

# **Final Project**

## **Surveying of HU Building**

**BCEE 371----Surveying**

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Course Number: \_\_\_\_\_  
Name: \_\_\_\_\_  
Signature: MD7XJJ  
G7XS

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I.D. #                           
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<sup>1</sup> Rules for reference citation can be found in "Form and Style" by Patrick MacDonagh and Jack Bordan, fourth edition, May, 2000, available at <http://www.enqs.concordia.ca/scs/Forms/Form&Style.pdf>.

Approved by the ENCS Faculty Council February 10, 2012

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# Introduction

Surveying enables people to get precise data to build and observe what they want. The latest technology enables people to accurately measure heights, horizontal distances, vertical distances, angles and many more measurements. After obtaining the data, we can use TPC, AutoCAD and other software to model and correct data errors. This project is to measure the data of the experimental building and surrounding objects, and model it on the computer.

# Objective

In this project, the objective is to obtain a detailed sketch of the selected building (HU building for group 8) and its surrounding features by implementing a traverse from the outside of the building. The result should include the location of stations, horizontal distances, angles, shape, and area. All data we collected are analyzed and used in TraversePC/AutoCAD to obtain the detailed plan of the building.



Figure 1. HU building

# **Materials Used**

1. One total station
2. One tripod
3. One measuring tape
4. Several pins
5. Fieldbook
6. One tension handle
7. Traverse PC (TPC software)
8. AutoCAD software
9. Prism

# **Procedure**

1. Select the locations of our surveying points A, B, C, D, and E and turning points (TP).
2. Starting from point C, set up the tripod and total station right on top of point C and set the horizontal angle as zero aiming at point B (next observation point).
3. Record the angle of direction of the north.
4. For features such as trees, roads, doors, and the corner of the building, we measure the horizontal distance and the corresponding angle for locating each feature and the side of the building.
5. Move our instrument to the next observation point B and repeat step 4 to collect the data of features.
6. All data will be used in TraversePC to compute a traverse and error will be calculated to adjust the polygon.

# Result

## Data collected

Table 1.

station	observation	angle	distance
A	B	0	51.701
A	C	89°31'50"	45.022
A	201	2°10'20"	40.580
A	202	7°54'50"	43.757
A	203	10°58'50"	28.346
A	204	4°31'10"	36.327
A	205	6°44'20"	28.953
A	206	24°47'10"	19.337
A	207	32°58'00"	22.199
A	208	56°38'50"	12.471
A	209	75°00'10"	11.036
A	210	80°45'10"	11.113
A	211	85°35'40	11.250
A	212	109°06'50"	4.024
A	213	140°13'10"	10.538
A	214	63°44'40"	18.889
A	215	58°46'20"	19.330

Table 2.

station	observation	angle	distance
B	D	0	43.277
B	A	105°49'30"'	51.693
B	D	105°49'20"'	43.277
B	301	5°24'30"'	52.127
B	302	23°56'10"'	28.253
B	303	26°26'30"'	28.889
B	304	27°30'00"'	24.457
B	305	18°54'30"'	27.409
B	306	22°00'40"'	23.500
B	307	34°13'50"'	15.306
B	308	38°12'00"'	13.844
B	309	14°52'20"'	22.647
B	310	42°46'30"'	16.539
B	311	44°52'20"'	15.739
B	312	65°10'40"'	12.100
B	313	109°17'00"'	3.950
B	314	150°49'40"'	10.541

Table 3.

station	observation	angle	distance
D	E	0	33.539
D	B	152°52'40"	43.219
D	E	152°52'50"	33.557
D	401	353°10'50"	21.28
D	402	355°57'50"	16.803
D	403	1°16'10"	22.673
D	404	5°06'30"	17.731
D	405	2°00'00'	19.793
D	406	4°10'10"	18.511
D	407	11°17'10"	14.304
D	408	17°13'40"	18.587
D	409	27°08'50"	15.975
D	410	40°11'50"	13.998
D	411	50°12'00"	12.418
D	412	77°48'20"	12.151
D	413	69°24'30"	10.944
D	414	121°50'40"	25.136

Table 4.

station	observation	angle	distance
E	F	0	29.6866
E	D	106°43'40"	33.536
E	F	106°43'40"	29.685
E	501	12°45'40"	33.540
E	502	15°02'20"	34.108
E	503	16°32'30"	30.587
E	504	87°13'20"	13.441
E	505	79°30'30"	15.441
E	506	33°07'00"	24.531
E	507	34°02'50"	22.337

Table 5.

station	observation	angle	distance
F	C	0°	42.143
F	E	124°22'00"	29.727
F	C	124°22'00"	42.136
F	601	37°56'30"	5.102
F	602	343°18'30"	4.963
F	603	342°19'30"	2.288
F	604	337°13'50"	10.641
F	605	322°35'10"	11.495
F	606	294°40'20"	16.904
F	607	359°13'10"	16.395
F	608	357°34'10"	18.194
F	609	19°40'10"	22.571
F	610	21°22'20"	28.405
F	611	43°49'40"	13.682
F	612	12°30'10"	33.609

F	613	$15^{\circ}14'50''$	40.911
F	614	$16^{\circ}09'30''$	40.619

Table 6.

station	observation	angle	distance
C	A	$0^{\circ}$	44.931
A	C	$140^{\circ}37'10''$	42.132
C	A	$140^{\circ}40'20''$	44.933
C	701	$59^{\circ}18'20''$	10.446
C	702	$33^{\circ}42'50''$	14.432
C	703	$28^{\circ}34'50''$	14.789
C	704	$21^{\circ}33'20''$	18.358
C	705	$46^{\circ}06'00''$	17.114
C	706	$48^{\circ}00'00''$	18.183
C	707	$84^{\circ}45'00''$	10.089
C	708	$60^{\circ}11'50''$	11.551
C	709	$57^{\circ}45'10''$	9.515
C	710	$47^{\circ}14'30''$	10.413
C	711	$4^{\circ}04'40''$	33.231
C	712	$6^{\circ}14'01''$	31.137

### Traverse PC Result

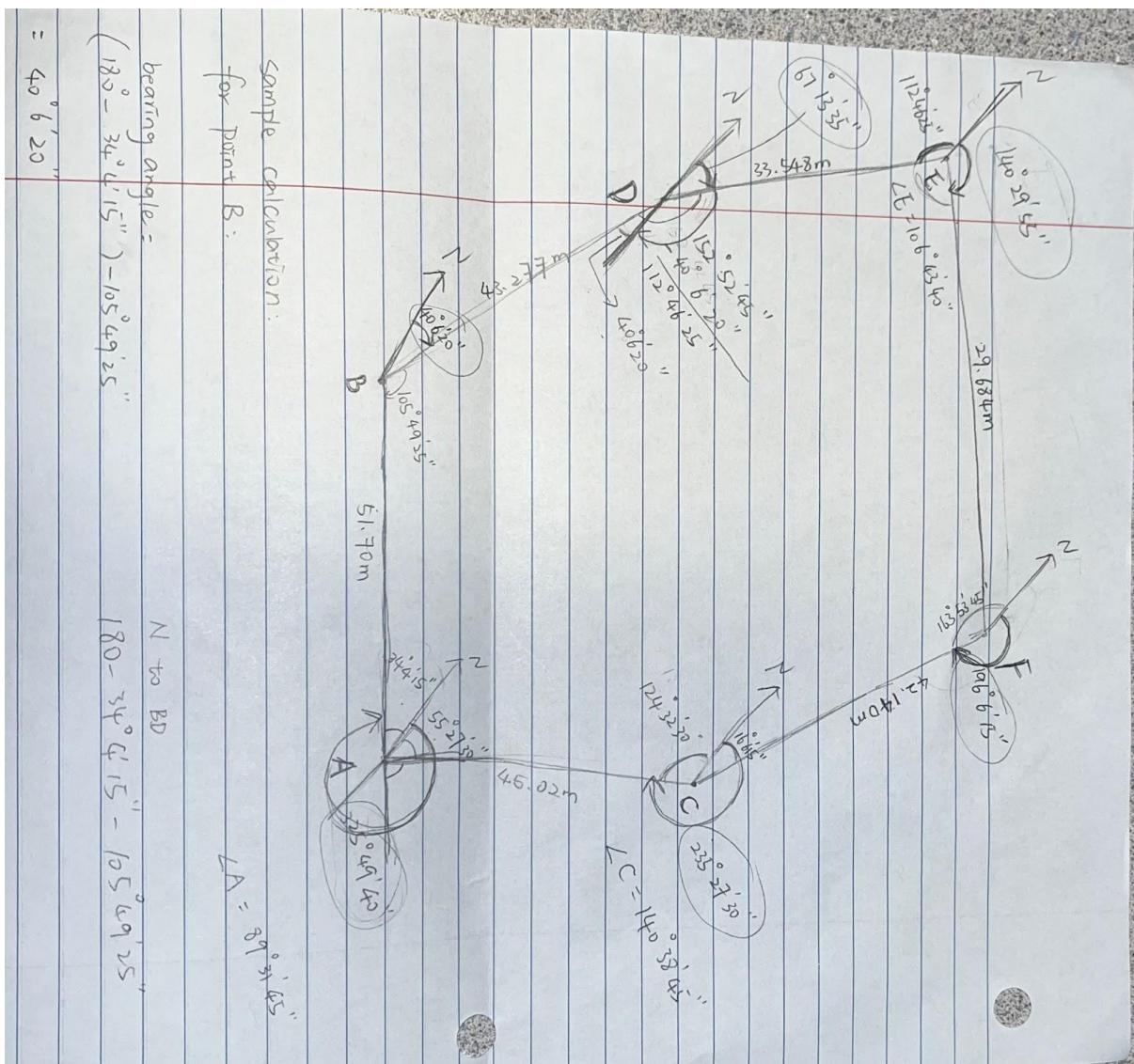


Figure.2 Bearing angle calculation

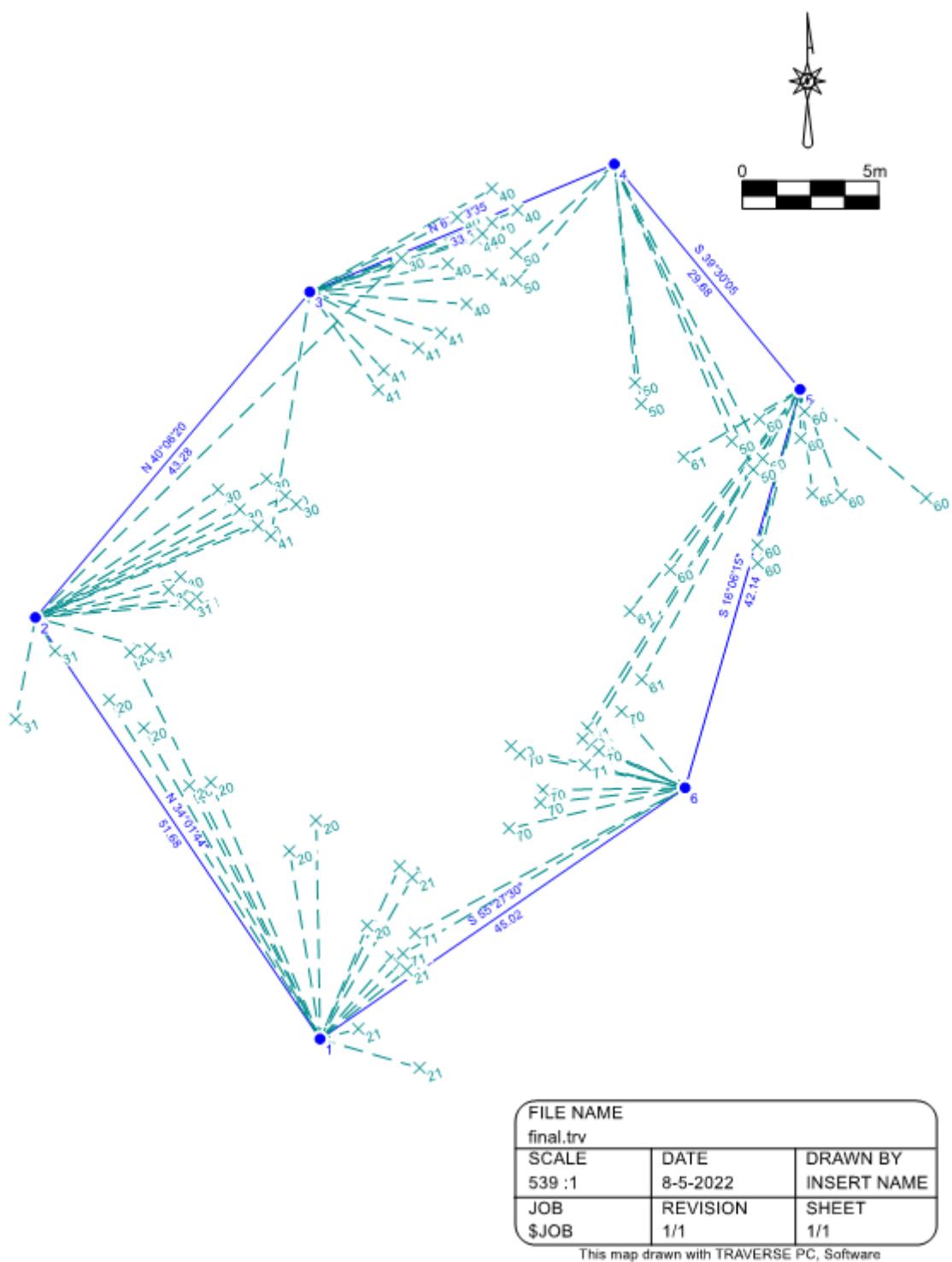


Figure.3

## Closure Error by Traverse PC

[[ Closure View5 ]]

Friday, August 05, 2022 14:48:59

Meters Factor=1.00000000

Grid Dist (grid or local Cartesian coordinates)

Grid Bearing (grid or local Cartesian coordinates)

[ Traverse Summary ]

Closed Loop 7 Points From 1 To 1

Horizontal Distance: 245.3495 Meters Slope Distance: 245.3495 Meters

Area: 4040.1109 SqM 0.4040 Hectares

[ Error Summary ]

Relative: 1:0 (Closed Loop) Linear:0.0000 Meters Direction:N0°00'00"E

Northing:0.0000 Meters Easting:0.0000 Meters Elevation:0.0000 Meters

Angular: None

[ Warnings ]

[ Rectangular Limits (PLSS) ]

Latitude 1:0 Departure 1:0

[ Closing Points ]

	Point	Northing	Easting	Elevation
From	1	-0.0563	-0.1181	0.0000
To	1	-0.0563	-0.1181	0.0000

[ Adjustments ]

Coordinates-Compass

Elevation

[ Adjustment Details ]

Point:1 Desc:

Adjusted : N:-0.0563 E:-0.1181 Z:0.0000

Raw : N:-0.1127 E:-0.2361 Z:0.0000

Difference: N:0.0563 E:0.1181 Z:0.0000

Linear Error: 0.1308 Meters Relative Error: 0

Point:2 Desc:

Adjusted : N:42.7741 E:-29.0390 Z:0.0000

Raw : N:42.7178 E:-29.1570 Z:0.0000

Difference: N:0.0563 E:0.1181 Z:0.0000

Linear Error: 0.1308 Meters Relative Error: 395

Point:3 Desc:

Adjusted : N:75.8749 E:-1.1600 Z:0.0000

Raw : N:75.8186 E:-1.2781 Z:0.0000

Difference: N:0.0563 E:0.1181 Z:0.0000

Linear Error: 0.1308 Meters Relative Error: 726

Point:4 Desc:

Adjusted : N:88.8611 E:29.7726 Z:0.0000

Raw : N:88.8047 E:29.6546 Z:0.0000

Difference: N:0.0563 E:0.1181 Z:0.0000  
 Linear Error: 0.1308 Meters Relative Error: 982

Point:5 Desc:  
 Adjusted : N:65.9566 E:48.6545 Z:0.0000  
 Raw : N:65.9003 E:48.5365 Z:0.0000  
 Difference: N:0.0563 E:0.1181 Z:0.0000  
 Linear Error: 0.1308 Meters Relative Error: 1209

Point:6 Desc:  
 Adjusted : N:25.4702 E:36.9655 Z:0.0000  
 Raw : N:25.4139 E:36.8475 Z:0.0000  
 Difference: N:0.0563 E:0.1181 Z:0.0000  
 Linear Error: 0.1308 Meters Relative Error: 1531

Point:1 Desc:  
 Adjusted : N:-0.0563 E:-0.1181 Z:0.0000  
 Raw : N:-0.1127 E:-0.2361 Z:0.0000  
 Difference: N:0.0563 E:0.1181 Z:0.0000  
 Linear Error: 0.1308 Meters Relative Error: 1875

Traverse View - 1 (Grid Bearing, Grid Dist, Meters)						
Point	Type	Grid Azimuth	Grid Dist	Northing	Easting	Description
1				-0.0563	-0.1181	
2		325°58'16"	51.6805	42.7741	-29.0390	
3		40°06'20"	43.2770	75.8749	-1.1600	
4		67°13'35"	33.5480	88.8611	29.7726	
5		140°29'55"	29.6840	65.9566	48.6545	
6		196°06'15"	42.1400	25.4702	36.9655	
1		235°27'30"	45.0200	-0.0563	-0.1181	
OP=6 FS=1						

Figure.4 Interior angles of a traverse shape

Traverse View - 201 (Grid Bearing, Grid Dist, Meters)

P...	T...	Grid Azi...	Horiz A...	Grid ...	Nort...	East...	Description
1					-0.0563	-0.1181	
2	BS	325°58'16"		51.6805			
201	SS	328°08'36"	2°10'20"	40.5800	42.7741	-29.0390	
202	SS	333°53'06"	7°54'50"	43.7570	34.4112	-21.5360	
203	SS	336°57'06"	10°58'50"	28.3460	39.2336	-19.3787	
204	SS	330°29'26"	4°31'10"	36.3270	26.0270	-11.2157	
205	SS	332°42'36"	6°44'20"	28.9530	31.5581	-18.0115	
206	SS	350°45'26"	24°47'10"	19.3370	25.6741	-13.3928	
207	SS	358°56'16"	32°58'00"	22.1990	19.0296	-3.2239	
208	SS	22°37'06"	56°38'50"	12.4710	22.1388	-0.5296	
209	SS	40°58'26"	75°00'10"	11.0360	11.4555	4.6782	
210	SS	46°43'26"	80°45'10"	11.1130	8.2759	7.1184	
211	SS	51°33'56"	85°35'40"	11.2500	7.5618	7.9729	
212	SS	75°05'06"	109°06'50"	4.0240	6.9369	8.6943	
213	SS	106°11'26"	140°13'10"	10.5380	0.9794	3.7704	
214	SS	29°42'56"	63°44'40"	18.8890	-2.9947	10.0020	
215	SS	24°44'36"	58°46'20"	19.3300	16.3487	9.2451	
					17.4990	7.9726	
FS=1							

Figure.5

Traverse View - 301 (Grid Bearing, Grid Dist, Meters)

P...	T...	Grid Azi...	Horiz A...	Grid ...	Nort...	East...	Description
2		40°06'20"		43.2770	42.7741	-29.0390	
3	BS	45°30'50"	5°24'30"	52.1270	75.8749	-1.1600	
301	SS	64°02'30"	23°56'10"	28.2530	79.3014	8.1495	
302	SS	66°32'50"	26°26'30"	28.8890	55.1410	-3.6363	
303	SS	67°37'20"	27°31'00"	24.4570	54.2718	-2.5365	
304	SS	59°00'50"	18°54'30"	27.4090	52.0852	-6.4237	
305	SS	62°06'30"	22°00'10"	23.5000	56.8851	-5.5415	
306	SS	74°20'10"	34°13'50"	15.3060	53.7675	-8.2689	
307	SS	78°18'20"	38°12'00"	13.8440	46.9067	-14.3014	
308	SS	54°58'40"	14°52'20"	22.6470	45.5802	-15.4823	
309	SS	82°52'50"	42°46'30"	16.5390	55.7711	-10.4927	
310	SS	84°58'40"	44°52'20"	15.7390	44.8240	-12.6275	
311	SS	105°17'00"	65°10'40"	12.1000	44.1520	-13.3604	
312	SS	149°23'20"	109°17'00"	3.9500	39.5847	-17.3669	
313	SS	190°56'00"	150°49'40"	10.5410	39.3746	-27.0276	
314	SS				32.4245	-31.0383	
FS=2							

Figure. 6

Traverse View - 401 (Grid Bearing, Grid Dist, Meters)

P...	T...	Grid Azi...	Horiz A...	Grid ...	Nort...	Eas...	Description
3		67°13'35"		33.5480	75.8749	-1.1600	
4	BS	60°24'25"	353°10'50"	21.2800	88.8611	29.7726	
401	SS	63°11'25"	355°57'50"	16.8030	86.3838	17.3441	
402	SS	68°29'45"	1°16'10"	22.6730	83.4536	13.8368	
403	SS	72°20'05"	5°06'30"	17.7310	84.1862	19.9347	
404	SS	69°13'35"	2°00'00"	19.7930	81.2555	15.7349	
405	SS	71°23'45"	4°10'10"	18.5110	82.8951	17.3462	
406	SS	78°30'45"	11°17'10"	14.3040	81.7805	16.3837	
407	SS	84°27'15"	17°13'40"	18.5870	78.7237	12.8574	
408	SS	94°22'25"	27°08'50"	15.9750	77.6712	17.3400	
409	SS	107°25'25"	40°11'50"	13.9980	74.6567	14.7685	
410	SS	117°25'35"	50°12'00"	12.4180	71.6835	12.1957	
411	SS	145°01'55"	77°48'20"	12.1510	70.1551	9.8622	
412	SS	136°38'05"	69°24'30"	10.9440	65.9175	5.8039	
413	SS	189°04'15"	121°50'40"	25.1360	67.9188	6.3546	
414	SS				51.0533	-5.1229	
FS=3							

Figure. 7

Traverse View - 501 (Grid Bearing, Grid Dist, Meters)

P...	T...	Grid Azi...	Horiz A...	Grid ...	Nort...	Eas...	Description
4					88.8611	29.7726	
5	BS	140°29'55"		29.6840	65.9566	48.6545	
501	SS	153°15'35"	12°45'40"	33.5400	58.9080	44.8638	
502	SS	155°32'15"	15°02'20"	34.1080	57.8149	43.8967	
503	SS	157°02'25"	16°32'30"	30.5870	60.6972	41.7041	
504	SS	227°43'15"	87°13'20"	13.4410	79.8187	19.8280	
505	SS	220°00'25"	79°30'30"	15.4410	77.0338	19.8459	
506	SS	173°36'55"	33°07'00"	24.5312	64.4820	32.5006	
507	SS	174°32'45"	34°02'50"	22.3370	66.6252	31.8957	

FS=4

Figure. 8

Traverse View - 601 (Grid Bearing, Grid Dist, Meters)

Figure 9 displays a Traverse View window with the following data:

P...	T...	Grid Azi...	Horiz A...	Grid ...	Nort...	Eas...	Description
5					65.9566	48.6545	
6	BS	196°06'15"		42.1400			
601	SS	234°02'45"	37°56'30"	5.1020	25.4702	36.9655	
602	SS	179°24'45"	343°18'30"	4.9630	62.9611	44.5245	
603	SS	168°25'45"	332°19'30"	2.2880	60.9939	48.7054	
604	SS	173°20'05"	337°13'50"	10.6410	63.7151	49.1134	
605	SS	158°41'25"	322°35'10"	11.4950	55.3876	49.8896	
606	SS	130°46'35"	294°40'20"	16.9040	55.2475	52.8319	
607	SS	195°19'25"	359°13'10"	16.3950	54.9165	61.4553	
608	SS	193°40'25"	357°34'10"	18.1940	50.1445	44.3218	
609	SS	215°46'25"	19°40'10"	22.5710	48.2783	44.3536	
610	SS	217°28'35"	21°22'20"	28.4050	47.6440	35.4599	
611	SS	239°55'55"	43°49'40"	13.6820	43.4143	31.3719	
612	SS	208°36'25"	12°30'10"	33.6090	59.1016	36.8137	
613	SS	211°21'05"	15°14'50"	40.9110	36.4505	32.5626	
614	SS	212°10'45"	16°04'30"	40.6190	31.0189	27.3691	
					31.5772	27.0221	

FS=5

Figure. 9

Traverse View - 701 (Grid Bearing, Grid Dist, Meters)

P...	T...	Grid Azi...	Horiz A...	Grid ...	Nort...	Eas...	Description
6		235°27'30"		45.0200	25.4702	36.9655	
1	BS	294°45'50"	59°18'20"	10.4460	-0.0563	-0.1181	
701	SS	269°10'20"	33°42'50"	14.4520	29.8459	27.4801	
702	SS	264°02'20"	28°34'50"	14.7890	25.2615	22.5150	
703	SS	257°00'50"	21°33'20"	18.3580	23.9344	22.2565	
704	SS	281°33'30"	46°06'00"	17.1140	21.3449	19.0771	
705	SS	283°27'30"	48°00'00"	18.1830	28.8993	20.1986	
706	SS	320°12'30"	84°45'00"	10.0890	29.7021	19.2819	
707	SS	295°39'20"	60°11'50"	11.5510	33.2224	30.5086	
708	SS	293°12'40"	57°45'10"	9.5150	29.2203	28.2207	
709	SS	282°42'00"	47°14'30"	10.4130	27.7595	26.8073	
710	SS	239°32'10"	4°04'40"	33.2310	8.6223	8.3221	
711	SS	241°41'31"	6°14'01"	31.1370	10.7047	9.5522	
712	SS						

FS=6

Figure. 10

## AUTOCAD Result

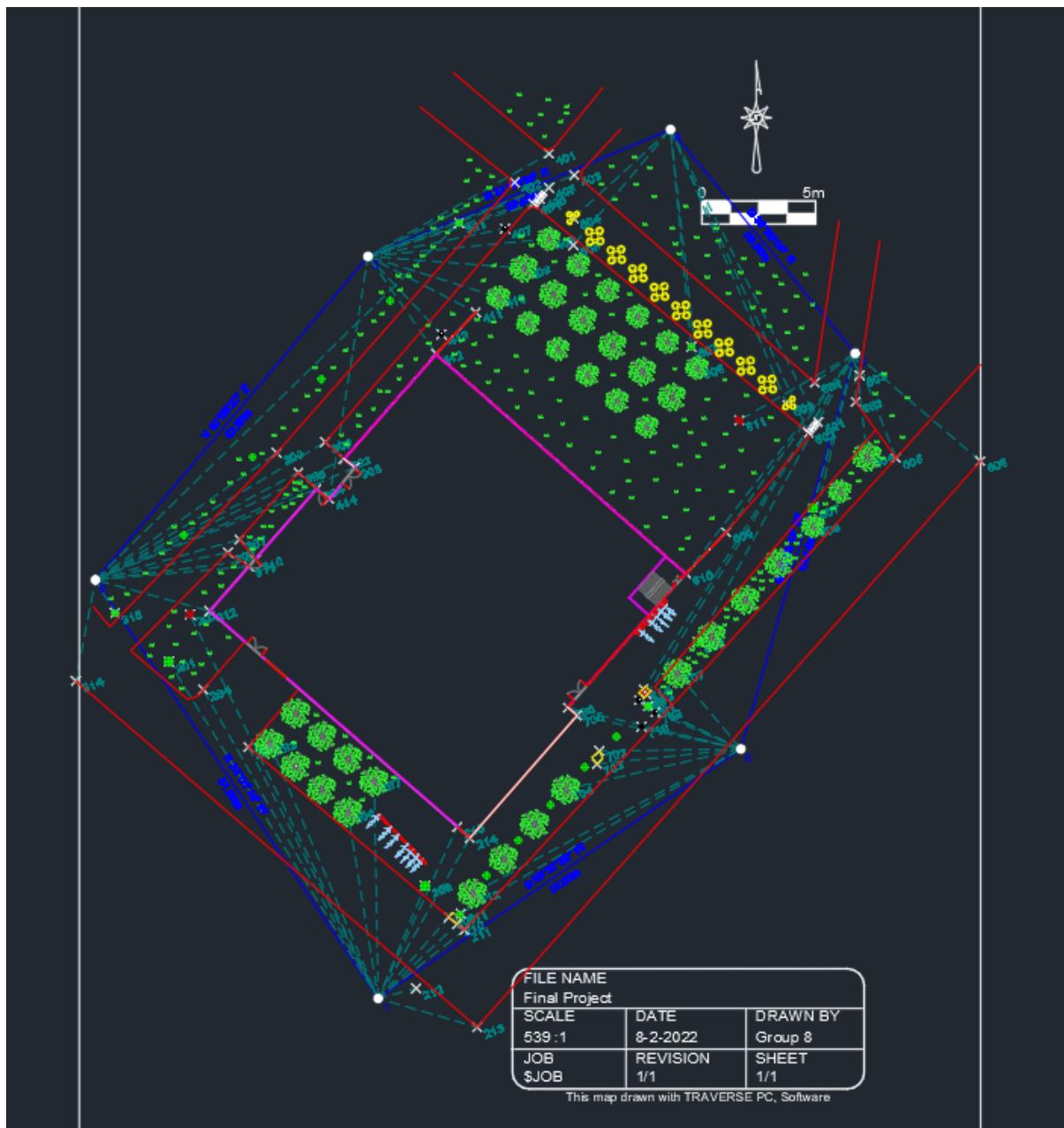


Figure. 11

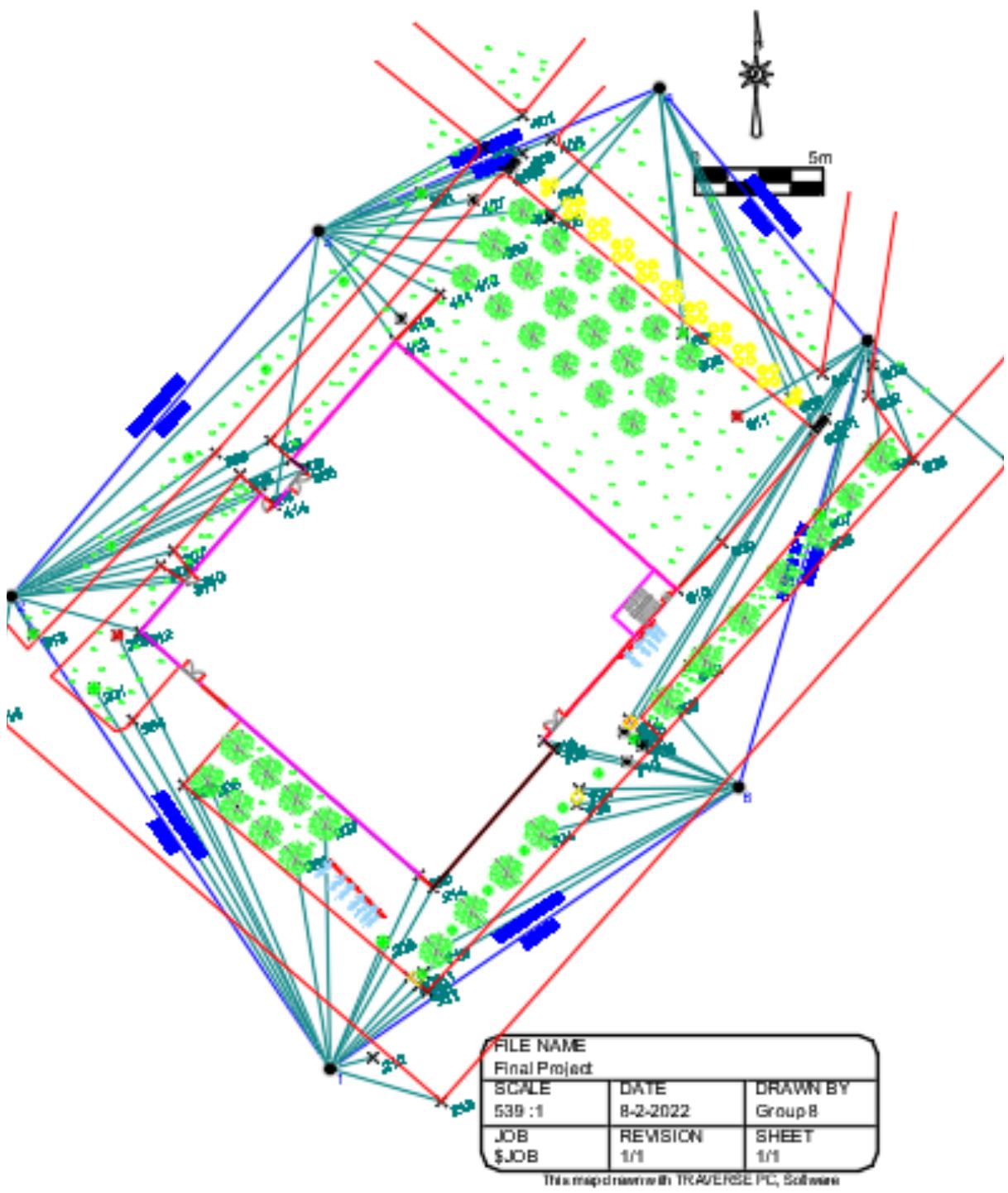


Figure. 12

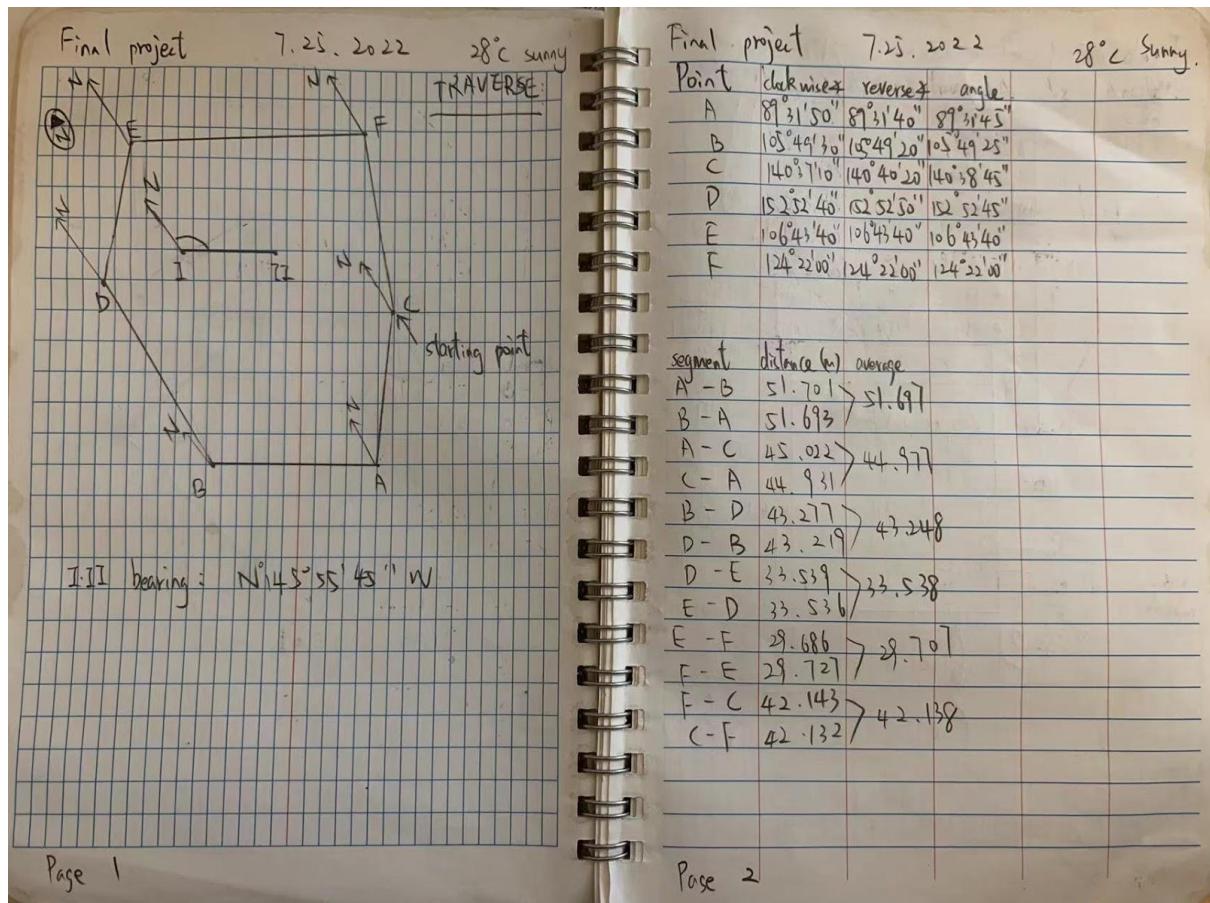
# **Analysis**

According to the data, there is some error between the measured data and the data input to the traverse PC after automatic calibration. The calculated azimuth in point 2 is  $325^{\circ}49'40''$ , but the corrected azimuth in point 2 is  $325^{\circ}58'16''$ . The measured distance between point 2 and 3 is 51.70m, while the corrected distance by traverse PC is 51.6805. These errors mean that the measurement is not accurate and there are some mistakes in the measurement which lead to these errors. When measured the distance, the alignment points may have different horizontal heights resulting in inaccurate measurement. Moreover, the turning point may be moved during the measurement process. In addition, there are some points which show the incorrect position on the figure drawn by the traverse PC. Therefore, in order to ensure the accuracy, the tape was used to measure again. The drawing finally made in autoCAD is not the same as the points shown in traverse.

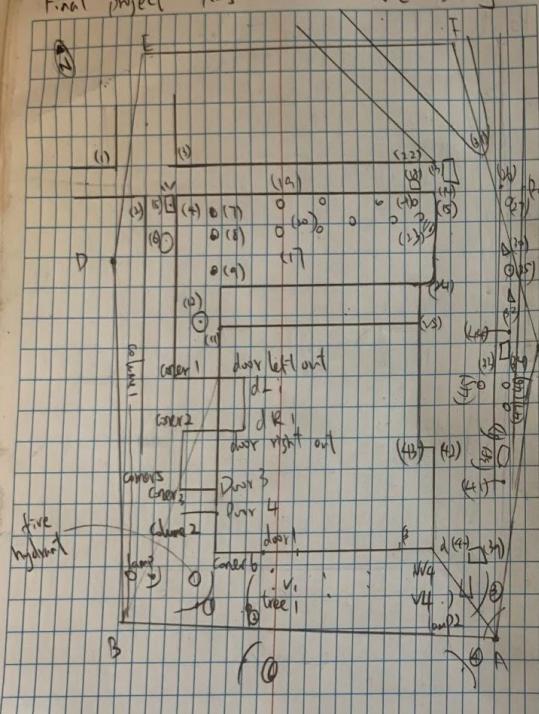
# **Conclusion**

In summary, the data of layout of the HU building was determined through the total station and measuring tape and then the figures were drawn by the AutoCAD software and Traverse software. During the measuring process, everything around the HU building is measured as a point, the position of these points was recorded. After measurement, these points would be drawn by the Traverse software and then the full view of the HU building and surrounding objects according to the marked positions by AutoCAD software. When measuring the points, the turning points might be moved, which would cause inaccurate results. Therefore, in the process of measurement one needs to pay attention to each step and each measurement, so that the final result of the graph becomes more accurate.

# Field Book Work



Final project 7.28.2022 28°C sunny



Page 3

Station	point	7.28.2022	28°C	sunny
		4	distance	
B	D	zero	43.277	
A		105°49'30"	51.693	
D		105°49'20"	43.277	
Column 1		5°24'30"	52.127	
DL 0		25°56'10"	28.253	
DL 1		25°26'30"	28.589	
DR 0		27°31'00"	24.457	
Corner 1		18°34'30"	27.409	
Corner 2		22°00'10"	23.500	
Corner 3		24°13'50"	15.306	
Corner 4		38°12'00"	13.844	
Corner 5		14°52'20"	22.647	
Door 3		42°46'30"	16.539	
Door 4		44°52'30"	15.739	
Corner 6		65°10'40"	12.1	
Column 2		109°17'00"	3.950	
(6)		150°49'40"	10.541	

Page 5.

Station	point	4	distance	
A	B	zero	51.701	
	C	89°31'50"	45.022	
	B	89°31'40"	45.017	
	Lamp	2°10'20"	40.580	
	fire hydrant	7°54'50"	43.757	
	1 tree	10°58'50"	28.346	
	(1)	4°31'10"	56.329	
	(2)	6°44'20"	28.953	
	4 tree	24°47'10"	22.779	
	VV 4	32°58'00"	79.331	
	Lamp 2	56°38'50"	12.471	
	D2 left	75°00'10"	11.036	
	D2 right	80°45'10"	11.113	
	(3)	85°35'40"	11.280	
	(4)	109°6'50"	4.024	
	(5)	140°13'10"	10.538	
	building d	69°44'40"	18.889	
	(2)	58°46'20"	19.330	

Page 4.

Station	point	4	distance	
D	E	zero	33.539	
B		152°52'40"	43.219	
E		152°52'50"	33.557	
(1)		353°10'50"	21.28	
(2)		355°37'50"	16.803	
(3)		1°16'10"	22.673	
(4)		5°06'30"	17.731	
(5) (15) / (16)		20°54'10" / 19°19'7.793 / 18.511		
(6)		11°17'10"	14.304	
(7)		17°13'40"	18.587	
(8)		27°08'50"	15.975	
(9)		40°11'50"	13.998	
(10)		50°12'00"	12.418	
(11)		77°48'20"	12.151	
(12)		69°24'30"	10.944	
DR;		121°50'40"	25.136	

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Final project		7.25.2022	28°C	sunny
Station	Point	4	distance	
E	F	zero	29.686	
D		10° 6' 43" 40"	33.536	
F		10° 6' 49" 40"	29.682	
(13)		12° 45" 40"	33.540	
(14)		15° 2' 20"	34.108	
(18)		16° 32' 30"	30.587	
(19)		87° 13' 20"	13.441	
(20)		79° 30' 30"	15.441	
(16)		33° 7' 0"	24.531	
(21)		34° 2' 50"	22.337	

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Final Station	project	7.25.2022	28°C	sunny
	point	#	distance	
F	C	zero	42.143	
E		124° 22' 0"	29.727	
C		124° 22' 0"	42.136	
(24)		37° 51' 30"	5.102	
(31)		343° 18' 30"	4.963	
(26)		332° 9' 30"	2.288	
(27)		337° 13' 50"	10.141	
(28)		322° 35' 10"	11.493	
(29)		294° 40' 20"	16.904	
(36)		359° 13' 10"	16.395	
(35)		157° 34' 10"	18.194	
(24)		19° 41' 10"	22.571	
(25)		21° 22' 20"	28.405	
(23)		43° 49' 40"	13.682	
(42)		12° 30' 10"	33.609	
(34)		15° 14' 50"	40.911	
(33)		16.7° 30"	40.619	

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Station	point	7.25.2022	28°	sunny
C	A	4	44.931	
F		140°37'10"	42.132	
A		140°40'20"	44.933	
(36)		59°18'20"	10.446	
(37)		35°42'50"	14.412	
(38)		28°34'50"	14.789	
(41)		21°33'20"	18.358	
(42)		46°5'0"	17.114	
(43)		48°0'0"	18.183	
(44)		84°45'0"	10.039	
(45)		60°11'30"	11.551	
(46)		57°45'10"	9.515	
(47)		47°14'30"	10.413	
(39)		4°4'40"	33.231	
(40)		6°14'1"	31.137	

↓

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## Appendix

Name	Jiabao Jiang	Tongtong Gao	Xinyu Tian	Sicheng Xiong	Paerhati Mierzhati
Abbreviation	JJ (10/10)	TG (10/10)	XT (10/10)	SX (10/10)	PM (10/10)

### 1. Account of members responsibilities

*Final Project:*

Final Project: full participation

Final Project (clockwise): Total station: XT & PM

Recording: TG & SX

Measurement check: JJ

Final Project (counterclockwise): Total station: TG & JJ

Recording: PM & SX

Measurement check: XT

