

Executive Summary

The purpose of this report is to propose an improved design for the Denver Police Department Crime Lab. The report breaks down into lighting and electrical depths, as well as construction and structural breadths.

In the lighting portion of this report, a redesign of four different spaces is performed. The spaces are embodied by the concept of “Identity,” which is touched upon in the summary of each space. The spaces: the Lobby, the Main DNA Lab, the Multipurpose Room, and the South Plaza are described and overviewed, including dimensions, materials and typical furnishings for the space. Design criteria, both qualitative and quantitative, are established using the IES Lighting Handbook, 10th Edition and 2012 IECC. The final design showcases the fixture schedule, reflected ceiling plans, and renderings for each space. Lighting calculations, performed via Revit 2015’s plugin ElumTools are reviewed and discussed as to whether they met the initial design criteria. A summary located at the end of each section brings together the criteria and calculations along with the concept to wrap up each space.

The electrical depth contains a branch circuit redesign, a fire alarm integration analysis and the implementation of a photovoltaic array on the roof of the Crime Lab. The branch circuit redesign analyzes the panelboards that contain the existing and new lighting loads for the four spaces designed in the lighting breadth. The new lighting loads were calculated and each fell within the maximum load per circuit, 16 kVA. This meant that a new design of the branch circuits was not necessary. As for the fire alarm integration, it proved uneconomical to install as a redesign. A building undergoing new construction could greatly benefit from Power over Ethernet cabling, but a retrofit would have great labor and material costs. The photovoltaic array located next to the penthouse on the Denver Crime Lab roof would supply over 160,000 kWh a year, but the system cost of \$650,000 would null the payback period. A full analysis of the array was performed with the National Renewable Energy Lab’s System Advisor Model (SAM).

Within the construction breadth, an analysis of the cost and construction schedule for the photovoltaic array are performed. Using RS Means Green Building 2015, the total cost of the PV installation came to nearly \$830,000. This cost, which was a \$180,000 increase from the SAM estimated cost, includes exact material and labor data. The duration times for the installation were taken for the RS Means Cost Data and the project would take approximately one month. Also within the construction breadth is an energy analysis of the existing and new fixtures within the building. Using Denver’s commercial utility rate of \$0.06/kWh, around \$600 are saved a year by implementing the new fixtures.

The structural breadth takes into account the added weight of the photovoltaic array on the existing roof systems. The entire array takes up most of the east side of the roof, and is supported by roof and composite deck. After performing structural calculations on the amount of PSF the decks could support, it was discovered that the PV array would be more than well supported atop the existing roof.