Hearing on special exception for 1018 Constitution Ave

May 20, 2003

Empirical data on impact of addition on the light and air of 204th 11 Street

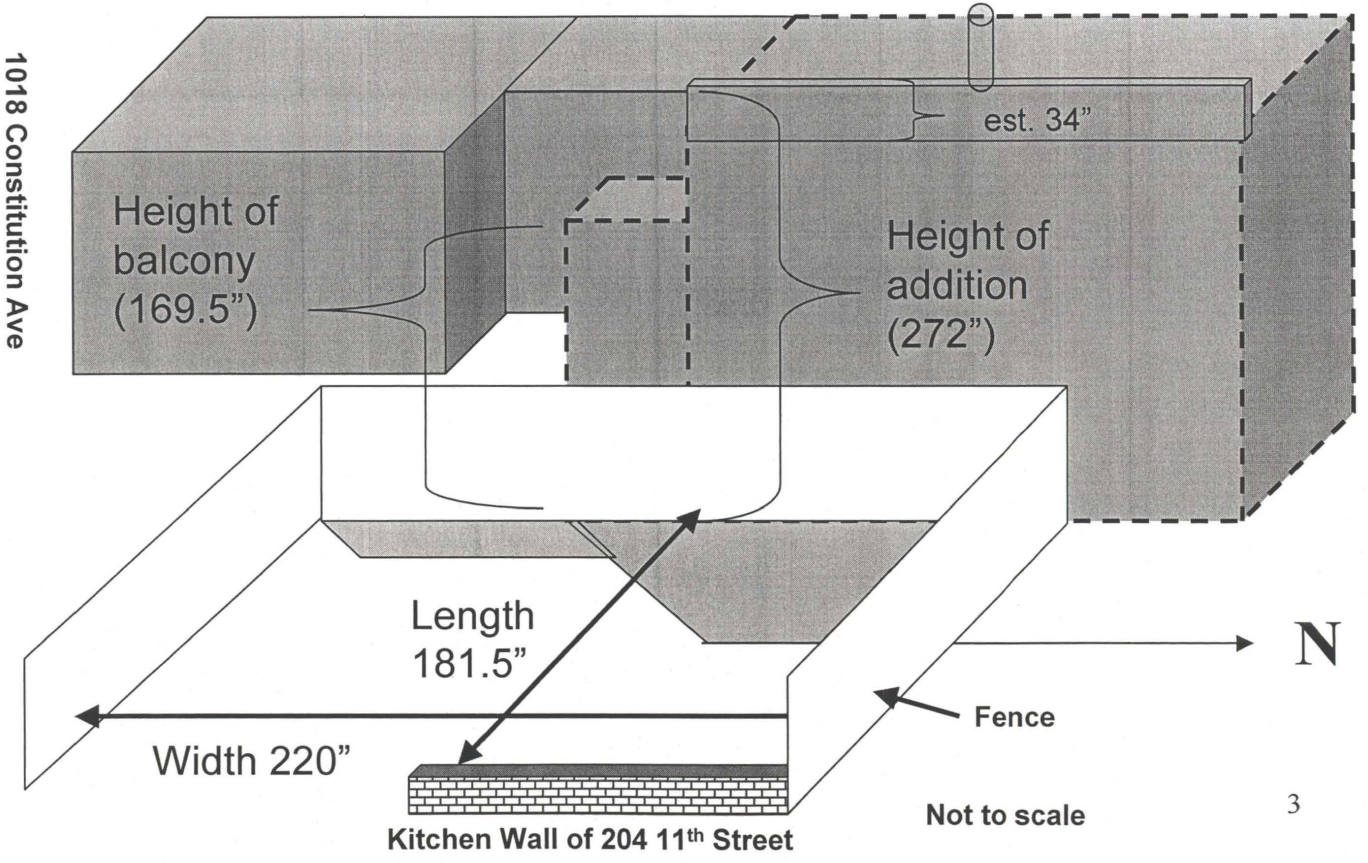
BZA
Case No. 17007
Exhibit No. 37

Topics

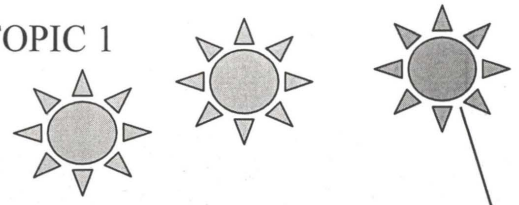
1) Measuring the amount of time the addition impacts the light and air of 204 11th Street rear yard
2) Measuring extent of impact the addition makes on light and air of 204 11th Street rear yard

TOPIC 1

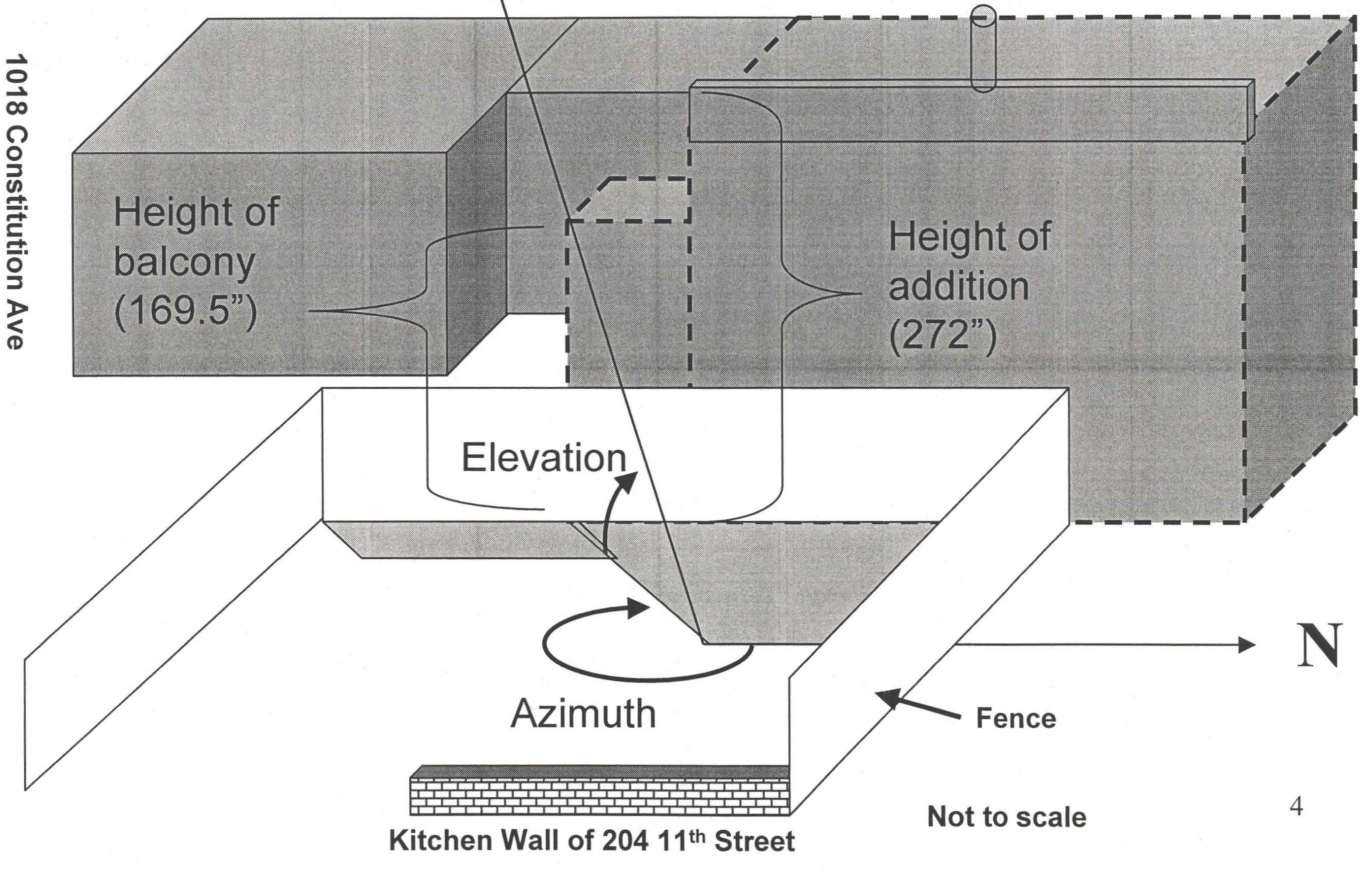
Model of 204 11th Street Rear Yard: the sun tracks east to west, depending on time and season



TOPIC 1



The shadow created by the addition depends on on the sun's azimuth and elevation



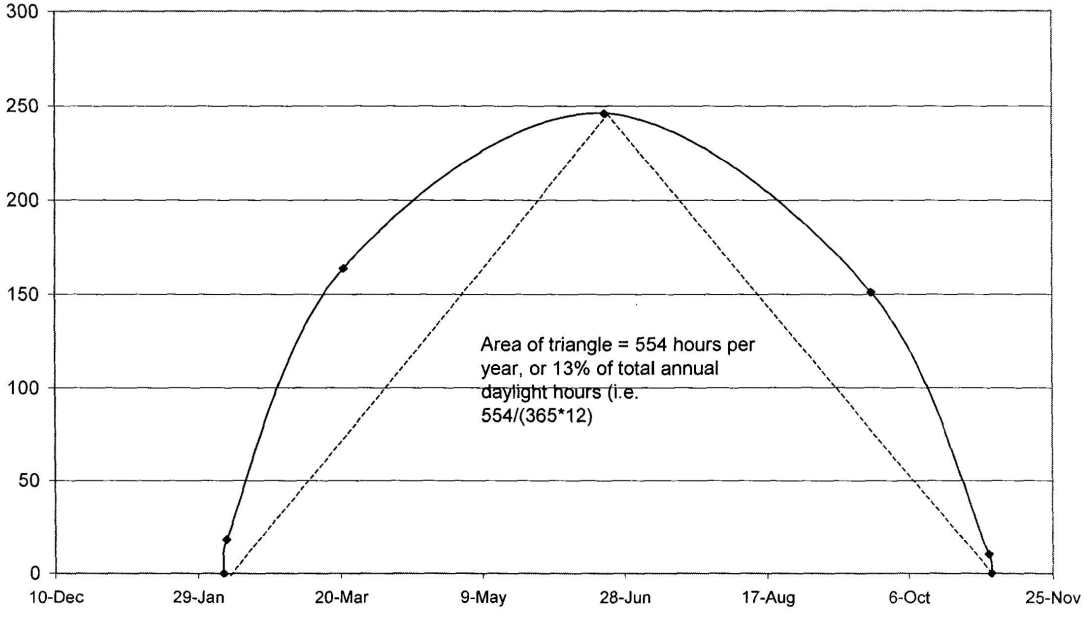
TOPIC 1

- When azimuth < 180 degrees, the sun shines onto the addition, when azimuth > 180, addition creates a shadow in 204 rear yard
- When sun elevation < 36 degrees, the sun is (generally) below the pre-addition 1018 Constitution Ave
- US National Oceanic and Atmospheric Administration solar position calculator (http://www.srrb.noaa.gov/highlights/sunrise/azel.html) was used to calculate the times when the azimuth is greater than 180 degrees, and sun elevation is greater than 36 degrees for 7 days of year

Date	Minutes	Begin time	End time	days
7-Feb	0			
8-Feb	18	12.23pm	12.41pm	1
21-Mar	164	13.16pm	15.00pm	41
21-Jun	246	13.10pm	17.16pm	92
23-Sep	151	13.01pm	15.32pm	94
3-Nov	10	11.52pm	12.02 pm	41
4-Nov	0			1

TOPIC 1

- The results can be shown graphically
- The area beneath the curve equals the number of minutes annually that the addition creates a shadow—more than 33,000 minutes per year, or 554 hours
- This equals 13% of total annual daylight hours



TOPIC 2

The extent of the shadow created by the addition varies by time of day and season—impact is least when sun is very high

Using a trigonometry model, we estimated:

1) The addition's shadow impact for 2 times:

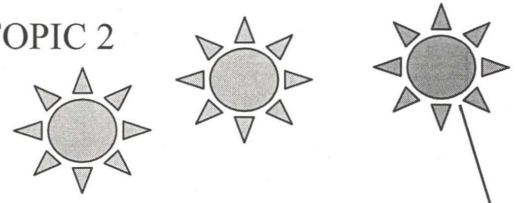
- June 21--summer solstice—at 2pm
- September 23--Autumn equinox—at 2pm.
- The impact on March 21 (Spring equinox) is similar to impact on Autumn equinox

The model was repeated for two other scenarios:

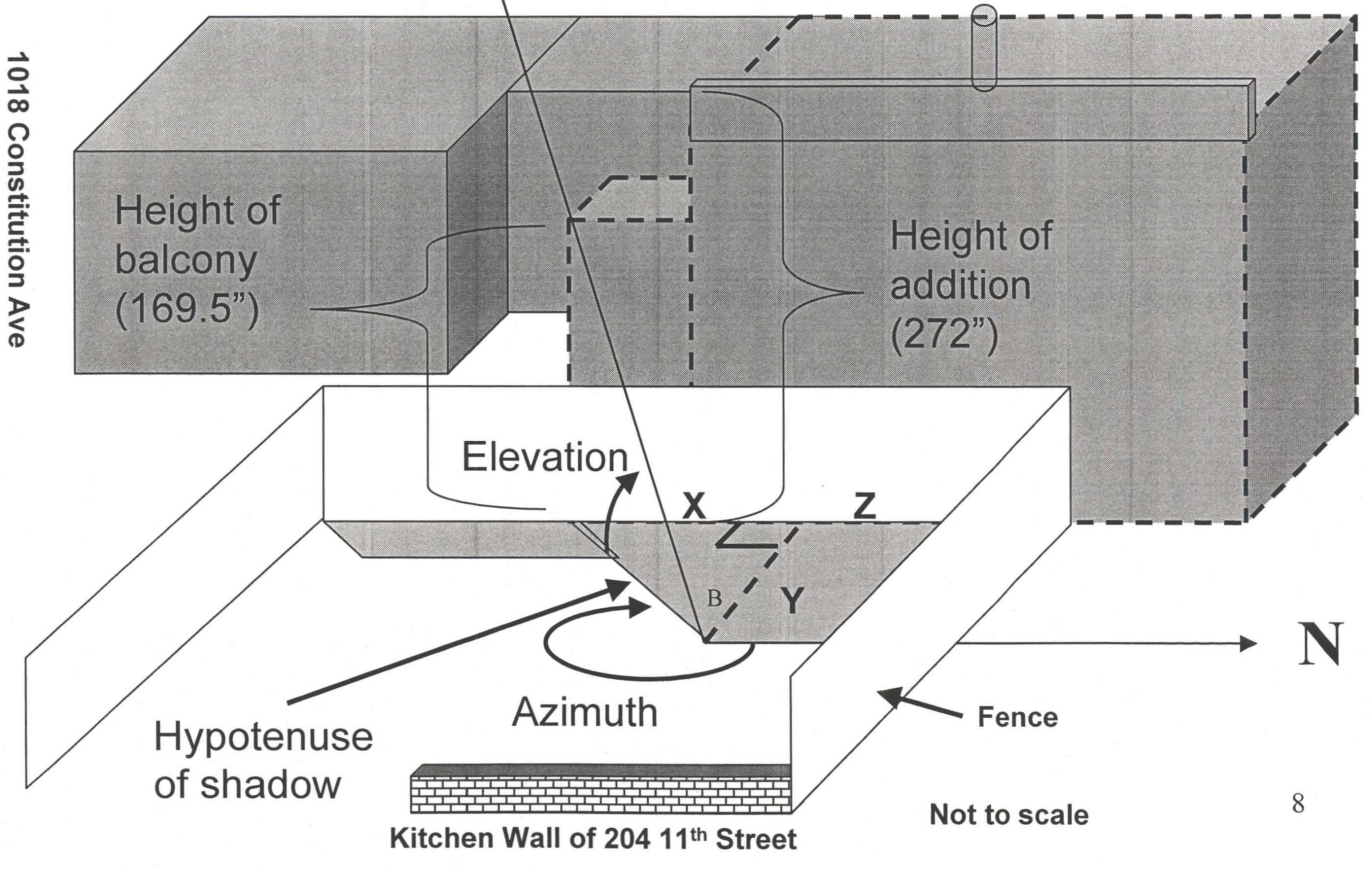
- Prior to the addition being built
- When the addition is setback 8-ft from 204 11th Street property line

2) The impact of the addition on the amount of sun in our kitchen window compared to the impact if the addition were set back 8 feet

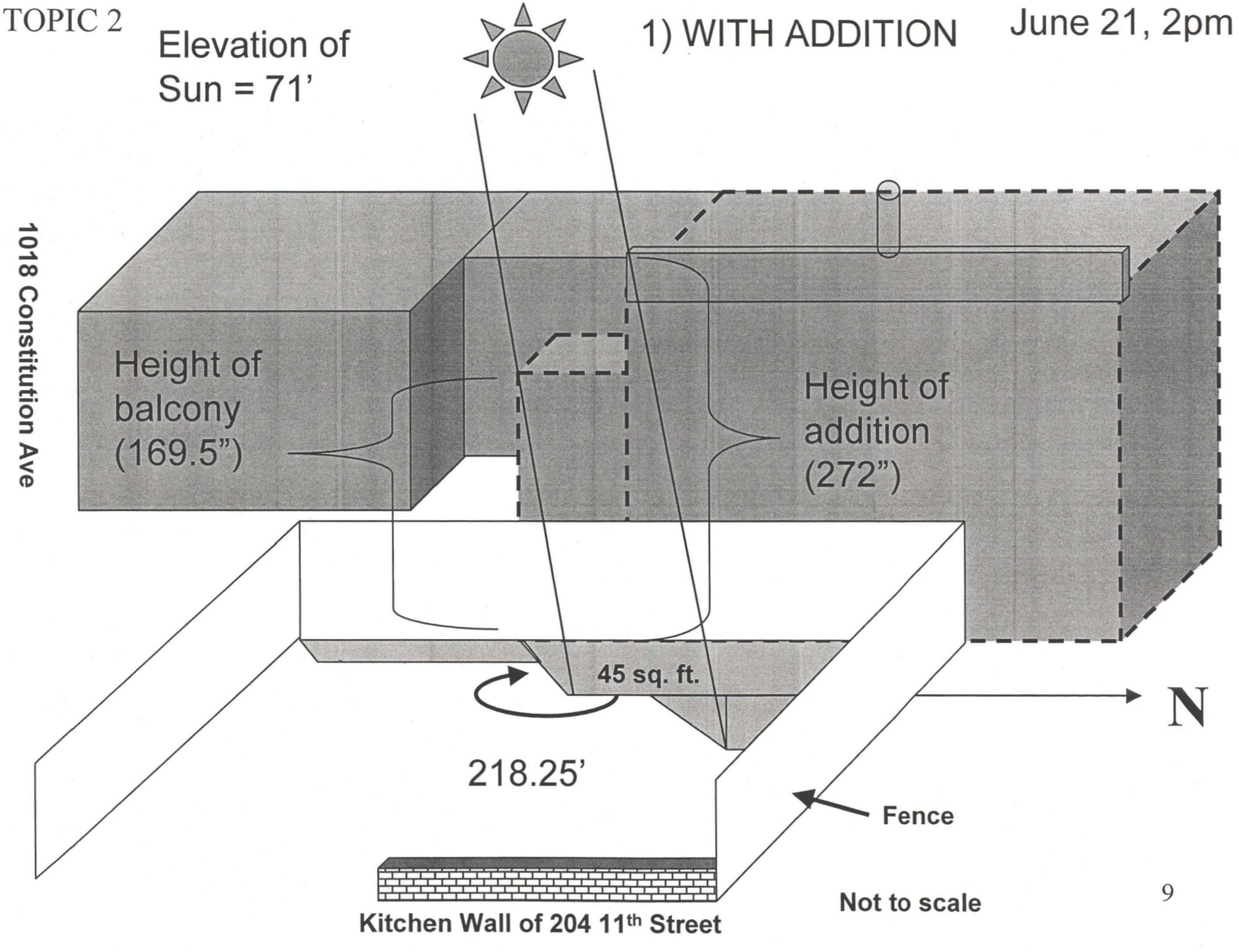
TOPIC 2



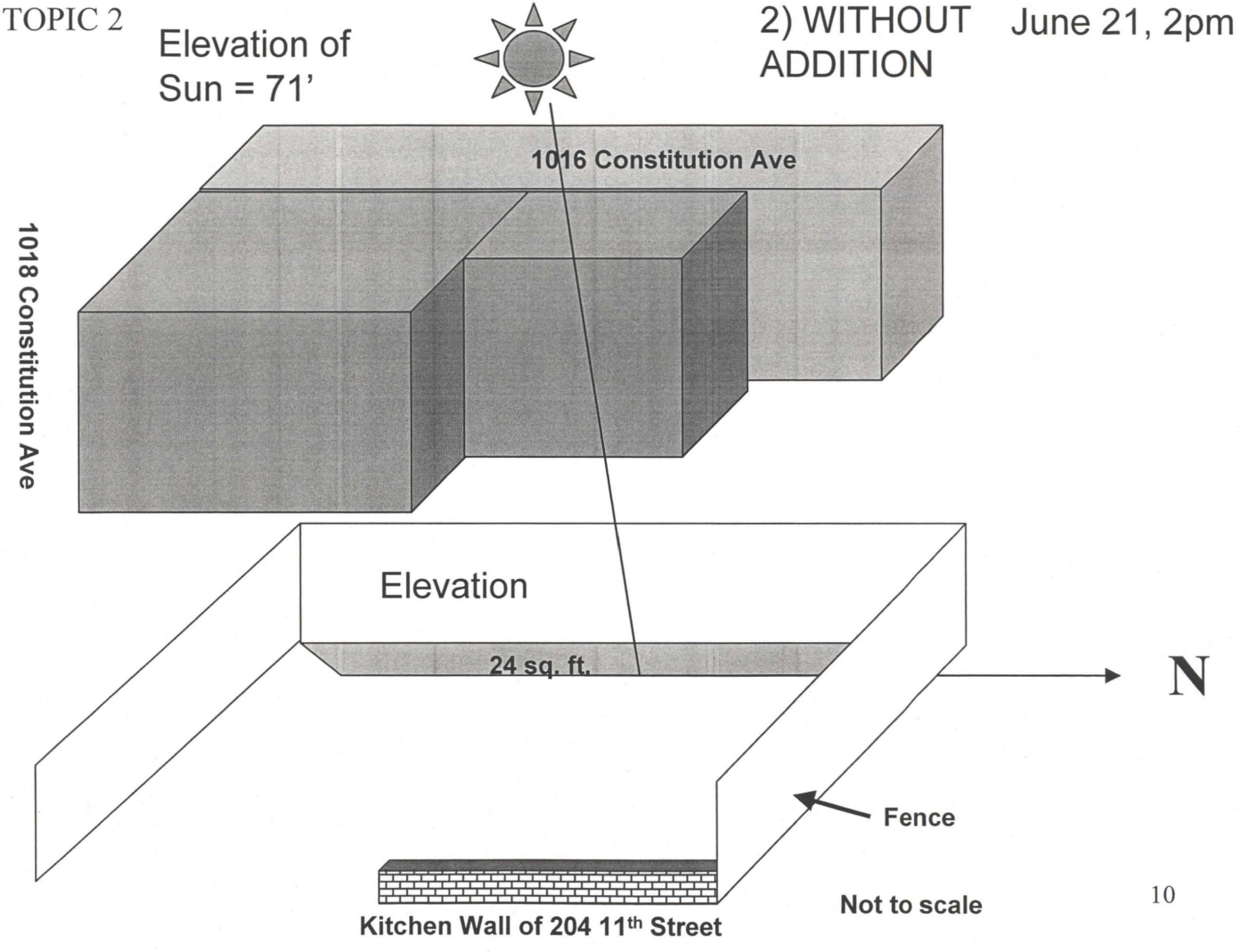
The shadow created by the addition can be estimated using the sun's azimuth and elevation and trigonometry



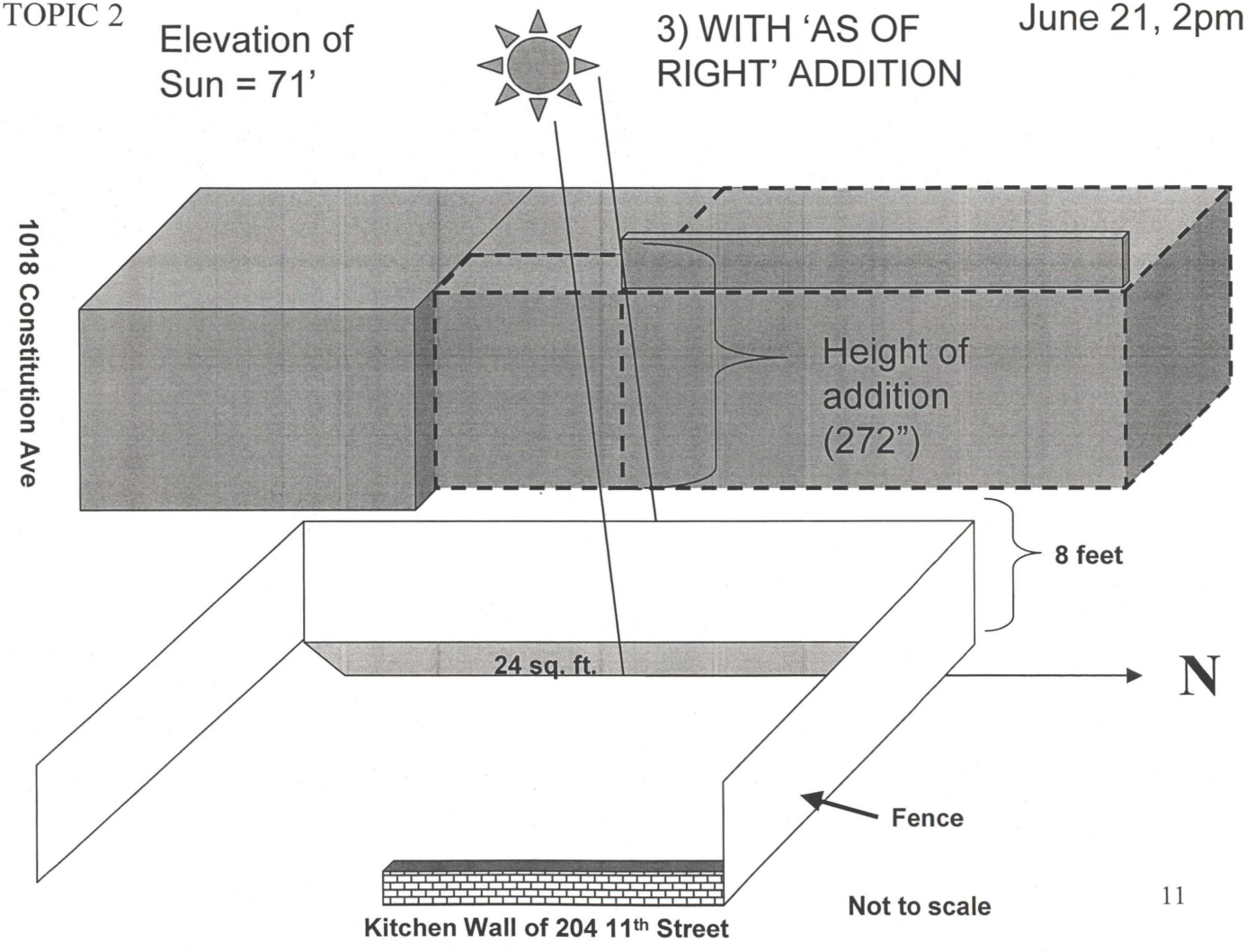
TOPIC 2


Elevation of Sun = 71'
1) WITH ADDITION
June 21, 2pm
1018 Constitution Ave
Height of balcony (169.5")
Height of addition (272")
45 sq. ft.
N
218.25'
Fence
Not to scale
Kitchen Wall of 204 11th Street

TOPIC 2


Elevation of Sun = 71'
2) WITHOUT ADDITION
June 21, 2pm
1016 Constitution Ave
1018 Constitution Ave
Elevation
24 sq. ft.
N
Fence
Not to scale
Kitchen Wall of 204 11th Street

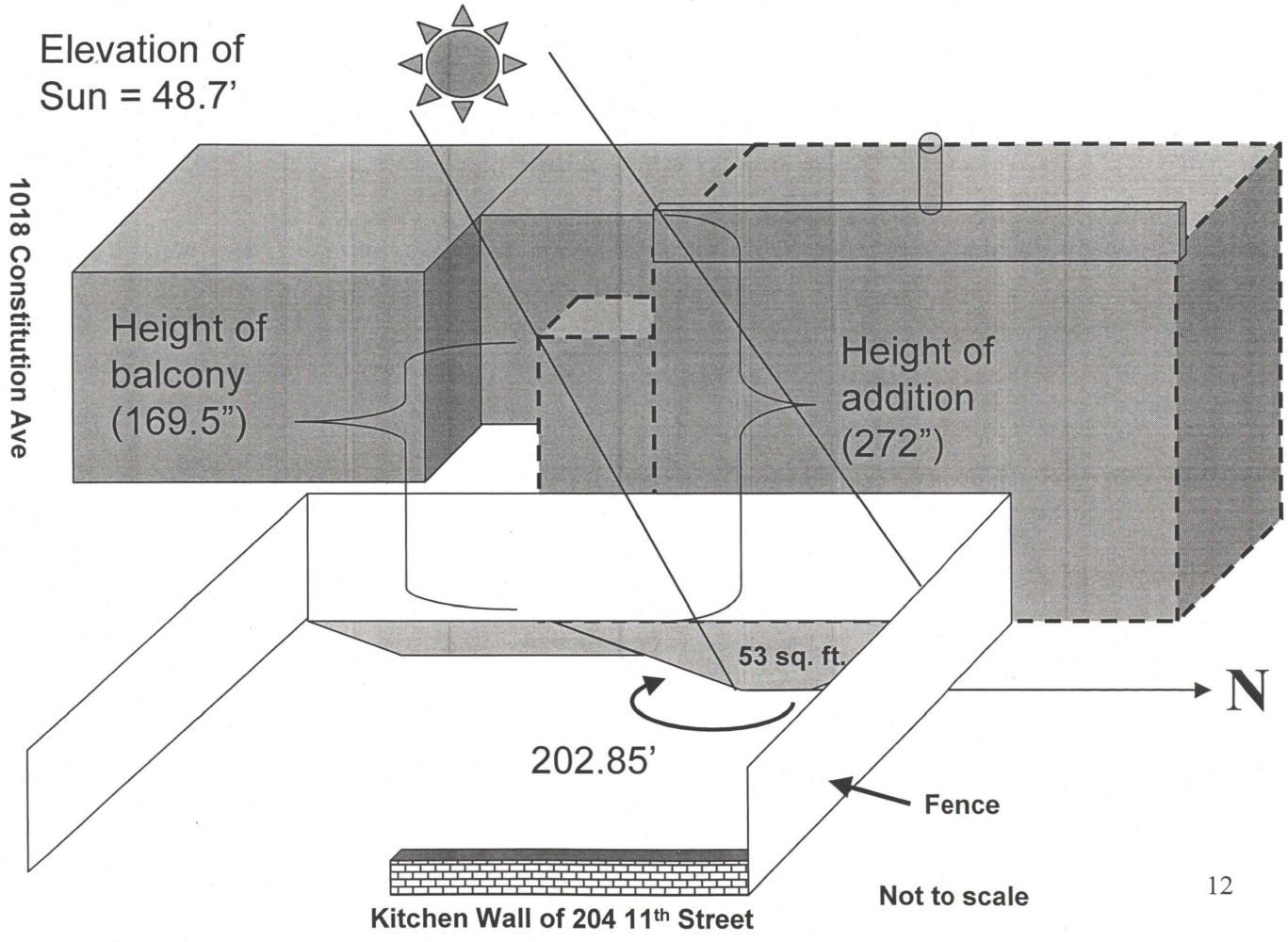
TOPIC 2


Elevation of Sun = 71'
3) WITH 'AS OF RIGHT' ADDITION
June 21, 2pm
1018 Constitution Ave
Height of addition (272")
8 feet
24 sq. ft.
N
Fence
Not to scale
Kitchen Wall of 204 11th Street

TOPIC 2

1) WITH ADDITION

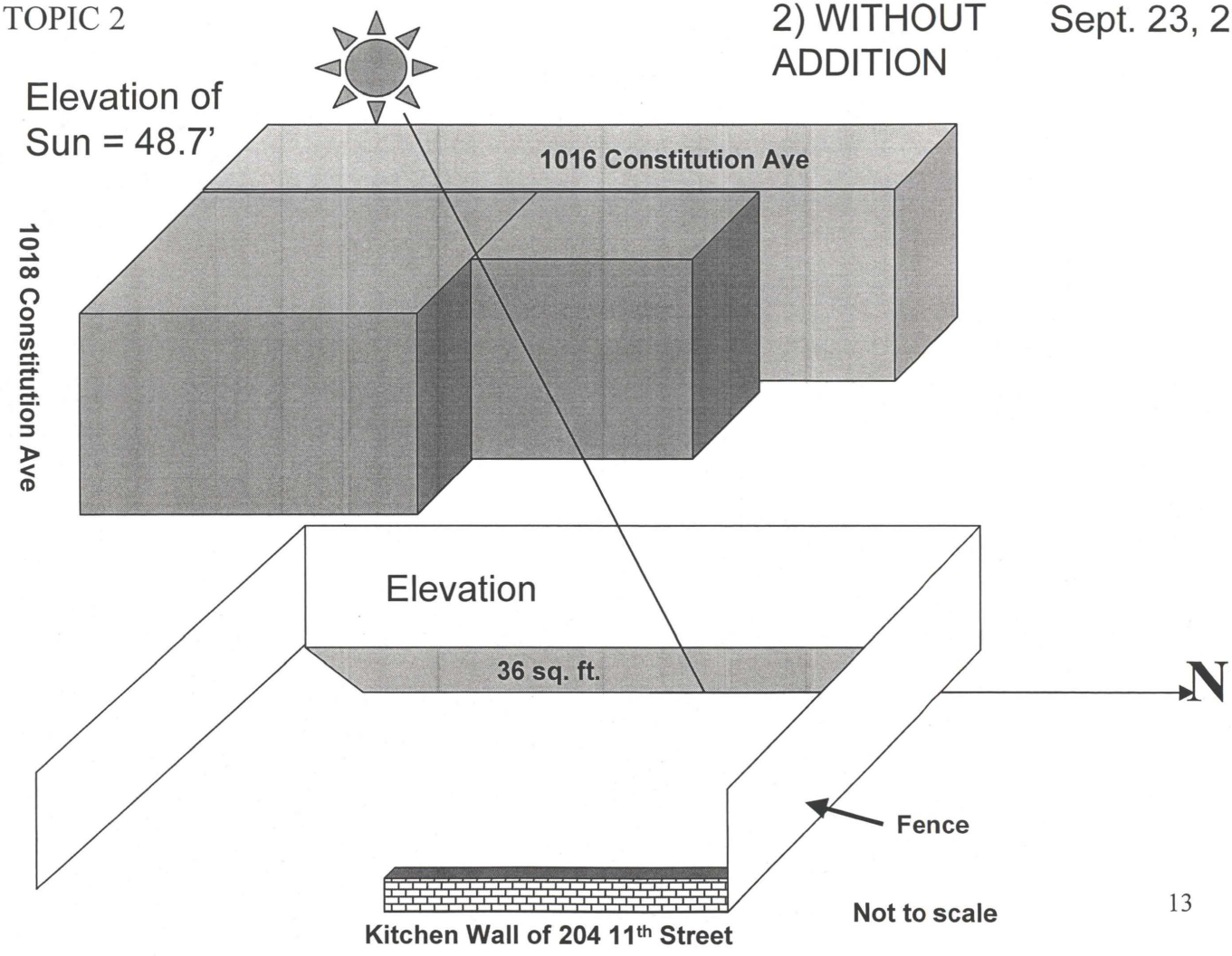
Sept. 23, 2pm



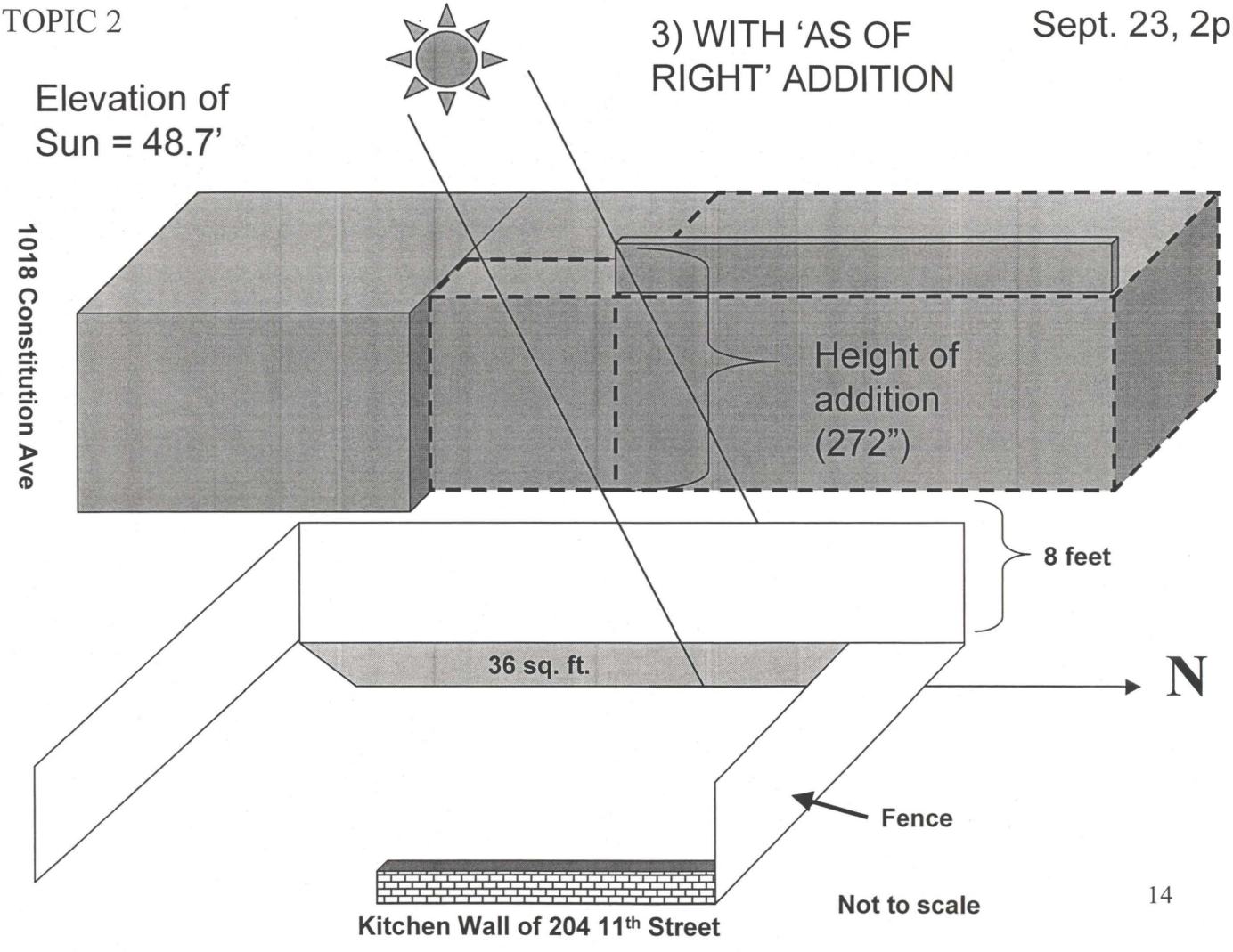
TOPIC 2

2) WITHOUT ADDITION

Sept. 23, 2pm



TOPIC 2


3) WITH 'AS OF RIGHT' ADDITION
Sept. 23, 2pm
Elevation of Sun = 48.7'
1018 Constitution Ave
Height of addition (272")
8 feet
36 sq. ft.
N
Fence
Not to scale
Kitchen Wall of 204 11th Street

TOPIC 2

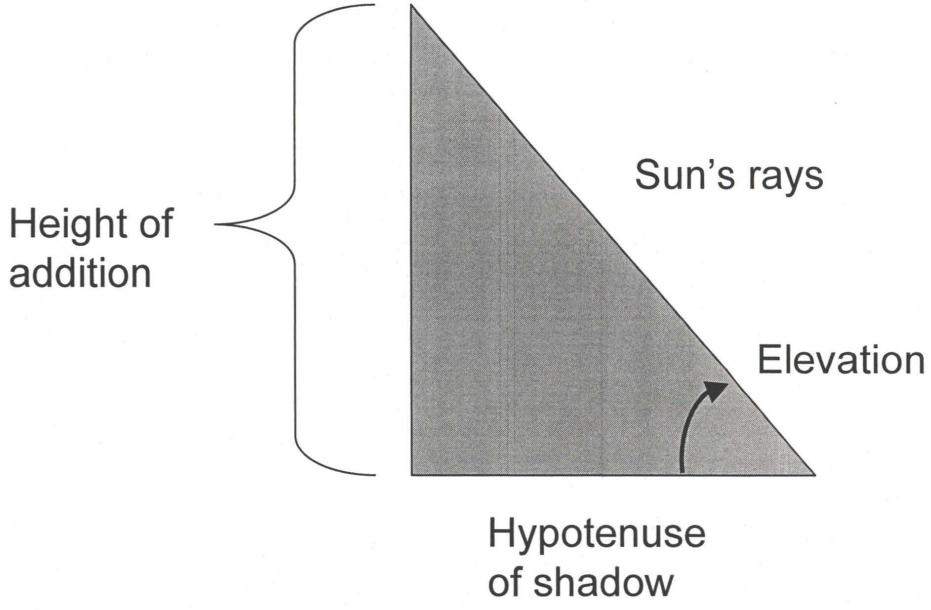
If the addition were set back 8 feet, on June 21 the kitchen would receive 1 hour more of sunlight than it receives with current addition.

June 21 was picked because at sunset, the sun is close to perpendicular to our rear yard and the calculations are straightforward

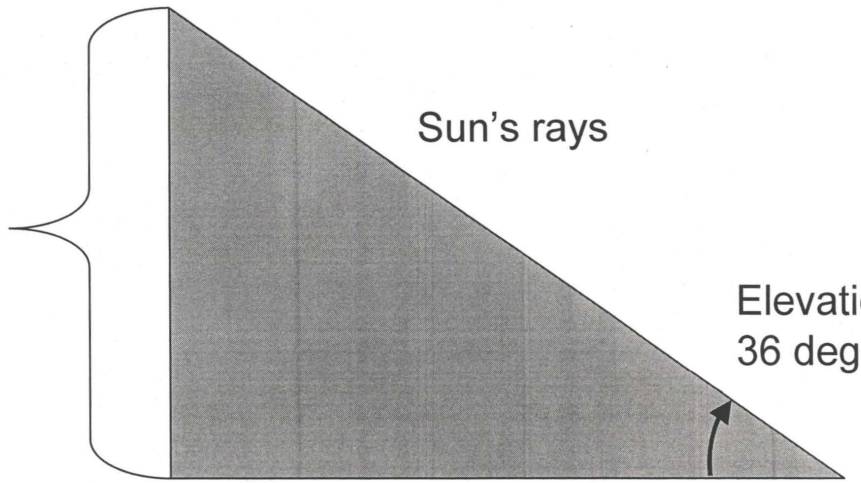
Times at which kitchen window is covered by shade:

	Date	Time	Azimuth	Elevation
At present:	21-Jun	4.57pm	269.55	39.88
If addition were set back 8 feet	21-Jun	5.57pm	278.45	28.26

Background Material



Hypotenuse of shadow = Height of addition / tangent (Elevation)



Tangent (Elevation) = Height of addition / Hypotenuse of shadow

Tangent (36) = 238/329.5

The model results were compared with actual measurements of shadows, taken at various points on the afternoon of Wednesday, May 14th

Date	Time	Model Coordinates of Shadow of Balcony (inches)		Measured Coordinates of Shadow of Balcony (inches)		Model Coordinates as % of Measured Coordinates	
		X	Y	X	Y	X	Y
14-May	2.17pm	59.4	48.4	56	55.5	106%	87%
14-May	2.37pm	57.4	64.8	53	72.5	108%	89%
14-May	3.04pm	53.7	88.2	55.5	96	97%	92%
14-May	3.16pm	51.7	99.3	52.5	107.5	99%	92%
14-May	3.49pm	44.5	132.6	45	140	99%	95%