17	72.808 120	342.58	1.231 394	.33	.315
44 1 5	637 847.92	101.261 67	72.787 565	342.68	1.231 414	.33	.309
44 1 6	643 923.62	101.261 83	72.767 004	342.78	1.231 434	.32	.303
44 1 7	649 999.33	101.262 17	72.746 437	342.88	1.231 453	.32	.297
44 1 8	656 075.06	101.262 50	72.725 864	342.98	1.231 472	.30	.290
44 1 9	662 150.81	101.262 83	72.705 285	343.10	1.231 490	.30	.284
44 2 0	668 226.58	101.263 00	72.684 699	343.20	1.231 508	.30	.278
44 2 1	674 302.36	101.263 50	72.664 107	343.30	1.231 526	.28	.272
44 2 2	680 378.17	101.263 67	72.643 509	343.40	1.231 543	.27	.266
44 2 3	686 453.99	101.264 00	72.622 905	343.52	1.231 559	.28	.259
44 2 4	692 529.83	101.264 17	72.602 294	343.60	1.231 576	.27	.253
44 2 5	698 605.68	101.264 67	72.581 678	343.72	1.231 592	.25	.247
44 2 6	704 681.56	101.264 83	72.561 055	343.82	1.231 607	.25	.241
44 2 7	710 757.45	101.265 17	72.540 426	343.92	1.231 622	.25	.235
44 2 8	716 833.36	101.265 50	72.519 791	344.03	1.231 637	.23	.228
44 2 9	722 909.29	101.265 83	72.499 149	344.12	1.231 651	.23	.222
44 3 0	728 985.24	101.266 00	72.478 502	344.23	1.231 665	.22	.216
44 3 1	735 061.20	101.266 50	72.457 848	344.33	1.231 678	.23	.210
44 3 2	741 137.19	101.266 67	72.437 188	344.43	1.231 692	.20	.204
44 3 3	747 213.19	101.266 83	72.416 522	344.53	1.231 704	.20	.197
44 3 4	753 289.20	101.267 33	72.395 850	344.63	1.231 716	.20	.191
44 3 5	759 365.24	101.267 67	72.375 172	344.75	1.231 728	.20	.185
44 3 6	765 441.30	101.267 83	72.354 487	344.83	1.231 740	.18	.179
44 3 7	771 517.37	101.268 17	72.333 797	344.95	1.231 751	.17	.173
44 3 8	777 593.46	101.268 50	72.313 100	345.05	1.231 761	.17	.166
44 3 9	783 669.57	101.268 83	72.292 397	345.15	1.231 771	.17	.160
44 4 0	789 745.70	101.269 00	72.271 688	345.25	1.231 781	.15	.154
44 4 1	795 821.84	101.269 50	72.250 973	345.37	1.231 790	.15	.148
44 4 2	801 898.01	101.269 67	72.230 251	345.45	1.231 799	.15	.142
44 4 3	807 974.19	101.270 00	72.209 524	345.57	1.231 808	.13	.135
44 4 4	814 050.39	101.270 17	72.188 790	345.67	1.231 816	.12	.129
44 4 5	820 126.60	101.270 67	72.168 050	345.77	1.231 823	.12	.123
44 4 6	826 202.84	101.270 83	72.147 304	345.87	1.231 830	.12	.117
44 4 7	832 279.09	101.271 17	72.126 552	345.97	1.231 837	.12	.111
44 4 8	838 355.36	101.271 50	72.105 794	346.07	1.231 844	.08	.104
44 4 9	844 431.65	101.271 83	72.085 030	346.18	1.231 849	.10	.098
44 5 0	850 507.96	101.272 00	72.064 259	346.28	1.231 855	.08	.092
44 5 1	856 584.28	101.272 50	72.043 482	346.38	1.231 860	.08	.086
44 5 2	862 660.63	101.272 67	72.022 699	346.48	1.231 865	.07	.080
44 5 3	868 736.99	101.273 00	72.001 910	346.58	1.231 869	.07	.073
44 5 4	874 813.37	101.273 17	71.981 115	346.68	1.231 873	.05	.067
44 5 5	880 889.76	101.273 67	71.960 314	346.78	1.231 876	.05	.061
44 5 6	886 966.18	101.273 83	71.939 507	346.90	1.231 879	.05	.055
44 5 7	893 042.61	101.274 17	71.918 693	347.00	1.231 882	.03	.049
44 5 8	899 119.06	101.274 50	71.887 848	347.08	1.231 884	.03	.036
45 0 0	911 272.02		71.856 216		1.231 887		- .030

TRANSVERSE MERCATOR PROJECTION  
NEW HAMPSHIRE

Lat.		$y_0$ feet	$\Delta y_0$ per second	H	$\Delta H$ per second	V	$\Delta V$ per second	a
45 0 0		911 2'2 .02	101.275 00	71.856 216	347.30	1.231 887	.02	-.030
45 0 1		917 348.52	101.275 50	71.835 378	347.40	1.231 888	.02	-.024
45 0 2		923 425.05	101.275 67	71.814 534	347.50	1.231 889	.00	-.018
45 0 3		929 501.59	101.276 00	71.793 684	347.60	1.231 889	.02	-.011
45 0 4		935 578.15	101.276 33	71.772 828	347.72	1.231 888	.00	-.005
45 0 5	941	654.73	101.276 50	71.751 965	347.80	1.231 888	.02	+.001
45 0 6	947	731.32	101.276 83	71.731 097	347.92	1.231 887	.03	.007
45 0 7	953	807.93	101.277 17	71.710 222	348.00	1.231 885	.03	.013
45 0 8	959	884.56	101.277 50	71.689 342	348.12	1.231 883	.03	.020
45 0 9	965	961.21	101.277 83	71.668 455	348.22	1.231 881	.05	.026
45 1 0	972	1037.88	101.278 17	71.647 562	348.32	1.231 878	.05	.032
45 1 1	978	114.57	101.278 33	71.626 663	348.42	1.231 875	.07	.038
45 1 2	984	191.27	101.278 67	71.605 758	348.52	1.231 871	.07	.044
45 1 3	990	267.99	101.279 00	71.584 847	348.63	1.231 867	.07	.051
45 1 4	996	344.73	101.279 33	71.563 929	348.72	1.231 863	.08	.057
45 1 5	1 002	421.49	101.279 50	71.543 006	348.82	1.231 858	.10	.063
45 1 6	1 008	498.26	101.280 00	71.522 077	348.93	1.231 852	.08	.069
45 1 7	1 014	575.06	101.280 17	71.501 141	349.03	1.231 847	.10	.075
45 1 8	1 020	651.87	101.280 50	71.480 199	349.12	1.231 841	.12	.082
45 1 9	1 026	728.70	101.280 67	71.459 252	349.23	1.231 834	.12	.088
45 2 0	1 032	805.54	101.281 17	71.438 298	349.33	1.231 827	.12	.094
45 2 1	1 038	882.41	101.281 33	71.417 338	349.43	1.231 820	.13	.100
45 2 2	1 044	959.29	101.281 67	71.396 372	349.53	1.231 812	.15	.106
45 2 3	1 051	1036.19	101.282 00	71.375 400	349.63	1.231 803	.13	.113
45 2 4	1 057	113.11	101.282 33	71.354 422	349.73	1.231 795	.15	.119
45 2 5	1 063	190.05	101.282 67	71.333 438	349.83	1.231 786	.17	.125
45 2 6	1 069	267.01	101.282 83	71.312 448	349.95	1.231 776	.17	.131
45 2 7	1 075	343.98	101.283 17	71.291 451	350.03	1.231 766	.17	.137
45 2 8	1 081	420.97	101.283 50	71.270 449	350.15	1.231 756	.18	.144
45 2 9	1 087	497.98	101.283 83	71.249 440	350.23	1.231 745	.18	.150
45 3 0	1 093	575.01	101.284 00	71.228 426	350.35	1.231 734	.20	.156
45 3 1	1 099	652.05	101.284 50	71.207 405	350.43	1.231 722	.18	.162
45 3 2	1 105	729.12	101.284 67	71.186 379	350.55	1.231 711	.22	.168
45 3 3	1 111	806.20	101.285 00	71.165 346	350.65	1.231 698	.22	.175
45 3 4	1 117	883.30	101.285 17	71.144 307	350.73	1.231 685	.22	.181
45 3 5	1 123	960.41	101.285 67	71.123 263	350.85	1.231 672	.22	.187
45 3 6	1 130	037.55	101.285 83	71.102 212	350.95	1.231 659	.23	.193
45 3 7	1 136	114.70	101.286 17	71.081 155	351.05	1.231 645	.25	.199
45 3 8	1 142	191.87	101.286 50	71.060 092	351.15	1.231 630	.25	.206
45 3 9	1 148	269.06	101.286 83	71.039 023	351.25	1.231 615	.25	.212
45 4 0	1 154	346.27	101.287 17	71.017 948	351.35	1.231 600	.27	.218
45 4 1	1 160	423.50	101.287 33	70.996 867	351.45	1.231 584	.27	.224
45 4 2	1 166	500.74	101.287 67	70.975 780	351.55	1.231 568	.27	.231
45 4 3	1 172	578.00	101.288 00	70.954 687	351.67	1.231 552	.28	.237
45 4 4	1 178	655.28	101.288 33	70.933 587	351.75	1.231 535	.30	.243
45 4 5	1 184	732.58		70.912 482		1.231 517		.250

## TRANSVERSE MERCATOR PROJECTION

## NEW HAMPSHIRE

$\Delta\lambda''$	b	$\Delta b$	c	$\Delta\lambda''$	b	$\Delta b$	c
0	0.000	+0.060	0.000				
100	+0.060	+0.059	0.000	2600	+1.105	+0.006	-0.111
200	+0.119	+0.059	-0.001	2700	+1.111	+0.002	-0.116
300	+0.178	+0.059	-0.002	2800	+1.113	-0.003	-0.121
400	+0.237	+0.059	-0.003	2900	+1.110	-0.007	-0.125
500	+0.296	+0.057	-0.005	3000	+1.103	-0.012	-0.130
600	+0.353	+0.057	-0.007	3100	+1.091	-0.017	-0.133
700	+0.410	+0.055	-0.010	3200	+1.074	-0.021	-0.135
800	+0.465	+0.054	-0.014	3300	+1.053	-0.027	-0.136
900	+0.519	+0.053	-0.018	3400	+1.026	-0.032	-0.135
1000	+0.572	+0.051	-0.022	3500	+0.994	-0.038	-0.133
1100	+0.623	+0.050	-0.027	3600	+0.956	-0.043	-0.131
1200	+0.673	+0.047	-0.032	3700	+0.913	-0.049	-0.128
1300	+0.720	+0.046	-0.038	3800	+0.864	-0.055	-0.124
1400	+0.766	+0.044	-0.043	3900	+0.809	-0.061	-0.120
1500	+0.810	+0.041	-0.049	4000	+0.748	-0.070	-0.115
1600	+0.851	+0.039	-0.055	4100	+0.678	-0.076	-0.109
1700	+0.890	+0.037	-0.061	4200	+0.602	-0.082	-0.101
1800	+0.927	+0.033	-0.067	4300	+0.520	-0.090	-0.091
1900	+0.960	+0.031	-0.073	4400	+0.430	-0.096	-0.078
2000	+0.991	+0.027	-0.079	4500	+0.334	-0.106	-0.063
2100	+1.018	+0.025	-0.085	4600	+0.228	-0.111	-0.045
2200	+1.043	+0.021	-0.091	4700	+0.117	-0.117	-0.025
2300	+1.064	+0.017	-0.096	4800	0.000	-0.118	0.000
2400	+1.081	+0.014	-0.101	4900	-0.118	-0.122	+0.026
2500	+1.095	+0.010	-0.106	5000	-0.240		+0.053

$$F = 7.00 \times 10^{-13}$$

## TRANSVERSE MERCATOR PROJECTION

TABLE FOR  $g$ 

$$\Delta\alpha'' = \sin \phi (\Delta\lambda'') + g$$

Latitude	$\Delta\lambda''$						
	0"	1000"	2000"	3000"	4000"	5000"	6000"
24°	0.00	0.00	0.02	0.07	0.17	0.33	0.58
25	0	0	0.02	0.07	0.17	0.34	0.59
26°	0.00	0.00	0.02	0.08	0.18	0.35	0.60
27	0	0	0.02	0.08	0.18	0.35	0.61
28	0	0	0.02	0.08	0.18	0.36	0.62
29	0	0	0.02	0.08	0.19	0.37	0.63
30	0	0	0.02	0.08	0.19	0.37	0.64
31°	0.00	0.00	0.02	0.08	0.19	0.37	0.64
32	0	0	0.02	0.08	0.19	0.38	0.65
33	0	0	0.02	0.08	0.19	0.38	0.65
34	0	0	0.02	0.08	0.19	0.38	0.65
35	0	0	0.02	0.08	0.19	0.38	0.65
36°	0.00	0.00	0.02	0.08	0.19	0.38	0.65
37	0	0	0.02	0.08	0.19	0.38	0.65
38	0	0	0.02	0.08	0.19	0.38	0.65
39	0	0	0.02	0.08	0.19	0.37	0.64
40	0	0	0.02	0.08	0.19	0.37	0.64
41°	0.00	0.00	0.02	0.08	0.19	0.37	0.63
42	0	0	0.02	0.08	0.18	0.36	0.63
43	0	0	0.02	0.08	0.18	0.36	0.62
44	0	0	0.02	0.08	0.18	0.35	0.61
45	0	0	0.02	0.08	0.18	0.35	0.60
46°	0.00	0.00	0.02	0.07	0.17	0.34	0.59
47	0	0	0.02	0.07	0.17	0.33	0.58
48	0	0	0.02	0.07	0.17	0.33	0.56
49	0	0	0.02	0.07	0.16	0.32	0.55
50	0.00	0.00	0.02	0.07	0.16	0.31	0.54

$$g = \left[ \frac{C (\sin 1'') \cos^3 \phi}{2A^2} + F \right] (\Delta\lambda'')^3$$

A, C and F are position factors.

**Y CORRECTION FOR COMPUTATION OF GEOGRAPHIC  
POSITIONS FROM PLANE COORDINATES  
TRANSVERSE MERCATOR PROJECTION, NEW HAMPSHIRE**

$$P(x'/10,000)^2 + d = V(\Delta Y 100)^2 + c$$

P taken out for y-coordinate  
d taken out for x'

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<b>y</b>	<b>P</b>	<b><math>\Delta P</math></b>	<b>x'</b>	<b>d</b>
0	2.18600	2108	0	0.00
100,000	2.20708	2127	50,000	0.00
200,000	2.22835	2145	100,000	+ 0.01
300,000	2.24980	2164	150,000	+ 0.02
400,000	2.27144	2184	200,000	+ 0.02
500,000	2.29328	2204	250,000	+ 0.01
600,000	2.31532	2224	300,000	- 0.02
700,000	2.33756	2246	350,000	- 0.09
800,000	2.36002	2266		
900,000	2.38268	2289		
1,000,000	2.40557	2310		
1,100,000	2.42867			

## TRANSVERSE MERCATOR PROJECTION

New Hampshire

$$\Delta\alpha = Mx' - e$$

y	M	$\Delta M$
0	0.009 0185	870
100,000	0.009 1055	877
200,000	0.009 1932	885
300,000	0.009 2817	893
400,000	0.009 3710	901
500,000	0.009 4611	909
600,000	0.009 5520	918
700,000	0.009 6438	927
800,000	0.009 7365	935
900,000	0.009 8300	944
1,000,000	0.009 9244	953
1,100,000	0.010 0197	963
1,200,000	0.010 1160	

e

y \ x'	150,000	200,000	250,000	300,000	350,000
0	0.0	0.1	0.2	0.3	0.5
500,000	0.0	0.1	0.2	0.4	0.6
1,000,000	0.0	0.1	0.2	0.4	0.6

TRANSVERSE MERCATOR PROJECTION  
NEW HAMPSHIRE

$x'$ (feet)	Scale in units of 7th place of logs	Scale expressed as a ratio	$x'$ (feet)	Scale in units of 7th place of logs.	Scale expressed as a ratio
0	-144.8	0.9999667	175,000	+ 7.1	1.0000016
5,000	-144.7	0.9999667	180,000	+ 15.9	1.0000037
10,000	-144.3	0.9999668	185,000	+ 25.0	1.0000058
15,000	-143.7	0.9999669	190,000	+ 34.3	1.0000079
20,000	-142.8	0.9999671	195,000	+ 43.8	1.0000101
25,000	-141.7	0.9999674	200,000	+ 53.6	1.0000123
30,000	-140.3	0.9999677	205,000	+ 63.6	1.0000146
35,000	-138.7	0.9999681	210,000	+ 73.9	1.0000170
40,000	-136.9	0.9999685	215,000	+ 84.5	1.0000195
45,000	-134.7	0.9999690	220,000	+ 95.3	1.0000219
50,000	-132.4	0.9999695	225,000	+106.3	1.0000245
55,000	-129.8	0.9999701	230,000	+117.6	1.0000271
60,000	-126.9	0.9999708	235,000	+129.1	1.0000297
65,000	-123.8	0.9999715	240,000	+140.9	1.0000324
70,000	-120.5	0.9999723	245,000	+152.9	1.0000352
75,000	-116.9	0.9999731	250,000	+165.2	1.0000380
80,000	-113.0	0.9999740	255,000	+177.7	1.0000409
85,000	-108.9	0.9999749	260,000	+190.5	1.0000439
90,000	-104.6	0.9999759	265,000	+203.5	1.0000469
95,000	-100.0	0.9999770	270,000	+216.8	1.0000499
100,000	- 95.2	0.9999781	275,000	+230.3	1.0000530
105,000	- 90.1	0.9999793	280,000	+244.1	1.0000562
110,000	- 84.8	0.9999805	285,000	+258.1	1.0000594
115,000	- 79.2	0.9999818	290,000	+272.3	1.0000627
120,000	- 73.4	0.9999831	295,000	+286.8	1.0000660
125,000	- 67.3	0.9999845	300,000	+301.6	1.0000694
130,000	- 61.0	0.9999860	305,000	+316.6	1.0000729
135,000	- 54.4	0.9999875	310,000	+331.9	1.0000764
140,000	- 47.6	0.9999890	315,000	+347.4	1.0000800
145,000	- 40.5	0.9999907	320,000	+363.1	1.0000836
150,000	- 33.2	0.9999924	325,000	+379.1	1.0000873
155,000	- 25.6	0.9999941	330,000	+395.4	1.0000910
160,000	- 17.8	0.9999959	335,000	+411.9	1.0000948
165,000	- 9.8	0.9999977	340,000	+428.7	1.0000987
170,000	- 1.5	0.9999997	345,000	+445.7	1.0001026
			350,000	+462.9	1.0001066

CORRECTIONS TO NATURAL SCALE RATIOS\*

(in units of the 7th decimal place)

For Lambert Projection				For Lambert or transverse Mercator Projection		
<u><math>\Delta\phi'</math></u>	as argument	<u><math>\Delta\phi'</math></u>	Corr'n (Plus)	<u><math>\Delta_y</math></u> or	<u><math>\Delta_x</math></u>	Corr'n (Plus)
1	0	31	34		10,000	0
2	0	32	36		20,000	0
3	0	33	38		30,000	1
4	1	34	40		40,000	2
5	1	35	43		50,000	2
6	1	36	45		60,000	3
7	2	37	48		70,000	5
8	2	38	51		80,000	6
9	3	39	53		90,000	8
10	4	40	56		100,000	10
11	4	41	59		110,000	11
12	5	42	62		120,000	14
13	6	43	65		130,000	16
14	7	44	68		140,000	19
15	8	45	71		150,000	21
16	9	46	74		160,000	24
17	10	47	77		170,000	27
18	11	48	81		180,000	31
19	13	49	84		190,000	34
20	14	50	88		200,000	38
21	15	51	91		210,000	42
22	17	52	95		220,000	46
23	19	53	98		230,000	50
24	20	54	102		240,000	55
25	22	55	106		250,000	59
26	24	56	110		260,000	64
27	26	57	114		270,000	69
28	27	58	118		280,000	74
29	29	59	122		290,000	80
30	32	60	126		300,000	86
$\Delta\phi'$ is the difference in latitude in minutes of the ends of the line.					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.