

**CITY OF LUBBOCK, TEXAS**

**N.A.D. 83 / 27 SCALE FACTORS  
FOR THE CITY  
GEODETIC NETWORK, AERIAL CONTROL, AND FEMA CONTROL**

POINT NO.	NAD83 SCALE FACTOR	NAD27 SCALE FACTOR
801	0.999745091	0.999749925
802	0.999747543	0.999747595
803	0.999753650	0.999753702
804	0.999754940	0.999754991
805	0.999762164	0.999762216
806	0.999760172	0.999760224
807	0.999770424	0.999770476
808	0.999767831	0.999767882
809	0.999758909	0.999758962
810	0.999750702	0.999750775
811	0.999768412	0.999768465
812	0.999749418	0.999749471
813	0.999763109	0.999763161
814	0.999744687	0.999744740
815	0.999773212	0.999773265
816	0.999756086	0.999756138
817	0.999768911	0.999768979
818	0.999767020	0.999767073
<b>AVE. SCALE FACTOR</b>	<b>0.999759016</b>	<b>0.999759336</b>

**PROJECT AREA SCALE FACTORS**

<i>GRID TO SURFACE</i>		<i>1.000241042</i>		<i>1.000240722</i>
<i>SURFACE TO GRID</i>		<i>0.999759016</i>		<i>0.999759336</i>



Consultants in Planning, Engineering, Architecture,  
Construction Management, and Related Services

City of Lubbock, Texas Geodetic Network and Aerial Control Report

The Aerial control points and Geodetic Network is defined by the perimeter of the aerial photography work done during the first quarter of 2000, an area covering 206 square miles (+/-). The project area was then divided by using 5-mile radius circles to establish monument locations. The 5-mile length was used to represent how far Carter & Burgess could project its radio link for the Real Time Kinematic (RTK) GPS portion of the project. Monument locations were then adjusted to find the most suitable locations for the monuments, such as parks and subdivision greenbelts. Additional monuments were set to match the agreed upon number of monuments between the City of Lubbock and Carter & Burgess.

The monuments set for Geodetic Network are 3-1/4 inch round, domed aluminum caps set on top of a 30-inch piece of 5/8-inch steel rebar. The monuments are set 0.1 to 0.2 feet below the surface of the ground. The caps are stamped "City of Lubbock Geodetic Monument" around the edge of the cap with the monument number stamped below the center punch mark. The aluminum cap and rebar are set inside a cylinder of concrete 30-inches deep.

Carter & Burgess recovered four Nation Geodetic Survey (NGS) triangulation stations and four NGS vertical stations (benchmarks). The station designations and datum classifications are as follows:

Station Type	Station Name	Horizontal Order	Vertical Order
Tri-Station	McCauley	1 <sup>st</sup>	None Listed
Tri-Station	J-71	2 <sup>nd</sup>	1 <sup>st</sup> – Class 2
Tri-Station	Lubbock Magnetic	2 <sup>nd</sup>	None Listed
Tri-Station	Shepard	1 <sup>st</sup>	3 <sup>rd</sup>
TxDOT Lubbock RRP Station		Cors	None Listed
Vert-Station	V905	*	1 <sup>st</sup> – Class 2
Vert-Station	Y905	*	2 <sup>nd</sup> – Class 0
Vert-Station	B71	*	1 <sup>st</sup> – Class 2
Vert-Station	M905	*	1 <sup>st</sup> – Class2

Carter & Burgess has knowledge of more recent NGS vertical stations set across the county of Lubbock but choose not to use them in the network because they have no 1929 National Geodetic Vertical Datum (NGVD) values. *Please note that this network used NGS Tri-Station J-71 and not NGS Tri-Station J-71-ECC.* These two monuments are only about 15-feet apart and a surveyor could easily set up over the wrong monument. Carter & Burgess selected monument J-71 because of its published vertical data. Monument J-71-ECC has no published vertical data.

Static GPS surveys were conducted through the above listed monuments and the 10 monuments constructed for this Geodetic Network. Each monument was independently occupied a minimum of two times, with session times of thirty minutes for each occupation. In addition the TxDOT RRP Station data was applied as a third independent occupation.

The Static GPS data was processed and checked. Prior to any network adjustment loop closures of the raw data were run to verify how well the data worked with itself prior to constraining it to any published data. Loop closures vary from 1-part in 250,000-parts, to a 1-part in 1,000,000-parts. All of the network adjustment was performed with geographical coordinate values (Latitudes, Longitudes and Ellipsoid Heights). Two databases were created, one for the North American

Datum (NAD) 1927, NGVD 1929, and one for the NAD1983, North American Vertical Datum (NAVD) 1988. Both database were then fully constrained to two published horizontal positions and three vertical positions. The adjusted monument positions were then applied to the RTK GPS surveys that were run to locate the nearly 500 aerial control points set across the project.

Two independent databases were created for the RTK GPS surveys, one for the NAD 27, NGVD 29 data, and one for NAD 83, NAVD 88 data. Upon completion of the RTK surveys the RTK data was calibrated (adjusted) to seven monuments (Static GPS points) across the project area. The RTK calibration is an adjustment method using "Least Squares", the residual error found in the RTK surveys ranged from 0.03 feet to 0.06 feet. Multiple checks were taken throughout the RTK surveying process. Any point found to be outside of the error range was deleted from the databases and relocated in the field.

Independent databases were created to insure accuracy and consistency between the two datum's. Although the reports show the latitudes and longitudes to be the same (WGS84) the coordinate values were derived from published coordinates, not translated coordinates through programs CORPSCON or VERTCON offered by the NGS.

01/17/00  
WINDY 60's

22

NO. 446

NATIONAL PRINTFAST

STATIC GPS FOR  
LUBBOCK MONUMENTS

020205610

FERRY  
JACKSON  
AILESWORTH  
3 TRIMBLE 400's  
1 TRIMBLE 400

MON McLAULEY

(WELL BASE)

FILE NAME 7798 UDD 1 START

ATT HEAT 1.534 MT 5.03 FT

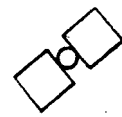
END

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01/19/00

WINDY 60'S

STATIC GPS FOR  
LUBBOCK MONUMENTS  
020205010



PERRI  
JACKSON  
AYLESWORTH  
3 TRIMBLE 400'S  
1 TRIMBLE 4700

Nov 1977

( WASH 4000 )

FILE NAME	211 MOD 1	START
ATT HEIGHT	404 FT	4.61 FT
		END

Nov 1975

FILE NAME	6210 000 2	START
ATT HEIGHT	1.479 MT	4.85 FT
		END 2:50 PM

Nov 1975

FILE NAME	6210 000 3	START
ATT HEIGHT	1.629 MT	5.35 FT
		END

Nov 1979

FILE NAME	6210 009 4	START
ATT HEIGHT	1.600 MT	5.25 FT
		END

Nov 1979

FILE NAME	6210 009 5	START
ATT HEIGHT	427 FT	4.68 FT
		END


MON SHEPPARD

FILE NAME            020 6            START 6.07 AM  
ATT HENT 1.        AT    4.        FT  
                      NOT USIN                    END



11/19/00  
WINDY 60'S

STATIC GPS FOR  
LUBBOCK MONUMENTS  
020205010

 PERP/  
JACKSON  
AYLES WORTH  
3 TRIMBLE 400'S  
1 TRIMBLE 4700

1 0-20

1905

LEW 4700

FILE NAME

4638 019

4700 +

START

15 1

ATT Ht

m

62 FT

END 2:0 PM

MON 1905

4638 019 1  
4700-2

START : 2:0 PM

Antenne Ht.

m 1.534 ft 5<sup>03</sup>

END = 3 00 PM

Mon #00

4638 019 2  
4700-3

start: 3:15 PM

antenne ht. : 1.625 m

5<sup>33</sup> ft

end. 3<sup>45</sup>

Mon #00

4638 019 3  
4700-4

start 4 PM

ante ht

1.666m

5<sup>46</sup> ft

end: 4<sup>45</sup> PM

571

4638 019 4  
4700-5

start 5 PM

antenne Ht.

1.328m

4<sup>35</sup> ft

end 5<sup>5</sup>

Mon 5

4638 019 5  
4700 6

start 6 PM

antenu Ht

1.411

4<sup>62</sup> ft

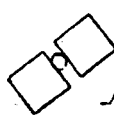
end

PM

01/20/99

PALM COUNTY 50'S

STATIC GPS FOR  
LUBBOCK MONUMENTS  
020205010

 PERRY  
JACKSON  
MILES WORTH  
3 TRIMBLE 4000'S  
1 TRIMBLE 4700

MON SHEPHERD (FT WORTH 4000)  
 FILE NAME 6210 020 7 START 9 50  
 ATT HEIGHT 1.256 MT 4.12 FT  
 END

MON SHEPHERD  
 FILE NAME 6210 020 8 START 11  
 ATT HEIGHT 1.447 MT 4.75 FT  
 STOP

MON 002  
 FILE NAME 6210 020 9 START 05  
 ATT HEIGHT 1.649 MT 5.41 FT  
 STOP

MON 002  
 FILE NAME 6210 020 A START 07  
 ATT HEIGHT 1.409 MT 4.886 FT  
 STOP

MON 002  
 FILE NAME 6210 020 B START  
 ATT HEIGHT 1.595 MT 5.235 FT  
 STOP

004 (FRESH 7000)

FILE NAME 6210 020 C START 3:22 PM

ATT H&H 1.566 MT 5.135 FT

END

MON 1371

FILE NAME 6210 020 -D START ~~4:21 PM~~ RESTART 4:47 PM

ATT H&H 1.536 MT 5.04 FT

END

MON 871

FILE NAME 6210 020 E START 5:26 PM

ATT H&H 1.529 MT 5.01 FT

END

MON LUBROCK MAGNETIC

FILE NAME 6210 ~~020~~<sup>021</sup> F START 6:58 PM

ATT H&H 1.538 MT 5.04 FT

END

1/3

01/20/99

POLY CLONING WINDY

50's

STATIC EPS FOR  
LUBBOCK MONUMENTS  
020205010

PERRY  
JACKSON  
ALYSWORTH  
3 TRIMBLE 4000's  
1 TRIMBLE 4700

1-20-2000  
FILE NEVER STARTED  
4638 020

571

antennae Lt. 1.345 m  
ANTENNA NOT CONNECTED

start 9<sup>05</sup> am  
441 #  
end ???

Mon 571

4638 020 <sup>D</sup>  
ant. Ht. 1.345 m

start 10<sup>25</sup>  
441 #  
end 10<sup>55</sup>

Mon 571

4638 020 <sup>1</sup>  
ant Ht. 1.246 m

start 11<sup>00</sup> am  
4<sup>08</sup> #  
end

Mon 001

4638 020 <sup>2</sup>  
ant. Ht. 1.656 m

start 11<sup>40</sup> am  
5 <sup>44</sup> #  
end 12<sup>20</sup> PM

Mon 001

4638 020 <sup>3</sup>  
ant Ht. 1.541 m

start 12<sup>25</sup> PM  
5<sup>06</sup> #  
end 1<sup>05</sup> PM

Mon 004

4638 020 <sup>4</sup>  
ant. Ht. 1.665 m

start 1<sup>35</sup> PM  
5 <sup>46</sup> #  
end 2<sup>05</sup> PM

MON Y905 4638 020  $\overline{72}^5$  start  $2 \frac{25}{PM}$   
 antennae Ht.  $\underline{1540}$  m  $5^{05}$  ft.  
 end  $3 \frac{05}{PM}$

Mon Y905 4638 020  $\overline{72}^6$  start  $3 \frac{10}{PM}$   
 antennae Ht.  $\underline{1440}$  m  $4 \frac{72}{ft.}$   
 end  $4 \frac{00}{PM}$

Mon Y905 4638 020  $\overline{74}^7$  start  $4^{05}$   
 antennae Ht.  $\underline{1624}$  m  $5 \frac{33}{ft.}$   
 end  $5 \frac{35}{}$

Mon J71 4638  $\overline{620}^D$   $\overline{75}^D$  start  $6 \frac{10}{PM}$   
 antennae Ht.  $\underline{1332}$  m  $4 \frac{37}{ft.}$   
 end  $6 \frac{40}{PM}$

Mon J71 4638  $\overline{620}^D$   $\overline{76}^D$  start  $6 \frac{50}{PM}$   
 antenna Ht.  $\underline{1283}$  m  $4 \frac{22}{ft.}$   
 end  $7 \frac{35}{PM}$



C Lubbock  
Mon  
Sta Survey

3 P.M  
G Perry

1-19 00  
P Sunny/Windy  
K. Jackson

245

6:58 pm.

14100

Mon, # 8

File Name 7854-D 0-1

Ant. Ht. 1.614 meters 5.30 Ft

Start 1:22 pm Finish 1:55 pm

Mon. Lub. Mag.

File Name 7854-000-2

Ant. Ht 1.610 meters 5.28 Ft.

Start. 2:19 pm. Finish 2:50

Mon. Lub. Mag.

File Name 7854-000-3

Ant. Ht 1.460 meters. 4.79 Ft

Start 2:57 pm Finish 3:40 pm

Mon. 6

File Name 7854-D 9-4

Ant. Ht 1.657 meters 5.43 Ft.

Start 4:06 Finish 4:36 pm

6  
 File No 8540 5  
 H. 1470 meters 4.8  
 start 44 pm Fin 45 pm

MON 10  
 File Name 7854 0 0-6  
 Ant. Ht 1.620 meter 3 Ft  
 start 6 8 pm F 6 33

11-20 99

MON. MCLAULE;  
 File Name 7798 0 2  
 Ant. Ht 1.482 meters 4.6 Ft  
 start Finish

Mon. 10  
 File Name 7 02 7  
 Ant. Ht. 1.627 34 Ft  
 start 9 3 AM Fin 49 AM

Mon. 10

File Name 7854-020-8

Ant. Ht 1.484 meters 4.86

start 10:58 am Finish 03 pm

Mon. 3

File Name 7854-020-9

Ant. Ht 1.596 5.24 Ft.

start 12:34 pm Finish 05 pm

Mon. 3

File Name 7854-020-A

Ant. Ht 1.422 meters 4.73 Ft. .LoloS

start 1:09 pm Finish 08 pm

Mon. 5

File Name 7854-020-B

Ant. Ht 1.631 meters 5.35 Ft.

start 2:31 pm Finish 02 pm

Mon 5

File Name 7854-020-L

Ant. Ht 1.438 meters 4.72 Ft.

start 3:06 pm Finish pm

Lub, Ma

File Name 7854 2 0 D

Ant. Ht 1.621 m or 5' 3"

Start 4: 4 p. Finish 1 pm

Sun. Shepard

File Name 7854 0 0 E

Ant. Ht 1.44 meters 4.75

Start 5 pm Fi 6 30 pm

MON. Shepard

File Name 7854 0 F

Ant. Ht 1.277 m or 1 FT

start 6 pm F 7 31 pm

STK	+	HI	-	FLFV	1/19/00
TBM	1.49/8.51	3244.11 3242.67	NAVD 88 NAVD 29	3242.62 3241.58	
○	5.36/9.65	3243.46 3242.22	6.01/9.00	3238.10 3236.80	
○	4.93/10.08	3243.01 3241.77	5.38/9.63	3238.00 3236.80	(986.969 m)
○	<del>6.34/8.06</del> 6.29/8.73	3244.71 3243.15	4.91/10.10	3238.10 3236.80	
✓ in			<del>1.49/13.20</del> 1.76/13.25	3241.50 3242.63	3242.62 (Error +0.01)

TBM	7.30/7.72	3173.62 3172.41		3166.32 3165.11	
○	5.78/9.24	3174.60 3173.47	4.72/10.29	3168.90 3167.69	
○	1.24/13.77	3175.35 3174.14	0.57/14.43	3174.11 3172.90	
✓ in			9.00/6.01	3166.35	3166.32 (Error +0.03) 3165.14

DJSL

119/00

Mon. V905

~~5/8" IRS w/red cap~~

5/8" IRS w/red CAB cap

Same as Beginning

Monument M905

5/8" IRS

Same as Beginning

City of Lubbock  
Ben loop  
Mon 7/

NO

NATIONAL PRINTFAST

3 P.M.  
to Perry

1-27-99  
Snowing/Icy  
K. Jackson  
T Drib



STP

+

HJ

FV

TBM

2.59/7.66

45.74

NAVD

324 15  
3 20

⊙

3.11/5.4

245.16

69/4.57

3240.05  
3238.45  
(1987.569 m)

✓

01/8 2

3243 51/2  
00)

5

DESC.

11/21/00

Mon B-71

5/4" IRB 100' +/- west of Monument

Same as Beginning