JFK - IAT

East Concourse 4th Floor Expansion

Reflected Glare Study

DRAFT 1

ARUP

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Reflected Glare Study

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EXECUTIVE SUMMARY

The fourth floor extension of the East Concourse introduces more vertical glazing and a risk of increased reflected glare for aircraft on the ramp.

We conclude that the addition of the fourth floor does not significantly increase the likelihood of reflected glare.

1. INTRODUCTION

1.1 Purpose of Report

The purpose of this report is to evaluate the risk of disabling glare as a result of the sun reflecting off the glass facades of the JFK Terminal 4 building. Glare may be a hazard to pilots in aircraft taxiing to and from the terminal and to ground personnel.

The report elaborates on information presented in the original glare study for the building and compares the glare due to the new construction with glare due to the existing construction.

1.2 Scope of Study

The scope of the study is as follows:

- Compare the probability of reflected sunlight from the East Concourse at positions across the ramp with and without the fourth floor extension.
- Probability of reflected sunlight is assessed by determining the duration of reflections at all given positions.
- Positions considered are over a wide area of the ramp and a more refined analysis close to the concourse.

1.3 Assumptions

- Viewpoints critical to taxiing aircraft and ground personnel were taken at 5 foot increments of elevation from ground level to 20 feet off the ground.
- The study was completed for the condition of a clear sky sunny day on June 21 in New York, NY.
- The study takes into account only glare reflected from the glass areas of the façade of the east concourse due to the new and existing construction.
- Airborne traffic viewpoints were not considered for this study.
- Analysis was based only on glare from sunlight reflected off the building façade, not glare from direct sunlight.
- The study does not take into account other buildings that may be near the terminal building.

2. PROCEDURE FOR STUDY

2.1 Outline of Procedure

The procedure for the study involved to following basic steps:

- Create a computer model of the building geometry, based on the East Concourse Architectural Drawings 4th Floor Addition Design Submittal, dated Nov 3, 2000.
- Create a computer model of the sunpath for June 21.
- Create a grid of sampling points to test for reflected sunlight.
- Test the sampling grid area for sunlight and plot the results.

2.2 Detailed Procedure

2.2.1 Building Geometry Model

A model of the building was constructed in AutoCAD 14 by referring to the plans of the previous and new construction for dimensions. The model includes the east concourse, main terminal building, and west concourse. The model was constructed in 3 dimensions and exported to a format suitable for input to the lighting simulation software Radiance.

The glass areas of the east concourse were assigned a different material from the rest of the building to model the reflection of the sun from these areas. The rest of the building (including the main terminal and west concourse) was modeled without any reflective surfaces that could contribute to reflected glare. Refer to Figures 1 and 2 in the appendix for images of the model.

2.2.2 Sunpath Model

Using geographical data for New York, NY, a sunpath model was created for the hours of June 21 between sunrise and sunset. The sunpath model indicated where the sun would be located in the sky and for how long.

The sunpath model was combined with the building geometry model and rotated to reflect the actual orientation of the building to the north direction.

See Figure 3 in the appendix for a diagram of the sunpath.

2.2.3 Testing Grid

The following grid geometries were used for the glare study:

- A 2000 foot by 2000 foot grid covering a large area of the ramp around the building at ground level, with 50 foot spacing for sampling points.
- An 800 foot by 800 foot grid covering an area of the ramp around the building for more detailed study at ground level, 5, 10, 15, and 20 feet from the ground, with 20 foot spacing for the sampling points.

For each grid point, test directions were created which would test for the mirror image of the sunpath reflected in the building glass.

2.2.4 Grid Analysis

A simulation war run using Radiance to test for the number of hours of reflected sun at each grid point. The total number of hours of sunlight at a given point was determined by adding up the number of hours of reflected sunlight seen from every direction on the sunpath. This value in hours was plotted to create a diagram indicating the amount of hours each point on the grid receives reflected sunlight.

3. SUMMARY OF RESULTS

The results of the study are presented in Figures 3 through 11 in the appendix. See Figure 5 for identification of gate numbers and facades.

3.1 North and East Façades

Reflections are limited within about 250 feet of the concourse. At the end of the jetway, reflected sunlight typically occurs for about the first hour of sunlight or less. Since sunrise on June 21 is at 5:24 a.m., there is almost no potential for glare after 6:30 a.m.

3.2 South Façade

Reflections from the south façade are limited to within about 25 feet of the façade during the midday hours. There is no time when the reflection reaches the end of the jetway.

3.3 Table of Results

The following table represents the number of hours of reflected sunlight at the end of each jetway position, at a viewpoint of 15 feet off the ground.

Duration of Reflected Sunlight at the End of Jetway, in Hours						
Gate	1	2	3	4	5	6
North of Concourse	-	-	-	-	.8	.8
East of Concourse	-	-	-	-	-	-
South of Concourse	-	-	-	-	-	-

3.4 Comparison of New and Existing Construction

The graphs if Figure 11 indicate that at a point near the end of the jetway the addition of the fourth floor new construction increases the amount of hours of reflected glare arriving at that point from about 0.4 hours to 0.6 hours.

4. CONCLUSION

The results of the study indicate that reflected glare will not be an issue for aircraft approaching gates 1, 2, 3, and 4.

There is a possibility for reflected glare from the viewpoint of a pilot taxiing towards the jetway at gates 5 and 6 during the first hour of sunlight. The glare seen by the pilot in this situation would not be directly in the pilot's eyes, but across his field of vision, reducing the effect of the glare.

The addition of the new construction will not affect the pattern of the reflected sunlight, only increase its duration slightly. By comparison of Figures 5 and 6 and the graphs of Figure 11, it can be seen that the difference in the duration of sunlight reflected to the ramp is marginal – an additional 0.2 hours of reflected sunlight would be seen at the end of the jetway.

Appendix

Figures

Figure 1:

Perspective view of the entire model.

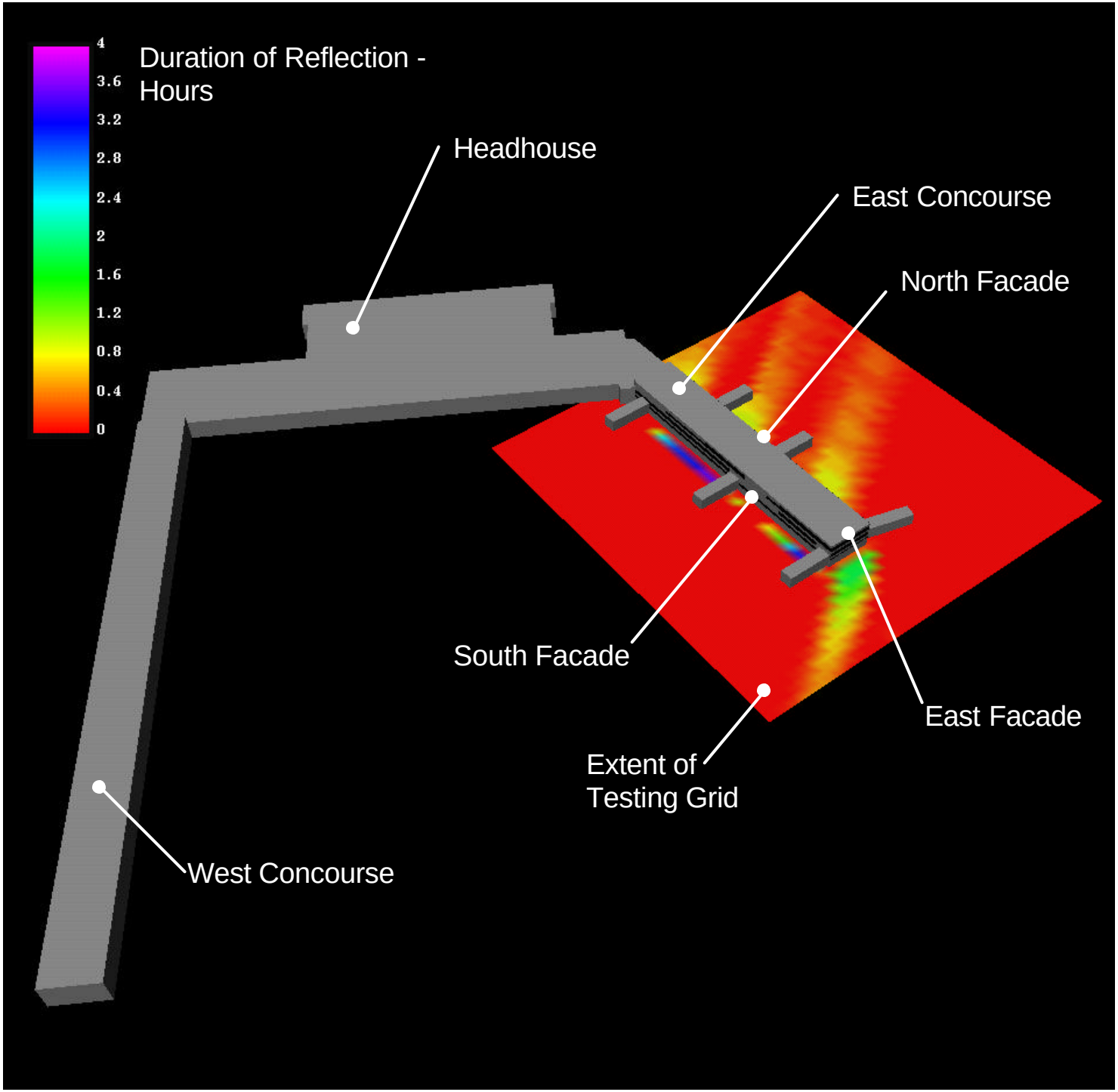

Figure 2:

Perspective view showing the model wireframe construction and grid sampling points.

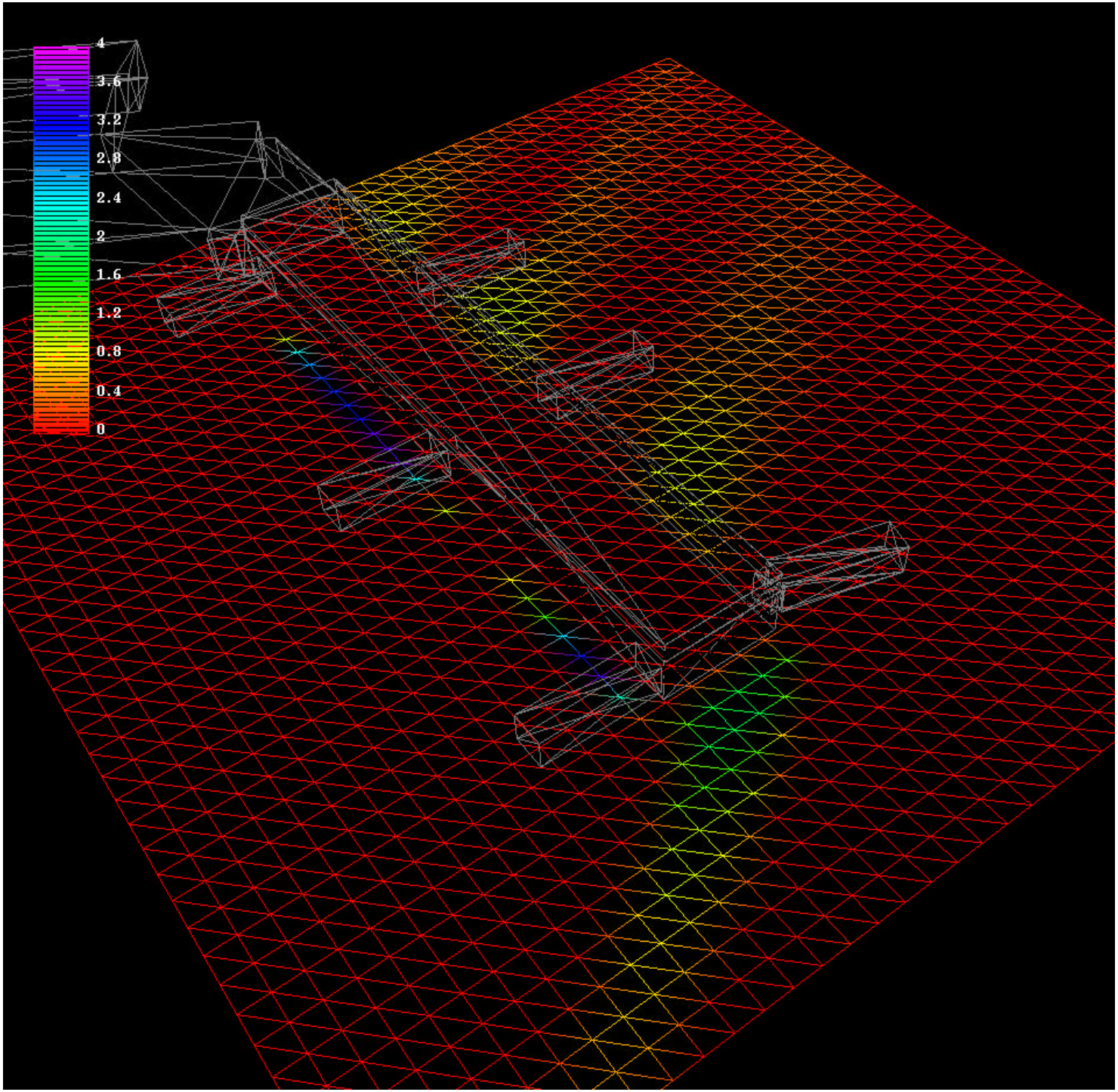

Figure 3:

Sunpath diagram for
New York, NY.

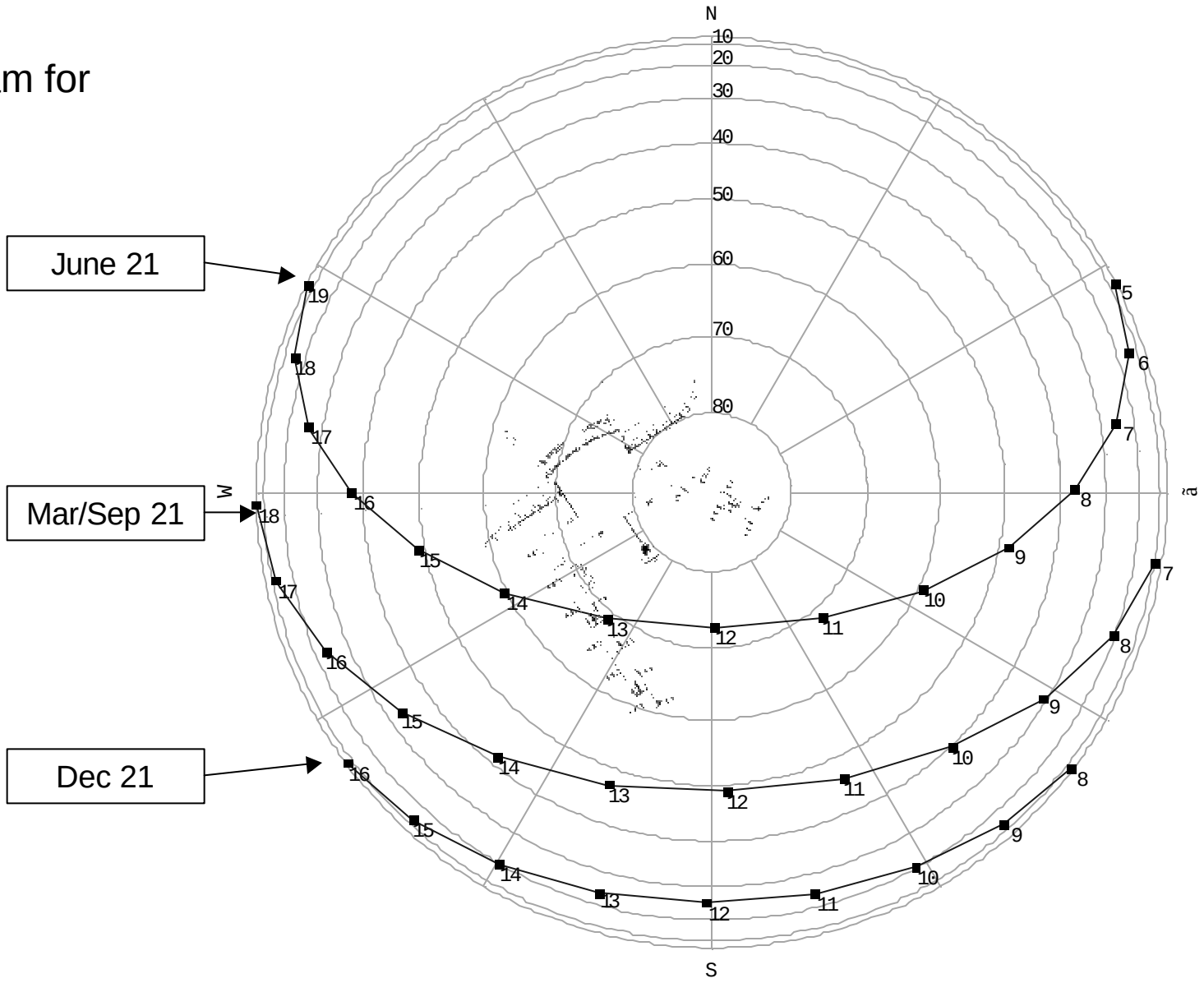

Figure 4:

Plot showing the amount (in hours) of sunlight reflected from the building glass on June 21.

Sampling Grid:

2000’ x 2000’

Elevation = 0’

New and Existing Construction

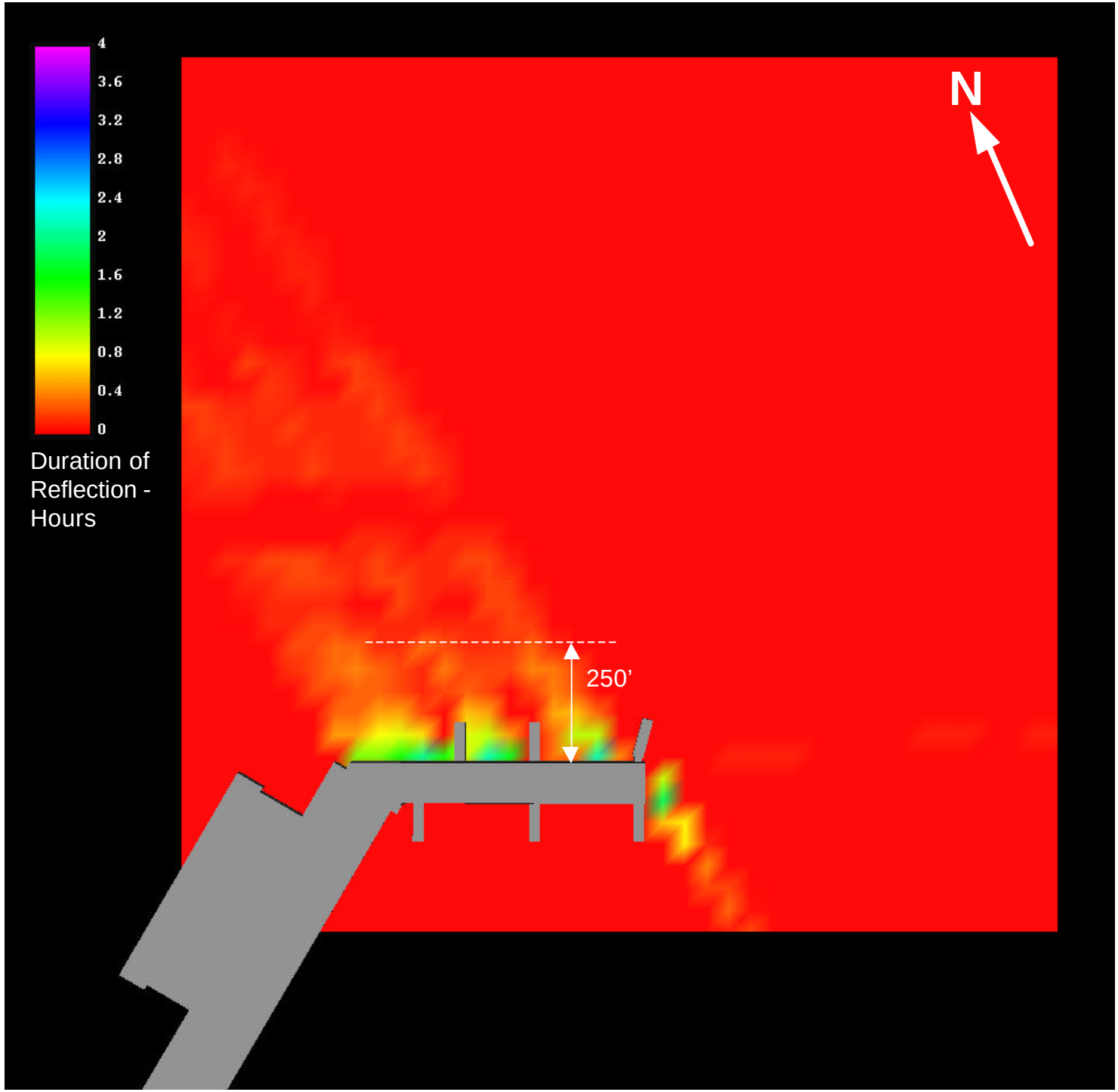

Figure 5:

Plot showing the amount (in hours) of sunlight reflected from the building glass on June 21.

Sampling Grid:

800’ x 800’

Elevation = 0’

New and Existing Construction

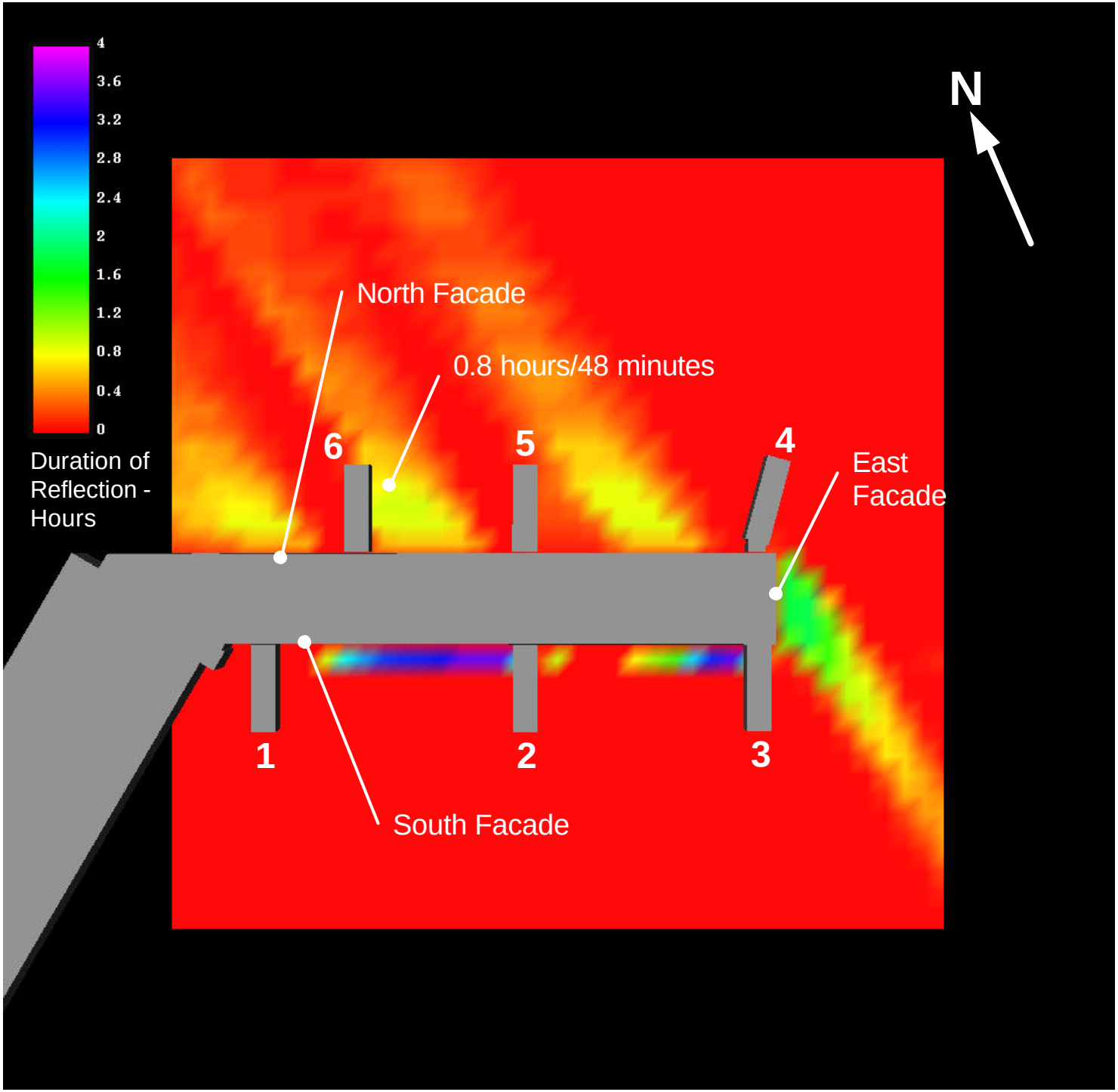

Figure 6:

Plot showing the amount (in hours) of sunlight reflected from the building glass on June 21.

Sampling Grid:

800’ x 800’

Elevation = 0’

Only Existing Construction

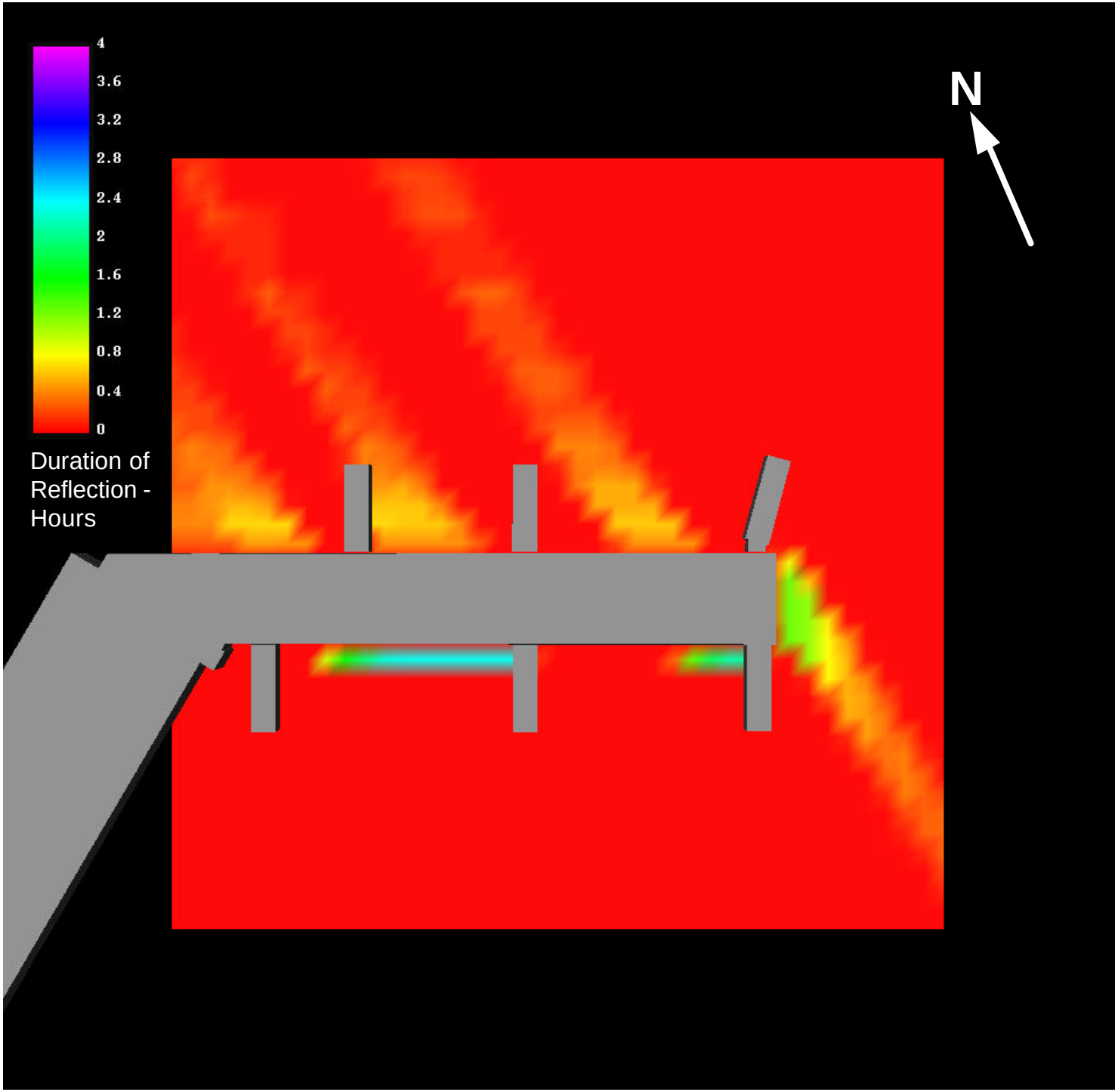

Figure 7:

Plot showing the amount (in hours) of sunlight reflected from the building glass on June 21.

Sampling Grid:

800’ x 800’

Elevation = 5’

New and Existing Construction

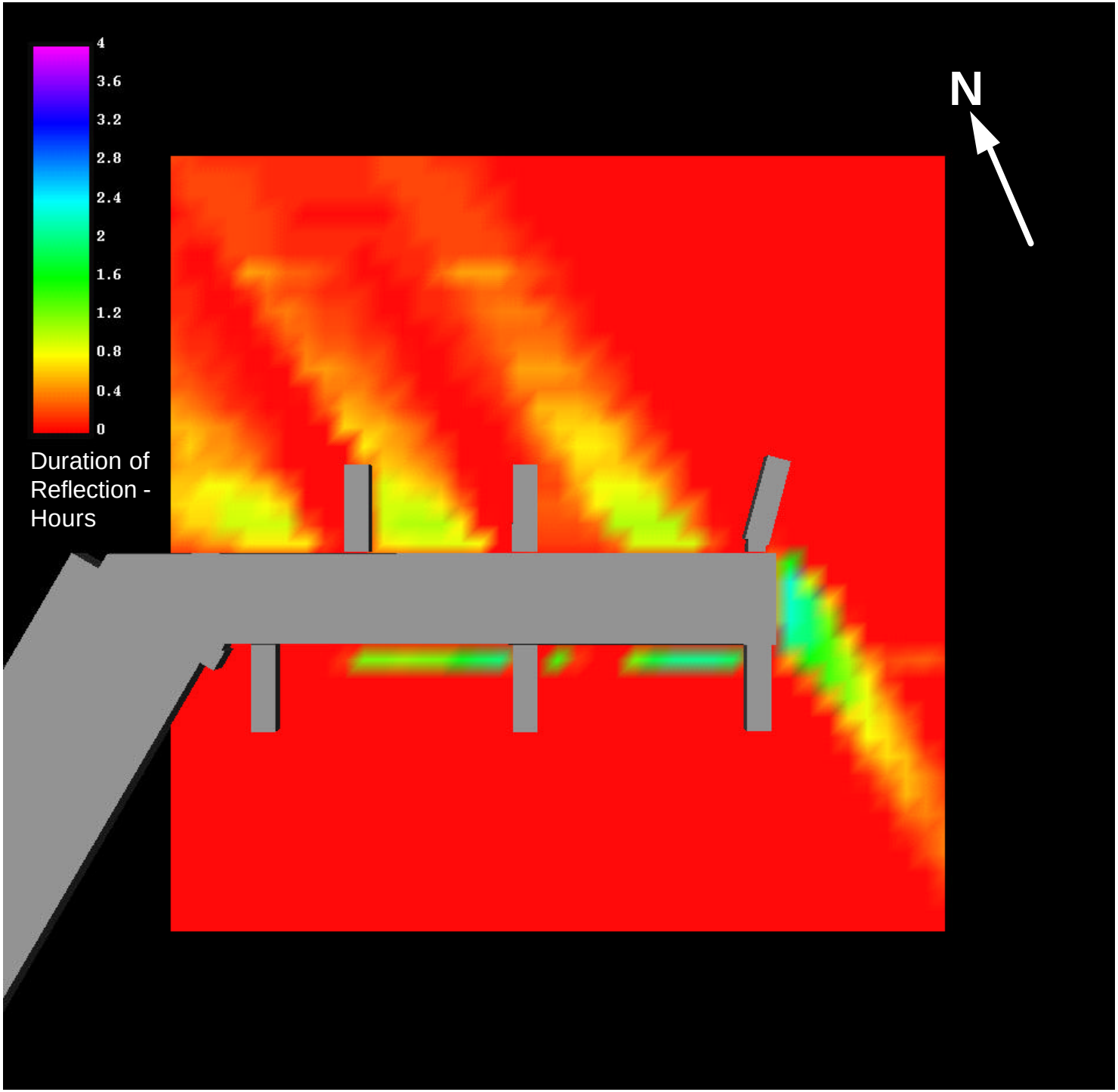

Figure 8:

Plot showing the amount (in hours) of sunlight reflected from the building glass on June 21.

Sampling Grid:

800’ x 800’

Elevation = 10’

New and Existing Construction

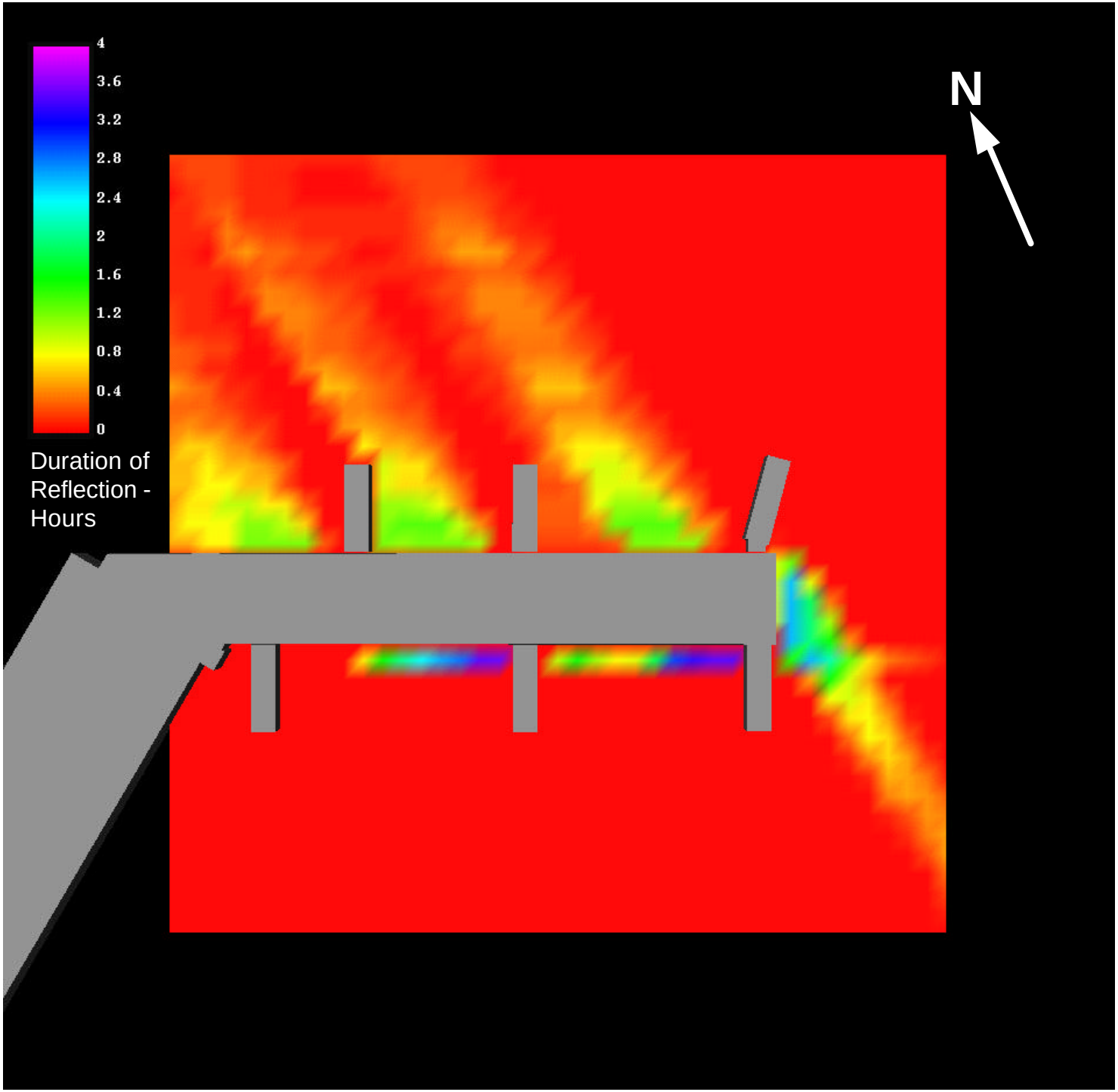

Figure 9:

Plot showing the amount (in hours) of sunlight reflected from the building glass on June 21.

Sampling Grid:

800’ x 800’

Elevation = 15’

New and Existing Construction

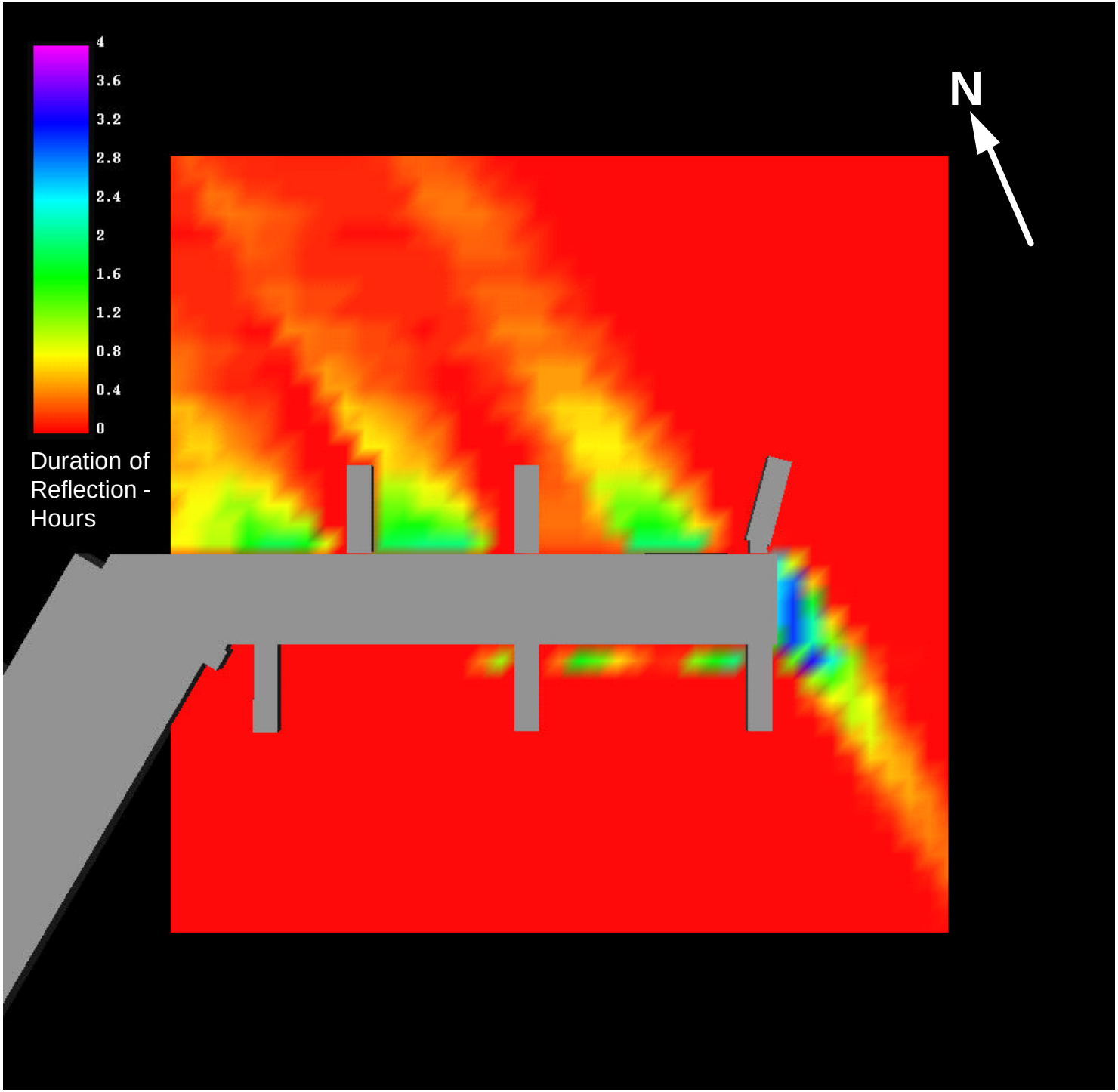

Figure 10:

Plot showing the amount (in hours) of sunlight reflected from the building glass on June 21.

Sampling Grid:

800’ x 800’

Elevation = 20’

New and Existing Construction

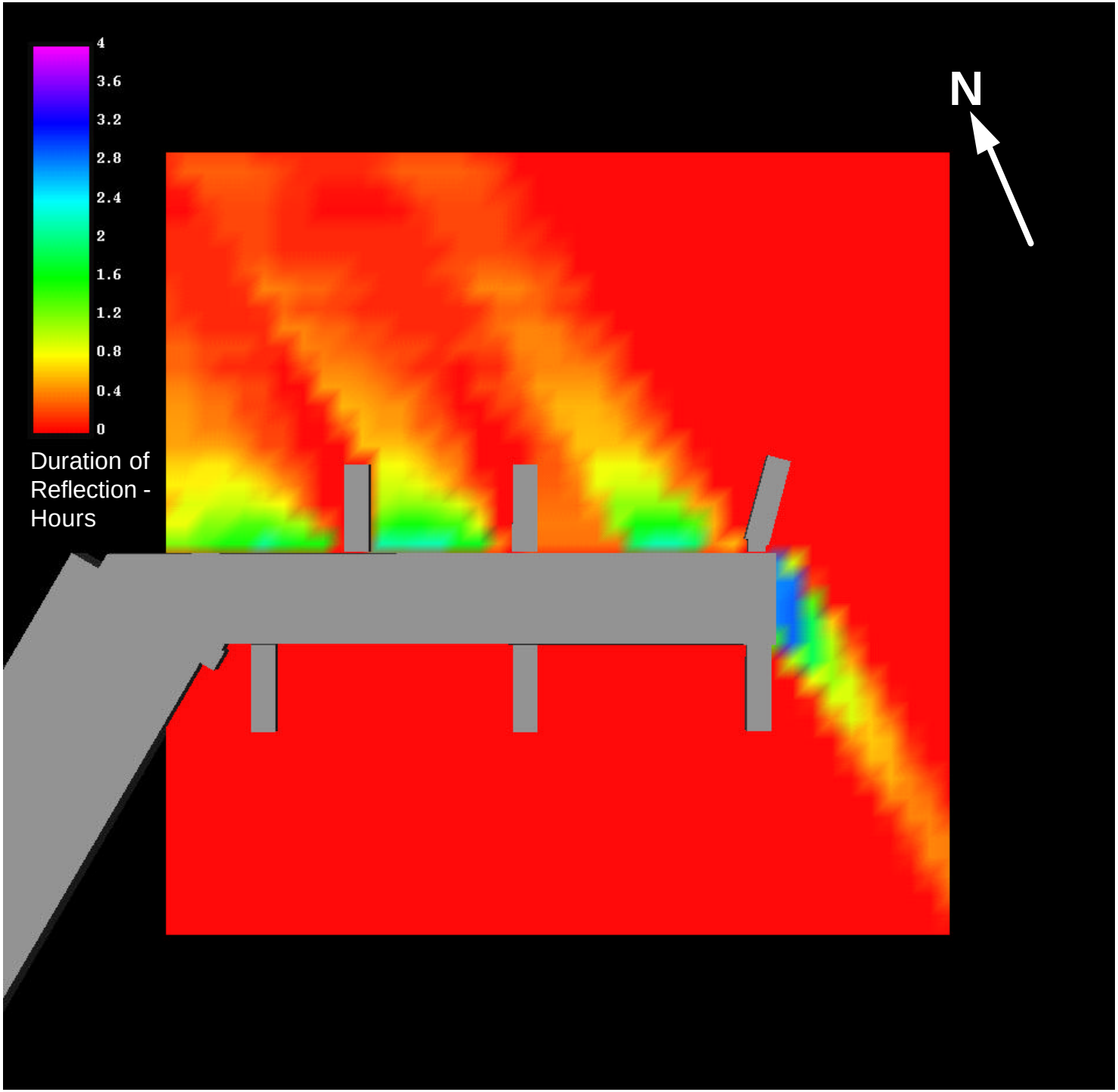

Figure 11:

Graphs showing amount of sunlight (in hours) reflected from the building glass to a line approximately 100’ from the building façade for existing and new construction.

Sampling Grid:

800’ x 800’

Elevation = 0’