



Comparing Solar Radiation on Domed Roofs and Flat Roofs in Arid Regions

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ABSTRACT

Roof is the building important element that is directly irradiated by sun; it absorbs a high amount of solar radiation which is the main reason of summer overheating in arid region. In addition, indoor thermal comfort in hot-arid region is also affected by large amount of solar radiation received by roof surfaces. Therefore, roof form and geometry should be designed with careful consideration to save them.

Designers have used domed, and flat roofs for a long time in hot-arid regions for historical, cultural, climatic, and structural reasons. The previous research work revealed that all domed roofs received more solar radiation than the flat roof, but material in dome form can change this fact. For instance, glazed tile in Iranian buildings has reversed this result. In addition, aesthetics factor, this may be a reason for using glazed tiles to cover the domes of all mosques, shrines, and other large buildings in Iran.

Domed roofs can reduce the solar radiation impact noticeably by covering them with glazed tiles. This is particularly important in locations with very high solar radiation to conserve energy with passive cooling method.

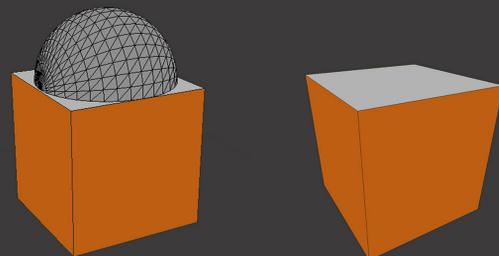
OBJECTIVES

- Determine Thermal performance for each model.
- Test a simpler simulation for both model on received solar radiation with different orientation.
- Comparing both of them to get sustainable model for arid region to conserve more energy.

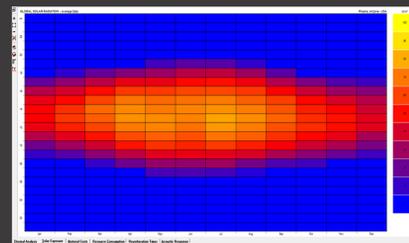
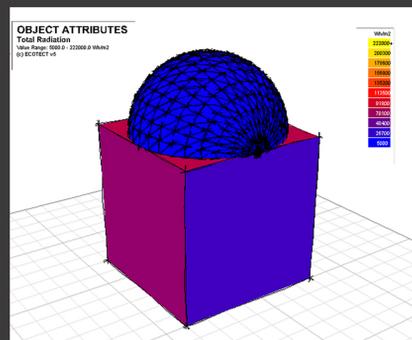
METHOD

I created model of two model with different roof types in Ecotect with same physical parameters, direction, and time. Then, I analyzed number of the solar tests for Flat and dome roof forms.

"Solar-exposure" study is one of the ECOTEECT thermal analysis applications. In order to remove the effect of construction material thermal properties and U values, both geometries have been tested employing the same situation (construction, material and roof layer components)

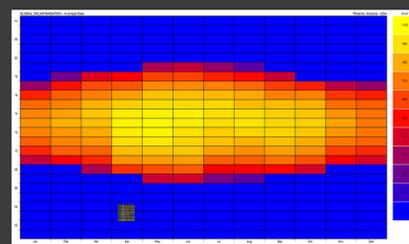
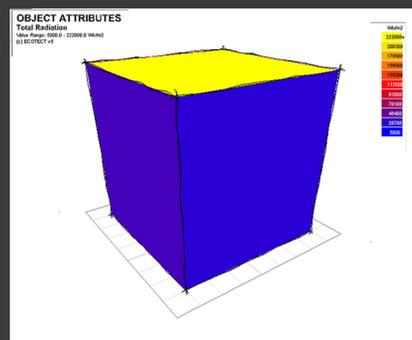


RESULT



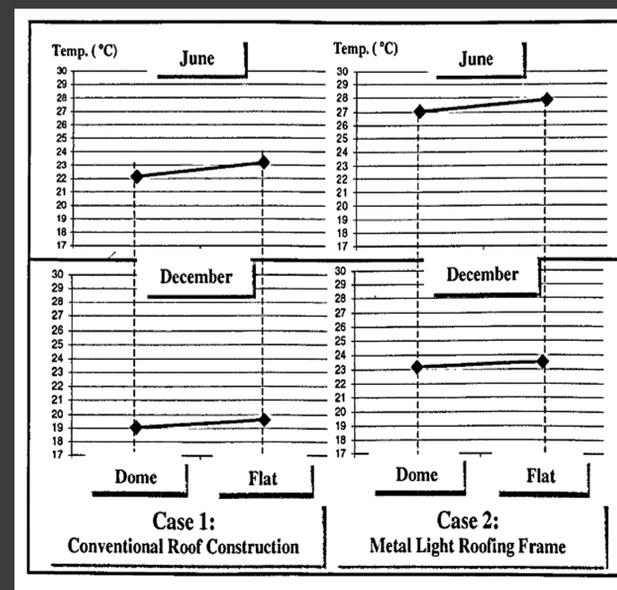
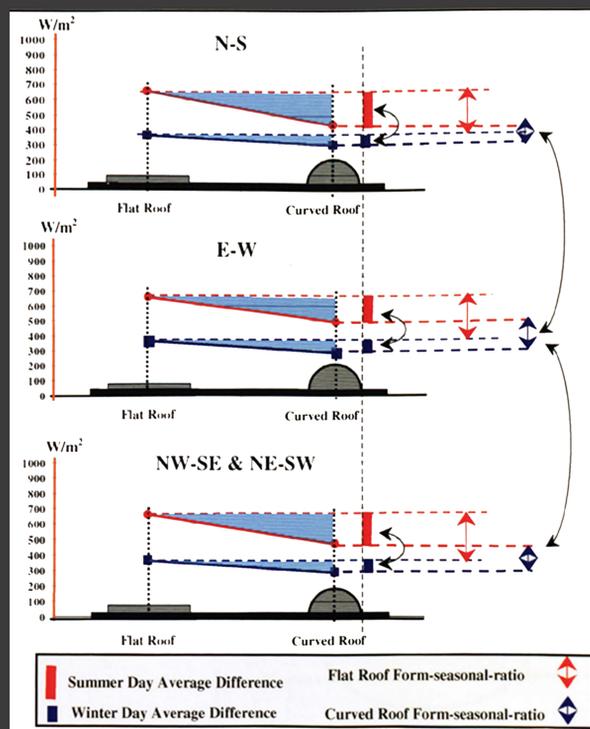
HOUR	*SUN ANGLE	SOLAR SHADE	Received (W/m ²)
06:00	79.2	39%	100
07:00	66.2	33%	267
08:00	53.0	23%	421
09:00	39.5	18%	534
10:00	25.9	12%	612
11:00	12.3	6%	658
12:00	2.0	0%	681
13:00	15.3	4%	658
14:00	28.9	10%	612
15:00	42.4	16%	534
16:00	55.9	21%	421
17:00	69.1	30%	267
18:00	81.9	37%	100
TOTALS			5865
AVERAGE			451.54

ECOTEECT Solar Intensity Distribution for dome roof

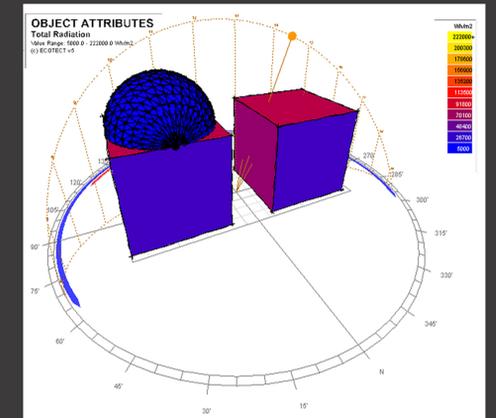
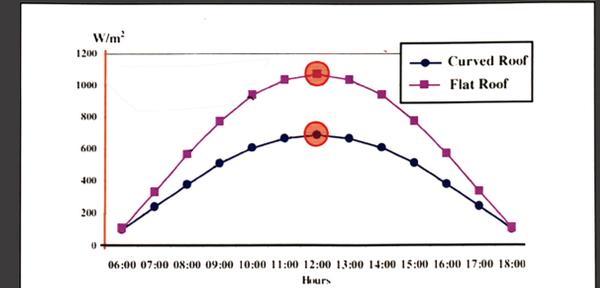


HOUR	*SUN ANGLE	SOLAR SHADE	Received (W/m ²)
06:00	79.2	0%	90
07:00	66.2	0%	295
08:00	53.0	0%	578
09:00	39.5	0%	798
10:00	25.9	0%	980
11:00	12.3	0%	1056
12:00	2.0	0%	1100
13:00	15.3	0%	1056
14:00	28.9	0%	980
15:00	42.4	0%	798
16:00	55.9	0%	578
17:00	69.1	0%	295
18:00	81.9	0%	90
TOTALS			8694
AVERAGE			668.78

ECOTEECT Solar Intensity Distribution for Flat roof

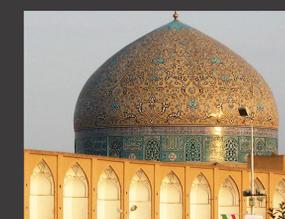


Day-average inner-surface temperature of Domed and Flat roofs



Conclusion

- (1) Thermal performance of the domed roof building under investigation is better than the building with flat roof on warm days, particularly when the dome is covered with glazed tiles.
- (2) Maximum inside air temperature of flat and domed roof building with similar conditions shows that domed roof buildings have better thermal performance in warm days



Isfahan-Iran



Santorini-Greek



Kashan-Iran



Tucson-US