

A. INTRODUCTION

This chapter presents the detailed shadow study that was conducted to determine whether the proposed One Vanderbilt development would cast any new shadows on sunlight-sensitive resources. Sunlight-sensitive resources can include parks, playgrounds, residential or office plazas, and other publicly accessible open spaces; sunlight-dependent features of historic resources; and important natural features such as water bodies.

Since the preparation of the shadow analysis in the Draft Environmental Impact Statement (DEIS), the height of the proposed One Vanderbilt development was increased. The shadow analysis in this Final Environmental Impact Statement (FEIS) has been revised to reflect this change including Figures 5-1 to 5-22 and 5-27.

PRINCIPAL CONCLUSIONS

This analysis compared shadows that would be cast by the proposed One Vanderbilt development, which would be built to a floor area ratio (FAR) of 30, with those that would be cast by the 15 FAR building that would be developed absent the proposed actions (the 15 FAR No-Action building). As described below, the analysis concluded that the proposed 30 FAR One Vanderbilt development would cast new shadows on Bryant Park, the west windows of Grand Central Terminal's main concourse and several other sunlight-sensitive resources. However, the new shadows would be limited in extent, duration and effects and would not result in any significant adverse shadow impacts, as demonstrated in detail below.

B. DEFINITIONS AND METHODOLOGY

This analysis has been prepared in accordance with CEQR procedures and follows the guidelines of the 2014 *City Environmental Quality Review (CEQR) Technical Manual*.

DEFINITIONS

Incremental shadow is the additional, or new, shadow that a structure resulting from a project would cast on a sunlight-sensitive resource.

Sunlight-sensitive resources are those resources that depend on sunlight or for which direct sunlight is necessary to maintain the resource's usability or architectural integrity. Such resources generally include:

- *Public open space* (e.g., parks, beaches, playgrounds, plazas, schoolyards, greenways, landscaped medians with seating). Planted areas within unused portions of roadbeds that are part of the Greenstreets program are also considered sunlight-sensitive resources.
- *Features of architectural resources that depend on sunlight for their enjoyment by the public*. Only the sunlight-sensitive features need be considered, as opposed to the entire

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resource. Such sunlight-sensitive features might include design elements that depend on the contrast between light and dark (e.g., recessed balconies, arcades, deep window reveals); elaborate, highly carved ornamentation; stained-glass windows; historic landscapes and scenic landmarks; and features for which the effect of direct sunlight is described as playing a significant role in the structure's importance as a historic landmark.

- *Natural resources* where the introduction of shadows could alter the resource's condition or microclimate. Such resources could include surface water bodies, wetlands, or designated resources such as coastal fish and wildlife habitats.

Non-sunlight-sensitive resources include, for the purposes of CEQR:

- *City streets and sidewalks* (except Greenstreets);
- *Private open space* (e.g., front and back yards, stoops, vacant lots, and any private, non-publicly accessible open space);
- *Project-generated open space*. In general, such open space is not considered to experience a significant adverse shadow impact from a project, according to the *CEQR Technical Manual*, because without the project the open space would not exist. However, because the condition of project-generated open space (the proposed public plaza on Vanderbilt Avenue between East 42nd and East 43rd Streets) is included in the qualitative analysis presented in Chapter 4, "Open Space" of this EIS, a discussion of how shadows would affect the new space is warranted.

A significant adverse shadow impact occurs when the incremental shadow added by a project falls on a sunlight-sensitive resource and substantially reduces or completely eliminates direct sunlight, thereby significantly altering the public's use of the resource or threatening the viability of vegetation or other resources. Each case must be considered on its own merits based on the extent and duration of new shadow and an analysis of the resource's sensitivity to reduced sunlight.

METHODOLOGY

Following the guidelines of the *CEQR Technical Manual*, a preliminary screening assessment is conducted to ascertain whether a project's shadow could reach any sunlight-sensitive resources at any time of year. The preliminary screening assessment consists of three tiers of analysis. The first tier projects a simple radius around the proposed structure representing the longest shadow that could be cast. If there are sunlight-sensitive resources within this radius, the analysis proceeds to the second tier, which reduces the area that could be affected by project shadow by accounting for the fact that shadows can never be cast between a certain range of angles south of the project site due to the path of the sun through the sky at the latitude of New York City.

If the second tier of analysis does not eliminate the possibility of new shadows on sunlight-sensitive resources, a third tier of screening analysis further refines the area that could be reached by project shadow by assessing specific representative days in each season and determining the maximum extent of shadow over the course of each representative day.

If the third tier of analysis does not eliminate the possibility of new shadows on sunlight-sensitive resources, a detailed shadow analysis is required to determine the extent and duration of the incremental shadow resulting from the project. The detailed analysis provides the data needed to assess the shadow impacts. The effects of the new shadows on the sunlight-sensitive resources are described, and their degree of significance is considered. The results of the analysis and assessment are documented with graphics, a table of incremental shadow durations, and narrative text.

C. PRELIMINARY SCREENING ASSESSMENT

A base map was developed using Geographic Information Systems (GIS)¹ showing the location of the project site and the surrounding streets and open spaces (see **Figure 5-1**). In coordination with the open space and historic resources assessments presented in other chapters, potential sunlight-sensitive resources were identified and shown on the map.

TIER 1 SCREENING ASSESSMENT

For the Tier 1 assessment, the longest shadow that the proposed building could cast is calculated, and, using this length as the radius, a perimeter is drawn around the project site. Anything outside this perimeter representing the longest possible shadow could never be affected by project-generated shadow, while anything inside the perimeter needs additional assessment.

According to the *CEQR Technical Manual*, the longest shadow that a structure can cast at the latitude of New York City occurs on December 21, the winter solstice, at the start of the analysis day at 8:51 AM, and is equal to 4.3 times the height of the structure.

The proposed One Vanderbilt development would be approximately 1,514 feet tall including its spire. Therefore, on December 21 at 8:51 AM it would cast a shadow approximately 6,510 feet in length (1,514 x 4.3). Using this length, a perimeter was drawn around the One Vanderbilt site that represents the longest shadow study area (see **Figure 5-1**). Many sun-sensitive resources are located within this perimeter. Therefore, the next tier of assessment was conducted.

TIER 2 SCREENING ASSESSMENT

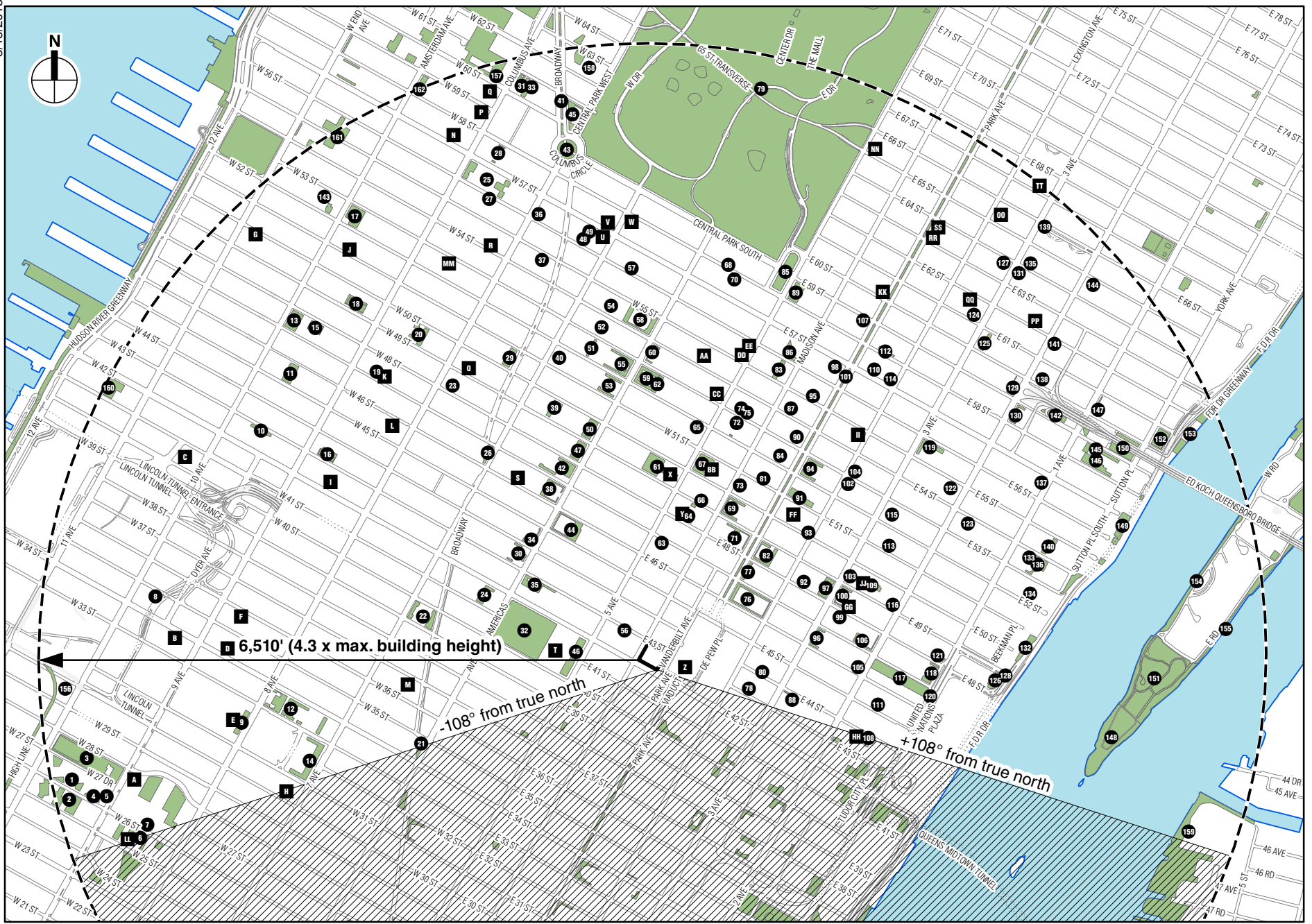
Because of the path that the sun travels across the sky in the northern hemisphere, no shadow can be cast in a triangular area south of any given project site. In New York City this area lies between -108 and +108 degrees from true north. **Figure 5-1** illustrates this triangular area south of the project site. The complementing area to the north within the longest shadow study area represents the remaining area that could potentially experience new, project-generated shadow.

There are 162 sunlight-sensitive and publicly accessible open space resources² and 46 historic resources that have sunlight-sensitive features³ that are located within the remaining longest shadow study area. These resources are shown and listed on **Figure 5-1**. In addition, a portion of the East River, an important natural resource, is located in the longest shadow study area. Further, the proposed actions include a City Map amendment to designate the portion of Vanderbilt Avenue between East 42nd and East 43rd Streets as a “public place” dedicated to pedestrian uses. This project-generated open space is also included in the assessment.

¹ Software: Esri ArcGIS 10.2; Data: New York City Department of Information Technology and Telecommunications (DoITT) and other City agencies, and site visits.

² A small number of spaces were screened out of the Tier 1/Tier 2 Assessment either because they were interior public spaces that did not have windows or skylights, or because based on site visits they did not have any sunlight-sensitive features; for example, a small “plaza” consisting of a widened sidewalk area with no seating or other amenities, or landscaping next to a driveway with no seating ledges.

³ Potential and eligible historic resources were considered, as well as listed and designated resources. If a resource had sunlight-dependent features, it was included in this tier, regardless of whether such features (stained-glass windows, for example) appeared to be oriented toward the project site or not, to ensure a comprehensive analysis.



One Vanderbilt Development Site
 Tier 1: Longest shadow study area boundary
 Tier 2: Area south of site that could never be shaded by proposed building

Open Space Resources
 Historic Resources with Sun-Sensitive Features

0 500 1,000 1,500 2,000 Feet

| | | | |
|---|--|--|---|
| <p>1 NYCHA: Elliott and Chelsea Addition Houses</p> <p>2 NYCHA: Elliott and Chelsea Houses</p> <p>3 Chelsea Park</p> <p>4 PS 33 Playground</p> <p>5 PS 33 Garden</p> <p>6 Penn Station South Houses Playground</p> <p>7 Penn South Open Spaces</p> <p>8 Bob's Park</p> <p>9 Farley Bldg Steps</p> <p>10 Gregory J.M. Portley Plaza</p> <p>11 May Matthews Playground</p> <p>12 One Penn Plaza</p> <p>13 Hells Kitchen Park</p> <p>14 Two Penn Plaza</p> <p>15 Clinton Community Garden</p> <p>16 Mccaffrey Playground</p> <p>17 PS 111 schoolyard</p> <p>18 NY School Of Printing Rec Area</p> <p>19 Ramone Aponte Park</p> <p>20 One Worldwide Plaza</p> <p>21 Herald Square</p> <p>22 1411 Broadway</p> <p>23 235 W. 48th St. Ritz</p> <p>24 1095 Sixth Ave.</p> <p>25 Sheffield</p> <p>26 Father Duffy Square</p> <p>27 330 W. 56th St.</p> <p>28 Colonade</p> <p>29 Paramount Plaza</p> <p>30 1133 Sixth Ave.</p> <p>31 Regent Plaza</p> <p>32 Bryant Park</p> <p>33 Beaumont Plaza</p> <p>34 1155 Sixth Ave.</p> <p>35 Grace Plaza</p> <p>36 Symphony House Plaza</p> <p>37 230 West 55th St. Plaza</p> <p>38 1185 Sixth Ave.</p> <p>39 745 7th Ave.</p> <p>40 Equitable Center Atrium Skylight</p> <p>41 Broadway Center Plots</p> <p>42 1211 Sixth Ave.</p> <p>43 Columbus Circle</p> <p>44 1166 Sixth Ave.</p> <p>45 Trump Intl Hotel And Tower Plaza</p> <p>46 Stephen A. Schwarzman Bldg Steps & Terrace</p> <p>47 1221 6th Ave.</p> <p>48 Carnegie Mews</p> <p>49 888 Seventh Ave. Plaza</p> <p>50 1251 6th Ave.</p> <p>51 Flatotel Galleria</p> <p>52 1325 6th Ave.</p> <p>53 PaineWebber Plaza</p> <p>54 151 W. 54th St.</p> <p>55 1301 Sixth Ave.</p> <p>56 Emigrant Savings Bank</p> <p>57 Metropolitan Tower Plaza</p> <p>58 Fisher Park</p> <p>59 CBS Building Plaza</p> <p>60 1330 Sixth Ave. Plaza</p> <p>61 Rockefeller Plaza</p> <p>62 31 W. 52nd St.</p> <p>63 575 5th Ave.</p> <p>64 Tower 49</p> <p>65 650 5th Ave.</p> <p>66 Saks Tower</p> <p>67 St. Patrick's Cathedral plaza</p> <p>68 Park Lane Hotel Plaza</p> <p>69 437 Madison Ave.</p> <p>70 9 West 57th St. Plaza</p> | <p>71 280 Park Ave.</p> <p>72 HarperCollins Plaza</p> <p>73 New York Palace Hotel courtyard</p> <p>74 Paley Park</p> <p>75 520 Madison Ave. Plaza</p> <p>76 245 Park Ave.</p> <p>77 275 Park Ave.</p> <p>78 425 Lexington Ave.</p> <p>79 Central Park</p> <p>80 Two Grand Central Tower</p> <p>81 40 E. 52nd St.</p> <p>82 Westvaco</p> <p>83 Sony Plaza</p> <p>84 Park Ave. Plaza</p> <p>85 Grand Army Plaza</p> <p>86 590 Madison Ave.</p> <p>87 Warburg Dillon Read Plaza</p> <p>88 685 3rd Ave.</p> <p>89 General Motors Bldg</p> <p>90 Lever House Plaza</p> <p>91 345 Park Ave.</p> <p>92 Cosmopolitan Condominiums</p> <p>93 560 Lexington Ave.</p> <p>94 Seagram Bldg</p> <p>95 Park Avenue Tower Plaza</p> <p>96 747 3rd Ave.</p> <p>97 780 3rd Ave.</p> <p>98 450 Park Ave. Plaza</p> <p>99 767 3rd Ave.</p> <p>100 777 3rd Ave.</p> <p>101 Park Ave Center Plots</p> <p>102 599 Lexington Ave.</p> <p>103 Crystal Pavilion</p> <p>104 Citigroup Center Plaza</p> <p>105 Dag Hammarskjold Tower</p> <p>106 885 2nd Ave.</p> <p>107 500 Park Ave. Plaza</p> <p>108 3 U.N. Plaza</p> <p>109 Amster Yard</p> <p>110 115 E. 57th St.</p> <p>111 320 E. 46th St.</p> <p>112 110 E. 59th St.</p> <p>113 Greenacre Park</p> <p>114 135 East 57th St.</p> <p>115 875 3rd Ave.</p> <p>116 Sterling Plaza</p> <p>117 Dag Hammarskjold Plaza</p> <p>118 Trump World Tower</p> <p>119 919 3rd Ave.</p> <p>120 Greenstreet</p> <p>121 100/871 U.N. Plaza</p> <p>122 The Brevard</p> <p>123 Connaught Tower</p> <p>124 Trump Plaza</p> <p>125 200 E. 61st St.</p> <p>126 General Douglas Macarthur Park</p> <p>127 188 E. 64th St.</p> <p>128 Greenstreet</p> <p>129 Tramway Plaza</p> <p>130 The Landmark</p> <p>131 200 E. 64th St.</p> <p>132 Peter Detmold Park</p> <p>133 Revere</p> <p>134 Rivercourt</p> <p>135 200 E. 65th St.</p> <p>136 River Tower</p> <p>137 The Morrison</p> <p>138 303 E. 60th St.</p> <p>139 Greenstreet</p> <p>140 415 E. 54th St.</p> | <p>141 300 E. 62nd St.</p> <p>142 14 Honey Locusts Park</p> <p>143 Oasis Community Garden</p> <p>144 304 East 65th St.</p> <p>145 418 E. 59th St.</p> <p>146 425 E. 58th St.</p> <p>147 400 West 59th St.</p> <p>148 Four Freedoms Park</p> <p>149 Sutton Place Park</p> <p>150 Queensboro Oval</p> <p>151 Southpoint Park</p> <p>152 Twenty-Four Sycamores Park</p> <p>153 Andrew Haswell Green Park</p> <p>154 Roosevelt Island Promenade West</p> <p>155 Roosevelt Island Promenade East</p> <p>156 High Line</p> <p>157 Fordham University</p> <p>158 1886 Broadway</p> <p>159 Gantry Plaza State Park</p> <p>160 River Place plaza</p> <p>161 Harborview Terrace</p> <p>162 St. Luke's - Roosevelt Hospital plaza</p> | <p>A Church of the Holy Apostles</p> <p>B Church of Saint Michael</p> <p>C St Raphael's Roman Catholic Church</p> <p>D West Side Jewish Center</p> <p>E Farley Building colonnade</p> <p>F Christ Church Memorial</p> <p>G St. Kyril & Metodi Bulgarian Eastern Cathedral</p> <p>H Church of St. John the Baptist</p> <p>I Church of the Holy Apostle/Cross</p> <p>J Sacred Heart of Jesus Church</p> <p>K Actors Temple</p> <p>L Saint Luke's Lutheran Church</p> <p>M Church of the Holy Innocents</p> <p>N Catholic Apostolic Church</p> <p>O St. Malachy's Church</p> <p>P William J. Syms Operating Theater</p> <p>Q St. Paul the Apostle Church</p> <p>R The St. George Tropeoforos Greek Orthodox Church</p> <p>S The Free Church of St. Mary the Virgin</p> <p>T Stephen A. Schwarzman Building</p> <p>U Rodin Studios</p> <p>V Osborne Apartments</p> <p>W Alwyn Court Apartments</p> <p>X Rockefeller Center: Rockefeller Plaza</p> <p>Y Swedish Seamen's Church</p> <p>Z Grand Central Terminal</p> <p>AA Rockefeller Apartments</p> <p>BB St. Patrick's Cathedral</p> <p>CC St. Thomas Church and Parish House</p> <p>DD Fifth Ave Presbyterian Church</p> <p>EE Former Coty Building</p> <p>FF St. Bartholomew's Church and Community House</p> <p>GG William Lescaze House and Office</p> <p>HH Beaux-Arts Apartments</p> <p>II Central Synagogue</p> <p>JJ Amster Yard</p> <p>KK Christ Church United Methodist</p> <p>LL St. Columba Church</p> <p>MM St. Benedict the Moor Church</p> <p>NN Temple Emanu-El</p> <p>OO Church of Saint Vincent Ferrer</p> <p>PP Church of Our Lady of Peace</p> <p>QQ Metropolitan Koryo United Meth Church</p> <p>RR Third Church of Christ, Scientist</p> <p>SS Central Presbyterian Church</p> <p>TT Park East Synagogue</p> |
|---|--|--|---|

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This figure has been updated for the FEIS

Tier 1 and Tier 2 Assessments
Figure 5-1

TIER 3 SCREENING ASSESSMENT

The direction and length of shadows vary throughout the course of the day and also differ depending on the season. In order to determine whether project-generated shadow could fall on a sunlight-sensitive resource, three-dimensional (3D) computer mapping software¹ is used in the Tier 3 assessment to calculate and display the project's shadows on individual representative days of the year. A computer model was developed containing 3D representations of the elements in the base map used in the preceding assessments, the topographic information of the study area, and a 3D representation of the proposed One Vanderbilt development.

In order to ensure a conservative, worst-case analysis, the 3D model of the proposed development included a 10-foot maximum zoning envelope in all dimensions. The development that would actually be built would therefore be smaller than what is presented in this chapter.

REPRESENTATIVE DAYS FOR ANALYSIS

Following the guidance of the *CEQR Technical Manual*, shadows on the summer solstice (June 21), winter solstice (December 21) and spring and fall equinoxes (March 21 and September 21, which are approximately the same in terms of shadow patterns) are modeled, to represent the range of shadows over the course of the year. An additional representative day during the growing season is also modeled, generally the day halfway between the summer solstice and the equinoxes, i.e., May 6 or August 6, which have approximately the same shadow patterns.

TIME FRAME FOR ANALYSIS

The shadow assessment considers shadows occurring between one and a half hours after sunrise and one and a half hours before sunset. At times earlier or later than this time frame for analysis, the sun is near the horizon, and the sun's rays reach the Earth at tangential angles, which diminishes the amount of solar energy and produces shadows that are long, move fast, and generally blend with shadows from existing structures until the sun reaches the horizon and sets. Consequently, shadows occurring outside the time frame for analysis are not considered significant under CEQR, and their assessment is not required.

TIER 3 SCREENING ASSESSMENT RESULTS

Figures 5-2 through 5-5 illustrate the range of shadows that would occur, in the absence of existing buildings, from the proposed One Vanderbilt development on the four representative days for analysis. As they move east and clockwise over the landscape, the shadows are shown occurring approximately every two to three hours from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset).

The Tier 3 assessment showed that about half of the open space resources and approximately two-thirds of the historic resources would not receive project-generated shadow on any of the four analysis days, and these resources therefore did not require any further analysis.

Table 5-1 presents a summary of the Tier 3 assessment, showing the 83 remaining open space resources and 20 remaining historic resources that could, in the absence of intervening buildings, receive project-generated shadow, and on which analysis days the new shadow could occur.

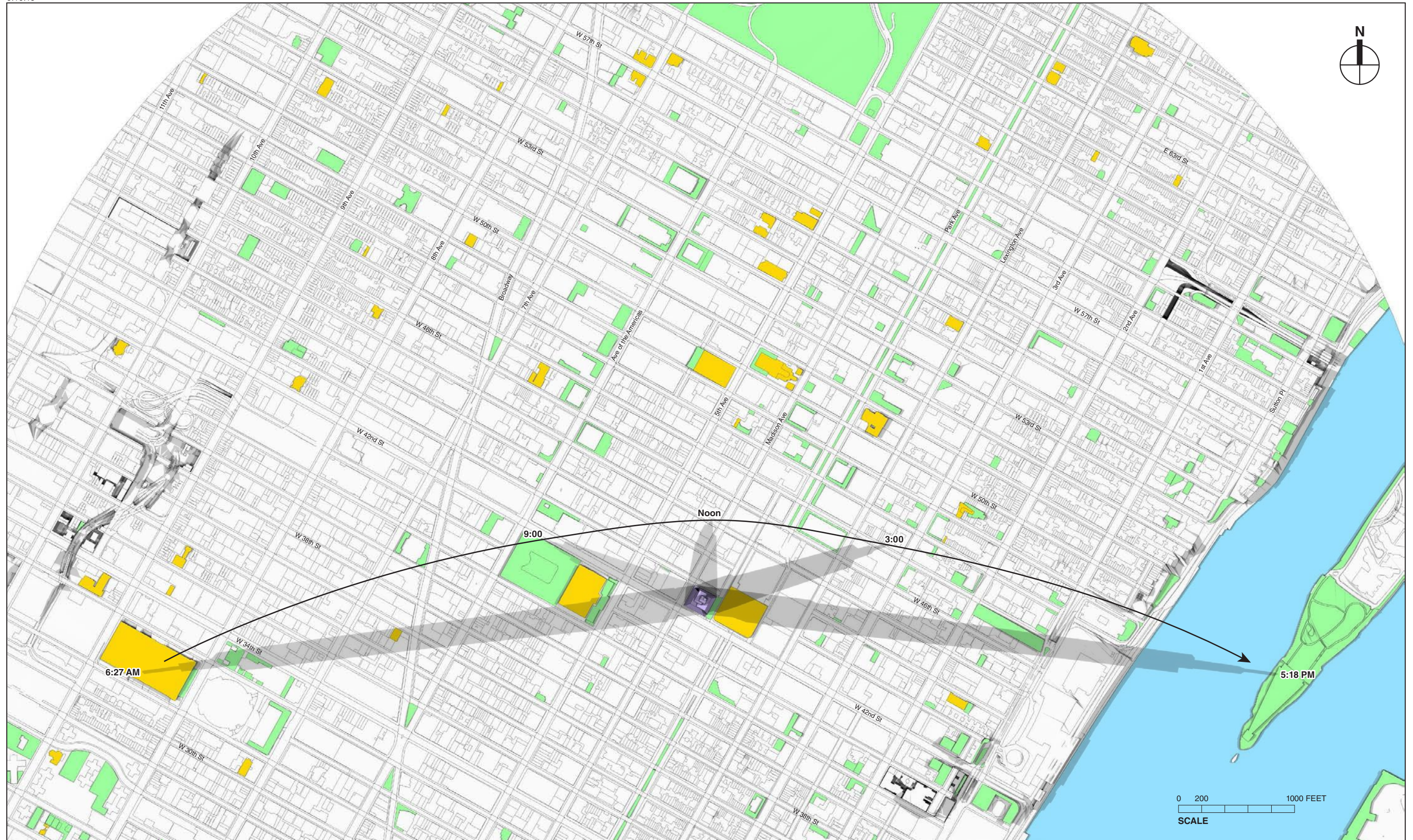
¹ MicroStation V8i (SELECTSeries 3).



- Publicly-Accessible Open Space (see Figure 5-1)
- Historic Resources with Sun-Sensitive Features (see Figure 5-1)

Note: Daylight Saving Time not used, per CEQR Technical Manual guidelines.

This figure illustrates the range of shadows that would occur from the proposed building, absent other existing buildings, on this representative day. The shadows are shown occurring approximately every two to three hours from the start of the analysis day (one and a half hours after sunrise) to the end of the analysis day (one and a half hours before sunset). The Tier 3 assessment serves to illustrate the daily path or "sweep" of the proposed project's shadow across the landscape, indicating which resources could potentially be affected on each analysis day, absent intervening buildings, by project-generated shadow.



- Publicly-Accessible Open Space (see Figure 5-1)
- Historic Resources with Sun-Sensitive Features (see Figure 5-1)

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Table 5-1
Tier 3 Assessment Results

| Map ID No. ¹ | Name | March 21 / Sept. 21 7:36 AM–4:29 PM | May 6 / August 6 6:27 AM–5:18 PM | June 21 5:57 AM–6:01 PM | December 21 8:51 AM–2:53 PM | Number of Analysis Days ² |
|---------------------------------|--|--|-------------------------------------|----------------------------|--------------------------------|--------------------------------------|
| Publicly Accessible Open Spaces | | | | | | |
| 7 | Penn South open spaces | NO | NO | YES | NO | 1 |
| 9 | Farley Building steps | NO | YES | NO | NO | 1 |
| 12 | One Penn Plaza | NO | YES | YES | NO | 2 |
| 14 | Two Penn Plaza | NO | NO | YES | NO | 1 |
| 18 | NY School Of Printing Rec Area | NO | NO | NO | YES | 1 |
| 19 | Ramone Aponte Park | NO | NO | NO | YES | 1 |
| 20 | One Worldwide Plaza | NO | NO | NO | YES | 1 |
| 21 | Herald Square | NO | NO | YES | NO | 1 |
| 23 | 235 W. 48th St. Ritz | NO | NO | NO | YES | 1 |
| 24 | 1095 Sixth Ave. | YES | NO | NO | NO | 1 |
| 26 | Father Duffy Square | NO | NO | NO | YES | 1 |
| 29 | Paramount Plaza | NO | NO | NO | YES | 1 |
| 30 | 1133 Sixth Ave. | YES | NO | NO | NO | 1 |
| 32 | Bryant Park | YES | YES | YES | NO | 3 |
| 33 | 1155 Sixth Ave. | YES | NO | NO | YES | 2 |
| 35 | Grace Plaza | YES | NO | NO | NO | 1 |
| 38 | 1185 Sixth Ave. | NO | NO | NO | YES | 1 |
| 39 | 745 7th Ave. | NO | NO | NO | YES | 1 |
| 40 | Equitable Center Atrium Skylight | NO | NO | NO | YES | 1 |
| 42 | 1211 Sixth Ave. | NO | NO | NO | YES | 1 |
| 44 | 1166 Sixth Ave. | YES | NO | NO | YES | 2 |
| 46 | Stephen A. Schwarzman Building steps & terrace | YES | YES | YES | NO | 3 |
| 47 | 1221 6th Ave. | NO | NO | NO | YES | 1 |
| 50 | 1251 6th Ave. | NO | NO | NO | YES | 1 |
| 53 | PaineWebber Plaza | NO | NO | NO | YES | 1 |
| 55 | 1301 Sixth Ave. | NO | NO | NO | YES | 1 |
| 56 | Emigrant Savings Bank | YES | YES | YES | YES | 4 |
| 59 | CBS Building Plaza | NO | NO | NO | YES | 1 |
| 61 | Rockefeller Plaza | NO | NO | NO | YES | 1 |
| 62 | 31 W. 52nd St. | NO | NO | NO | YES | 1 |
| 63 | 575 5th Ave. | YES | NO | NO | YES | 2 |
| 64 | Tower 49 | NO | NO | NO | YES | 1 |
| 65 | 650 5th Ave. | NO | NO | NO | YES | 1 |
| 66 | Saks Tower | NO | NO | NO | YES | 1 |
| 67 | St. Patrick's Cathedral plaza | NO | NO | NO | YES | 1 |
| 69 | 437 Madison Ave. | NO | NO | NO | YES | 1 |
| 71 | 280 Park Ave. | YES | NO | NO | YES | 2 |
| 72 | HarperCollins Plaza | NO | NO | NO | YES | 1 |
| 73 | New York Palace Hotel courtyard | NO | NO | NO | YES | 1 |
| 74 | Paley Park | NO | NO | NO | YES | 1 |
| 75 | 520 Madison Ave. Plaza | NO | NO | NO | YES | 1 |
| 76 | 245 Park Ave. | YES | YES | NO | NO | 2 |
| 77 | 275 Park Ave. | YES | NO | NO | NO | 1 |
| 78 | 425 Lexington Ave. | NO | NO | YES | NO | 1 |
| 80 | Two Grand Central Tower | NO | YES | YES | NO | 2 |
| 81 | 40 E. 52nd St. | NO | NO | NO | YES | 1 |
| 82 | Westvaco Building | YES | NO | NO | YES | 2 |
| 83 | Sony Plaza | NO | NO | NO | YES | 1 |
| 84 | Park Ave. Plaza | NO | NO | NO | YES | 1 |
| 86 | 590 Madison Ave. | NO | NO | NO | YES | 1 |
| 87 | Warburg Dillon Read Plaza | NO | NO | NO | YES | 1 |
| 88 | 685 3rd Ave. | NO | NO | YES | NO | 1 |
| 90 | Lever House Plaza | NO | NO | NO | YES | 1 |
| 91 | 345 Park Ave. | NO | NO | NO | YES | 1 |

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**Table 5-1 (cont'd)
Tier 3 Assessment Results**

| Map ID No. ¹ | Name | March 21 / Sept. 21 7:36 AM–4:29 PM | May 6 / August 6 6:27 AM–5:18 PM | June 21 5:57 AM–6:01 PM | December 21 8:51 AM–2:53 PM | Number of Analysis Days ² |
|---|--|--|-------------------------------------|----------------------------|--------------------------------|--------------------------------------|
| Publicly Accessible Open Spaces, cont'd | | | | | | |
| 92 | Cosmopolitan Condominiums | YES | NO | NO | NO | 1 |
| 94 | Seagram Building | NO | NO | NO | YES | 1 |
| 95 | Park Avenue Tower Plaza | NO | NO | NO | YES | 1 |
| 96 | 747 3rd Ave. | NO | YES | YES | NO | 2 |
| 97 | 780 3rd Ave. | YES | NO | NO | NO | 1 |
| 98 | 450 Park Ave. Plaza | NO | NO | NO | YES | 1 |
| 99 | 767 3rd Ave. | YES | YES | NO | NO | 1 |
| 100 | 777 3rd Ave. | YES | NO | NO | NO | 1 |
| 101 | Park Ave Center Plots | YES | NO | NO | YES | 2 |
| 103 | Crystal Pavilion | YES | NO | NO | NO | 1 |
| 105 | Dag Hammarskjold Tower | NO | YES | YES | NO | 2 |
| 106 | 885 2nd Ave. | NO | YES | NO | NO | 1 |
| 107 | 500 Park Ave. Plaza | NO | NO | NO | YES | 1 |
| 109 | Amster Yard | YES | NO | NO | NO | 1 |
| 110 | 115 E. 57th St. | NO | NO | NO | YES | 1 |
| 111 | 320 E. 46th St. | NO | NO | YES | NO | 1 |
| 112 | 110 E. 59th St. | NO | NO | NO | YES | 1 |
| 113 | Greenacre Park | YES | NO | NO | NO | 1 |
| 114 | 135 East 57th St. | NO | NO | NO | YES | 1 |
| 117 | Dag Hammarskjold Plaza | NO | YES | YES | NO | 2 |
| 118 | Trump World Tower | NO | YES | NO | NO | 1 |
| 120 | Greenstreet | NO | YES | YES | NO | 2 |
| 121 | 100/871 U.N. Plaza | NO | YES | NO | NO | 1 |
| 126 | General Douglas Macarthur Park | NO | YES | NO | NO | 1 |
| 127 | 188 E. 64th St. | NO | NO | NO | YES | 1 |
| 128 | Greenstreet | NO | YES | NO | NO | 1 |
| 133 | Revere | YES | NO | NO | NO | 1 |
| 140 | 415 E. 54th St. | YES | NO | NO | NO | 1 |
| 148 | Four Freedoms Park | NO | YES | NO | NO | 1 |
| 159 | Gantry Plaza State Park | NO | NO | YES | NO | 1 |
| Historic Resources with Sun-Sensitive Features ³ | | | | | | |
| E | Farley Building colonnade | NO | YES | NO | NO | 1 |
| H | Church of St. John the Baptist | NO | NO | YES | NO | 1 |
| K | Actors Temple | NO | NO | NO | YES | 1 |
| M | Church of the Holy Innocents | NO | YES | YES | NO | 2 |
| O | St. Malachy's Church | NO | NO | NO | YES | 1 |
| S | The Free Church of St. Mary the Virgin | NO | NO | NO | YES | 1 |
| T | Stephen A. Schwarzman Building | YES | YES | YES | NO | 3 |
| X | Rockefeller Center: Rockefeller Plaza | NO | NO | NO | YES | 1 |
| Y | Swedish Seamen's Church | NO | NO | NO | YES | 1 |
| Z | Grand Central Terminal | YES | YES | YES | NO | 3 |
| AA | Rockefeller Apartments | NO | NO | NO | YES | 1 |
| BB | St. Patrick's Cathedral | NO | NO | NO | YES | 1 |
| CC | St. Thomas Church and Parish House | NO | NO | NO | YES | 1 |
| DD | Fifth Ave Presbyterian Church | NO | NO | NO | YES | 1 |
| FF | St. Bartholomew's Church and Community House | NO | NO | NO | YES | 1 |
| GG | William Lescaze House and Office | YES | NO | NO | NO | 1 |

Table 5-1 (cont'd)
Tier 3 Assessment Results

| Map ID No. ¹ | Name | March 21 / Sept. 21 7:36 AM–4:29 PM | May 6 / August 6 6:27 AM–5:18 PM | June 21 5:57 AM–6:01 PM | December 21 8:51 AM–2:53 PM | Number of Analysis Days ² |
|--|--|--|-------------------------------------|----------------------------|--------------------------------|--------------------------------------|
| Historic Resources with Sun-Sensitive Features ³ , cont'd | | | | | | |
| HH | Beaux-Arts Apartments | NO | NO | YES | NO | 1 |
| II | Central Synagogue | NO | NO | NO | YES | 1 |
| JJ | Amster Yard | YES | NO | NO | NO | 1 |
| QQ | Metropolitan Koryo United Methodist Church | NO | NO | NO | YES | 1 |
| Notes: This table shows, for each resource, whether it could be potentially shaded, absent intervening buildings, on each of the four analysis days. 1) See Figure 5-1 . 2) Indicates the total number of analysis days out of the possible four for which the resource requires analysis. 3) At Tier 3 level of analysis, only the location of the historic resource is considered. The location and orientation of the specific sun-sensitive feature (e.g., windows) relative to the proposed building is not accounted for. If the resource footprint is in the sweep on at least one analysis day, it will be included in the next level of analysis, where a more detailed analysis will be conducted. | | | | | | |

Most of the remaining sun-sensitive resources could only receive project-generated shadow on one of the four analysis days. One resource is located in the shadow sweep on all four analysis days: a small strip of plaza a block to the west of the One Vanderbilt site (the resource is the Emigrant Savings Bank Plaza at 6 East 43rd Street, number 56 on **Figure 5-1**). Four other nearby resources are located in the shadow sweep on three of the four analysis days (the spring, summer, and fall days): to the west are Bryant Park¹; the New York Public Library's Stephen A. Schwarzman Building² Fifth Avenue façade and its Fifth Avenue steps and terrace, which function as public open space; and to the east are the west-facing windows of the main concourse of Grand Central Terminal.³ There are 15 other resources that could receive project-generated shadow on two of the four analysis days, and the remaining 83 resources could only receive project-generated shadow on one of the four analysis days.

In addition, a portion of the East River, a sunlight-sensitive natural resource, is located in the shadow sweep on two of the four analysis days.

The proposed public place adjacent to the proposed One Vanderbilt development would receive project-generated shadow on all four analysis days (not taking into account existing shadows).

D. DETAILED ANALYSIS

A detailed analysis was conducted to determine the extent and duration of project-generated incremental shadows that would fall on the sunlight-sensitive resources identified in the Tier 3 assessment (see **Table 5-2**). A baseline condition was established, containing existing buildings, the 15 FAR No-Action building, and known future developments planned in the study area, to illustrate the baseline shadows. The proposed One Vanderbilt development and its shadows was then compared with the baseline condition to determine the incremental shadows that would result with the proposed One Vanderbilt development.

¹ Bryant Park is also a New York City Scenic Landmark and listed on the State and National Registers of Historic Places (S/NR).

² The Stephen A. Schwartzman Building is S/NR listed, is a National Historic Landmark (NHL) and a New York City Landmark (NYCL).

³ NYCL, S/NR, NHL

Table 5-2

Incremental Shadow Durations on Sun-Sensitive Resources

| Analysis day and timeframe window | March 21 / Sept. 21 7:36 AM–4:29 PM | May 6 / August 6 6:27 AM–5:18 PM | June 21 5:57 AM–6:01 PM | December 21 8:51 AM–2:53 PM |
|---|--|---|--|--|
| Publicly Accessible Open Spaces | | | | |
| Bryant Park | 7:36 AM–8:20 AM Duration: 44 min | 7:05 AM–9:05 AM Duration: 2 hr | 7:40 AM–9:10 AM Duration: 1 hr 30 min | — |
| Stephen A. Schwarzman Building terrace | 8:00 AM–8:10 AM Duration: 10 min | 8:35 AM–9:00 AM Duration: 25 min | 8:30 AM–9:30 AM Duration: 1 hr | — |
| 1095 Sixth Ave. | 8:15 AM–8:25 AM Duration: 10 min | — | — | — |
| Grace Plaza | 8:45 AM–9:15 AM Duration: 25 min | — | — | — |
| 1155 Sixth Ave. | 9:36 AM–9:43 AM Duration: 7 min | — | — | — |
| 1166 Sixth Ave. | 10:23 AM–10:26 AM Duration: 3 min | — | — | — |
| Emigrant Savings Bank Plaza | — | — | 10:15 AM–10:35 AM Duration: 20 min | — |
| HarperCollins Plaza | — | — | — | 1:05 PM–1:10 PM Duration: 5 min |
| Park Ave. Center Plots | Between E. 48th/49th Sts. 2:00 PM–2:15 PM Duration: 15 min Between E. 47th/48th Sts. 2:00 PM–2:20 PM Duration: 20 min Between E. 46th/47th Sts. 2:05 PM–2:30 PM Duration: 25 min | — | — | Between E. 56th/59th Sts. 2:15 PM–2:20 PM Duration: 5 min |
| Westvaco Building 299 Park Ave. | 2:10 PM–2:35 PM Duration: 25 min | — | — | — |
| 275 Park Ave. | 2:15 PM–2:45 PM Duration: 30 min | — | — | — |
| 245 Park Ave. | — | 2:25 PM–2:30 PM Duration: 5 min | — | — |
| Seagram Building | — | — | — | 2:30 PM–2:38 PM Duration: 8 min |
| 345 Park Ave. | — | — | — | 2:35 PM–2:40 PM Duration: 5 min |
| Dag Hammarskjöld Plaza | — | 4:35 PM–4:55 PM Duration: 20 min | — | — |
| General Douglas MacArthur Park | — | 5:05 PM–5:10 PM Duration: 5 min | — | — |
| 320 E. 46th St. | — | — | 5:13 PM–5:18 PM Duration: 5 min | — |
| <u>Four Freedoms Park</u> | ≡ | <u>5:17 PM–5:18 PM</u> Duration: 1 min | ≡ | ≡ |
| Gantry Plaza State Park | — | — | 6:00 PM–6:01 PM Duration: 1 min | — |
| Historic Resources with Sun-Sensitive Features | | | | |
| Stephen A. Schwarzman Building Fifth Ave. façade | — | 8:15 AM–8:50 AM Duration: 35 min | 8:05 AM–9:25 AM Duration: 1 hr 20 min | — |
| Swedish Seamen's Church front façade | — | — | — | 12:40 PM–12:50 PM Duration: 10 min |
| St. Patrick's Cathedral south façade | — | — | — | Clerestory window: 1:10 PM–1:20 PM Duration: 10 min Lady Chapel window: 1:25 PM–1:30 PM Duration: 5 min |
| Grand Central Terminal main concourse west windows | 2:50 PM–3:35 PM Duration: 45 min | 1:50 PM–3:05 PM Duration: 1 hr 15 min | 1:35 PM–2:35 PM Duration: 1 hr | — |
| St. Bartholomew's Church | — | — | — | 2:37 PM–2:44 PM Duration: 7 min |
| Natural Resources | | | | |
| East River | — | 4:55 PM–5:18 PM Duration: 23 min | 5:15 PM–6:01 PM Duration: 46 min | — |

Notes:

Table indicates entry and exit times and total duration of incremental shadow for each sunlight-sensitive resource. Daylight saving time is not used—times are Eastern Standard Time, per *CEQR Technical Manual* guidelines. However, as Eastern Daylight Time is in effect for the March/September, May/August and June analysis periods, add one hour to the given times to determine the actual clock time.

As noted above, in order to conduct a conservative, worst-case analysis, the 3D model of the proposed One Vanderbilt development has a 10-foot maximum zoning envelope, ensuring that the building that would actually be built could never exceed this model in any one dimension. However, this means that the building that would be built is guaranteed to be smaller in total bulk than the model presented here.

Three-dimensional representations of the existing buildings in the study area were developed using data obtained from NYC DoITT, Fugro Earthdata, and photos taken during study area visits, and were added to the three-dimensional model used in the Tier 3 assessment. Shadows are in constant movement. The computer simulation software produces an animation showing the movement of shadows over the course of each analysis period. The analysis determines the time when incremental shadow would enter each resource, and the time it would exit. **Figures 5-6 to 5-22** document the results of the analysis by providing graphic representations from the computer animation of times when incremental shadow would fall on a sun-sensitive resource. The figures illustrate the extent of additional, incremental shadow at that time, highlighted in red, and also show existing shadow and remaining areas of sunlight.

Shadow analyses were performed for each of the representative days and analysis periods indicated in the Tier 3 assessment.

Regarding the proposed public place that would be developed on Vanderbilt Avenue between East 42nd and East 43rd Streets, the *CEQR Technical Manual* states that a project-generated open space can never be considered to experience a significant adverse shadow impact from a project, because without the project the open space would not exist. However, the detailed analysis included a consideration of shadows and their potential effects on the proposed public place for informational purposes.

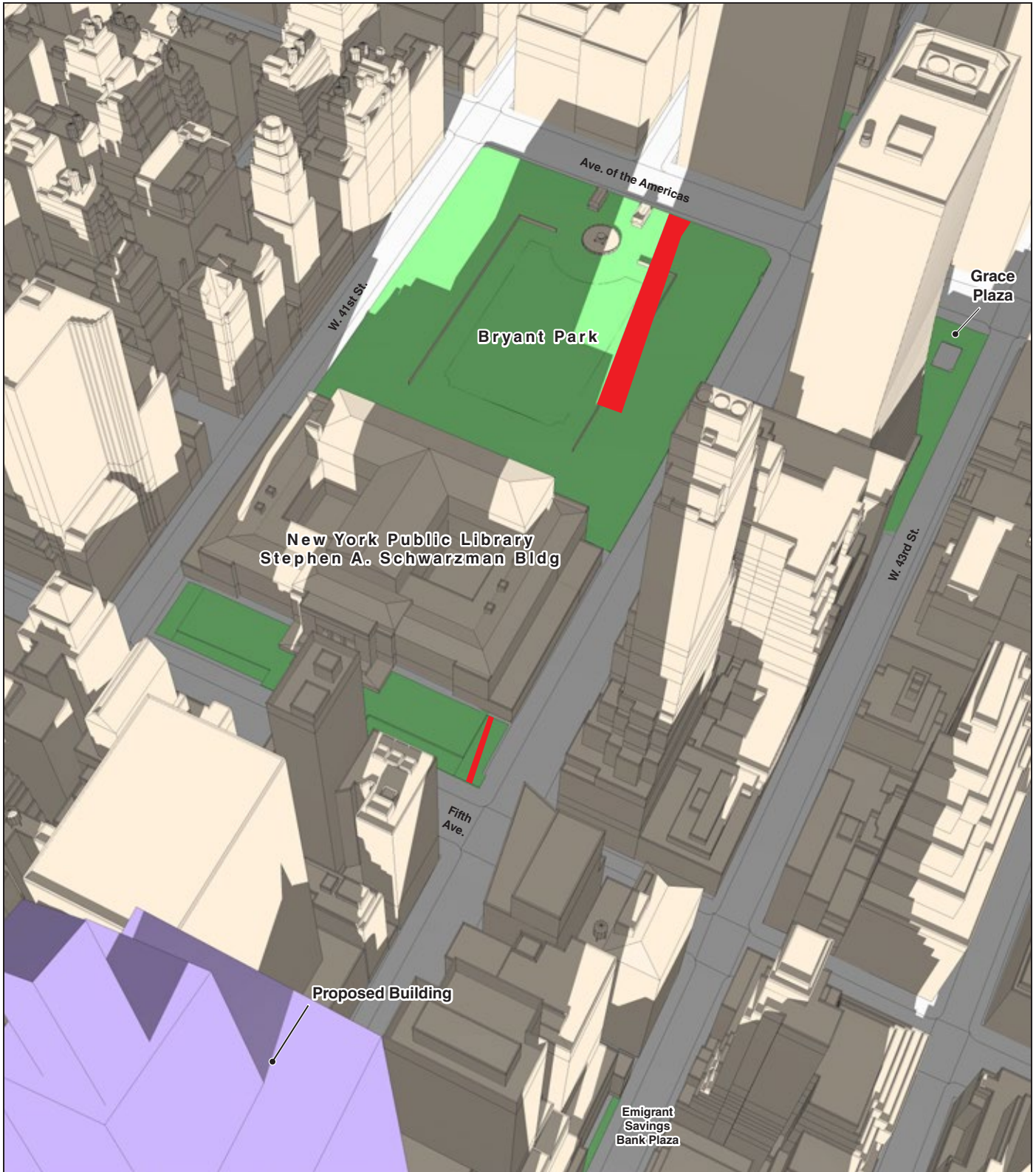
MARCH 21/SEPTEMBER 21

March is considered the beginning of the growing season in New York City, and September 21, which has the same shadow patterns as March 21, is also within the growing season. Shadows on March 21 and September 21 are of moderate length.

Shadows fall west-northwest at the start of the analysis day at 7:36 AM. The proposed One Vanderbilt development would cast a narrow area of new shadow on the western part of Bryant Park, falling primarily on the Fountain Terrace area (see **Figure 5-23**, which shows a plan of Bryant Park and its amenities). The area of new shadow would remain small as it moves roughly clockwise, across the Fountain Terrace and a small portion of the adjacent Lawn, to the northwest of the park and then to the north, moving across the 42nd Street Allée area and the pétanque court, and would exit at 8:20 AM (see **Figure 5-6** showing 8:00 AM). There would be sunlit areas of the park throughout this 44-minute period.

Incremental shadow would remove the remaining narrow strip of sunlight on the Stephen A. Schwarzman Building Fifth Avenue terrace at 8:00 AM, but only for 10 minutes (see **Figure 5-6**). A small area of sun at the northwest corner of the plaza at 1095 Sixth Avenue would be eliminated by incremental shadow from 8:15 AM to 8:25 AM.

The proposed One Vanderbilt development's shadow would pass across the Grace Plaza at West 43rd Street and Sixth Avenue between 8:45 AM and 9:15 AM, eliminating the only sunlight, albeit a small rectangle in the corner, between 8:55 AM and 9:10 AM (see **Figure 5-7**).



- Proposed Building
- Publicly-Accessible Open Space
- Incremental Shadow on Sun-Sensitive Resource

Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

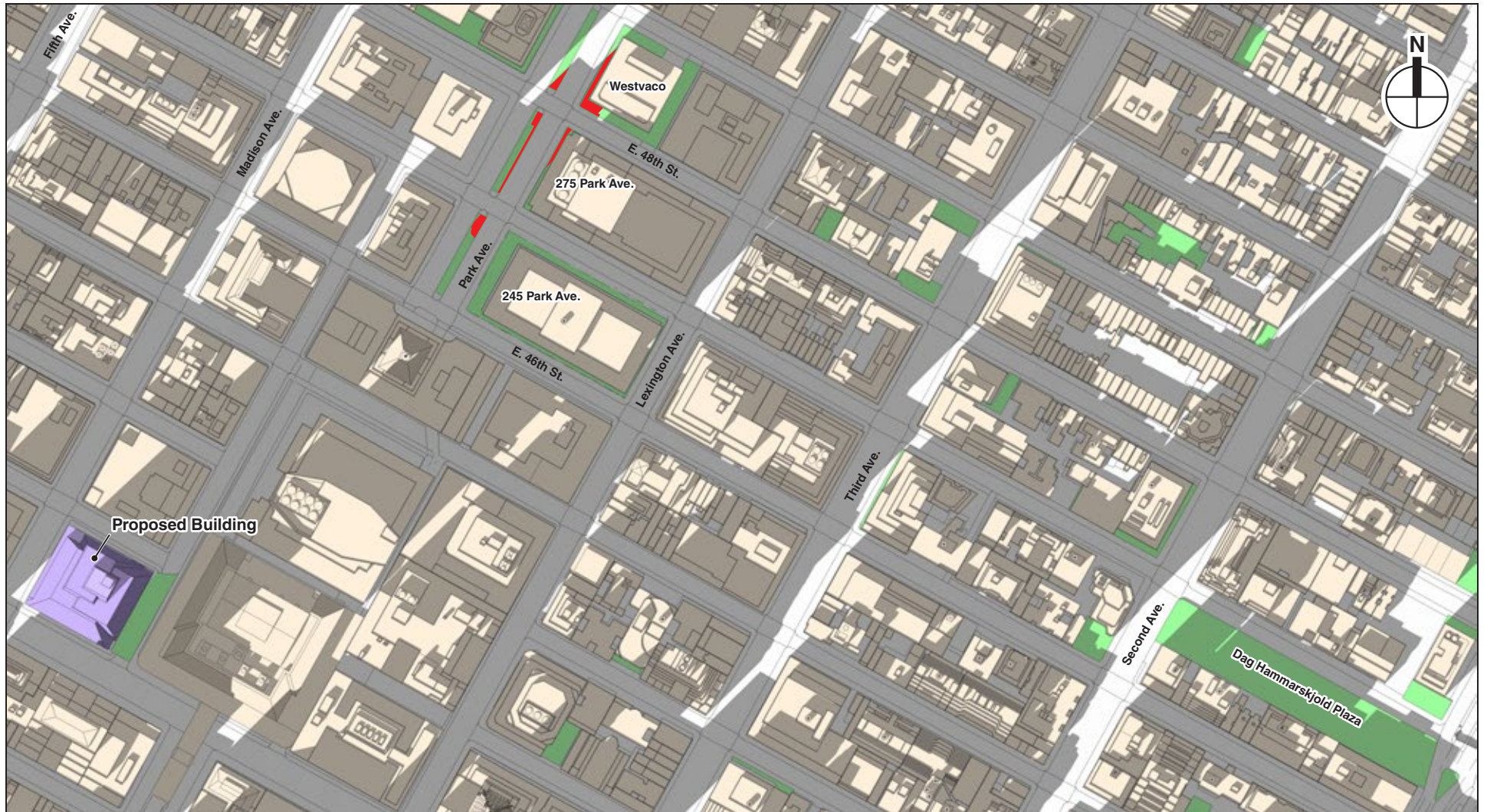
March 21 / Sept. 21 - 8:00 AM EST
View West
Figure 5-6






- Proposed Building
- Publicly-Accessible Open Space
- Incremental Shadow on Sun-Sensitive Resource

Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

March 21 / Sept. 21 - 9:00 AM EST
View West
Figure 5-7



-  Proposed Building
-  Publicly-Accessible Open Space
-  Incremental Shadow on Sun-Sensitive Resource



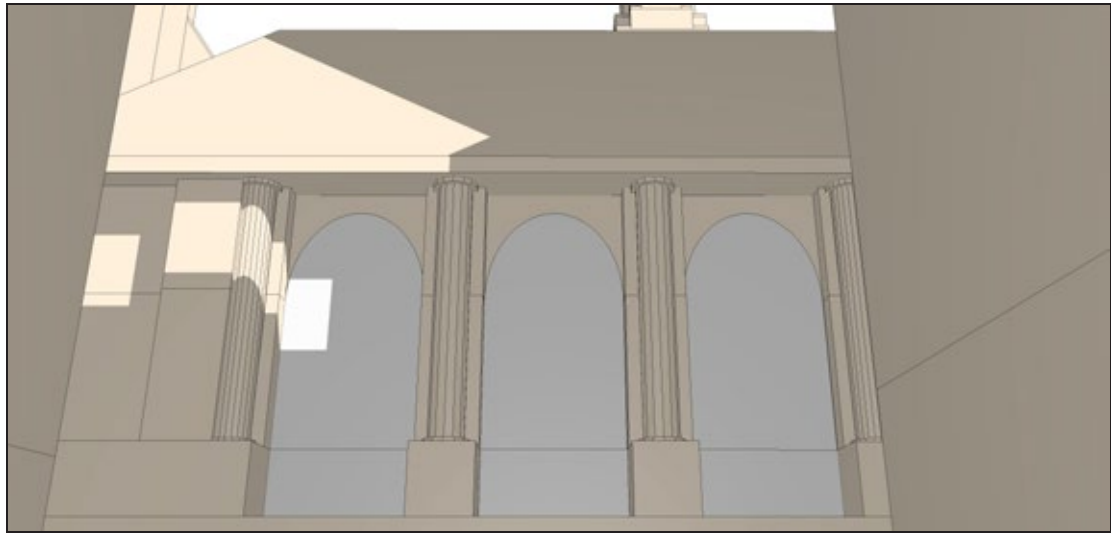
Vanderbilt Corridor and One Vanderbilt

This figure has been updated for the FEIS

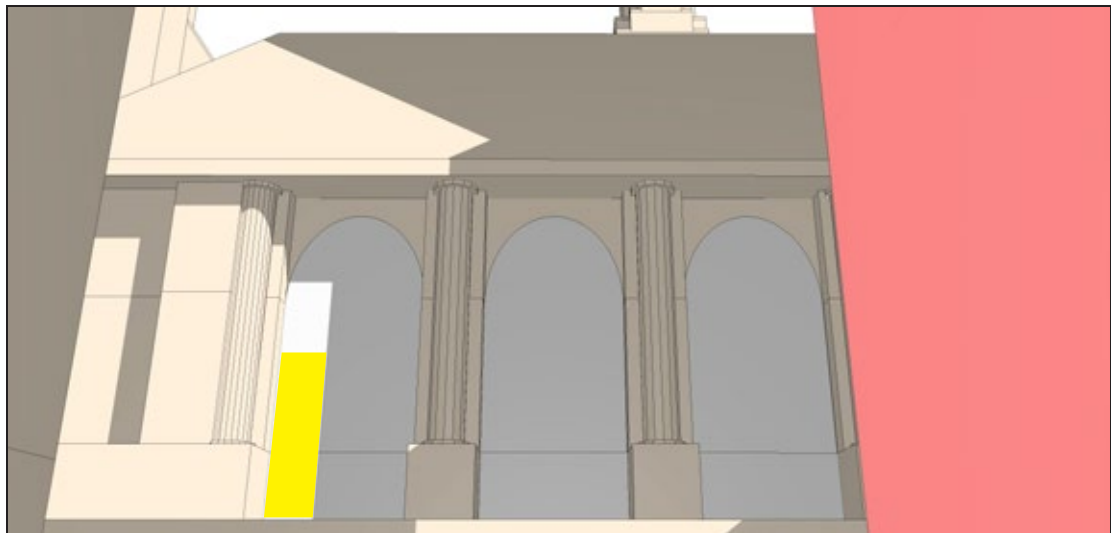
March 21 / Sept. 21 - 2:15 PM EST
Figure 5-8

2:50 PM EST

3.18.15



Existing



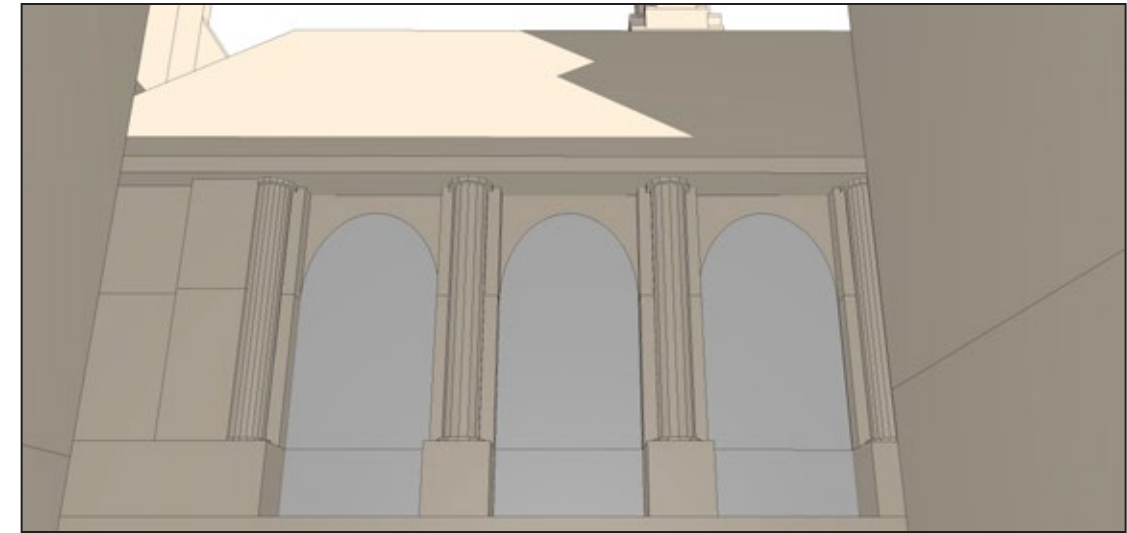
No Action



Proposed



3:05 PM EST



Existing



No Action

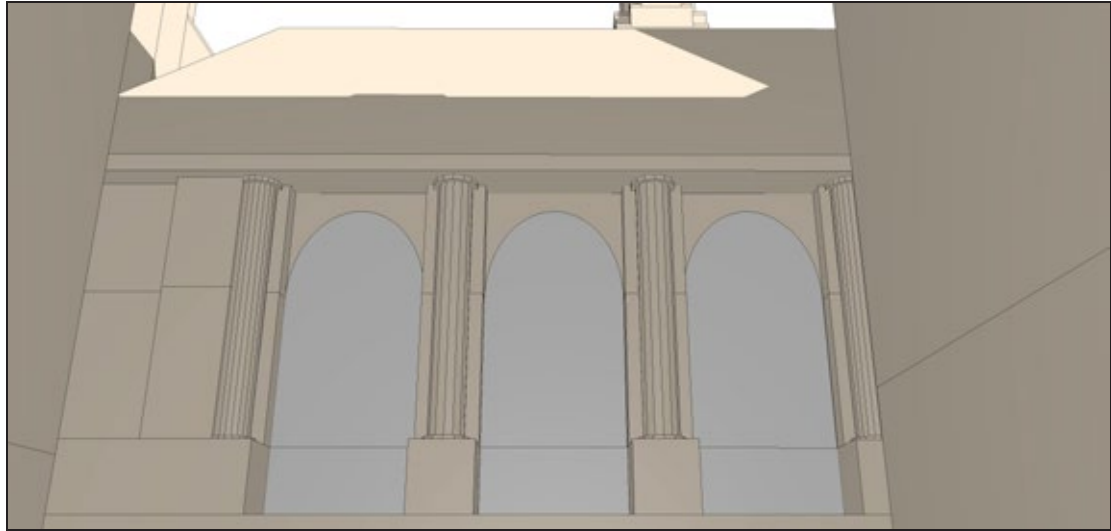


Proposed

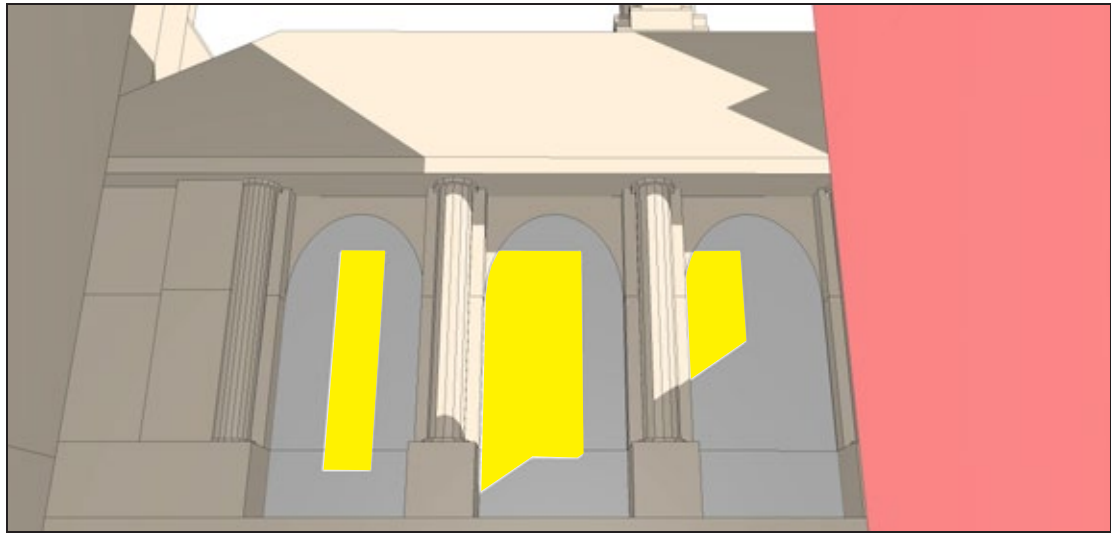
Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

3:20 PM EST

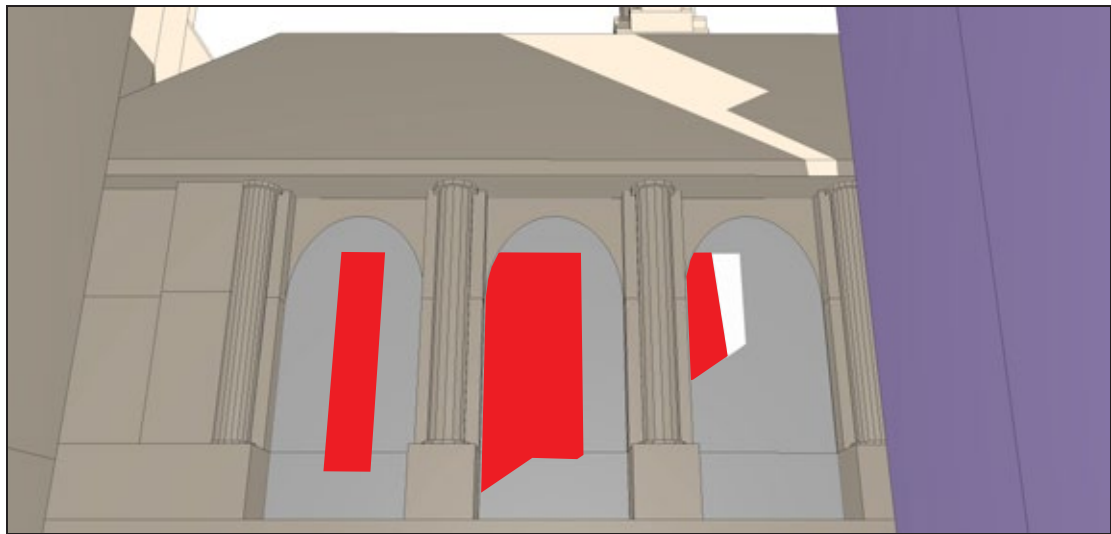
3.18.15



Existing



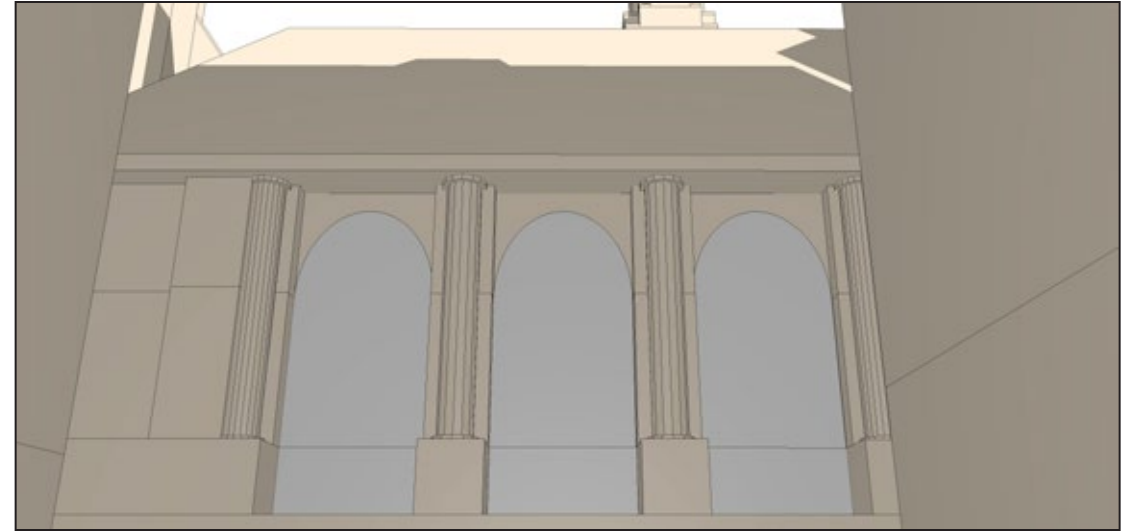
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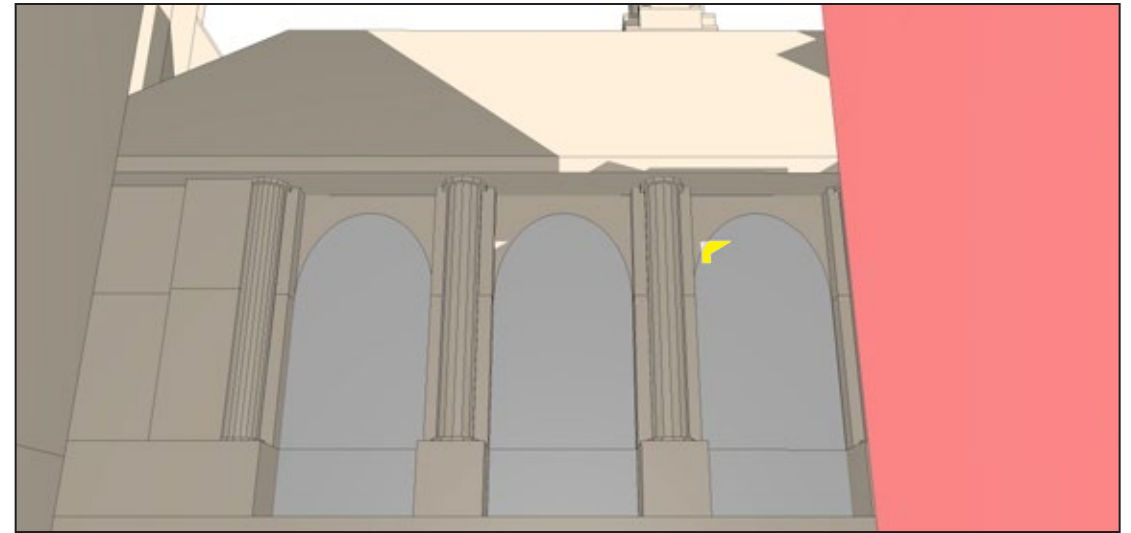
Proposed



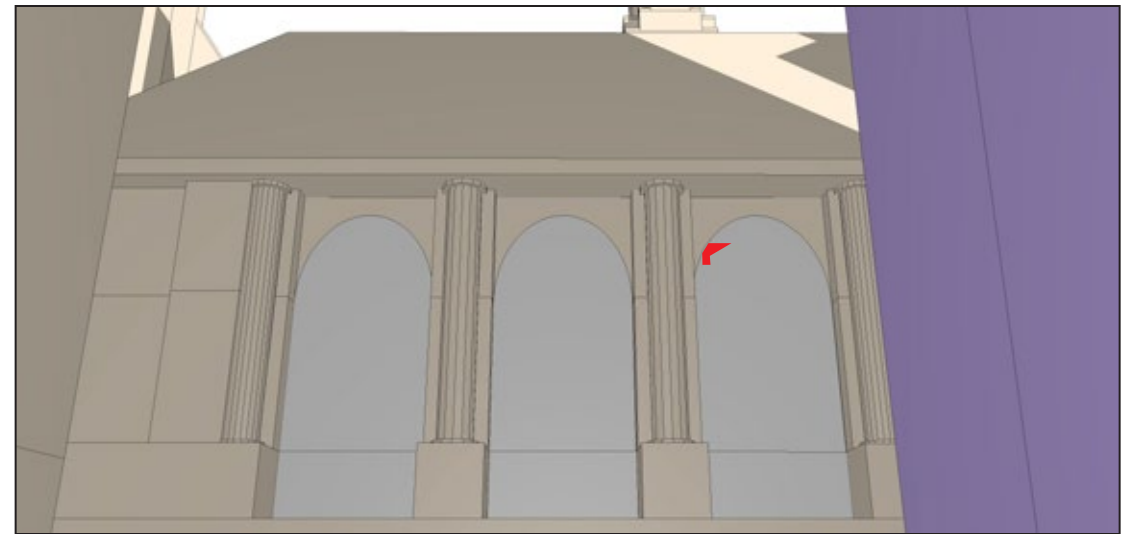
3:35 PM EST



Existing



No Action



Proposed

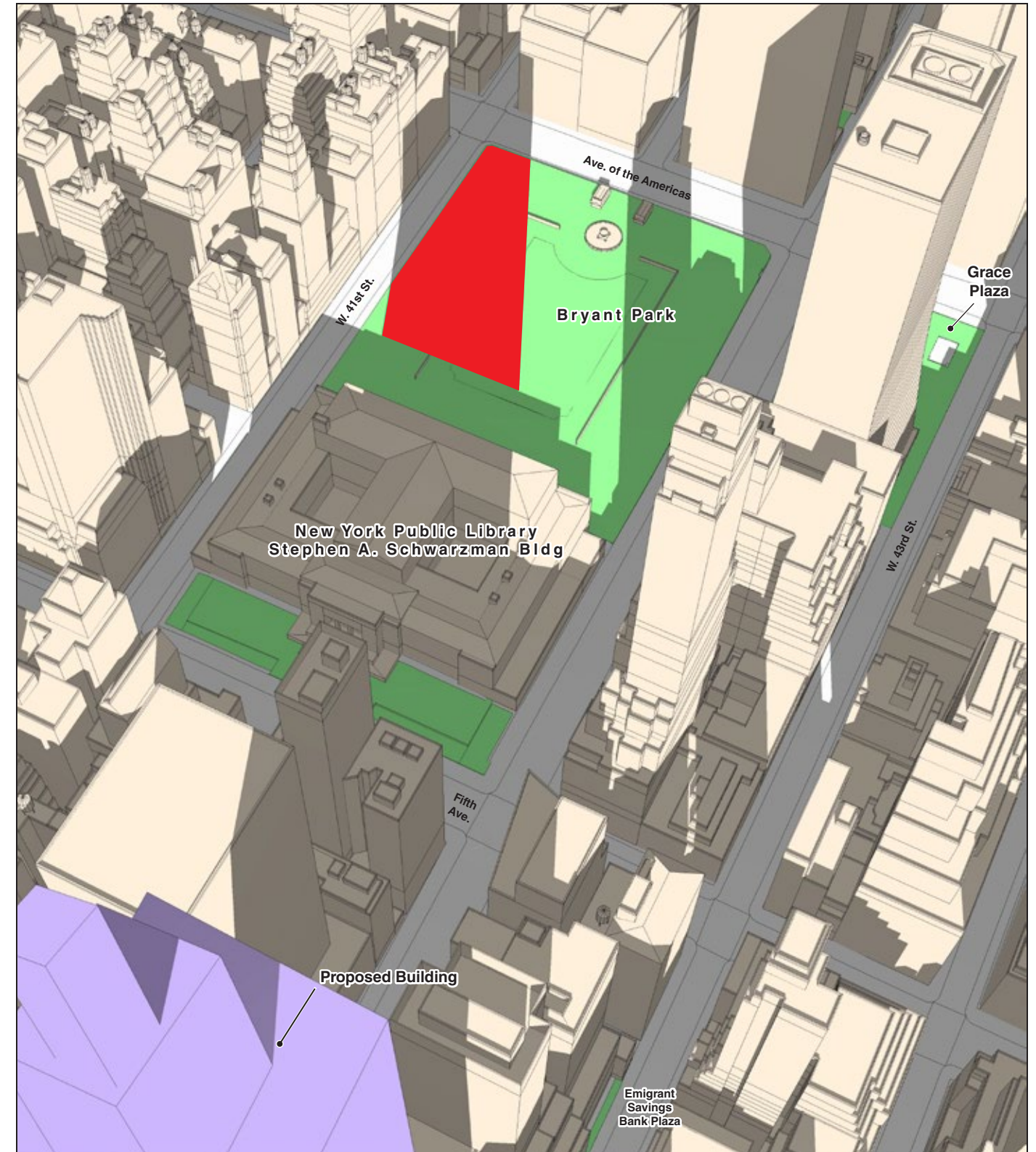
Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

3.18.15

7:20 AM EST



7:50 AM EST



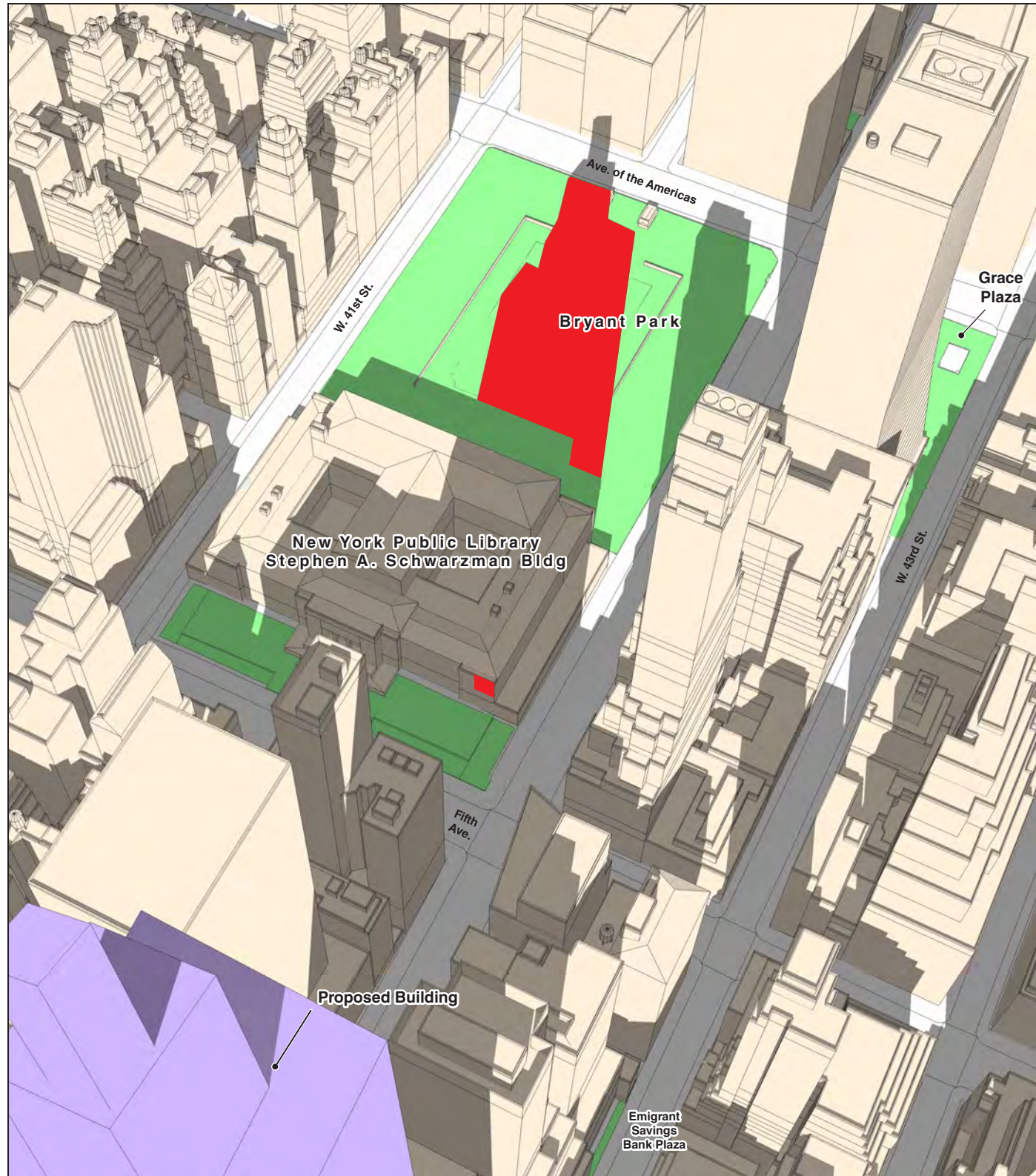
- Proposed Building
- Publicly-Accessible Open Space
- Incremental Shadow on Sun-Sensitive Resource

Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

May 6 / August 6
View West
Figure 5-11

3.18.15

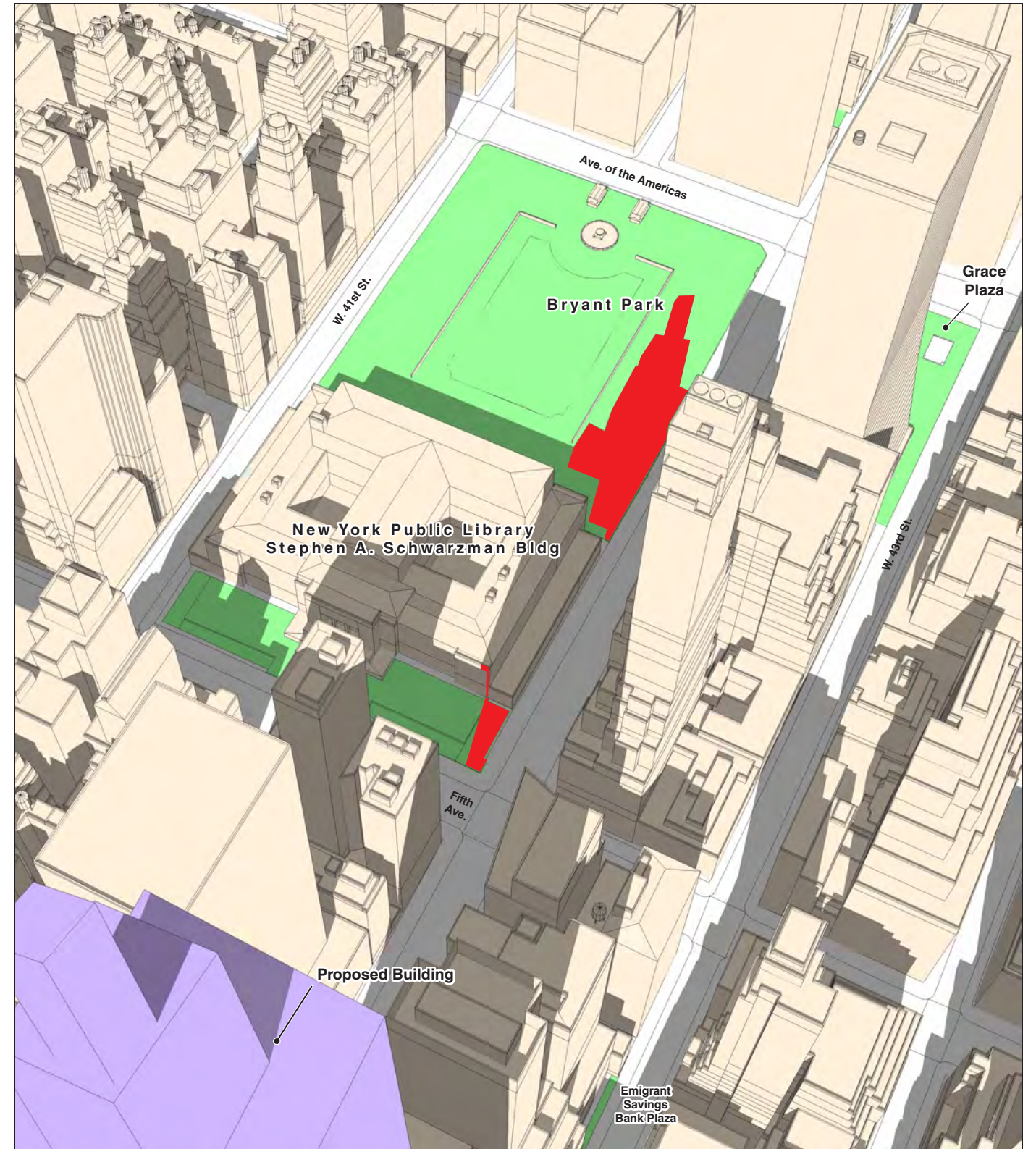
8:20 AM EST



- Proposed Building
- Publicly-Accessible Open Space
- Incremental Shadow on Sun-Sensitive Resource

Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

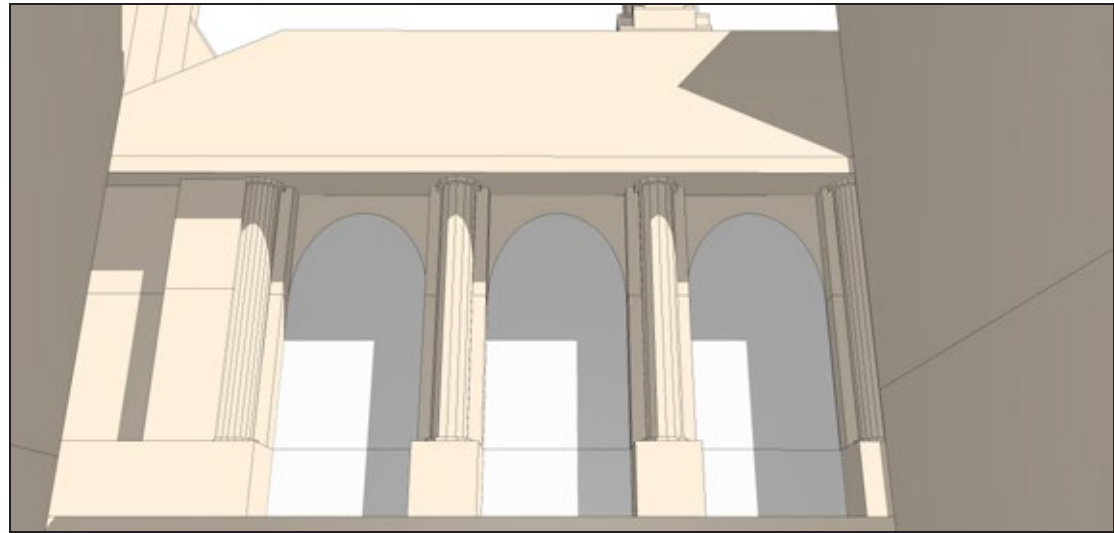
8:50 AM EST



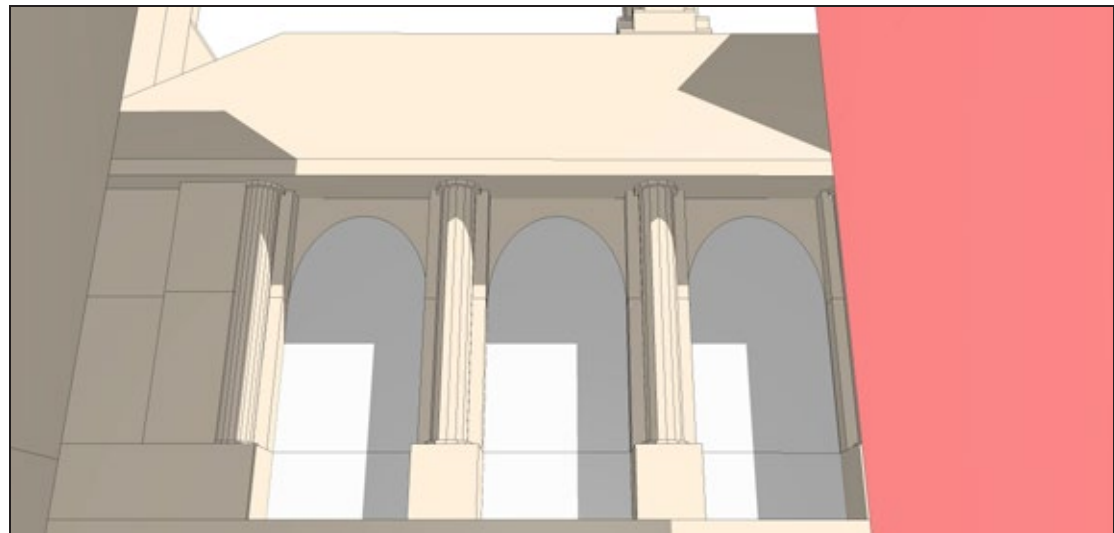
May 6 / August 6
View West
Figure 5-12

3.18.15

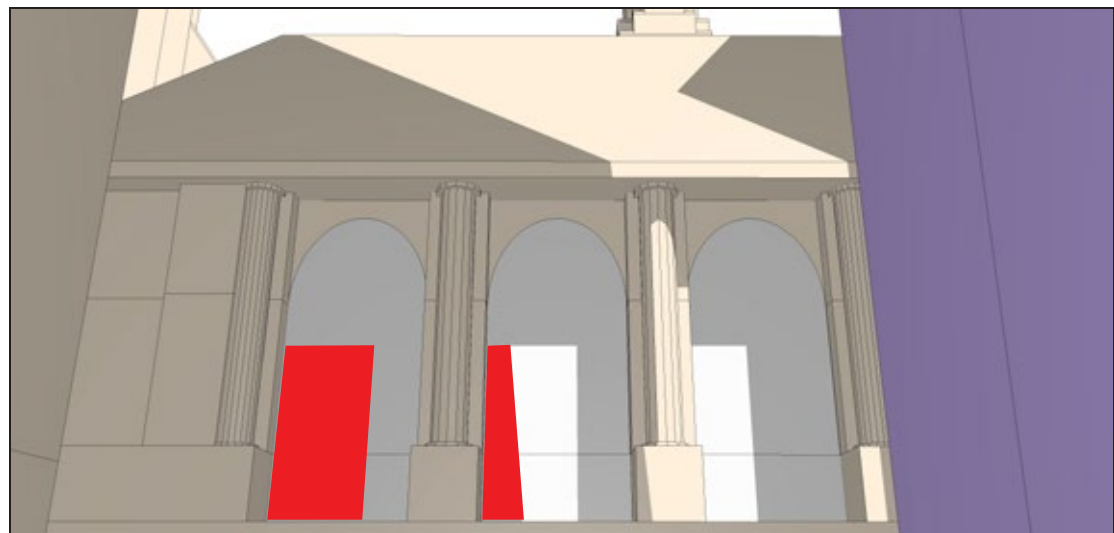
2:00 PM EST



Existing



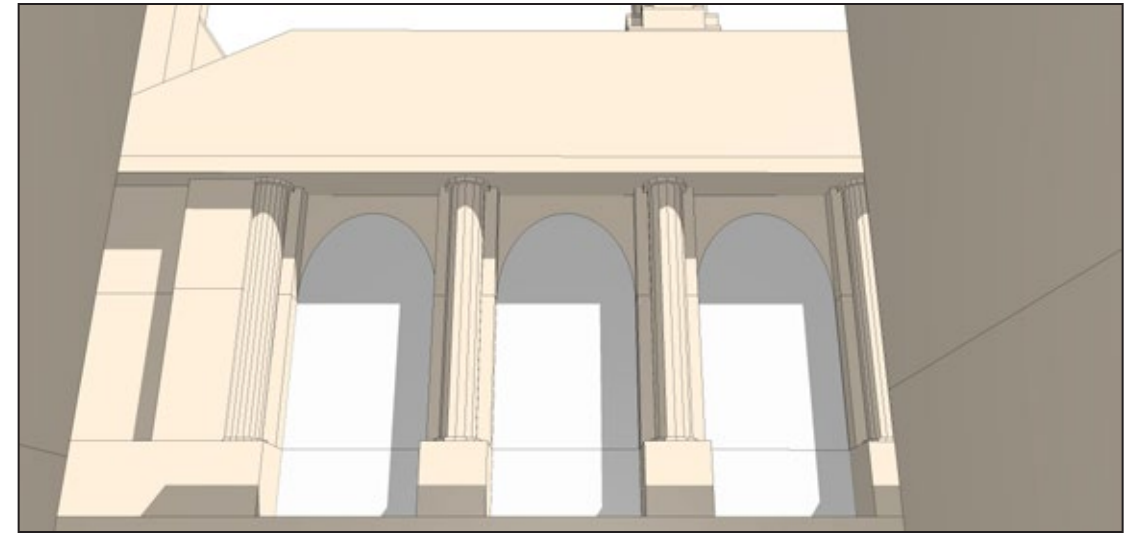
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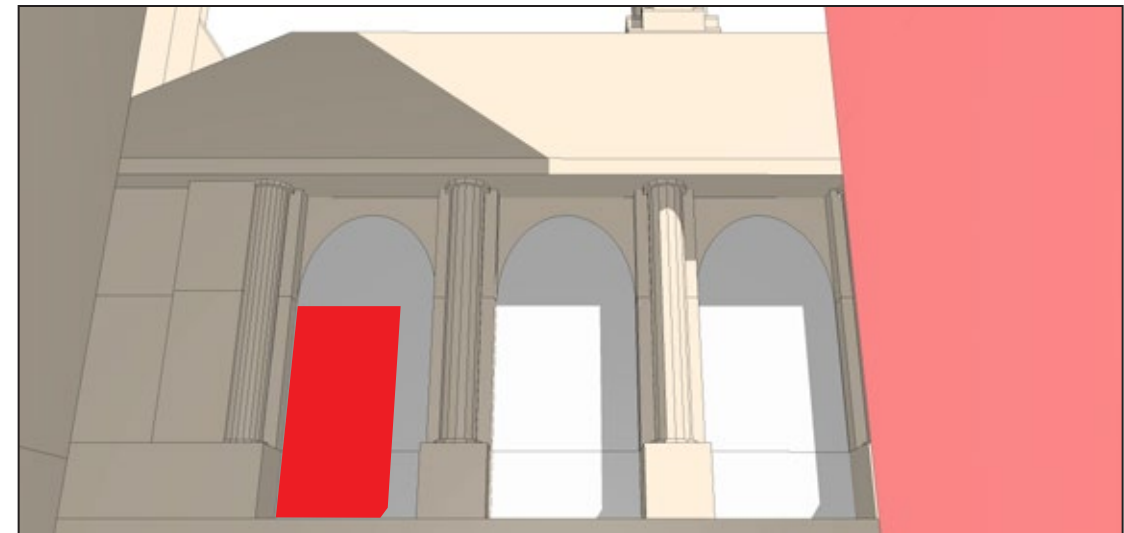
Proposed



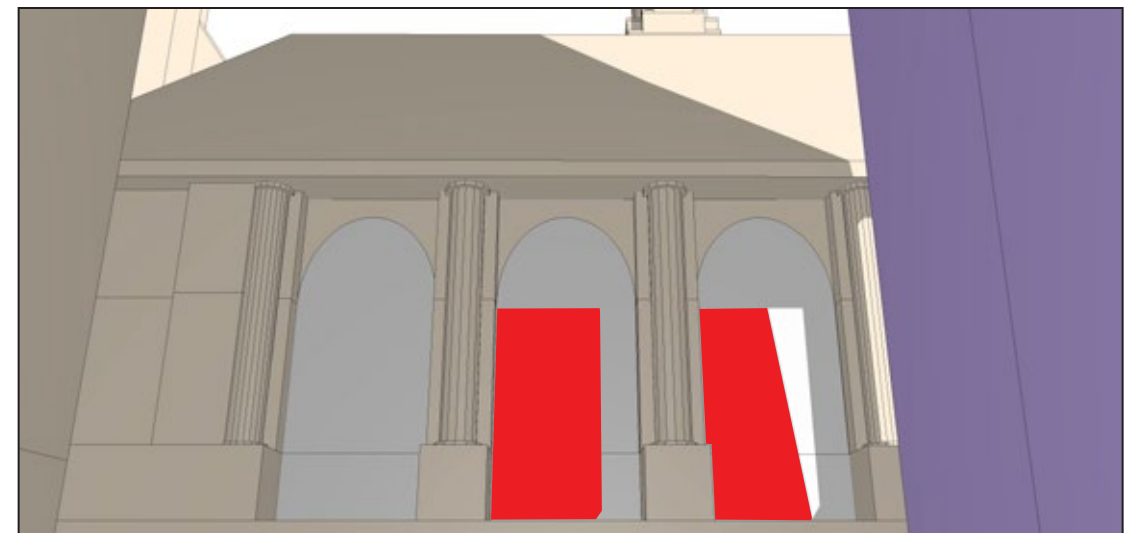
2:20 PM EST



Existing



No Action

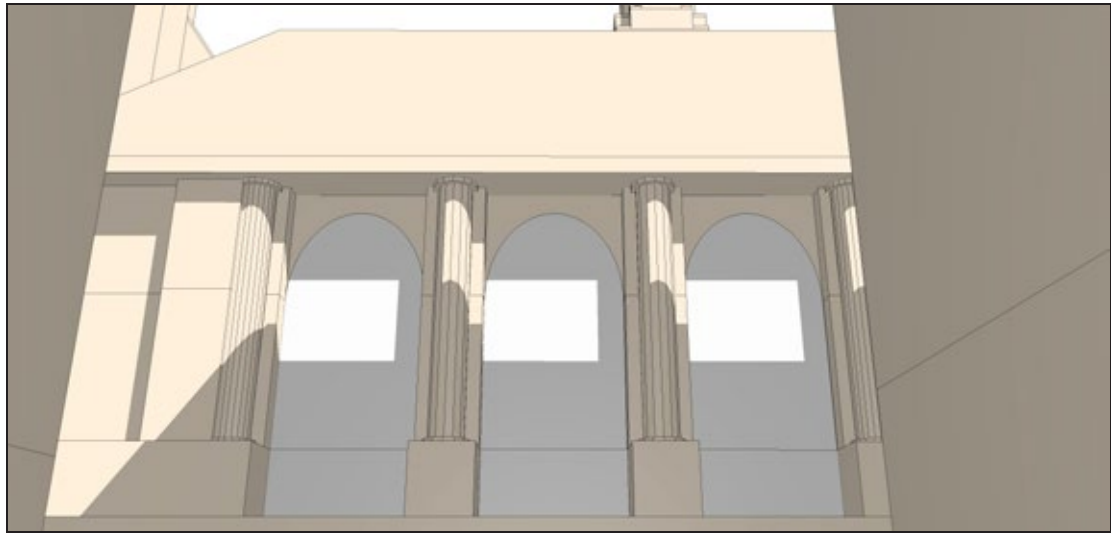


Proposed

Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

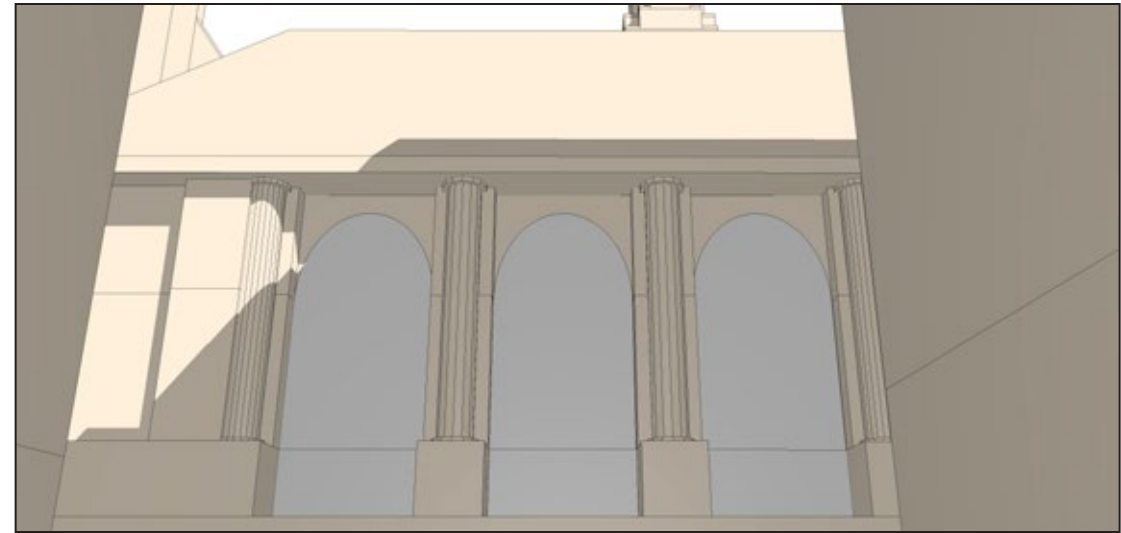
2:40 PM EST

3.18.15

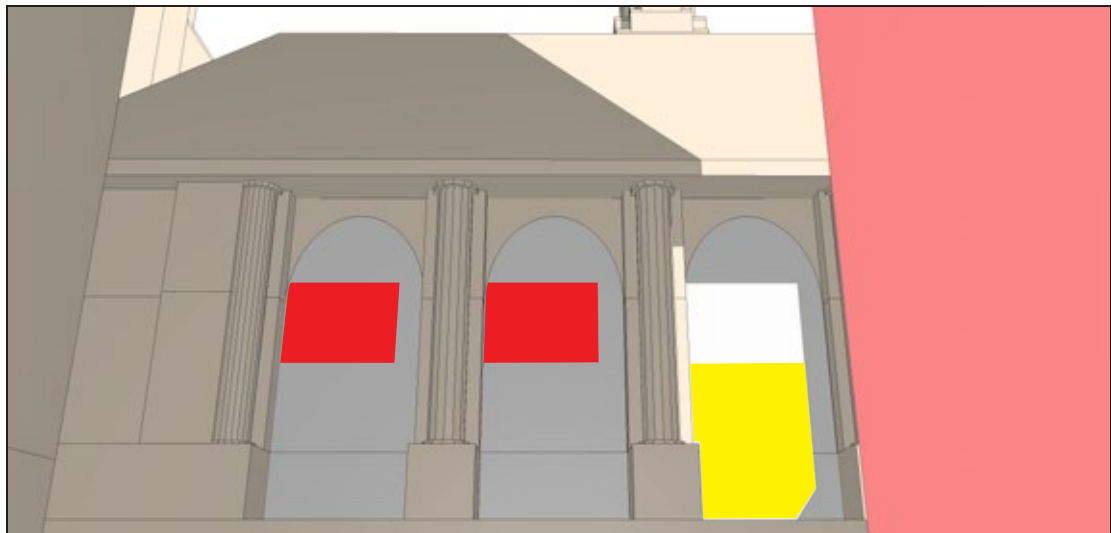


Existing

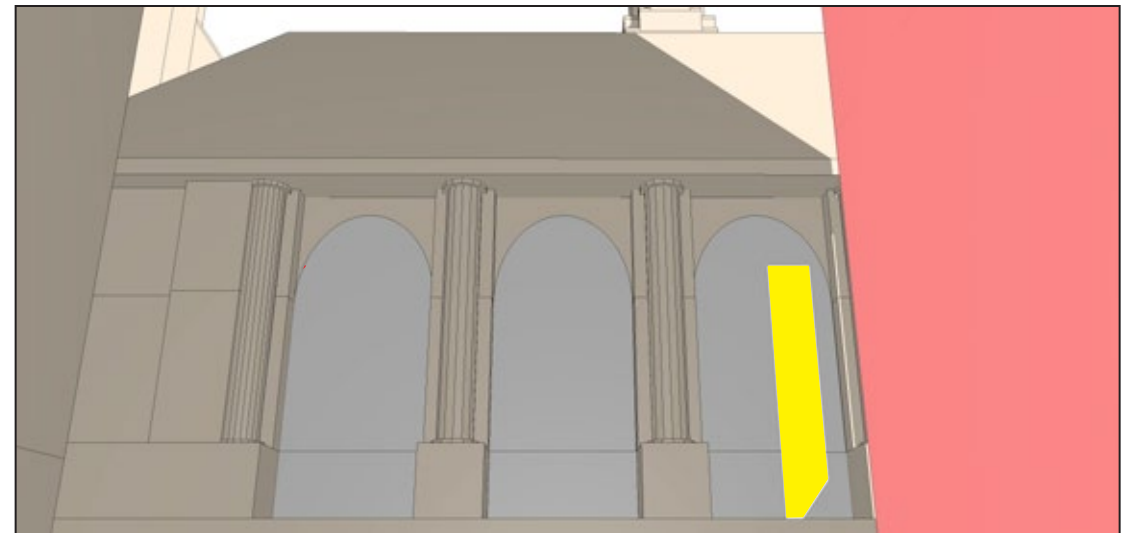
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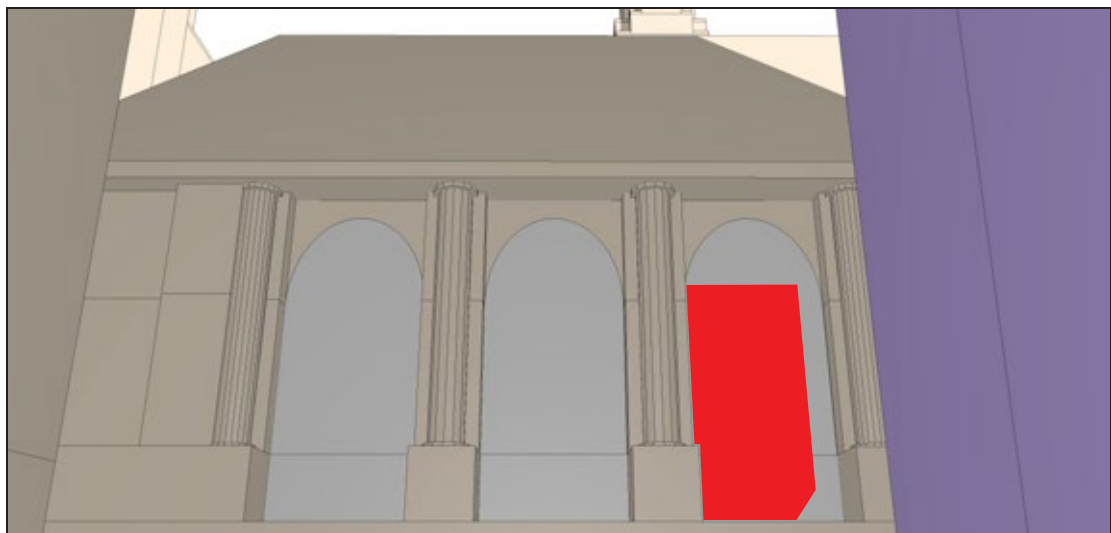
Existing



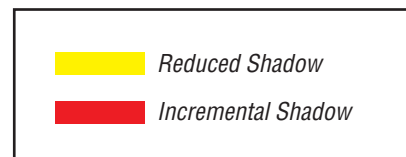
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No Action






Proposed



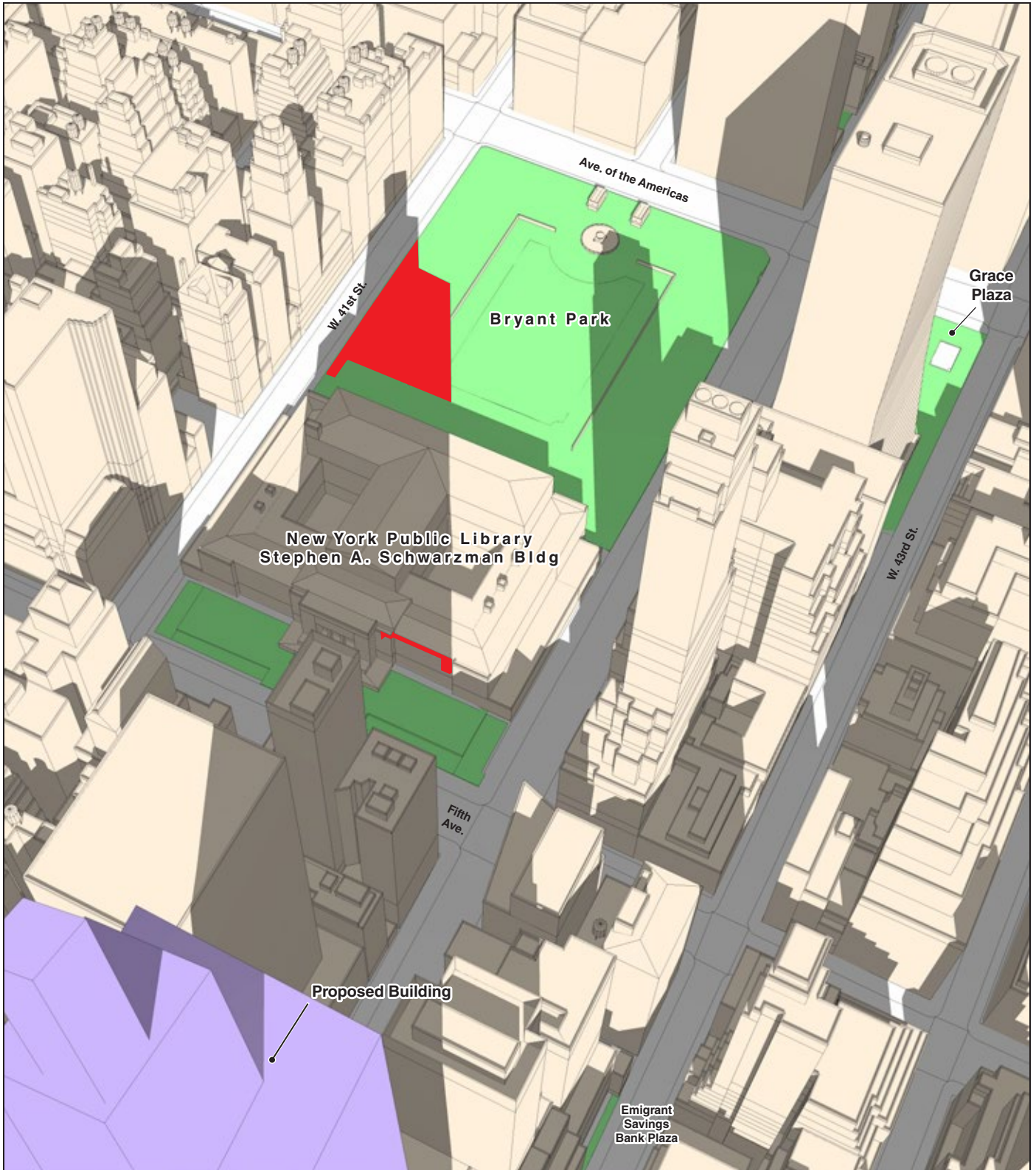
Proposed

Daylight Savings Time was not used, per CEQR Technical Manual guidelines.



-  Proposed Building
-  Publicly-Accessible Open Space
-  Incremental Shadow on Sun-Sensitive Resource





- Proposed Building
- Publicly-Accessible Open Space
- Incremental Shadow on Sun-Sensitive Resource

Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

June 21 - 8:15 AM EST
View West
Figure 5-16

Vanderbilt Corridor and One Vanderbilt

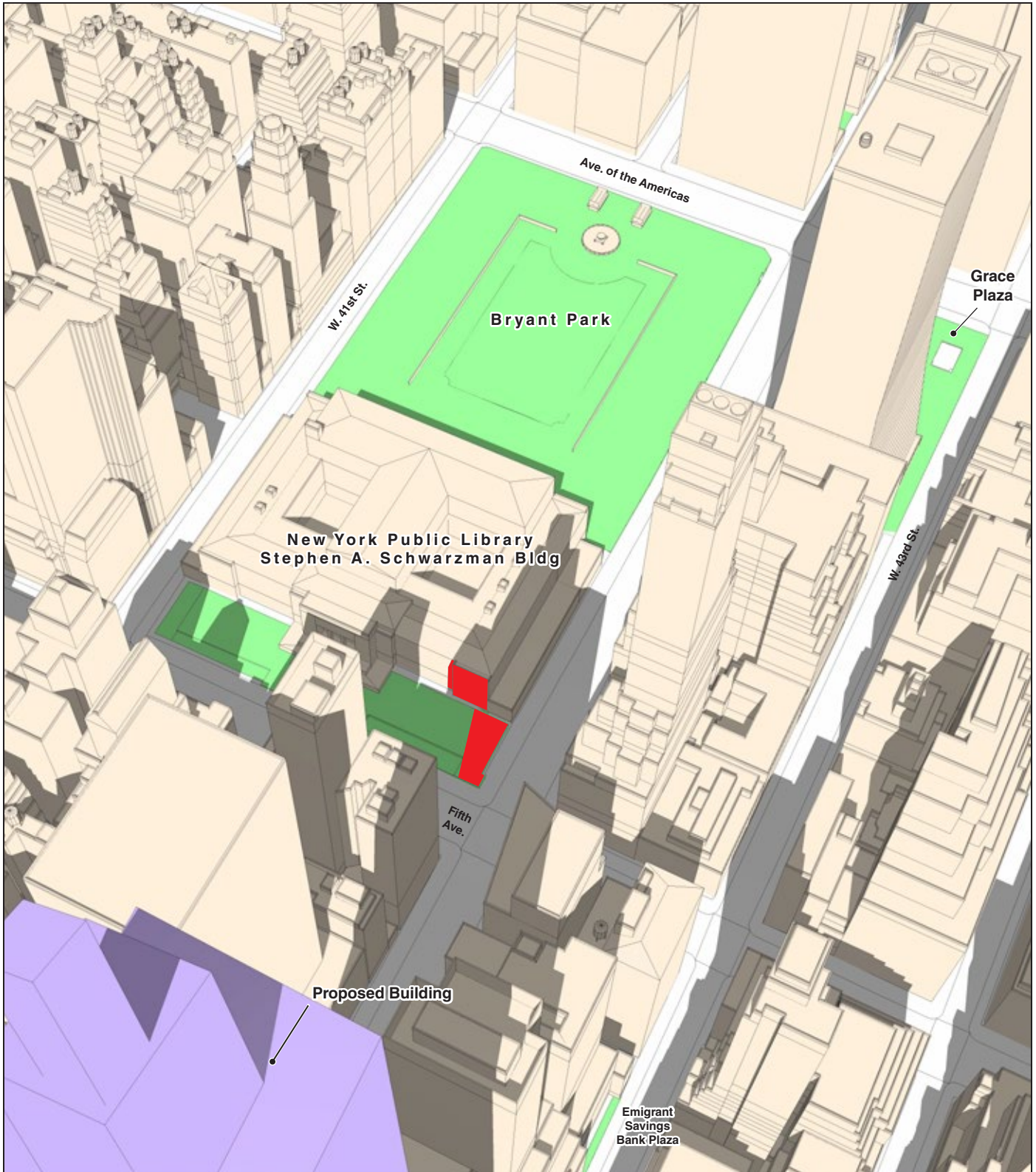
This figure has been updated for the FEIS



- Proposed Building
- Publicly-Accessible Open Space
- Incremental Shadow on Sun-Sensitive Resource

Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

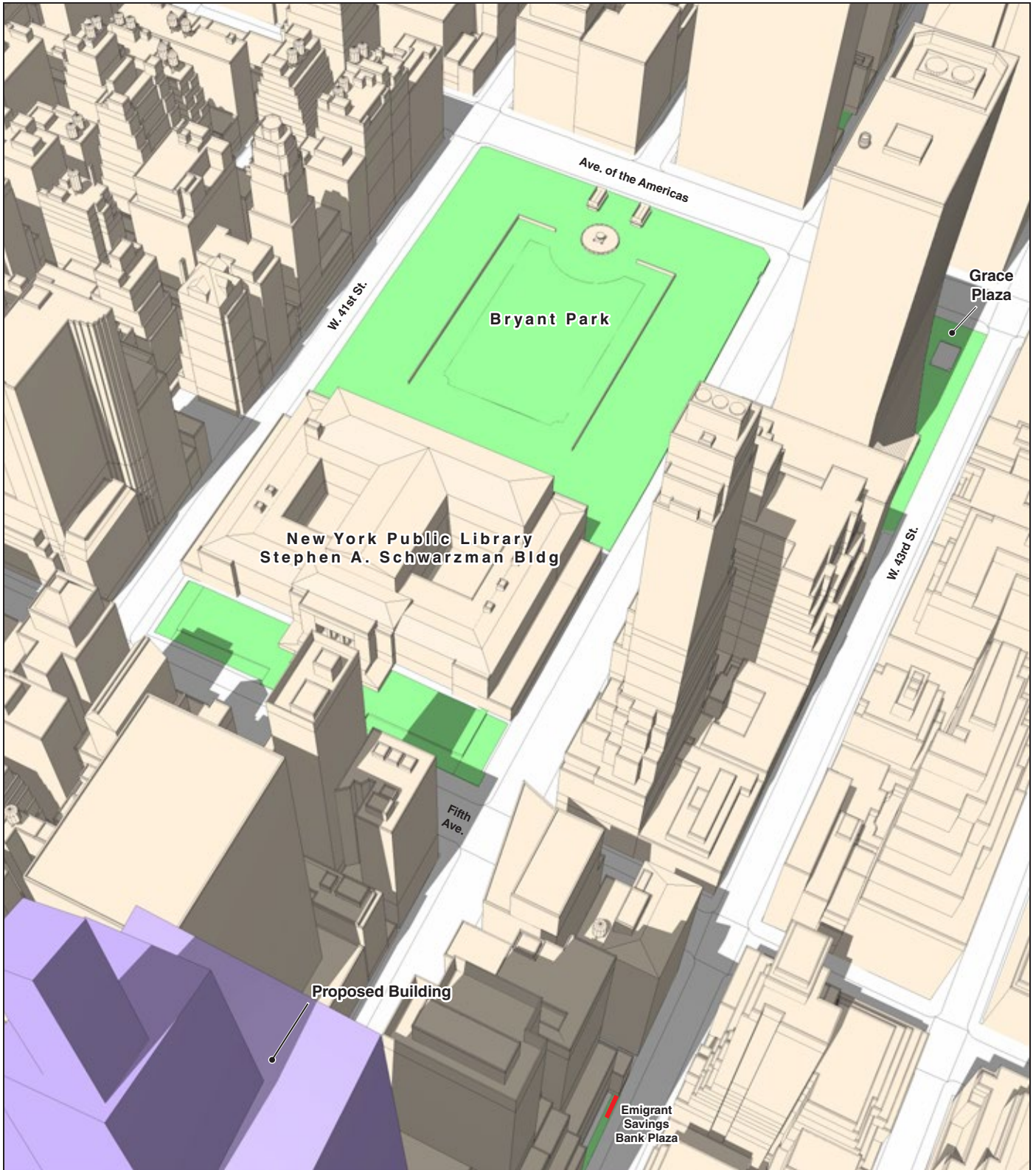
June 21 - 8:45 AM EST
View West
Figure 5-17



- Proposed Building
- Publicly-Accessible Open Space
- Incremental Shadow on Sun-Sensitive Resource

Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

June 21 - 9:15 AM EST
View West
Figure 5-18



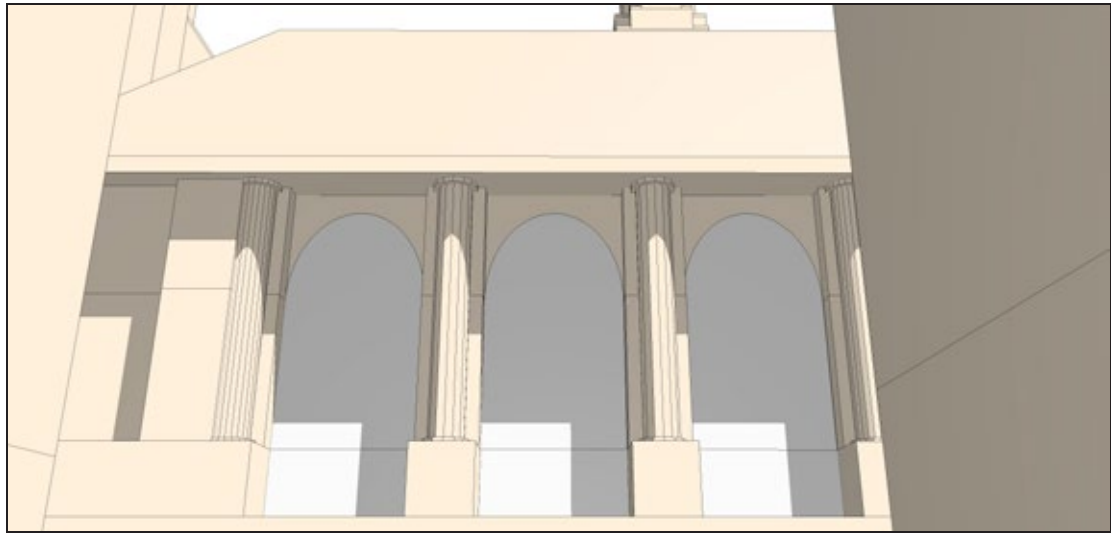
- Proposed Building
- Publicly-Accessible Open Space
- Incremental Shadow on Sun-Sensitive Resource

Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

June 21 - 10:30 AM EST
View West
Figure 5-19

1:35 PM EST

3.18.15



Existing



No Action



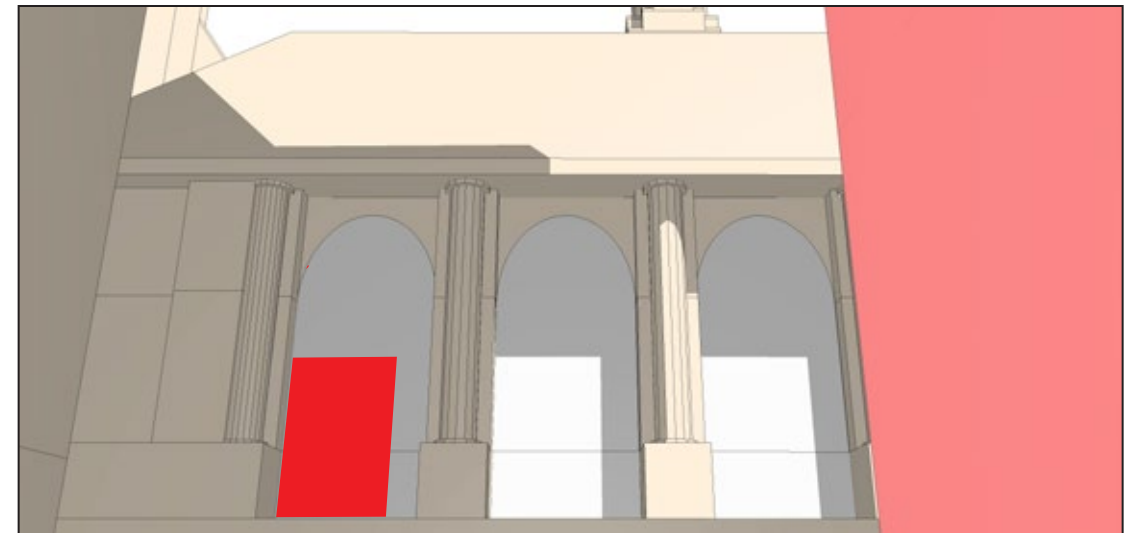
Proposed



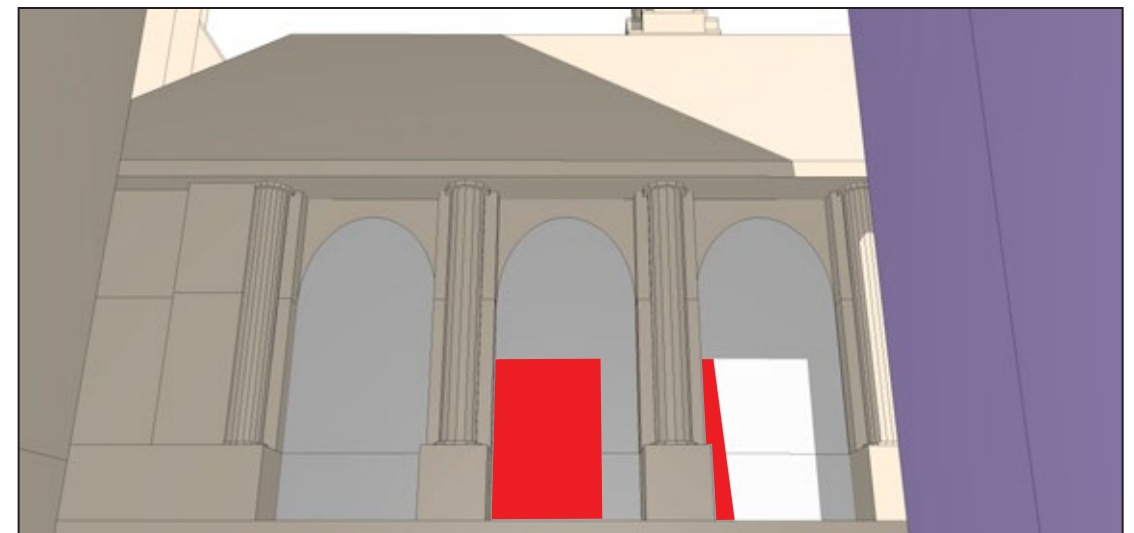
1:55 PM EST



Existing



No Action



Proposed

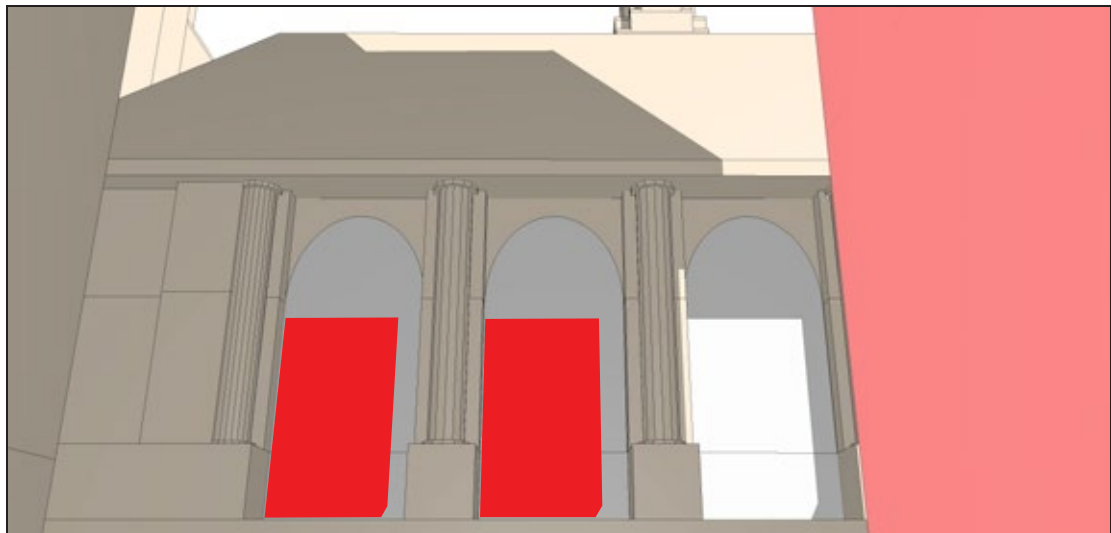
Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

2:15 PM EST

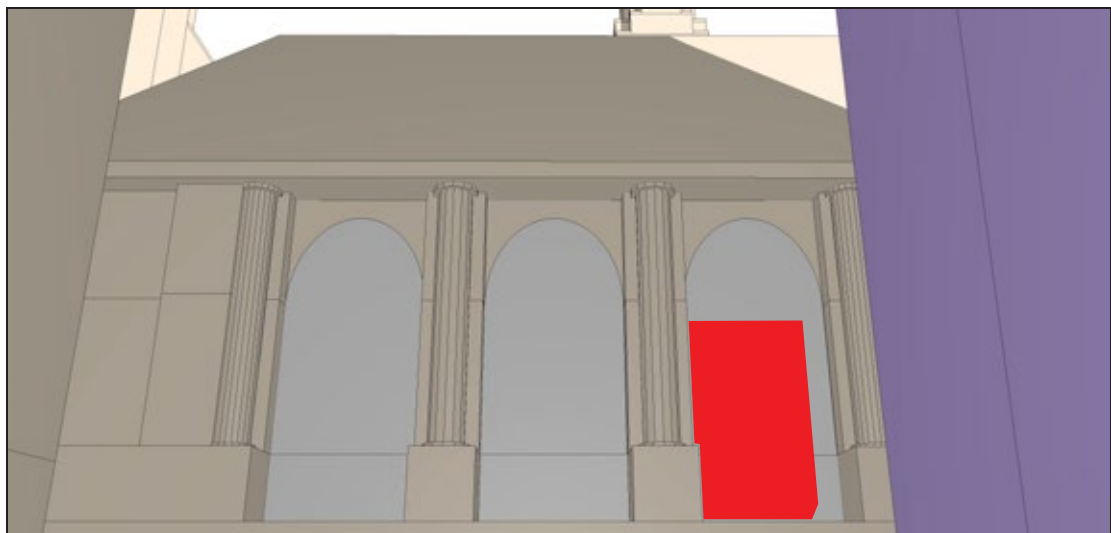
3.18.15



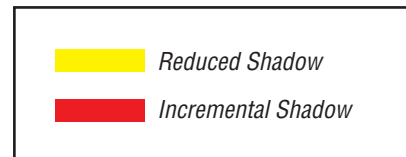
Existing



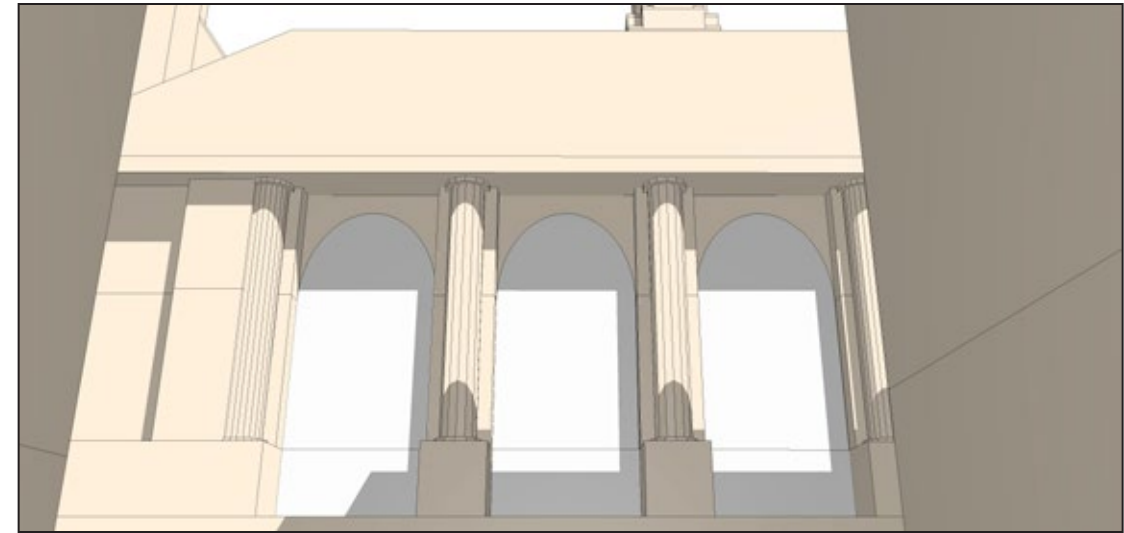
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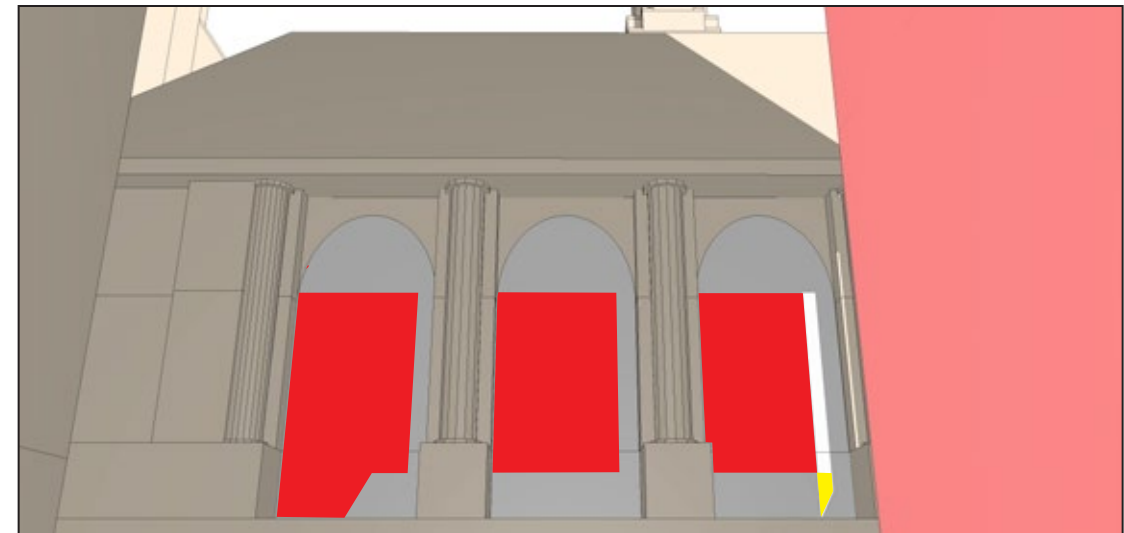
Proposed



2:35 PM EST



Existing



No Action



Proposed

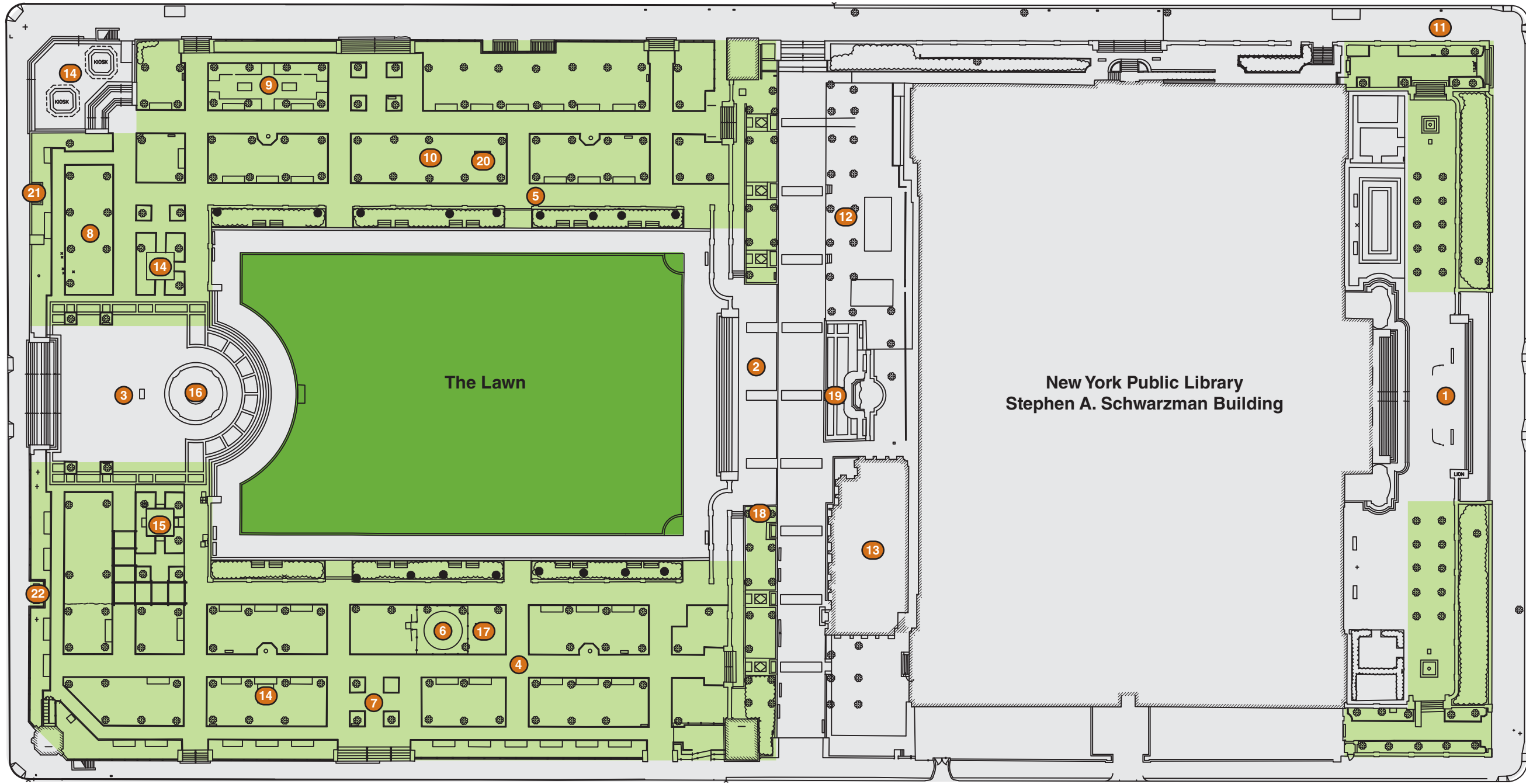
Daylight Savings Time was not used, per CEQR Technical Manual guidelines.



- Proposed Building
- Publicly-Accessible Open Space
- Incremental Shadow on Sun-Sensitive Resource

Daylight Savings Time was not used, per CEQR Technical Manual guidelines.

December 21 - 1:15 PM EST
View West
Figure 5-22



- | | | | |
|---------------------|-----------------------------|---------------------------|----------------------------------|
| 1 Library Terrace | 6 Le Carrousel | 12 Bryant Park Grill | 16 Shaw Lowell Memorial Fountain |
| 2 Upper Terrace | 7 Games, Chess & Backgammon | 13 Bryant Park Café | 17 Goethe Monument |
| 3 Fountain Terrace | 8 Pétanque | 14 'wichcraft Food Kiosks | 18 Gertrude Stein Monument |
| 4 40th Street Allée | 9 Bryant Park Ping Pong | 15 Southwest Porch | 19 Bryant Memorial |
| 5 42nd Street Allée | 10 Bryant Park Reading Room | | 20 Dodge Monument |
| | 11 Shoe Shine Stand | | 21 Juarez Monument |
| | | | 22 Andrada Monument |

Vanderbilt Corridor and One Vanderbilt

Shadow from the proposed One Vanderbilt development's spire would pass across a portion of the plaza at 1155 Sixth Avenue, for seven minutes, leaving most of the plaza in sunlight.

In the early afternoon, the proposed One Vanderbilt development's shadow would pass across Park Avenue, and new shadow would fall on three of the planted malls in the center of the avenue and portions of two office plazas on the east side of the avenue. Each of the three Park Avenue center plots would receive between 15 and 25 minutes of new shadow. New shadow would fall on a portion of the Westvaco Building plaza (299 Park Avenue) between East 48th and East 49th Streets from 2:10 PM to 2:35 PM, on the south side, leaving the north side still in sun (see **Figure 5-8**). New shadow would also pass across the plaza one block south at 275 Park Avenue from 2:15 PM to 2:45 PM, eliminating the remaining sunlight on that plaza (see **Figure 5-8**).

The tower of the proposed One Vanderbilt development would be bulkier than that of the 15 FAR No-Action building that would be built on the One Vanderbilt site absent the proposed actions. In the mid-afternoon of the spring and fall equinox analysis day, when shadows fall to the northeast, the southeast corner of the proposed building's tower would cast new shadow across Vanderbilt Avenue onto portions of the three large, west-facing windows of the main concourse of Grand Central Terminal, from 2:50 PM to 3:35 PM (see **Figures 5-9 and 5-10**). The proposed development would eliminate the remaining sunlight on the windows for much of this 45-minute period. After 3:35 PM the windows would be entirely in shadows from the No-Action building and other existing buildings.

MAY 6/AUGUST 6

May 6 falls halfway between the March 21 equinox and the June 21 summer solstice. August 6 falls halfway between June 21 and the September 21 equinox, and has the same shadow patterns as May 6. The May 6/August 6 analysis day is representative of the growing season in the city. Shadows on this day are shorter than on the equinoxes, and the length of the day is longer.

Incremental shadow from the proposed One Vanderbilt development would pass across Bryant Park early on the May 6 and August 6 analysis day. It would start small on the southern side as it enters the park at 7:05 AM, grow larger as it passes across the middle of the park, including portions of the 40th Street Allée, the Lawn, and the Fountain Terrace, moving northward/clockwise (see **Figure 5-11** showing 7:20 AM and 7:50 AM). By 8:20 AM the proposed One Vanderbilt development's shadow would be off the 40th Street Allée, falling on the Lawn and Fountain Terrace, and would enter the 42nd Street Allée (see **Figure 5-12**). By 8:50 AM the incremental shadow would be off the Lawn, shading a portion of the 42nd Street Allée (see **Figure 5-12**) and would then become small in the northeast section before exiting at 9:05 AM. Large areas of sun would remain on Bryant Park throughout this two-hour period. A narrow shadow would also fall near the northern edge of the Stephen A. Schwarzman Building terrace for 25 minutes near the end of this same period (see **Figure 5-12**). Incremental shadow would also fall on a small area near the northern edge of the Fifth Avenue façade of the Stephen A. Schwarzman Building from 8:15 AM to 8:50 AM (see **Figure 5-12**).

From 1:50 PM to 3:05 PM, shadow from the proposed One Vanderbilt development would fall on portions of the west-facing windows of the main concourse of Grand Central Terminal. The incremental shadow would be approximately one and a half window-widths in extent, so for example, at 2:00 PM one and a half of the windows would be in shade in the With-Action condition, compared with none in the No-Action condition (see **Figure 5-13**), and at 2:40 PM, all three windows would be in shade in the With-Action condition rather than two in the No-

Action condition (see **Figure 5-14**). From 2:25 PM to 3:05 PM the incremental shadow would eliminate the remaining sunlight on the west-facing windows. Direct sun would continue to reach one or two of the clerestory windows on the south side of the main concourse for about half of the 50-minute period of incremental shadow on the west-facing windows.

New shadow would fall on a small portion of the office plaza at 245 Park Avenue for five minutes, from 2:25 PM to 2:30 PM.

Near the end of the analysis day, the proposed One Vanderbilt development would fall on Dag Hammarskjold Plaza, far to the east of the site at East 47th Street between First and Second Avenues, for 20 minutes. The new shadow would eliminate the remaining strip of sun for 15 of those 20 minutes, from 4:40 PM to 4:55 PM (see **Figure 5-15**). New shadow would also eliminate the remaining sunlight on General Douglas MacArthur Park for five minutes, from 5:05 PM to 5:10 PM.

Incremental shadow would fall on a small portion of the East River for the final 23 minutes of the analysis day.

JUNE 21

June 21 has the longest amount of daylight of the year, with an analysis period of 12 hours. Shadows fall to the southwest early in the morning and to the southeast late in the afternoon, and shadows at midday on June 21 are shorter than at any other time of year. June 21 is also in the growing season.

At the start of the analysis day at 5:57 AM, shadows fall to the southwest. Nearly two hours later, the proposed One Vanderbilt development's shadow would move onto the southern edges of Bryant Park. From 7:40 AM to 9:10 AM incremental shadow would move across the south and east part of the park, falling on portions of the 40th Street Allée and the Lawn, but the shadow would remain relatively small in extent, leaving plenty of sunlight on the park (see **Figures 5-16 and 5-17**, showing 8:15 AM and 8:45 AM). Incremental shadow would also fall on the Stephen A. Schwarzman Building terrace for an hour, from 8:30 AM to 9:30 AM, and would be limited to an area on the northern part of the terrace (see **Figure 5-17** showing 8:45 AM and **5-18** showing 9:15 AM). The incremental shadow would also extend up and onto the northern part of the Stephen A. Schwarzman Building's Fifth Avenue façade, starting small at the top of the façade, and between 8:30 AM and 9:00 AM covering a large part of the northern section, but never eliminating all the sun at any time.

From 10:15 AM to 10:35 AM, new shadow from the proposed One Vanderbilt development would fall on the western side of the small plaza in front of the Emigrant Savings Bank building at 6 East 43rd Street, a half-block west of the development site, eliminating the remaining sun for the 20-minute period (see **Figure 5-19**).

In the afternoon, incremental shadow would fall on portions of the three west-facing windows of the main concourse of Grand Central Terminal for one hour, from 1:35 PM to 2:35 PM (see **Figures 5-20 and 5-21**). As on the May 6 and August 6 analysis day, the new shadow would shade up to approximately one and a half additional windows compared with the No-Action condition during the one-hour period. From 2:05 PM to 2:35 PM the incremental shadow would eliminate the remaining sunlight on west-facing windows. However, direct sunlight would continue to shine through the clerestory windows on the south side of the main concourse throughout this one-hour period on the June 21 analysis day of incremental shadow on the west-facing windows.

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Incremental shadow would fall on a portion of the East River for the final 46 minutes of the analysis day.

DECEMBER 21

December 21, representing the winter months, does not fall within the growing season. Shadow falling on vegetation in winter is not generally considered to cause a significant adverse impact, according to the *CEQR Technical Manual*. However, winter shadow can adversely impact users of open space who may rely on sunlight for warmth.

Shadows are long in the winter, and move faster than in other seasons. In the “urban forest” of Midtown Manhattan tall buildings create generally shady conditions throughout the study area, even in the middle of the day, and certainly at the beginning and end of the analysis period.

The proposed One Vanderbilt development’s shadow would not fall far enough to the south to affect either Bryant Park or the Stephen A. Schwarzman Building in the morning, nor Grand Central Terminal in the afternoon.

The proposed One Vanderbilt development would cast 10 minutes of new shadow on a small area at the top of the front façade of the Swedish Seamen's Church building on East 48th Street between Fifth and Madison Avenues.

It would cast new shadow for eight minutes or less on three East Midtown plazas, including the HarperCollins Plaza, 345 Park Avenue, the Seagram Building, and as well as three Park Avenue landscaped medians.

From 1:10 PM to 1:20 PM, a small area of new shadow from the proposed One Vanderbilt development would fall northward between several tall buildings and onto the upper south façade of St. Patrick’s Cathedral (see **Figure 5-22**). From 1:25 PM to 1:30 PM, new shadow would fall on a portion of the window looking into the Lady Chapel at the rear of the cathedral.

Near the end of the analysis day, from 2:37 PM to 2:44 PM, incremental shadow would fall on small sections of the Park Avenue façade of St. Bartholomew’s Church.

ASSESSMENT OF SHADOW IMPACTS

According to the *CEQR Technical Manual*, an incremental shadow is not considered significant when its duration is shorter than 10 minutes at any time of year and the resource continues to receive substantial direct sunlight. A significant shadow impact generally occurs when an incremental shadow of 10 minutes or longer falls on a sunlight sensitive resource and results in one of the following:

- Vegetation
 - A substantial reduction in sunlight available to a sunlight-sensitive feature of the resource to less than the minimum time necessary for its survival (when there was sufficient sunlight in the No-Action condition).
 - A reduction in direct sunlight exposure where the sensitive feature of the resource is already subject to substandard sunlight (i.e., less than minimum time necessary for its survival).

- Historic and Cultural Resources
 - A substantial reduction in sunlight available for the enjoyment or appreciation of the sunlight-sensitive features of an historic or cultural resource.
- Open Space Utilization
 - A substantial reduction in the usability of open space as a result of increased shadows (cross reference with information provided in Chapter 4, “Open Space,” regarding anticipated new users and the open space’s utilization rates throughout the affected time periods).
- For Any Sunlight-Sensitive Feature of a Resource
 - Complete elimination of all direct sunlight on the sunlight-sensitive feature of the resource, when the complete elimination results in substantial effects on the survival, enjoyment, or, in the case of open space or natural resources, the use of the resource.

OPEN SPACE AND NATURAL RESOURCES

A number of open spaces would receive 10 minutes or less of incremental shadow as a result of the proposed One Vanderbilt development. This limited duration is not considered significant and these resources need not be assessed in further detail. These resources include the 1095 Sixth Avenue plaza, 1155 Sixth Avenue plaza, 1166 Sixth Avenue plaza, HarperCollins Plaza, 245 Park Avenue plaza, Seagram Building plaza, 345 Park Avenue plaza, General Douglas MacArthur Park, 320 East 46th Street plaza, and Gantry Plaza State Park.

Open spaces and natural resources receiving more than 10 minutes of incremental shadow are described below.

Bryant Park

Bryant Park is a large, well-used park. It is also a New York City Scenic Landmark and is S/NR-listed. A large lawn occupies the central portion of the park, and promenades and gardens provide seating and strolling opportunities along the north and south sides. On the park’s west side there is a large fountain, a pétanque court and food kiosks, and on the east side between the lawn and the Stephen A. Schwarzman Building there is a paved terrace area and outdoor cafes. **Figure 5-23** illustrates the park layout and its major features and amenities.

On March 21 and September 21, incremental shadow from the proposed building would fall on the park for 44 minutes early in the morning and would be small in extent as shown in **Figure 5-6**. On May 6 and August 6, when shadows fall farther south at the start of the analysis day, the incremental shadow would last two hours, passing across much of the garden and promenade area on the south side, then the lawn, and finally shortening and moving across the eastern part of the gardens and promenade on the north side before exiting at 9:05 AM (see **Figures 5-11 and 5-12**). Large areas of the park would remain in sun even during this early morning period. On June 21, as shown in **Figures 5-16 and 5-17**, the incremental shadow would pass across only the southeast part of the park from 7:40 AM and 9:10 AM, falling on a portion of the gardens and promenade on the south side and then the eastern edges of the lawn and the upper terrace area between the lawn and the outdoor café areas, exiting the park completely by 9:10 AM. Most of the park would be in sun during this one hour and 30 minute period.

On all three of these analysis days that occur during the growing season, the park would continue to experience approximately six hours of direct sunlight exposure; thus, the incremental

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shadows would not be expected to result in any significant adverse impacts to flower gardens, trees, and other vegetation. In regard to the use of the park, while the park is active during the morning commute hours when the shadow impact would occur, it is likely not as heavily used as the anticipated lunch-time peak. Further, in the morning shadows shorten and move relatively quickly as the sun climbs above the horizon. Throughout the duration of incremental shadow, there would be seating and other amenities in non-shaded areas of this large park for visitors seeking sun. Therefore, no significant adverse impacts to passive recreation uses are anticipated.

Stephen A. Schwarzman Building Terrace

Technically part of Bryant Park, the terrace along the Fifth Avenue frontage of the Stephen A. Schwarzman Building is a well-used open space that featuring the famous steps and iconic lion statues in the center of the area and contains areas with mature trees, plantings, and tables with movable chairs along the sides.

On the March 21/September 21 analysis day there would be 10 minutes of incremental shadow and on May 6/August 6 there would be 25 minutes; in both cases, the incremental shadow would be limited in extent to a small area near the north edge of the terrace. This area of the terrace contains several mature trees providing shade, other plantings, and moveable chairs for seating. The limited duration of these new shadows would not cause significant adverse shadow impacts to the trees and plantings, which are accustomed to the generally shady environment of midtown. Passive recreation use of the seating would likely be light at this early time, and in any case the area is already well-shaded by the mature trees towering overhead and users of this area would not likely be there for the purpose of using the direct sunlight. Given these factors, the brief new, early morning shadow would not cause significant adverse shadow impacts in these seasons.

On June 21 the new shadow would last longer (for an hour), but would still be limited primarily to the area described in the preceding paragraph, and briefly to the area just south of this, at the north end of the raised terrace, containing a flagpole, some moveable chairs and tables, and some plantings. The rest of the terrace on the north side of the steps would be in existing shadow during most of this hour, but the terrace on the south side would be partly in sun. These incremental shadows would not be expected to substantially reduce the usability of the terrace on June 21, given their limited extent and duration and the fact that they would be gone by 9:30 AM. The terrace would continue to receive direct sunlight exposure in the late morning and early afternoon when utilization would likely be at its peak. On June 21, the northern part of the terrace would receive a minimum of four to six hours of direct sunlight, which means the vegetation would not be significantly impacted by the hour-long period of incremental shadow.

275 Park Avenue Plaza

This plaza is a mostly empty, paved expanse that features a broad seating ledge along the outer edge that borders the surrounding sidewalks, and unenclosed planted areas at the north and south ends (see **Figure 5-24**). In front of the building entrances are free-standing planters/bollards. New shadow would pass across this plaza on the March 21/September 21 day only. The new shadow would last from 2:15 PM to 2:45 PM, eliminating the remaining sunlight during that period (see **Figure 5-8**). On this analysis day, Daylight Saving Time is in effect, so that the new shadow would for practical purposes occur from 3:15 PM to 3:45 PM. Utilization rates for office plazas such as this are generally low after the peak use at lunch time. Even so, if any users seek sunlit seating areas during this 30-minute period, there is seating one block to the north at the



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adjacent Westvaco Building office plaza. The proposed One Vanderbilt development would, therefore, not result in significant adverse impacts to this plaza.

Westvaco Building Plaza (299 Park Avenue)

This narrow, elevated plaza on Park Avenue wraps around onto both East 48th and East 49th Streets. There are perimeter planters, but they do not have any sitting surfaces. At the south end of the plaza, there are two benches. At the north end of the plaza, there are six benches, two of them on the Park Avenue frontage and four of them on the north side of the building along East 49th Street.

As with 275 Park Avenue, project-generated shadow would fall on this resource only on the March 21/September 21 analysis day, being too short to reach it in the late spring and summer (see **Figures 5-3 and 5-4**), while in winter it would be in shadow from existing buildings in the afternoon. On March 21/September 21, new shadow would fall on a portion of the Westvaco Building plaza between East 48th and 49th Streets from 2:10 PM to 2:35 PM, on the south side, leaving the north side still in sun (see **Figure 5-8**). As noted in the preceding paragraph, Daylight Saving Time is in effect, so that the new shadow would for practical purposes occur from 3:15 PM to 3:45 PM. Utilization rates for office plazas such as this are generally low after the peak use at lunch time. In any case, the northern portion of the space on Park Avenue with its two benches would remain in sun for users seeking direct sun at this time. The limited extent and duration of this incremental shadow would, therefore, not cause a significant adverse impact to this plaza.

Grace Plaza

This office plaza at 1114 Sixth Avenue would receive 25 minutes of new shadow early on the March 21/September 21 analysis day. The new shadow would fall on the northwest corner of the plaza at East 43rd Street, a paved area that contains a broad seating ledge and shallow steps connecting the raised plaza to the sidewalk (see **Figure 5-25**). At 9:00 AM, when the incremental shadow would occur, utilization rates would likely be low at this office plaza. The plaza is bathed in reflected sunlight at this time from the glassy façade of the building opposite the plaza on the north side of West 43rd Street (see **Figure 5-25**). Given these factors and the limited extent and duration of the new shadow, the proposed One Vanderbilt development would not cause significant adverse shadow impacts to this plaza.

Dag Hammarskjöld Plaza

This plaza on the south side of East 47th Street extends the full block between Second and First Avenues and contains benches and mature trees. In the late afternoon of the May 6/August 6 analysis day, the proposed One Vanderbilt development's shadow would fall on this plaza for 20 minutes. The plaza would be almost entirely in existing shadows at that time, and the new shadow would eliminate the remaining small strip of sun for 15 minutes, from 4:40 PM to 4:55 PM, or, given that on this analysis day Daylight Saving Time is in effect, at 5:40 PM to 5:55 PM (see **Figure 5-15**). The new shadow would occur for a brief 20 minutes, late in the day after the time of peak usage, and would be small in extent as shown on Figure 5-15. The mature tree canopy shades the park, and users would likely not notice the small and brief new shadow. The incremental shadow, therefore, would not be expected to affect the park's use. The park would receive plenty of direct sun in the morning and early afternoon due to the lack of structures to the east and southeast. The proposed One Vanderbilt development would, therefore, not result in



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significant adverse impacts to this plaza on May 6/August 6. No new shadow would occur on the other analysis days.

Emigrant Savings Bank Plaza

This is a narrow sidewalk-level strip of plaza at the office building entrance whose only amenities are two elevated planter beds. The walls around these beds are low, always below knee height. The walls have sloped horizontal surfaces that make them difficult to sit upon (see **Figure 5-26**).

The plaza would receive 20 minutes of new shadow on the June 21 analysis day in the late morning. No new shadow would occur later in the summer, or in the fall, winter or spring. This brief duration of new shadow in this underutilized space would not be expected to affect the use of the plaza or the vegetation in its planters. Further, the space receives substantial reflected sunlight from the building directly north across West 43rd Street in the middle of the day, as can be seen in **Figure 5-26**, and this would not change with the proposed One Vanderbilt development.

East River

River currents move phytoplankton and other natural elements through the shaded areas, and fish move through different areas of the river. The brief duration of new shadows from May through August would not adversely affect the health of the aquatic habitat.

HISTORIC RESOURCES

Incremental shadow on the Swedish Seaman's Church and St. Bartholomew's Church would be for 10 minutes or less. This limited duration is not considered significant and these resources need not be assessed in further detail.

Historic resources that would receive more than 10 minutes of incremental shadow are described below.

Grand Central Terminal Main Concourse Windows

The main concourse of this landmark building has windows on all four sides. The west and east façades are dominated by large, arched windows—three on each side. The north and south sides each have a row of smaller, but still fairly large, clerestory windows high up where the roof begins to arch. In the spring, summer and fall, direct sunlight enters the concourse space during the late morning and early afternoon. Sunlight also enters the space through the east and north façade windows in the morning, and the west façade windows in the mid-afternoon, although at times the sun is blocked by the surrounding buildings, particularly on the east side where the Grand Hyatt Hotel and Graybar Building nearly abut Grand Central Terminal. In winter, shadows in Midtown are long and move quickly, and direct sun is rare and fleeting in the main concourse.

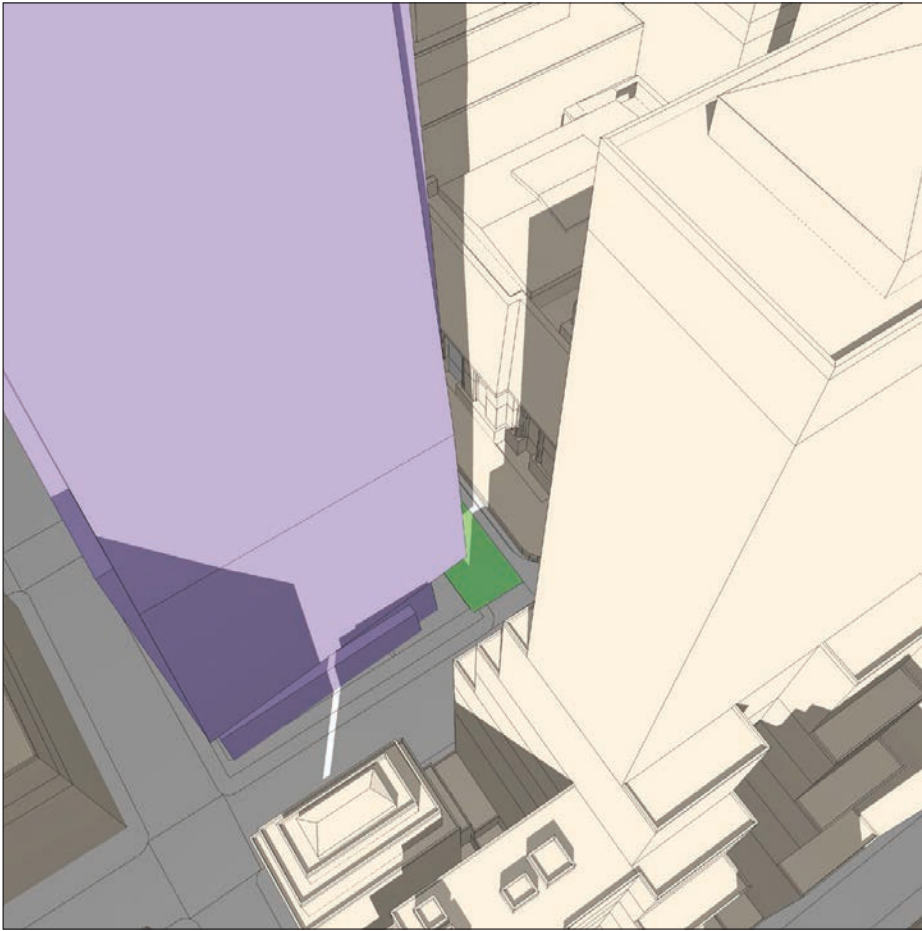
Both the proposed One Vanderbilt development and the 15 FAR No-Action building would cast new shadows on the west-facing windows in the mid-afternoon. The proposed One Vanderbilt development would have a bulkier tower portion compared with the 15 FAR No-Action building, which would be massed with setbacks above the base, and so would shade approximately an additional window and a half, for a period of between 45 minutes to an hour and 15 minutes, in the mid-afternoon in the spring, summer and fall analysis days. **Figure 5-27** illustrates how the bulkier tower of the proposed development, particularly the lower portion of



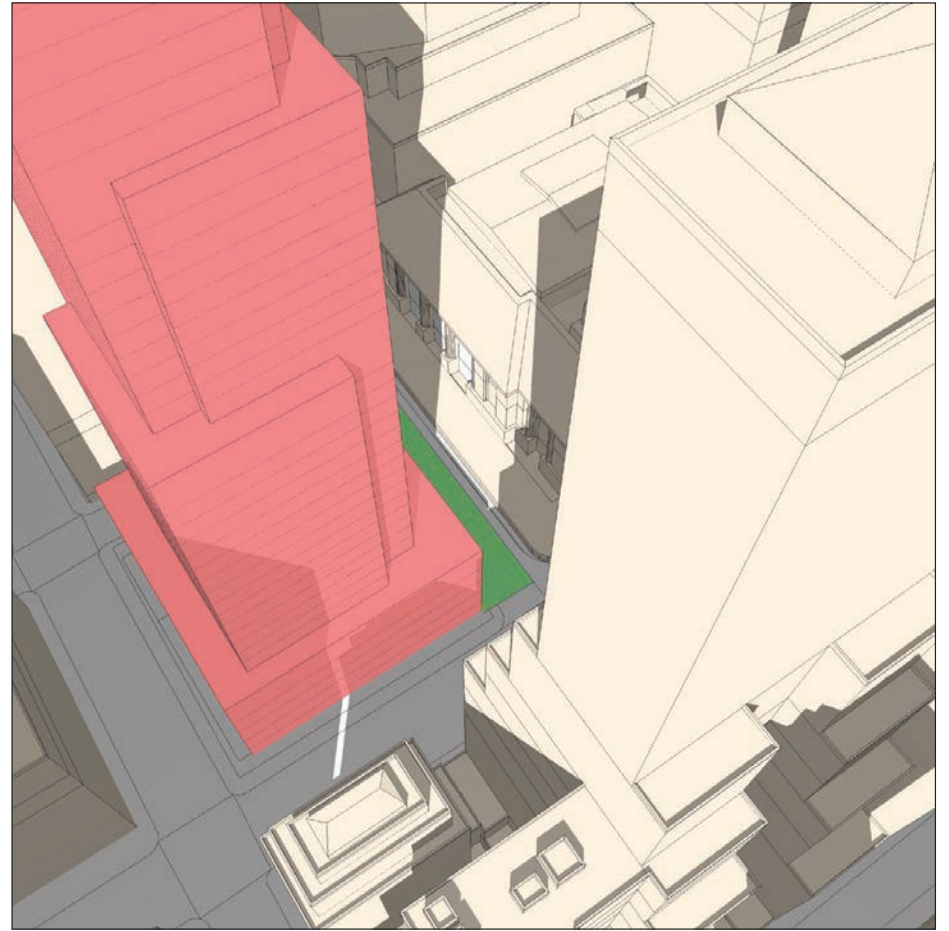
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Proposed Development



No Action Development

the tower, would cast a slightly wider shadow on the Grand Central Terminal windows than would the 15 FAR No-Action building.

Direct sunlight, reflected sunlight, and ambient daylight would continue to illuminate the concourse interior through the windows on the north, south, and east sides during this period when the west windows would be shaded. Further, the windows at the east and west facades consist of two separated planes of glass with metal and glass walkways traversing the interstitial spaces. These walkways connect the floors to the north and south across the windows, and the window design makes direct sunlight and diffuse daylight appear similar to someone within the concourse.

Figures 5-28 through 5-31 are photos of existing conditions that show periods when there is partial or no direct sunlight on the west windows, similar to the condition with the proposed One Vanderbilt development. The main concourse interior is illuminated by a combination of direct sunlight shining in the south façade windows and/or ambient daylight coming through windows in the other three façades.

Given the direct orientation of the west windows of the main concourse to West 43rd Street, the design intent of the architects appears to indicate that the sunlight afforded to these windows would remain permanently unobstructed, thus insuring that the great windows would continue to illuminate the interior of the main concourse. In summary, the new shadows on the west windows attributable to One Vanderbilt would cause an adverse impact to Grand Central Terminal. However, the five clerestory lunette windows on the south side would continue to be unobstructed, and the remaining concourse windows would still provide direct and indirect lighting to the interior. Therefore, the analysis concluded that the adverse shadow impacts would not significantly impact the appreciation of the Grand Central Terminal concourse for users during the limited duration of approximately one hour it would fall on the west façade windows.

Stephen A. Schwarzman Building Fifth Avenue Façade

This landmarked building's façade features a columned entrance porch in the center portion and sculptural relief on the north and south sides of the façade.

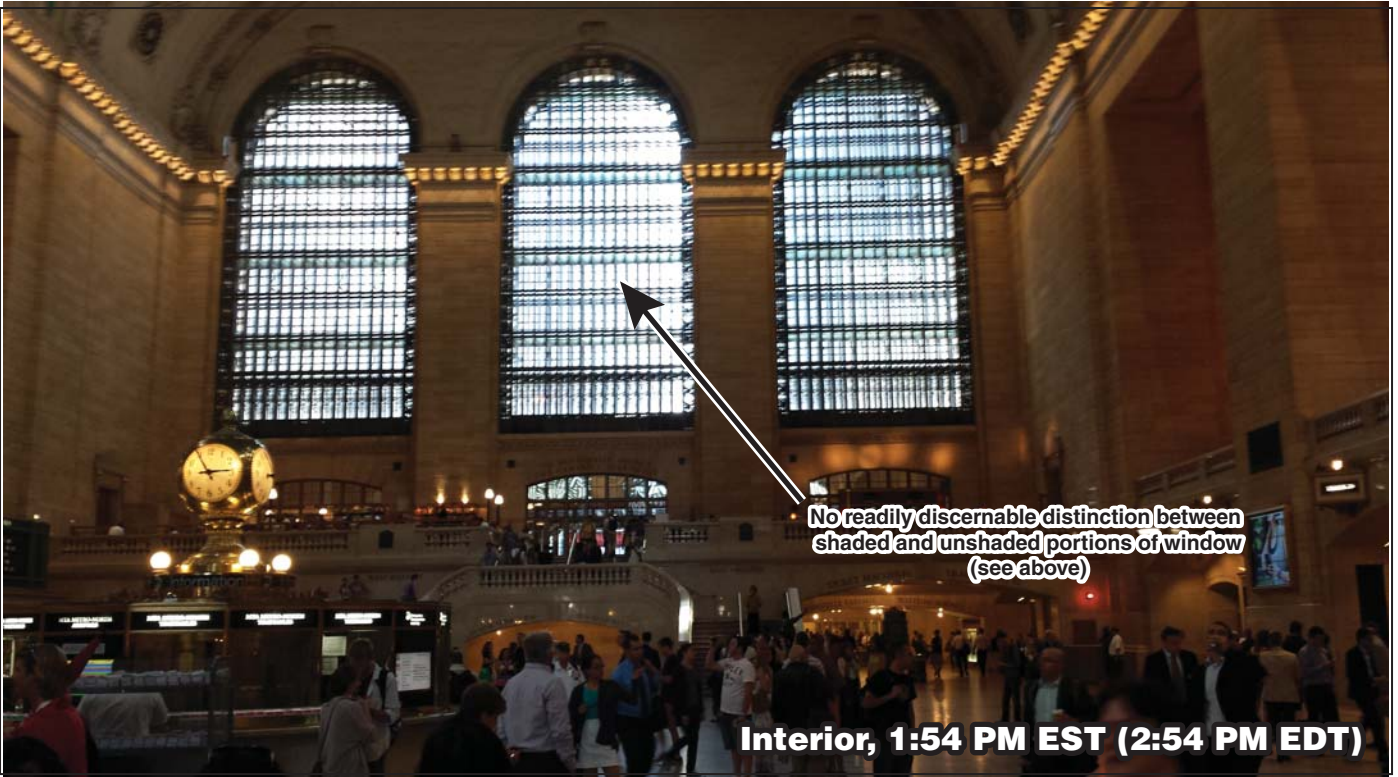
On the May 6/August 6 analysis day, incremental shadow would fall on a small area near the northern edge of the Fifth Avenue façade from 8:15 AM to 8:50 AM. This limited extent and duration of new shadow would not significantly impact the façade. On June 21, incremental shadow would fall onto the northern part of the façade, starting small at the top of the façade, and between 8:30 AM and 9:00 AM covering a large part of the northern section, but never eliminating all the sun at any time. By 9:15 AM, a large area of the northern section would be in sun, along with most of the center and southern part of the façade, and the area of incremental shadow would be small again. The new shadow would be limited in duration and would occur early in the day, when use of the resource would likely be lower than at other times. Therefore the proposed One Vanderbilt development would not cause a significant adverse impact.

St. Patrick's Cathedral Windows

The Cathedral of St. Patrick (commonly called St. Patrick's Cathedral, NYCL, S/NR, NHL) is a Gothic-style Roman Catholic cathedral church that occupies, along with the Archbishop's house and rectory, the full block bounded by Fifth and Madison Avenues and East 50th and East 51st Streets. The southern façade of the cathedral—which is the only sunlight-sensitive portion of the building that could experience incremental shadow from the proposed One Vanderbilt development—is ornamented with two levels of stained-glass windows. The proposed One



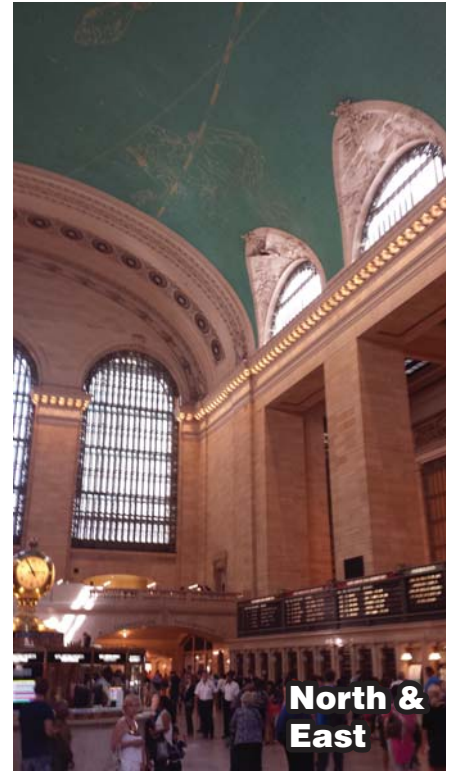
Exterior, 1:52 PM EST (2:52 PM EDT)



No readily discernable distinction between shaded and unshaded portions of window (see above)

Interior, 1:54 PM EST (2:54 PM EDT)

10.6.14



Interior, Grand Central Terminal
July 30, 1:54 PM EST (2:54 PM EDT)
Figure 5-29

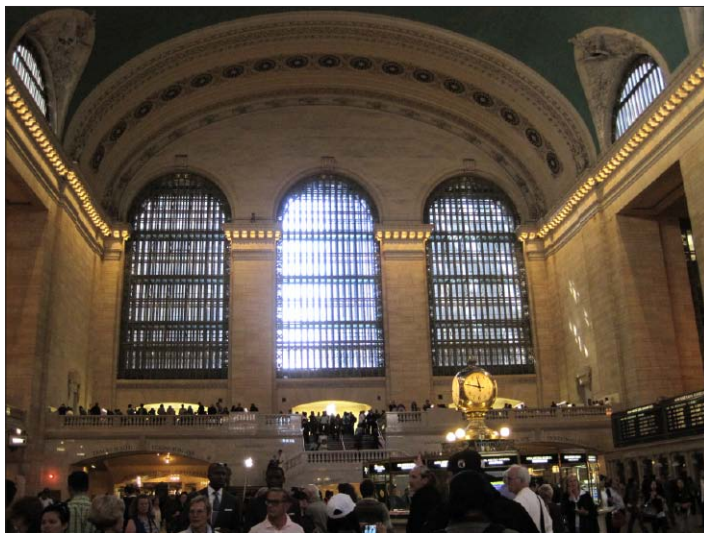
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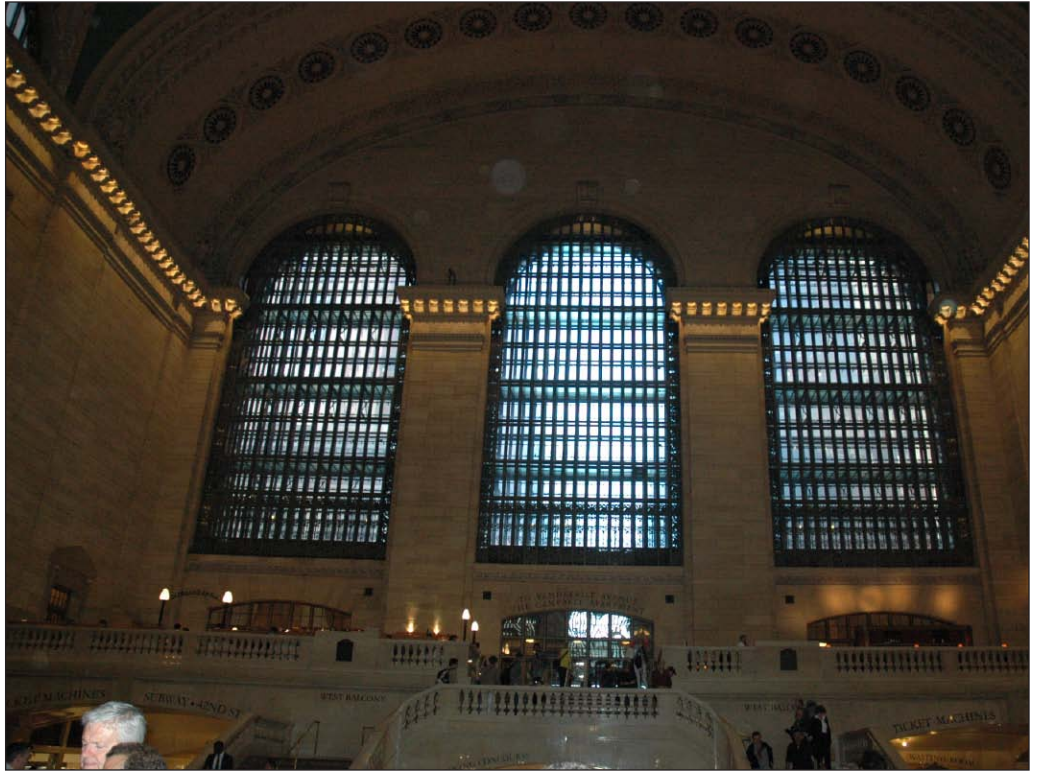
West exterior 1



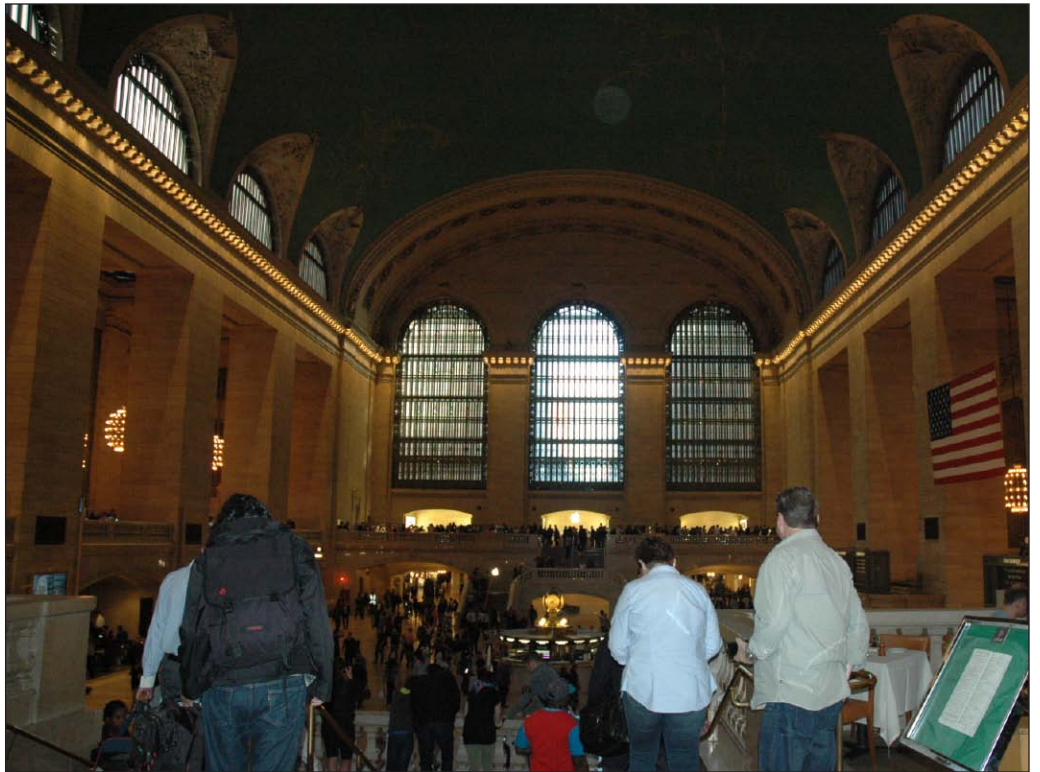
West interior 2



East interior 3



West interior 4



East interior 5

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Vanderbilt development's shadow would not be long enough to reach this cathedral in the spring, summer or fall seasons.

On December 21, the proposed development's shadow would be long enough to pass across a portion of one clerestory window at the eastern end of the nave. The incremental shadow would last for approximately 10 minutes, from 1:10 PM to 1:20 PM (see **Figure 5-22**). The south façades and any windows on them would be in existing shadows at this time, and the brief new shadow would not likely be discernable to any pedestrian located either outside or inside the public areas of the building. The incremental shadow would, therefore, not significantly affect the enjoyment of this resource. As the proposed One Vanderbilt development's shadow continues to move eastward, it would pass across a portion of one of the Lady Chapel's windows, located at the rear of the cathedral, for about five minutes. This new shadow would not result in a significant adverse impact, given its duration of under 10 minutes on the Lady Chapel's window.

PROPOSED PUBLIC PLACE

According to the *CEQR Technical Manual*, project-generated open space cannot experience a significant adverse shadow impact as a result of the project, because without the project the open space would not exist. However, the detailed analysis included the proposed public space for general informational purposes and to potentially inform the future design of the space.

The extent and duration of shadows on the proposed public place adjacent to the One Vanderbilt development would be virtually identical in the winter and March 21/September 21 analysis periods. In the late spring and summer analysis periods, they would be similar. In the early afternoon a larger area of the space would be in sun with the 15 FAR No-Action building, due to its less bulky tower portion compared with the proposed development, while later in the afternoon the setback southeast corner of the proposed One Vanderbilt development would result in a larger area of sun compared to the No-Action condition.

Given that either with the proposed One Vanderbilt development or with the No-Action building the proposed public place would be generally fairly shady for much of the day, as must be expected in the dense urban environment of midtown, the space's design will account for the shade by including shade-tolerant plantings and attempting to locate seating in areas expected to receive the direct sun that might be available, to the extent practicable. *