5450

5450

Form 504
Rev. Dec. 1933
DEPARTMENT OF COMMERCE
U.S. COAST AND GEODETIC SURVEY
R. S. PATTON, DIRECTOR

DESCRIPTIVE REPORT

Air Photo
Topographic
~~Hydrographic~~ } Sheet No. T-5450

State New Jersey

LOCALITY

~~Hudson River~~

Hoboken and Jersey City

Date of Photos ~~193 6~~ Nov. 1934

CHIEF OF PARTY

J.C.Partington

U.S. GOVERNMENT PRINTING OFFICE: 1934

7

Applied to Chart ~~III~~ 746 - May 1937 - L.M.Z.
Applied to Chart 369 - April 1939 L.M.Z.

Form 537a
Ed. Nov. 1929

DEPARTMENT OF COMMERCE
U.S. COAST AND GEODETIC SURVEY

REG. NO.

TOPOGRAPHIC TITLE SHEET

T5450

The Topographic Sheet should be accompanied by this form, filled in as completely as possible, when the sheet is forwarded to the Office.

Field No. 82

REGISTER NO. T-5450

State New Jersey

General locality ~~Hudson River~~

Locality Hoboken and Jersey City

Scale 1: 5000 Date of ~~survey~~ photographs Nov. 25, 1934, 19

Date of Compilation July 20, 1936

Vessel Air Photo Compilation Party # 25

Reviewed and recommended for approval J. C. Partington

Chief of party J.C.Partington

Surveyed by See STATISTICS SHEET, page 2 of this report.

Inked by J.K.Batchellor and R.H.Young

Heights in feet above - - - to ground to tops of trees

Contour, Approximate contour, Form line interval - - feet

Instructions dated March 14, 1934

Remarks: Compiled on a scale of 1: 5000 and printed by photo-lithography.

STATISTICS

on

AIR PHOTO TOPOGRAPHIC SHEET, FIELD NO. 82 ; REGISTER NO. T-5450

PHOTOGRAPH NO.	DATE	TIME	TIDE High Time	High Ht.	TIDE Low Time	Low Ht.
V 77 to 85(870 M-8)	Nov.25,1934	10:50 AM	10:54 AM	4.3	4:42 Am	0.3
			11:47 PM	3.5	5:19 PM	0.0

	By	Date
SCALE FACTOR (1.000)	R.C.Bolstad	(Previously determined)
PROJECTION	R.H.Peckworth	3-8-35
PROJECTION CHECKED	D.B.Bennett	3-8-35
CONTROL PLOTTED	R.H.Peckworth	3-11-35
CONTROL CHECKED	D.B.Bennett	3-12-35
SMOOTH RADIAL LINE PLOT	R.H.Peckworth	
RADIAL LINE PLOT CHECKED	R.C.Bolstad	March 1936
DETAIL INKED	J.K.Batchellor R.H.Young	5-11-36 to 6-11-36 6-26-36 to 7-15-36
PRELIMINARY REVIEW OF SHEET	J.C.Partington (signed: J.C. Partington)	7-16-36 to 7-20-36

AREA OF DETAIL INKED (land area) 4.1 Square Statute Miles

AREA OF DETAIL INKED (shoals) 0.0 Square Statute Miles

LENGTH OF SHORELINE (more than 200 M. from opposite shore) 26.7 Stat. Miles

LENGTH OF SHORELINE (rivers & sloughs less than 200 M.wide) 2.9 Stat.Miles

LENGTH OF STREETS, ROADS, RAILROADS, TRAILS 383.1 Stat. Miles

GENERAL LOCATION New Jersey

LOCATION Hoboken and Jersey City

DATUM North American 1927

STATION Castle Stevens, 1875 r' 33 (N.J.)

Latitude	40°	44'	41.152"	1269.4 m.
Longitude	74	01	28.040	657.9 m.

(Adjusted computations)

Long Island System of Plane Coordinates.
Castle Stevens, 1875 X = 1,993,223.32 ft. ✓
Y = 189,173.71 ft.

New Jersey System of Plane Coordinates ✓
Castle Stevens, 1875. X = 2,177,954.74 ft.
Y = 696,903.49 ft.

COMPILER'S REPORT

for

AIR PHOTO TOPOGRAPHIC SHEET, FIELD NO. 82; REGISTER NO. T-5450

GENERAL INFORMATION.

The Air-photo Field Inspection Report for New Jersey, Part 1, Hudson River, George Washington Bridge to Bedloes Island, attached to the descriptive report for compilation T-5448, furnished the necessary information for the compilation ~~of this sheet~~.

The sheet has been compiled from single lens photographs taken on Nov. 25, 1934 at the time of high water. The photographs were taken by the Army Air Corps at Mitchell Field, Long Island, N.Y. with a special camera known as the "K-7C" by the Army, but called the "K-7A" by the Fairchild Camera Corporation. This camera was recently developed by the Fairchild Camera Corporation, 62-10 Woodside Ave., Woodside, New York City. The Army plane was ~~piloted~~ piloted by Lieut. Cullen at an altitude very close to 15,000 feet; the photographer was Sergeant Cates. A 24 inch cone (focal length 24") was used which placed the original negatives on a scale of 1: 7500. Contact prints were furnished the field party for inspecting purposes and the original negatives were used to enlarge a set of office prints to a scale of 1: 5000. The enlarging was done in the Washington office of the U.S.Coast and Geodetic Survey. The office prints were furnished the field party and were used in the compilation ~~of this sheet~~.

CONTROL.

(a) Sources.

Control, for the compilation ~~of this sheet~~ was obtained from the following sources:

1. Triangulation 1930-33 by R.W.Woodworth. As the final office adjusted positions on N.A. 1927 datum were not available except for main scheme stations, the field positions on N.A. datum were used after applying a correction determined by a comparison of common stations for the area. The following corrections were applied to the N.A. datum to convert to the N.A. 1927 datum:
   Latitude minus 12.0 meters
   Longitude plus 3.2 meters

2. U.S.Engineers stations described on Form 524 submitted with this report.
3. Stork Line Tank, a 3 point theodolite fix attached to this report and described on Form 524.

(b) Errors.

No error was discovered in the position of any of the triangulation stations and only one U.S.Engineers station was found to be incorrect in position, namely Castle Stevens (U.S.E.)

The radial line plot position of "Castle Stevens" (U.S.E.) does not agree with the U.S.E. coordinate position. (See Form 524 for the station). The coordinate position of triangulation station "Castle Stevens" agrees with the geographic position. The station "Castle Stevens" (U.S.E.) is on the same structure and lies 17.77 feet S.E. of the triangulation station. The distance 17.77 feet was verified by R.W.Woodworth in 1932 on recovery card No. 349 R.

(b) Errors. (cont.)

The U.S.E coordinates do not conform to this measurement. The spotting on the photos was verified and conforms to field inspection data; it also agrees with sketches by the U.S.Engineers and by R.W.Woodworth.

The correct position of this station is shown on this ~~sheet~~ compilation by a $2\frac{1}{2}$ m m circle. This position lies about 25 feet south of the U.S.E. coordinate position.

COMPILATION.

(a) Method.

The usual radial line method of plotting was used in this compilation. ~~of this sheet.~~

The U.S.E. stations described on Form 524 attached to this report were used as supplementary control for the radial line plot. They were plotted on an aluminum sheet from their coordinate positions and transferred to the celluloid sheet by fitting coordinate positions of triangulation stations on the aluminum sheet to their corresponding geographical position on the celluloid sheet. The transferred position of the U.S.E. stations was not accepted unless it adhered strictly to the radial line plot, as there is sufficient triangulation control to independently establish the plot.

(b) Adjustments of Plot.

No unusual adjustments of the plot were effected. Some adjustment was necessary along the western boundary of this ~~sheet~~ compilation where a junction is made with Compilation No. T-5277 (1: 10000 scale). Due to the weak angle of intersection in this area the radials give a somewhat weak determination in an east and west direction with a strong determination in a north and south direction. The 1: 10000 scale plot was used to strengthen the positions of these radial points and to obtain an agreement at the junction of the two ~~sheets.~~ compilations.

(c) Interpretation.

No great difficulty was experienced in interpretating the photographic detail for this compilation.

The usual symbols were used as approved by the Board of Surveys and Maps (1932). All of the buildings along the waterfront have been shown and some of the more important buildings inland. Appropriate notes on the overlay sheet have been used to designate features which are not self-evident.

In areas where elevated tracks obscure the curb line of streets the curb line has been omitted to avoid a confusion of lines on the sheet.

(d) Information from Other Sources.

Railroad blue-prints showing the track layouts were used in interpretating detail in regard to the railroads shown on this

* A more reasonable estimate of the error of position is from 0.3 to 0.5 mm for intersected points and from 0.3 to 0.8 mm for points between intersections.

Sam.
Aug. 25, 1936.

(d) Information from Other Sources. (cont.)

sheet. The blue-prints were also used for obtaining names of streets, etc.

(e) Names.

All geographical names shown on this compilation have been listed on the special forms in the back of this report. For street names see the blue-prints enclosed with this sheet, and the Port Authority Maps.

COMPARISON WITH OTHER SURVEYS.

No other surveys of this area are on hand in this party and no comparison with other surveys has been made.

No direct comparison of this compilation with the charts by means of contact negatives has been made since the negatives were not available at the time of completion of this ~~sheet.~~ compilation.

JUNCTIONS.

This ~~sheet~~ compilation joins compilation T-5449 (1: 5000 scale) on the north and compilation T-5470 (1: 5000 scale) on the south. These junctions are in agreement.

This ~~sheet~~ compilation joins compilation T-5277 (1: 10000 scale) on the west and the junction between the two ~~sheets~~ compilations is in agreement.

LANDMARKS.

The list of landmarks for the area covered by this compilation were previously submitted, Feb. 22, 1933, By R.W.Woodworth. Chart Letter 176 (1933)

LIST OF RECOVERABLE STATIONS.

Eight descriptive cards Form 524 accompany this report. Seven of these stations were located by the radial line plot and the eighth station, "Stork Line Tank", was located by a 3 point theodolite fix.

BRIDGES.

Only one bridge over a water area is shown on this compilation, located at the west end of the Morris and Essex Canal. It is of no importance to navigation.

RECOMMENDATIONS FOR FURTHER SURVEYS. (see opp. page.)

The~~is~~ compilation ~~of this sheet~~ is believed to have a probable error of not over 1 meter in position for well defined waterfront detail of importance for charting, not over 2 meters for other waterfront detail, and not to exceed 3 meters for inland detail.

This compilation is believed to be complete in all detail of importance for charting and no additional surveys are recommended.

Submitted by

J. C. Partington

J.C.Partington
Chief of Party # 25

	Remarks	Decisions
1		
2		
3	* Not Shown + not shown	
4	* Not Shown not shown	
5		
6	* Not Shown + not shown	
7		
8	* Not Shown	
9		
10	* Not Shown	
11	* Not Shown	
12	* Not Shown ** Shown as "Holland Vehicular Tunnel".	
13	* Hudson and Manhattan R.R.	
14	** Shown as "P. R. R. Station L. V. R. R."	
15	* Not Shown	
16	* Not Shown	
17	* Not Shown ** Shown as "Morris Canal Basin".	
18	* Not Shown	
19	* Not Shown	
20	* Not Shown	
21		
22		
23		
24	* not shown	
25	* not shown ** Shown as " Church Sq. Pk."	
26		
27		

M 234

GEOGRAPHIC NAMES

Survey No. T-5450

Air Photo Compilation

Name on Survey	A On Chart No. (Chart 745)	B On previous survey No.	C On U. S. quadrangle	D From local information (Port of N.Y. Authority; N.Y.C. R.R. Terminal Map)	E On local maps (Board of Estimate and Apportionment)	F P. O. Guide or Map	G Rand McNally Atlas	H U. S. Light List	K	
Hoboken	x			x	x	✓	✓			1
Jersey City	x			x	x	✓	✓			2
Castle Point	x			*	*					3
Erie R. R.	*			x	*	R.R. Guide				4
Washington St.	x			x	x					5
Hoboken Manufacturers RR	*			x	*					6
Newark St.	x			x	x					7
D.L. and W. R.R. Yards	x			x	*					8
Henderson St.	x			x	x					9
Erie R. R. Yards	x			x	*					10
Hudson and Manhattan Tubes	*			x	*					11
Holland Tunnel	*			x	**					12
Pennsylvania Railroad	x			x	*		✓			13
Pennsylvania R.R. Station	x			*	x	R.R. Guide				14
Essex St.	x			*	*					15
Morris Basin	x			*	*					16
Morris and Essex Canal	x			*	**					17
Lehigh Valley Railroad	x			x	*	R.R. Guide	✓			18
C.R.R. of N.J.	x			x	*	R.R. Guide	✓			19
C.R.R. of N.J. Station	*			x	x					20
Weehawken Cove	x									21
Elysian Field	x									22
Canal Basin	x									23
Hudson Square	x			*	*					24
Church Square	*			**	*					25
										26
										27

Names underlined in red approved on 8/15/36 by C.R.D.

M 234

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 24A
Rev. Oct., 1932

LIST OF DIRECTIONS

Station Stork Line Tank (Ecc.) *State* New Jersey

Chief of party R.C. Bolstad *Date* March 27, 1935 *Computed by* D.B. Bennett

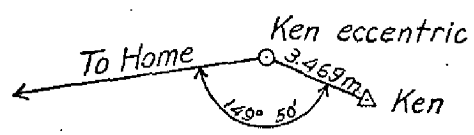
Observer R.L. Fisher *Instrument* Berger # 232 *Checked by* R.L. Fisher

OBSERVED STATION	Observed direction	Eccentric reduction	Sea level reduction*	Corrected direction with zero initial	Adjusted direction*
	° ′ ″	′ ″	″	° ′ ″	′ ″
S. Twin Tank (Ellis Island) (1932)	0 00 00.00			0 00 00.00	
Dome (Courthouse) (1932)	220 31 05.0				
S. Flagpole (Storehouse) (1932)	294 20 27.5				
Stork Line Tank	96 33 50.0				
(Eccentric distance to tank		= 80.0 ft.)			
		24.38 M ✓			

* These columns are for office use and should be left blank in the field

Station: Ken | *State:* Maryland
Chief of party: C. V. H. | *Date:* 1917 | *Computed by:* O. P. S.
Observer: C. V. H. | *Instrument:* No. 168 | *Checked by:* W. F. R.

OBSERVED STATION	Observed direction	Eccentric reduction	Sea level reduction	Corrected direction with zero initial	Adjusted direction
	° ′ ″	′ ″	″	° ′ ″	′ ″
Chevy	0 00 00.00	− 7.31		0 00 00.00	
Tank west of △ Dulce	29 03 37.0	−1 09.8		29 02 34.5	
Ken (center), 3.469 meters	176 42				
Forest Glen standpipe	313 24 53.0	+3 01.2		313 28 01.5	
Home	326 31 30.21	+ 31.93		326 32 09.45	
Bureau of Standards, wireless pole	352 17 20.8	+ 5.7		352 17 33.8	
Reno	357 28 48.63	− 1.16		357 28 54.78	
Reference mark, 16.32 m	358 31 20				



This form, with the first three and fifth columns properly filled out and checked, must be furnished by field parties. *To be acceptable it must contain every direction observed at the station.*

It should be used for observations with both repeating and direction theodolites.

The directions at only one station should be placed on a page.

If a repeating theodolite is used, do not abstract the angles in tertiary triangulation. The local adjustment corrections (to close horizon only) are to be written in the Horizontal Angle Record, and the List of Directions is to be made from that record directly.

Choose as an initial for Form 24A some station involved in the local adjustment, and preferably one which has been used as an initial for a round of directions on objects not in the main scheme. Use but one initial at a station. Call the direction of the initial 0° 00′ 00.″ 00, and by applying the corrected angles to this, fill in opposite each station its direction reckoned *clockwise* around the whole circumference regardless of the direction of graduation of the instrument. The clockwise reckoning is necessary for uniformity and to make the directions comparable with azimuths.

If a station has been occupied eccentrically, reduce to the center and enter in this form, in ink, the resulting corrections to the observed directions in the column provided for them. If an eccentric reduction is necessary, but not made in the field, leave the column blank. If the station was occupied centrally, and no eccentric reduction is required, put dashes in the column to show that no corrections are necessary.

Directions in the main scheme should be entered to hundredths of seconds in first-order triangulation; otherwise to tenths only. Points observed upon but once, direct and reverse, should be carried to tenths in first-order and second-order triangulation, and to even seconds only in third-order triangulation. In general, but two uncertain figures should be given.

It is recommended that the following simple plan of observing be used with a repeating instrument: Measure each single angle in the scheme at each station and the outside angle necessary to close the horizon. *Measure no sum angles.* Follow each measurement of every angle immediately by a measurement of its explement. Six repetitions are to constitute a measurement. The local adjustment will consist simply of the distribution of the error of closure of the horizon.

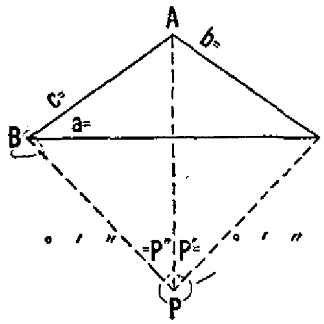
11—9503

N.A. Datum

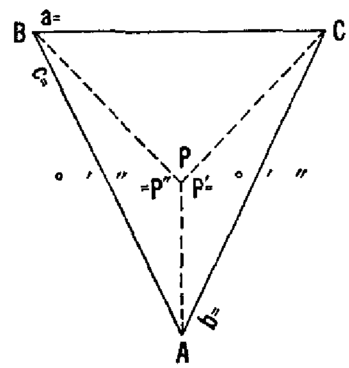
DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 655
Ed. Sept., 1929

COMPUTATION OF THREE-POINT PROBLEM

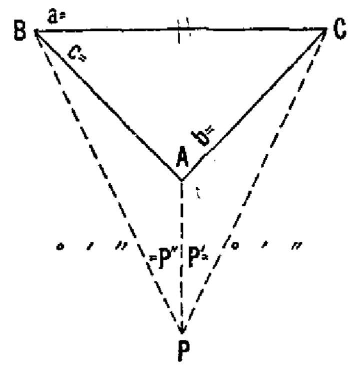
Case 1



Case 2



Case 3



Cases 1 and 2

P′	65	39	32.5 ✓
P″	73	49	22.5 ✓
A	109	20	22.8 ✓
Sum	248	49	17.8 ✓
½ Sum	124	24	38.9 ✓
S=180°−½ sum=	55	35	21.1 ✓

Log c =	3.402 864 0 ✓
Log sin P′ =	9.959 510 3 ✓
Colog b =	6.672 159 0 ✓
Colog sin P″ =	0.017 545 5 ✓
Sum=log tan Z=	0.052 138 8 ✓
Z=	48 25 51.8 ✓
Z+45°=	93 25 51.8 ✓
Log cot (Z+45°) =	8.777 825 4 ✓
Log tan S=	0.164 315 0 ✓
Sum=log tan ε=	8.942 140 4 ✓ (sign —)
ε	5 00 07.8 ✓
S	55 35 21.1 ✓

Case 3

P′

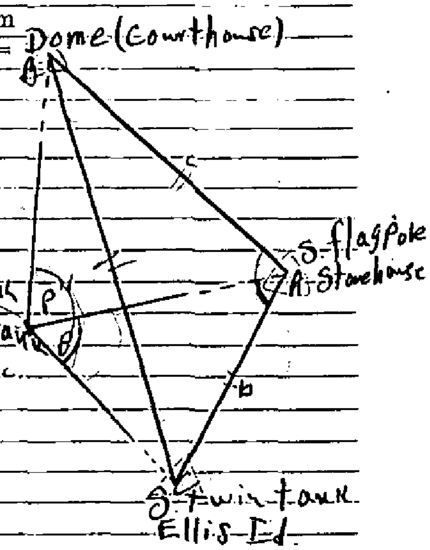
P″

Sum

A

A−sum

S=½ (A−sum)=



(Tan ε+)				(Tan ε−)
S+ε=angle ABP	50	35	13.3 ✓	S−ε=angle ABP
S−ε=angle ACP	60	35	28.9 ✓	S+ε=angle ACP

BPA	APC	PCB
ABP	PCA	CBP
PAB	CAP	BPC

(For explanation of this form see Special Publication No. 138, pages 191 and 192, or Special Publication No. 145, pages 98–100)

U. S. GOVERNMENT PRINTING OFFICE: 1929
11—9912

N.A. Datum

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 662
Rev. April, 1931

INVERSE POSITION COMPUTATION

$$s_1 \sin\left(\alpha+\frac{\Delta\alpha}{2}\right)=\frac{\Delta\lambda_1 \cos\phi_m}{A_m}$$

$$s_1 \cos\left(\alpha+\frac{\Delta\alpha}{2}\right)=\frac{-\Delta\phi_1 \cos\frac{\Delta\lambda}{2}}{B_m}$$

$$-\Delta\alpha=\Delta\lambda \sin\phi_m \sec\frac{\Delta\phi}{2}+F(\Delta\lambda)^3$$

in which $\log \Delta\lambda_1=\log(\lambda'-\lambda)$ − correction for arc to sin*; $\log \Delta\phi_1=\log(\phi'-\phi)$ − correction for arc to sin*; and $\log s=\log s_1+$ correction for arc to sin*.

	NAME OF STATION		
1. ϕ	40° 43′ 06.30″ S. flagpole (Storehouse)	λ	74° 02′ 00.59″ ✓
2. ϕ'	40 43 53.83 Dome (Courthouse)	λ′	74 03 28.37 ✓
$\Delta\phi\ (=\phi'-\phi)$	+ 47.53	$\Delta\lambda\ (=\lambda'-\lambda)$	+ 1′ 28.″78
$\frac{\Delta\phi}{2}$	23.765	$\frac{\Delta\lambda}{2}$	
$\phi_m\left(=\phi+\frac{\Delta\phi}{2}\right)$	40 43 30.065		
$\Delta\phi$ (secs.)	+ 47.53	$\Delta\lambda$ (secs.)	+ 87.″78
log $\Delta\phi$	1.6769678	**log $\Delta\lambda$**	1.9433956
cor. arc−sin	−	cor. arc−sin	−
log $\Delta\phi_1$	1.6769678	log $\Delta\lambda_1$	1.9433956
log cos $\frac{\Delta\lambda}{2}$		**log cos ϕ_m**	9.8795830
colog B_m	1.4892034	**colog A_m**	1.4909000
log $s_1 \cos\left(\alpha+\frac{\Delta\alpha}{2}\right)$	3.1661712 − (opposite in sign to $\Delta\phi$)	**log $s_1 \sin\left(\alpha+\frac{\Delta\alpha}{2}\right)$**	3.3138786 +
		log $s_1 \cos\left(\alpha+\frac{\Delta\alpha}{2}\right)$	3.1661712 −
log $\Delta\lambda$	1.9433956 (3 log $\Delta\lambda$)	**log tan $\left(\alpha+\frac{\Delta\alpha}{2}\right)$**	0.1477074
log sin ϕ_m	9.8145334 (log F)	$\alpha+\frac{\Delta\alpha}{2}$	125 26 21.″08 / 54 33 38.92 ✓
log sec $\frac{\Delta\phi}{2}$	(log b)	**log sin $\left(\alpha+\frac{\Delta\alpha}{2}\right)$**	9.9110144 ✓
log a	1.7579290	**log cos $\left(\alpha+\frac{\Delta\alpha}{2}\right)$**	9.7633071
a		**log s_1**	3.4028642 ✓
b		cor. arc−sin	+
$-\Delta\alpha$ **(secs.)**	+ 57.″27	log s	3.402864
$\frac{\Delta\alpha}{2}$	28.64		
	+ 28.″64		
$\alpha+\frac{\Delta\alpha}{2}$	125 26 21.08		
α (1 to 2)	125 26 49.7		
$\Delta\alpha$	− 57.3		
	180		
α' (2 to 1)	305 25 52.4		

*Use the table on the back of this form for correction of arc to sin.

NOTE.—For log s up to 4.52 and for $\Delta\phi$ or $\Delta\lambda$ (or both) up to 10′, omit all terms below the heavy line except those printed (in whole or in part) in heavy type or those underscored, if using logarithms to 6 decimal places. 11—9810

U. S. GOVERNMENT PRINTING OFFICE: 1931

Table of arc-sin corrections for inverse position computations

log s_1	Arc-sin correction in units of seventh decimal of logarithms	log $\Delta\phi$ or log $\Delta\lambda$	log s_1	Arc-sin correction in units of seventh decimal of logarithms	log $\Delta\phi$ or log $\Delta\lambda$	log s_1	Arc-sin correction in units of seventh decimal of logarithms	log $\Delta\phi$ or log $\Delta\lambda$
4.177	1	2.686	5.223	124	3.732	5.525	497	4.034
4.327	2	2.836	5.234	130	3.743	5.530	508	4.039
4.415	3	2.924	5.243	136	3.752	5.534	519	4.043
4.478	4	2.987	5.253	142	3.762	5.539	530	4.048
4.526	5	3.035	5.260	147	3.769	5.543	541	4.052
4.566	6	3.075	5.269	153	3.778	5.548	553	4.057
4.599	7	3.108	5.279	160	3.788	5.553	565	4.062
4.628	8	3.137	5.287	166	3.796	5.557	577	4.066
4.654	9	3.163	5.294	172	3.803	5.561	588	4.070
4.677	10	3.186	5.303	179	3.812	5.566	600	4.075
4.697	11	3.206	5.311	186	3.820	5.570	613	4.079
4.716	12	3.225	5.318	192	3.827	5.575	625	4.084
4.734	13	3.243	5.326	199	3.835	5.579	637	4.088
4.750	14	3.259	5.334	206	3.843	5.583	650	4.092
4.765	15	3.274	5.341	213	3.850	5.587	663	4.096
4.779	16	3.288	5.349	221	3.858	5.591	674	4.100
4.792	17	3.301	5.356	228	3.865	5.595	687	4.104
4.804	18	3.313	5.363	236	3.872	5.600	702	4.109
4.827	20	3.336	5.369	243	3.878	5.604	716	4.113
4.857	23	3.366	5.376	251	3.885	5.608	729	4.117
4.876	25	3.385	5.383	259	3.892	5.612	743	4.121
4.892	27	3.401	5.390	267	3.899	5.616	757	4.125
4.915	30	3.424	5.396	275	3.905	5.620	771	4.129
4.936	33	3.445	5.403	284	3.912	5.624	785	4.133
4.955	36	3.464	5.409	292	3.918	5.628	800	4.137
4.972	39	3.481	5.415	300	3.924	5.632	814	4.141
4.988	42	3.497	5.422	309	3.931	5.636	829	4.145
5.003	45	3.512	5.428	318	3.937	5.640	845	4.149
5.017	48	3.526	5.434	327	3.943	5.644	861	4.153
5.035	52	3.544	5.440	336	3.949	5.648	877	4.157
5.051	56	3.560	5.446	345	3.955	5.652	893	4.161
5.062	59	3.571	5.451	354	3.960	5.656	909	4.165
5.076	63	3.585	5.457	364	3.966	5.660	925	4.169
5.090	67	3.599	5.462	373	3.971	5.663	941	4.172
5.102	71	3.611	5.468	383	3.977	5.667	957	4.176
5.114	75	3.623	5.473	392	3.982	5.671	973	4.180
5.128	80	3.637	5.479	402	3.988	5.674	989	4.183
5.139	84	3.648	5.484	412	3.993	5.678	1005	4.187
5.151	89	3.660	5.489	422	3.998			
5.163	94	3.672	5.495	433	4.004			
5.172	98	3.681	5.500	443	4.009			
5.183	103	3.692	5.505	453	4.014			
5.193	108	3.702	5.510	464	4.019			
5.205	114	3.714	5.515	474	4.024			
5.214	119	3.723	5.520	486	4.029			

11—9810

N.A. Datum

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 662
Rev. April, 1931

INVERSE POSITION COMPUTATION

$$s_1 \sin\left(\alpha+\frac{\Delta\alpha}{2}\right)=\frac{\Delta\lambda_1 \cos\phi_m}{A_m}$$

$$s_1 \cos\left(\alpha+\frac{\Delta\alpha}{2}\right)=\frac{-\Delta\phi_1 \cos\frac{\Delta\lambda}{2}}{B_m}$$

$$-\Delta\alpha=\Delta\lambda \sin\phi_m \sec\frac{\Delta\phi}{2}+F(\Delta\lambda)^3$$

in which log $\Delta\lambda_1$=log $(\lambda'-\lambda)$ − correction for arc to sin*; log $\Delta\phi_1$=log $(\phi'-\phi)$ − correction for arc to sin*; and log s=log s_1+ correction for arc to sin*.

		NAME OF STATION	
1. ϕ	40° 43′ 06.30″	S. flag Pole (Storehouse)	74° 02′ 00.59″
2. ϕ'	40 42 00.04	S. twin tank (Ellis Id.)	74 02 25.73
$\Delta\phi$ $(=\phi'-\phi)$	−1 06.26	$\Delta\lambda$ $(=\lambda'-\lambda)$	+0 25.14
$\frac{\Delta\phi}{2}$	−33.13	$\frac{\Delta\lambda}{2}$	
$\phi_m\left(=\phi+\frac{\Delta\phi}{2}\right)$	40-42-33.17		
$\Delta\phi$ (secs.)	−66.26″	$\Delta\lambda$ (secs.)	+25.14″
log $\Delta\phi$	1.8212514	**log $\Delta\lambda$**	1.4003653
cor. arc−sin	−	cor. arc−sin	−
log $\Delta\phi_1$	1.8212514	log $\Delta\lambda_1$	1.4003653
log cos $\frac{\Delta\lambda}{2}$		**log cos ϕ_m**	9.8796861
colog B_m	1.4892022	**colog A_m**	1.4908995
log $\left\{s_1 \cos\left(\alpha+\frac{\Delta\alpha}{2}\right)\right\}$	3.3104536 + (opposite in sign to $\Delta\phi$)	**log** $\left\{s_1 \sin\left(\alpha+\frac{\Delta\alpha}{2}\right)\right\}$	2.7709509 +
		log $\left\{s_1 \cos\left(\alpha+\frac{\Delta\alpha}{2}\right)\right\}$	3.3104536 +
log $\Delta\lambda$	1.4003653 (3 log $\Delta\lambda$)	**log tan** $\left(\alpha+\frac{\Delta\alpha}{2}\right)$	9.4604973
log sin ϕ_m	9.814395 (log F)	$\alpha+\frac{\Delta\alpha}{2}$	16° 06′ 18.74″
log sec $\frac{\Delta\phi}{2}$	(log b)	**log sin** $\left(\alpha+\frac{\Delta\alpha}{2}\right)$	9.4431095
log a	1.214760	**log cos** $\left(\alpha+\frac{\Delta\alpha}{2}\right)$	9.9826122
a		**log s_1**	3.3278414
b		cor. arc−sin	+
$-\Delta\alpha$ **(secs.)**	+16.40″	log s	3.327841
$\frac{\Delta\alpha}{2}$	+8.20″		
	+ 08.20″		
$\alpha+\frac{\Delta\alpha}{2}$	16 06 18.74		
α **(1 to 2)**	16 06 26.9		
$\Delta\alpha$	− 16.4		
	180		
α' **(2 to 1)**	196 06 10.5		

*Use the table on the back of this form for correction of arc to sin.

NOTE.—For log s up to 4.52 and for $\Delta\phi$ or $\Delta\lambda$ (or both) up to 10′, omit all terms below the heavy line except those printed (in whole or in part) in heavy type or those underscored, if using logarithms to 6 decimal places. 11—9810

U. S. GOVERNMENT PRINTING OFFICE: 1931

Table of arc-sin corrections for inverse position computations

log s_1	Arc-sin correction in units of seventh decimal of logarithms	log $\Delta\phi$ or log $\Delta\lambda$	log s_1	Arc-sin correction in units of seventh decimal of logarithms	log $\Delta\phi$ or log $\Delta\lambda$	log s_1	Arc-sin correction in units of seventh decimal of logarithms	log $\Delta\phi$ or log $\Delta\lambda$
4.177	1	2.686	5.223	124	3.732	5.525	497	4.034
4.327	2	2.836	5.234	130	3.743	5.530	508	4.039
4.415	3	2.924	5.243	136	3.752	5.534	519	4.043
4.478	4	2.987	5.253	142	3.762	5.539	530	4.048
4.526	5	3.035	5.260	147	3.769	5.543	541	4.052
4.566	6	3.075	5.269	153	3.778	5.548	553	4.057
4.599	7	3.108	5.279	160	3.788	5.553	565	4.062
4.628	8	3.137	5.287	166	3.796	5.557	577	4.066
4.654	9	3.163	5.294	172	3.803	5.561	588	4.070
4.677	10	3.186	5.303	179	3.812	5.566	600	4.075
4.697	11	3.206	5.311	186	3.820	5.570	613	4.079
4.716	12	3.225	5.318	192	3.827	5.575	625	4.084
4.734	13	3.243	5.326	199	3.835	5.579	637	4.088
4.750	14	3.259	5.334	206	3.843	5.583	650	4.092
4.765	15	3.274	5.341	213	3.850	5.587	663	4.096
4.779	16	3.288	5.349	221	3.858	5.591	674	4.100
4.792	17	3.301	5.356	228	3.865	5.595	687	4.104
4.804	18	3.313	5.363	236	3.872	5.600	702	4.109
4.827	20	3.336	5.369	243	3.878	5.604	716	4.113
4.857	23	3.366	5.376	251	3.885	5.608	729	4.117
4.876	25	3.385	5.383	259	3.892	5.612	743	4.121
4.892	27	3.401	5.390	267	3.899	5.616	757	4.125
4.915	30	3.424	5.396	275	3.905	5.620	771	4.129
4.936	33	3.445	5.403	284	3.912	5.624	785	4.133
4.955	36	3.464	5.409	292	3.918	5.628	800	4.137
4.972	39	3.481	5.415	300	3.924	5.632	814	4.141
4.988	42	3.497	5.422	309	3.931	5.636	829	4.145
5.003	45	3.512	5.428	318	3.937	5.640	845	4.149
5.017	48	3.526	5.434	327	3.943	5.644	861	4.153
5.035	52	3.544	5.440	336	3.949	5.648	877	4.157
5.051	56	3.560	5.446	345	3.955	5.652	893	4.161
5.062	59	3.571	5.451	354	3.960	5.656	909	4.165
5.076	63	3.585	5.457	364	3.966	5.660	925	4.169
5.090	67	3.599	5.462	373	3.971	5.663	941	4.172
5.102	71	3.611	5.468	383	3.977	5.667	957	4.176
5.114	75	3.623	5.473	392	3.982	5.671	973	4.180
5.128	80	3.637	5.479	402	3.988	5.674	989	4.183
5.139	84	3.648	5.484	412	3.993	5.678	1005	4.187
5.151	89	3.660	5.489	422	3.998			
5.163	94	3.672	5.495	433	4.004			
5.172	98	3.681	5.500	443	4.009			
5.183	103	3.692	5.505	453	4.014			
5.193	108	3.702	5.510	464	4.019			
5.205	114	3.714	5.515	474	4.024			
5.214	119	3.723	5.520	486	4.029			

11—9810

Check on Inverses

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 27
Ed. April, 1929

POSITION COMPUTATION, THIRD-ORDER TRIANGULATION

			°	′	″
α	2	to 3			
2d ∠		&	+		
α	2	to 1	196	06	10.5
Δα			+		16.4
			180	00	00.0
α′	1	to 2	16	06	26.9

			°	′	″
α	3	to 2			
3d ∠		&	305	25	53.4
α	3	to 1	234	33	10.3
Δα			+		57.3
			180	00	00.0
α′	1	to 3	54	34	07.6

First Angle of Triangle

	°	′	″			°	′	″
φ	40	42	00.04	2 S. twin lake Ellis Id.	λ	74	02	25.73
Δφ	+	01	06.26		Δλ	—		25.14
φ′	40	43	06.30	1 S. flag P. (Storehouse)	λ′	74	02	00.59

	°	′	″			°	′	″
φ	40	43	53.83	3 Dome Ch.	λ	74	03	28.37
Δφ	—		47.53		Δλ	—	01	27.78
φ′	40	43	06.30	1 S. flag P. (St. ho.)	λ′	74	02	00.59

	Logarithms	Values in seconds	
s	3.327841		
Cos α	9.982617		
B	8.510798		
h	1.821256	1st term	66.260
s²	6.6557		
Sin² α	8.8861		
C	1.3390		
	6.8808	2d term	+.0008
h²	3.642		
D	2.388		
	6.030	3d term	+.0001
		−Δφ	66.26

½(φ+φ′) 40-42-33.2

	Logarithms	Values in seconds
s	3.327841	
Sin α	9.443049	
A′	8.509100	
Sec φ′	0.120374	
Δλ	1.400364	25.140
Sin ½(φ+φ′)	9.814394	
−Δα	1.214758	16.40

	Logarithms	Values in seconds	
s	3.402864		
Cos α	9.763372		
B	8.510796		
h	1.677032	1st term	+ 47.534
s²	6.8057		
Sin² α	9.8219		
C	1.3395		
	7.9671	2d term	+.009
h²	3.354		
D	2.38		
	5.72	3d term	+.0001
		−Δφ	47.53

½(φ+φ′) 40-43-30.1

	Logarithms	Values in seconds
s	3.402864	
Sin α	9.918977	
A′	8.509100	
Sec φ′	0.120374	
Δλ	1.943364	87.78
Sin ½(φ+φ′)	9.814534	
−Δα	1.757929	57.27

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N.A. Datum

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 25
Ed. Jan., 1929

11—9121

COMPUTATION OF TRIANGLES

State: ____________

NO.	STATION	OBSERVED ANGLE	CORR'N	SPHER'L ANGLE	SPHER'L EXCESS	PLANE ANGLE AND DISTANCE	LOGARITHM
	2-3						3.402864 ✓
	1 Stork line tank ecc.	73 49 22.5 ✓					0.0175455
	2 Dome Courtho.	50 35 13.3 ✓					9.8879490
	3 S. flagpole St. No.	(55 35 24.2) ✓					9.9164621
	1-3						3.308359 ✓
	1-2						3.336872
	2-3						3.327841 ✓
	1 Stork line tank ecc.	65 39 32.5 ✓					0.0404297
	2 S. flagpole St. No.	(53 44 58.6) ✓					9.9065724
	3 S. twin tank Ellis Id.	60 35 28.9 ✓					9.9400879
	1-3						3.274843
	1-2						3.308359 ✓
	2-3						
	1						
	2						
	3						
	1-3						
	1-2						
	2-3						
	1						
	2						
	3						
	1-3						
	1-2						

Do not write in this margin

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 27
Ed. April, 1929

POSITION COMPUTATION, THIRD-ORDER TRIANGULATION

			°	′	″
α	2	to 3	16	06	26.9
2d ∠		&	+53	44	58.6
α	2	to 1	69	51	25.5
Δα			−		53.1
			180	00	00.0
α′	1	to 2	249	50	32.4
		First Angle of Triangle	65	39	32.5

	°	′	″			°	′	″
φ	40	43	06.300	2 S. flagpole stone house	λ	74	02	00.590
Δφ	−		22.716	stork line	Δλ	+	01	21.355
φ′	40	42	43.584	1 tank ecc.	λ′	74	03	21.945

	Logarithms	Values in seconds	
s	3.308359		
Cos α	9.537016		
B	8.510797		
h	1.356172	1st term +	22.7076
s²	6.6167		
Sin² α	9.9452		
C	1.3393		
	7.9012	2d term +	.0080
h²	2.70		
D	2.388		
	—	3d term +	—
		−Δφ	22.7156

½(φ+φ′)	40-42-54.9	
	Logarithms	Values in seconds
s	3.308359	
Sin α +	9.972590	
A′	8.509100	
Sec φ′	0.120333	
Δλ	1.910382	81.3546
Sin ½(φ+φ′)	9.814448	
−Δα	1.724830	53.07

			°	′	″
α	3	to 2	196	06	10.5
3d ∠		&	−60	35	28.9
α	3	to 1	135	30	41.6
Δα			−		36.7
			180	00	00.0
α′	1	to 3	315	30	04.9

	°	′	″			°	′	″
φ	40	42	00.040	3 S twin tank ecc. Id.	λ	74	02	25.730
Δφ	+		43.544	stork line	Δλ	+		56.215
φ′	40	42	43.584	1 tank ecc.	λ′	74	03	21.945

	Logarithms	Values in seconds	
s	3.274843		
Cos α	9.853328		
B	8.510798		
h	1.638969	1st term	43.5481
s²	6.5497		
Sin² α	9.6911		
C	1.3390		
	7.5798	2d term +	.0038
h²	3.278		
D	2.388		
	5.666	3d term +	—
		−Δφ	43.5443

½(φ+φ′)	40-42-21.8	
	Logarithms	Values in seconds
s	3.274843	
Sin α +	9.845573	
A′	8.509100	
Sec φ′	0.120333	
Δλ	1.749849	56.2146
Sin ½(φ+φ′)	9.814367	
−Δα	1.564216	36.66

N.A. Datum

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Form 27
Ed. April, 1929

POSITION COMPUTATION, THIRD-ORDER TRIANGULATION

			°	′	″				°	′	″
α	2 ecc —	~~to 3~~ S. twin tank	315	30	04.9	α	3	to 2			
2d ∠		&	+ 96	33	50.0	3d ∠		&	–		
α	2	to 1	52	03	54.9	α	3	to 1			
Δα			–		0.5	Δα					
			180	00	00.0				180	00	00.0
α′	1	to 2	232	03	54.4	α′	1	to 3			

FIRST ANGLE OF TRIANGLE

	°	′	″			°	′	″		°	′	″			°	′	″
φ	40	42	43.584	2 ecc.	λ	74	03	21.945	φ				3	λ			
Δφ	–		0.486	24.38 M. Stork line	Δλ	+		0.819	Δφ					Δλ			
φ′	40	42	43.098	1 tank	λ′	74	03	22.764	φ′				1	λ′			

	Logarithms	Values in seconds				Logarithms	Values in seconds
s	1.387034	1329.4 m.		½(φ+φ′)			
Cos α	9.788708	(521.4) m.		s		1.387034	
B	8.510797			Sin α	+	9.896918	534.3 m
h	9.686539	1st term +	.4859	A′		8.509100	(874.0) m
s²	2.774			Sec φ′		0.120332	
Sin² α	9.794			Δλ		9.913384	0.8192
C	1.339			Sin ½(φ+φ′)		9.814	
	3.907	2d term	+ —	–Δα		9.727	0.53
h²							
D							
		3d term	+ —				
		–Δφ	.4859				

	Logarithms	Values in seconds				Logarithms	Values in seconds
s				½(φ+φ′)			
Cos α				s			
B				Sin α			
h		1st term		A′			
s²				Sec φ′			
Sin² α				Δλ			
C				Sin ½(φ+φ′)			
		2d term	+	–Δα			
h²							
D							
		3d term	+				
		–Δφ					

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Above position is on N.A. Datum

For N.A. 1927 Datum
Apply:—
Lat. – 12.0
Long. + 3.5

N.A. 1927 Datum
40°- 42′- 1317.4
74°- 03′- 537.8

Geodetic positions from transverse Mercator coordinates

State *New Jersey* Station X = 2,172,500 Y = 690,000

x	2 172 500.00	log S_g	5.23678416
C	2	log (1200/3937)	9.48401583
x' (=x−C)	+ 172 500.00	log (1/R)	1086
$x'^3/(6\rho_o^2)_g$	− 1.96	log S_m	4.72081085
S_g	+ 172 498.04	cor. arc to sine	− 490
		log S_1	4.72080595
log S_m^2	9.44162170	log A	8.50910000
log C	1.339429	log sec ϕ	0.12042293
log $\Delta\phi$	0.781051	log $\Delta\lambda_1$	3.35032888
		cor. sine to arc	+ 854
y	690 000.00	log $\Delta\lambda$	3.35033742
ϕ'(by interpolation)	40° 43' 39".3677	$\Delta\lambda$	2240".4 ~~171~~ 612
$\Delta\phi$	− 06.0402	λ (central mer.)	74° 40' 00".000
ϕ	40 43 33.328	$\Delta\lambda$	37 20.4 ~~17~~ 61
Sec. in meters	1028.0	λ	~~75 17 20.417~~
	(822.7)		74° 02 39.539

plotted

927.9 927.9 (480.2)

add 1/450 distortion correction

Station X = 2175000 Y = 690,000

x	2 175 000.00	log S_g	5.24308299
C		log (1200/3937)	9.48401583
x' (=x−C)	175 000.00	log (1/R)	1.086
$x'^3/(6\rho_o^2)_g$	− 2.04	log S_m	4.72705968
S_g	174 997.96	cor. arc to sine	− 505
		log S_1	4.72705463
log S_m^2	9.45411936	log A	8.50910000
log C	1.339429	log sec ϕ	0.12042261
log $\Delta\phi$	0.793548	log $\Delta\lambda_1$	3.35657724
		cor. sine to arc	+ 879
y	690 000.00	log $\Delta\lambda$	3.35658603
ϕ'(by interpolation)	40° 43' 39".3677	$\Delta\lambda$	2272".9298
$\Delta\phi$	− 06.2165	λ (central mer.)	74° 40' 00".000
ϕ	40 43 33.151	$\Delta\lambda$	37 52.930
	1022.6	λ	~~75 17 52.930~~
	(828.2)		74° 02 07.070

plotted

165.9 165.9

1408.1 (1242.2)

(M-29)

(over)

Explanation of form:

$$x' = x - C$$

$$S_g = x' - \frac{x'^3}{(6\rho_o^2)_g}$$

$$S_m = \frac{1}{R}\left(\frac{1200}{3937}\right)S_g$$

R = scale reduction factor

ϕ' is interpolated from table of y

$\Delta\phi = C\, S_m^2$

$\phi = \phi' - \Delta\phi$

$\Delta\lambda_1 = S_1 A \sec\phi$

$\log S_1 = \log S_m$ – cor. arc to sine

$\log \Delta\lambda = \log \Delta\lambda_1$ + cor. arc to sine

$\lambda = \lambda$(central mer.) $- \Delta\lambda$

Geodetic positions from transverse Mercator coordinates

State *New Jersey* Station *x = 2,172500* *Y = 700,000*

x	2172 500.00	log S_g	5.23678416
C	2000 000.00	log (1200/3937)	9.48401583
x' (=x−C)	172 500.00	log (1/R)	1086
$x'^3/(6\rho_o^2)_g$	− 1.96	log S_m	4.72081085
S_g	172 498.04	cor. arc to sine	− 490
		log S_1	4.72080595
log S_m^2	9.44162170	log A	8.509 09930
log C	1 339847	log sec ϕ	0.120 60213
log $\Delta\phi$	0.781469	log $\Delta\lambda_1$	3.35050738
		cor. sine to arc	+ 855
y	700 000.00	log $\Delta\lambda$	3.35051593
ϕ'(by interpolation)	40° 45' 18".1826	$\Delta\lambda$	2241".3822
$\Delta\phi$	− 06.0460	λ (central mer.)	74° 40' 00".000
ϕ	40 45 12.137	$\Delta\lambda$	37 21.382
sec. in meters.	374.4	λ	74° 02' 38.618 ~~75 17 21.382~~
	(1476.4)		905.9 905.9

(501.7)

1407.6

Station *x = 2,175000* *Y 700,000*

x	2 175 000.00	log S_g	5.24303299
C		log (1200/3937)	9.48401583
x' (=x−C)	175 000.00	log (1/R)	1086
$x'^3/(6\rho_o^2)_g$	− 2.04	log S_m	4 727 05968
S_g	174 997.96	cor. arc to sine	− 505
		log S_1	4.727 05463
log S_m^2	9 454 11936	log A	8.509 09930
log C	1.339847	log sec ϕ	0.120 60181
log $\Delta\phi$	0.793966	log $\Delta\lambda_1$	3.35675574
		cor. sine to arc	+ 880
y	700000.00	log$\Delta\lambda$	3.35676454
ϕ'(by interpolation)	40° 45' 18".1826	$\Delta\lambda$	2273".86443
$\Delta\phi$	− 06.2225	λ (central mer.)	74° 40' 00".000
ϕ	40 45 11.960	$\Delta\lambda$	37 53.864
sec. in meters.	368.9	λ	74° 02 06.136 ~~75 17 53.864~~
	(1481.9)		143.9

(1263.7) (over)

(M-29)

Explanation of form:

$$x' = x - C$$

$$S_g = x' - \frac{x'^3}{(6\rho_o^2)_g}$$

$$S_m = \frac{1}{R}\left(\frac{1200}{3937}\right)S_g$$

R = scale-reduction factor

ϕ' is interpolated from table of y

$\Delta\phi = C\ S_m^2$

$\phi = \phi' - \Delta\phi$

$\Delta\lambda_1 = S_1 A \sec\phi$

$\log S_1 = \log S_m$ − cor. arc to sine

$\log \Delta\lambda = \log \Delta\lambda_1$ + cor. arc to sine

$\lambda = \lambda$(central mer.) $- \Delta\lambda$

2/3 6

23473

Geodetic positions from transverse Mercator coordinates

State *New Jersey* Station *x = 2,170,000; y = 685,000*

x	2 170 000.00	log S_g	5.23044414
C		log (1200/3937)	9.48401583
x′ (=x−C)	170 000.00	log (1/R)	1086
$x'^3/(6\rho_o^2)_g$	− 1.87	log S_m	4.71447083
S_g	169 998.13	cor. arc to sine	− 476
		log S_1	4.71446607
log S_m^2	9.42894166	log A	8.50910034
log C	1.339220	log sec ϕ	0.12033372
log $\Delta\phi$	0.768162	log $\Delta\lambda_1$	3.34390013
		cor. sine to arc	+ 829
y	685 000.00	log $\Delta\lambda$	3.34390842
ϕ'(by interpolation)	40° 42′ 49.9602″	$\Delta\lambda$	2207″.5392
$\Delta\phi$	− 05.8636	λ (central mer.)	74° 40′ 00.000″
ϕ	40 42 44.0973 [?]	$\Delta\lambda$	36 47.539
	1360.2 m	λ *plotted*	~~75 16 47.539~~ 74 03 12.461 [?]
	(490.6)		292.4

(1116.0)

Station *x = 2,175,000; y = 685,000*

x	2 175 000.00	log S_g	5.24303299
C		log (1200/3937)	9.48401583
x′ (=x−C)	175 000.00	log (1/R)	1086
$x'^3/(6\rho_o^2)_g$	− 2.04	log S_m	4.72705968
S_g	174 997.96	cor. arc to sine	− 605
		log S_1	4.72705463
log S_m^2	9.45411936	log A	8.50910035
log C	1.339220	log sec ϕ	0.12033308
log $\Delta\phi$	0.793339	log $\Delta\lambda_1$	3.35648806
		cor. sine to arc	+ 879
y	685 000.00	log $\Delta\lambda$	3.35649685
ϕ'(by interpolation)	40° 42′ 49.9602″	$\Delta\lambda$	2272″.4632
$\Delta\phi$	− 06.2135	λ (central mer.)	74° 40′ 00.000″
ϕ	40 42 43.747	$\Delta\lambda$	37 52.463
	1349.4 m	λ *plotted*	~~75 17 52.463~~ 74° 02′ 07.537
	(501.4)		176.8

(1231.6)

(M-29)

(over)

Explanation of form:

$$x' = x - C$$

$$S_g = x' - \frac{x'^3}{(6\rho_o^2)_g}$$

$$S_m = \frac{1}{R}\left(\frac{1200}{3937}\right)S_g$$

R = scale reduction factor

ϕ' is interpolated from table of y

$\Delta\phi = C\,S_m^2$

$\phi = \phi' - \Delta\phi$

$\Delta\lambda_1 = S_1 A \sec\phi$

$\log S_1 = \log S_m$ − cor. arc to sine

$\log \Delta\lambda = \log \Delta\lambda_1$ + cor. arc to sine

$\lambda = \lambda$(central mer.) $- \Delta\lambda$

Geodetic positions from Lambert coordinates

x = 1,985,000
Y = 175,000

State *Long Island* Station *Intersection*

x	1,985,000	$R_b + A$	24,462,545.30
C	2	y	175,000
x' (= x−C)	−15,000	$R_b + A - y$	24,287,545.30
tan θ	0.0006176004950	R	
θ	0° 02′ 07.″389230		
	″	y	175,000
$\frac{\theta}{\ell}$ (= Δλ)		y″	− 4.63
		y'	174,995.37
λ (central mer.)	74° ′ ″		
− Δλ	3 14.760	ϕ (by interpolation)	40° 42′ 21.″061
λ	74 03 14.760		
sec. in meters	346.5		649.6

1062.0 (1201.2)

x = 1,990,000
Station Y = 175,000

x	1,990,000	$R_b + A$	24,462,545.30
C	2	y	175,000
x' (= x−C)	−10,000	$R_b + A - y$	24,287,545.30
tan θ	0.0004117336633	R	
θ	0° 1′ 24.″926159		
	″	y	175,000
$\frac{\theta}{\ell}$ (= Δλ)		y″	− 2.06
		y'	174,997.94
λ (central mer.)	74° ′ ″		
− Δλ	2 09.840	ϕ (by interpolation)	40° 42′ 21.″087
λ	74 02 09.840		
sec. in meters	231.0		650.4

(1177.5) (1200.4)

$\tan\theta = \frac{x - C}{R_b + A - y}$

$\Delta\lambda = \frac{\theta}{\ell}$

$\lambda = \lambda(\text{central mer.}) - \Delta\lambda$

$R = (R_b + A - y)\sec\theta$

$y'' = 2R\sin^2\frac{\theta}{2}$

$y' = y - y''$

C is constant added to x' in computation of coordinates

R_b is map radius of lowest parallel

A is value of y' for R_b; in most cases it is zero

ϕ is interpolated from table of y'

(M-28)

Geodetic positions from Lambert coordinates

State *Long Island* Station *Intersection* X = 1,987,500 Y = 190,000

x	1,987,500	R_b+A	24,462,545.30
C	2	y	190,000
x' (= x−C)	−12,500	R_b+A-y	24,272,545.30
tan θ	0.0005149851343	R	
θ	0° 1' 46".22330 (299)		
	"	y	190,000
$\frac{\theta}{\ell}$ (= Δλ)		y"	− 3.22
		y'	189,996.78
λ (central mer.)	74° ' "		
− Δλ	2 42.401	φ (by interpolation)	40° 44 49".294
λ	74 02 42.401		
Sec. in meters	994.7		1520.5

(412.9) (330.3)

Station X = 1,990,000 Y = 190,000

x	1,990,000	R_b+A	24,462,545.30
C	2	y	190,000
x' (= x−C)	− 10,000	R_b+A-y	24,272,545.30
tan θ	0.0004119881074	R	
θ	0° 1' 24".978642		
	"	y	190,000
$\frac{\theta}{\ell}$ (= Δλ)		y"	− 2.06
		y'	189,997.94
λ (central mer.)	74° ' "		
− Δλ	2 09.920	φ (by interpolation)	40° 44' 49".123 (506)
λ	74 02 09.920		
Sec. in meters.	232.7		1520.9

(1174.9) (329.9)

$\tan\theta = \frac{x-C}{R_b+A-y}$

$\Delta\lambda = \frac{\theta}{\ell}$

$\lambda = \lambda$ (central mer.) $- \Delta\lambda$

$R = (R_b+A-y)\sec\theta$

$y'' = 2R\sin^2\frac{\theta}{2}$

$y' = y - y''$

C is constant added to x' in computation of coordinates

R_b is map radius of lowest parallel

A is value of y' for R_b; in most cases it is zero

φ is interpolated from table of y'

(M-26)

Geodetic positions from Lambert coordinates

State *Long Island* Station *Intersection* $x = 1,987,500$ $Y = 180,000$

x	1,987,500	$R_b + A$	24,462,545.30
C	2	y	180,000
x' (= x−C)	-12,500	$R_b + A - y$	24,282,545.30
tan θ	0.0005147730539	R	
θ	0° 1' 46".179555		
	"	y	180,000
$\frac{\theta}{\ell}$ (= Δλ)		y"	− 3.22
		y'	179,996.78
λ (central mer.)	74° ' "		
− Δλ	+ 2 42.334	φ (by interpolation)	40° 43' 10".482
λ	74 02 42.334		
sec in meters	993.6		323.3

(4147) (1527.5)

Station $x = 1,990,000$ $Y = 180,000$

x	1,990,000	$R_b + A$	24,462,545.30
C	2	y	180,000
x' (= x−C)	−10,000	$R_b + A - y$	24,282,545.30
tan θ	0.0004118184431	R	
θ	0° 1' 24".943647		
	"	y	180,000
$\frac{\theta}{\ell}$ (= Δλ)		y"	− 2.06
		y'	179,997.94
λ (central mer.)	74° ' "		
− Δλ	2 09.867	φ (by interpolation)	40° 43' 10".493
λ	74 02 09.867		
sec in meters	231.6		323.7

(1176.7) (1527.1)

$\tan\theta = \frac{x - C}{R_b + A - y}$

$y'' = 2R\sin^2\frac{\theta}{2}$

$y' = y - y''$

$\Delta\lambda = \frac{\theta}{\ell}$

C is constant added to x' in computation of coordinates

$\lambda = \lambda$ (central mer.) $- \Delta\lambda$

R_b is map radius of lowest parallel

$R = (R_b + A - y)\sec\theta$

A is value of y' for R_b; in most cases it is zero

φ is interpolated from table of y'

Geodetic positions from Lambert coordinates

State *Long Island* Station { 1,994,000 / 192,000 }

x	1,994,000	$R_b + A$	24,462,545.30
C	2	y	192,000
x' (= x−C)	−6,000	$R_b + A - y$	24,270,545.30
tan θ	.000247213234	R	
θ	0° 0' 50.991389"		
	"	y	192,000
$\frac{\theta}{\ell}$ (= Δλ)	77.9587	y"	− 0.74
		y'	191,999.26
λ (central mer.)	74° 00' 00.000"		
− Δλ	1 17.959	φ (by interpolation)	40° 45' 09.081" ✓
λ	74 01 17.959 ✓		
see in m.	421.3		280.11

1850.8
1407.6

Station

x		$R_b + A$	
C		y	
x' (= x−C)		$R_b + A - y$	
tan θ		R	
θ	° ' "		
	"	y	
$\frac{\theta}{\ell}$ (= Δλ)		y"	−
		y'	
λ (central mer.)	° ' "		
− Δλ		φ (by interpolation)	° ' "
λ			

$\tan\theta = \frac{x - C}{R_b + A - y}$

$\Delta\lambda = \frac{\theta}{\ell}$

$\lambda = \lambda\text{(central mer.)} - \Delta\lambda$

$R = (R_b + A - y) \sec\theta$

$y'' = 2R \sin^2\frac{\theta}{2}$

$y' = y - y''$

C is constant added to x' in computation of coordinates

R_b is map radius of lowest parallel

A is value of y' for R_b; in most cases it is zero

φ is interpolated from table of y'

(M-28)

Form No. 743
DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
Ed. May 1935

GEODETIC POSITIONS FROM TRANSVERSE MERCATOR COORDINATES

STATE New Jersey STATION {2,178,000 / 700,000}

x	2,178,000	$\log S_g$	5.25041475
K	2	log (1200/3937)	9.48401583
x' (=$x-K$)	+ 178,000	log (1/R)	1086
$x'^3/(6\rho_o^2)_g$	− 2.15	$\log S_m$	4.73444144
S_g	+ 177,997.85	cor. arc to sine	− 522
		$\log S_1$	4.73443622
3 log x'	1575126	log A	8.50909931
$\log 1/(6\rho_o^2)_g$	4.58102	log sec ϕ	0.12060142
$\log x'^3/(6\rho_o^2)_g$	0.33228	$\log \Delta\lambda_1$	3.36413695
		cor. sine to arc	+ 910
$\log S_m^2$	9.468883	$\log \Delta\lambda$	3.36414605
log C	1.3398447	$\Delta\lambda$	+ 2312.8424″
$\log \Delta\phi$	0.808730		
y	700,000		
ϕ' (by interpolation)	40° 45′ 18″.183	λ (central mer.)	74° 40′ ″
$\Delta\phi$	− 6.438	$\Delta\lambda$	38 32.842 ✓
ϕ	~~34.621~~	λ ✓	74 01 27.158 ✓
	40 45 11.745		637.0

sec in meters 362.3

Explanation of form:

1850.8
1407.6

$x' = x - K$

$S_g = x' - \dfrac{x'^3}{(6\rho_o^2)_g}$

$S_m = \dfrac{1}{R}\left(\dfrac{1200}{3937}\right) S_g$

R=scale reduction factor

ϕ' is interpolated from table of y

$\Delta\phi = C\,S_m^2$

$\phi = \phi' - \Delta\phi$

$\Delta\lambda_1 = S_1 A \sec\phi$

$\log S_1 = \log S_m -$ cor. arc to sine

$\log \Delta\lambda = \log \Delta\lambda_1 +$ cor. arc to sine

$\lambda = \lambda$ (central mer.) $- \Delta\lambda$

U. S. GOVERNMENT PRINTING OFFICE 11—11521

Plane coordinates on Lambert projection

1875

(for Datum Station) State *Long Island* Station *Castle Stevens (N.J.)*

$\phi =$ 40° 44' 41".152 $\lambda =$ 74° 01' 28".040

Tabular difference of R for 1" of $\phi =$ 101.20167

R (for min. of ϕ)		24,277,537.19	y' (for min. of ϕ)		185,008.11
Cor. for sec. of ϕ		− 4,164.65	Cor. for sec. of ϕ		+ 4,164.65
R		24,273,372.54	y'		189,172.76
			y'' $(=2R \sin^2 \frac{\theta}{2})$		+ 0.95
θ (for min. of λ)		− 0°00'39".24493	y		189,173.71
Cor. for sec. of λ		− 18.34046			
θ		− 57.58539	$\frac{\theta}{2}$		0°00'28".792695
θ''	For machine computation	"		For machine computation	
			log θ''		1.76031231
log θ''		1.76031231	colog 2		9.69897000
S for θ		4.68557486	S for $\frac{\theta}{2}$		4.68557487
log sin θ	sin θ	6.44588717	log sin $\frac{\theta}{2}$	sin $\frac{\theta}{2}$	6.14485718
log R		7.38513012		R sin $\frac{\theta}{2}$	
log x'		3.83101729	log sin² $\frac{\theta}{2}$	R sin² $\frac{\theta}{2}$	2.28971436
x'	R sin θ	− 6,776.68	log R		7.38513012
		2,000,000.00	log 2		0.30103000
x		1,993,223.32	log y''		9.97587448

$x = 2{,}000{,}000.00 + R \sin \theta$

$y = y' + 2R \sin^2 \frac{\theta}{2}$

y' = the value of y on the central meridian for the latitude of the station

S = log of ratio for reducing arc expressed in seconds to sine (see log tables)

R, y', and θ are given in special tables

For plotting only. E.S.B. Aug 19, 1936

(R 340)

REVIEW OF AIR PHOTO COMPILATION T-5450 (1934)
Scale 1:5,000

Comparison with Graphic Control Surveys

T-6127 (1934), 1:10,000

Survey T-6127 was made during September, October 1934 about one month before the photographs of this area were taken. T-6127 shows all waterfront detail between Ellis Island and Constable Point.

The common area between T-6127 and this compilation is small. Over this area all detail on T-6127 is also shown on this compilation. The piles and dolphins were transferred to the compilation in this office.

There are differences in location of detail between this compilation (scale 1:5,000) and T-6127 (scale 1:10,000) of from 2 to 15 meters. The large difference of 15 meters is for a small section only. The compilation is well controlled, is on a larger scale and is accepted after examination in this office. A note has been placed on T-6127.

Comparison with Previous Topographic Surveys

T- 16	(1837),	1:10,000	
T- 17	(1837)	"	
T- 18	(1837)	"	
T-482	(1855)	"	Jersey City to Caven Point
T-484	(1855)	"	Jersey City and vicinity
T-610a	(1859)	"	Hoboken and Jersey City
T-610b	(1873)	"	Castle Point to Ellis Island
T-610c	(1875)	"	Guttenberg to Bulls Ferry
T-662	(1857)	"	Vicinity of Communipaw

Comparison with the old surveys listed above shows that this compilation is complete and adequate to supersede the sections of those surveys which it covers. There have been numerous and extensive changes due to harbor developments since the time these surveys were made. No detailed discussion will be made for them.

T-1573 (1885), 1:5,000

Survey T-1573 covers the Hudson River between Castle Point and Guttenberg. Numerous large changes have occurred since 1885. The compilation is adequate in order to supersede T-1573 over the common area.

T-1575 (1885), 1:5,000

Survey T-1575 is in the vicinity of Ellis Island. Over the common area there have been many changes of detail. The large pier located at lat. 40° 42.25', long. 74° 02.1' has been removed. T-1575 is superseded by this compilation over the common area.

T-1578 (1885), 1:5,000

Survey T-1578 covers the Hudson River from latitude 40° 42.5' to Castle Point. There have been numerous changes of piers and docks in this area since 1885. T-1578 is superseded by this compilation, over the common area.

T-2323 (1889), 1:10,000, Chart 369[4]
T-3150 (1911), " " "
T-3226 (1911), " " "

The surveys T-2323, T-3150, T-3226 are revision surveys which have been made directly on current editions of chart 369[4]. Revised detail is shown in red. The compilation is adequate in order to supersede the portions of these surveys which it covers.

There are no new hydrographic surveys covering this area.

1933 ?

Comparison with charts Nos. 745, 369, 1215.

All current landmarks shown on charts 745 and 369 within this area are shown on this compilation. These landmarks are contained in chart letter 176 (1935). No additional landmarks have been recommended in this area. There are no lights or other non-floating aids to navigation in this area.

The extent of the high water line at the inshore ends of the ferry slips shown on this compilation at lat. 40° 44.1', long. 74° 01.6', lat. 40° 43.6', long. 74° 01.8' and lat. 40° 42.4', long. 74° 02.1' cannot be determined from the photographs on account of these ends falling under roof coverings. The compilation in each case shows the line around the slips to the point where they join the projection of the roof on the plane of the slip. The slips are joined by the roof projections.

A portion of the building on Pier 16 at lat. 40° 45.3', long. 74° 01.5' has been removed.

Two buildings shown at lat. 40° 45.0', long. 74° 01.5' have been removed.

Two small buildings shown at lat. 40° 43.55', long. 74° 02.3' have been removed.

The shaded city block at lat. 40° 43.2', long. 74° 02' on chart 745 should be left blank as there are no buildings in this block.

Plane Coordinate Grids

Both the Long Island and the New Jersey Systems of Plane Coordinates are shown on this compilation. These coordinates, marked at intervals of 2,000 feet, were plotted in this office from geographic positions of intersections computed in the Division of Geodesy. Computations are attached at back of this report. Grids points plotted by L.A. McGann. and plotting checked by B.G.J.
Intermediate points plotted on projection machine

Sept. 16, 1936.

Reviewed by L. A. McGann.
Leonard A. McGann
✓ B.G. Jones

The projection for this compilation was hand drawn. The lines are very heavy in places and in several places vary up to 0.1 to 0.3 mm from correct position. The grid has been worked slightly to fit as nearly as possible with the projection.

B.G.J.

REVIEW OF AIR PHOTO COMPILATION NO. T-5450.

Chief of Party: J.C.Partington | Compiled by: See STATISTICS SHEET

Project: HT-175 | Instructions dated: Mar. 14, 1934.

1. The charts of this area have been examined and topographic information necessary to bring the charts up to date is shown on this compilation. (Par. 16a, b,c,d,e,g and i; 26; and 64)

2. Change in position, or non-existence of wharfs, lights, and other topographic detail of particular importance to navigation which affect the chart, is discussed in the descriptive report. (Par. 26; and 66 g,n)
   There are no large changes in position of wharfs. There are no lights or other non-floating aids to navigation within the area of this compilation.

3. Ground surveys by plane table, sextant, or theodolite have been used to supplement the photographic plot where necessary to obtain complete information, and all such surveys are discussed in the descriptive report. (Par. 65; and 66 d,e)

   3 point theodolite fix used as control and included with descriptive report. Survey T-6127 covers a small area of this compilation at its southern end. T-6127 (1934) G.C.S.

4. Blue-prints and maps from other sources which were transmitted by the field party contain sufficient control for their application to the charts. (Par. 28)

   Blue-prints used as an aid in detailing sheet and for names only.

5. Differences between this compilation and contemporary plane table and hydrographic surveys have been examined and rectified in the field before forwarding the compilations to the office and are discussed in the descriptive report.

   No contemporary surveys on hand in this party for comparison. T-6127 was being finished at the time the photos were taken, however.

6. The control and adjustment of the photo plot are discussed in the descriptive report. Unusual or large adjustments are discussed in detail and limits of the area affected are stated. (Par. 12b; 4X; and 66 c,h,i)

7. High water line on ~~marshy and mangrove~~ coast is clear and adequate for chart compilation. (Par. 16a, 43, and 4X)
   No sand beach in this area.

NOTE: Strike out paragraphs, words or phrases not applicable and modify those requiring it. Paragraph numbers refer to those in the Topographic Manual. Refer also to the pamphlet "Notes on the Compilation of Planimetric Line Maps from Five Lens Air Photographs."

M-87

8. The representation of low water lines, reefs, coral reefs and rocks, and legends pertaining to them is satisfactory. (Par. 36, 37, 38, 39, 40, 41)
No low water lines shown.

9. Recoverable objects have been located and described on Form 524 in accordance with circular 30, 1933, circular letter of March 3, 1933, and circular 31, 1934. (Par. 29, 30, and 57)

Cards form 524 included in this report. and filed under compilation No. T-5450.

10. A list of landmarks was furnished on Form 567 and instructions in the Director's letter of July 16, 1934, Landmarks for Charts, complied with. (Par. 16d, e; and 60)

List of Landmarks previously submitted by R.W.Woodworth.
See Chart Letter 176 (1933).

11. All bridges shown on the compilation are accompanied by a note stating whether fixed or draw, clearance, and width of draw if a draw bridge. Additional information of importance to navigation is given in the descriptive report. (Par. 16c)

No bridges of importance to navigation in the area of this sheet.

12. Geographic names are shown on the overlay tracing. The accepted local usage of new names has been determined and they are listed in the report, together with a general statement as to source of information and a specific statement when advisable. Complete discussion of place names differing from the charts and from the U. S. G. S. Quadrangles is given in the descriptive report, together with reasons for recommendations made. (Par. 64, and 66k)

13. The geographic datum of the compilation is N.A. 1927 and the reference station is correctly noted.

14. Junctions with adjoining compilations have been examined and are in agreement. (Par. 66j)

15. The drafting is satisfactory and particular attention has been given the following:

    1. Standard symbols authorized by the Board of Surveys and Maps have been used throughout except as noted in the report. ✓

    2. The degrees and minutes of Latitude and Longitude are correctly marked. ✓

3. All station points are exactly marked by fine ✓ black dots.

4. Closely spaced lines are drawn sharp and clear ✓ for printing.

5. Topographic symbols for similar features are of ✓ uniform weight.

6. All drawing has been retouched where partially ✓ rubbed off.

7. Buildings are drawn with clear straight lines ✓ and square corners where such is the case on the ground.

(Par. 34, 35, 36, ~~37~~, ~~38~~, 39, 40, ~~41~~, 42, 43, ~~44~~, 45, 46, 48)

16. No additional surveying is recommended at this time.

17. Remarks:

18. Examined and approved;

J. C. Partington
Chief of Party

19. Remarks after review in office:
See ~~following~~ pages immediately preceding

Reviewed in office by: Leonard A. McGavin Sept. 16, 1936.

Examained and approved:

C. K. Green
Chief, Section of Field Records

Fred. L. Peacock
Chief, Section of Field Work

L. O. Colbert
Chief, Division of Charts

G. Wade
Chief, Division of Hydrography and Topography.