



technical report IV.B

Denver Police Department Crime Lab || Denver, Colorado

lighting || electrical

Jackie Eury || January 13, 2015 || Shawn Good

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 a lighting and electrical depths, as well as two breadths. Each area will be studied in the spring semester and be a part of the final report and presentation.

The lighting portion of this report focuses on the concept used within the crime lab, and the proposed designs in each space. It includes professional feedback from the Lutron presentation along with personal comments. Tasks for the spring semester are outlined as well as split into phases. To perform each task, the intended tools are assigned as needed.

In the electrical depth, a branch circuit redesign will be performed. This alteration is necessary due to the new fixtures and controls that will call for different loads. The incorporation of the fire alarm system into the building's network will make for reliable coordination between the alarms and security systems. It will also be less laboring to install a PoE cable instead of two separate wires to each alarm. Furthermore, there will be the addition of a photovoltaic array. The array will save energy and supply a small amount of back-up power for the building.

The two breadths that are being analyzed are structural and construction related. The structural breadth will be the study of the current roof system and how it will be affected by the photovoltaic array. The construction breadth will be a cost analysis of the new fixtures, sensors, and array. This analysis will be weighed against the energy saving potential.

Table of Contents

Executive Summary	1
Building Overview	3
Lighting Depth	4
Concept	
Lobby	
Main DNA Lab	
Multipurpose Room	
South Plaza	
Professional Feedback & Personal Review	
Tasks and Tools	
Electrical Depth	7
Branch Circuit Redesign	
Fire Alarm System Integration	
Photovoltaic Array	
Breadths	8
Structural	
Construction	
Appendix A Spring Semester Schedule	9

Building Overview

All 60,000 SF of the Denver Police Department Crime Lab serve the public of Colorado through proper and thorough forensic investigation. Neighboring the lab in downtown Denver is the Police Department and Department of Safety, along with several other government buildings. The lab itself houses many facilities such as conference rooms, a multipurpose room, open offices, and various laboratories that allow their users to be able to work efficiently and effectively. Architecturally, the crime lab showcases a unique façade that was modeled after a double helix, or DNA molecule. This contemporary look continues on the interior of the building, where distinctive ceiling systems and modern labs.

Building Data

Building Name: Denver Police Department Crime Lab

Location and Site: 1371 Cherokee Street, Denver, CO 80204

Building Occupant Name: Denver Police Department

Occupancy or Function Types: Laboratory

Classification: B, A-3

Size: 60,000 GSF

Stories: 3

Dates of Construction: March 2011 – July 2012

Actual Cost Information: \$28 million

Project Delivery Method: CM at Risk

Primary Project Team

Owner: Denver Police Department

General Contractor and Construction Management: JE Dunn

Architect: Durrant

Design Architect and Engineer, Lab Planner: SmithGroupJJR

Electrical Engineer: Scanlon Szynskie Group

Mechanical Engineer: Gehring and Associates

Structural Engineer: MNA

Civil Engineer: S.A. Miro, Inc.

Concept

The people of the Denver Crime Lab are constantly researching, studying, and analyzing evidence. Their work leads to the solution of a case, the conviction of a criminal, and the peaceful mind of a victim. What the employees are ultimately doing is discovering someone's **IDENTITY**. It could be a drop of blood left at a crime scene, a physical feature observed by a witness, or a fingerprint on a murder weapon. All of these components are ways to discover a person's identity. This concept, along with the architecture and function of each space influence the proposed lighting design.

Lobby

As the main entrance space, and first visually impactful room in the crime lab, the lobby should be aesthetically pleasing. The lobby stretches from the south to north end of the building, with occupants entering through the south. Within the lobby are two atriums that carry through the three stories of the building and accommodate corridors. An elevator and large staircase help transition employees throughout the building.

It is here that the DNA fingerprint, the start to defining a being, is utilized to influence the space. In order to assist in the transition, recessed linear fluorescent fixtures will create a focal point on the wood paneled wall next to the large staircase and lounge. This will create a pleasant feel for the inhabitants. Linear fixtures will also provide light in the corridor for transition. Over the lounge space in the north atrium will be pendants hung at different heights to provide a non-uniform distribution of light. During the day, the lobby is a brightly lit space due to the glass façade on the north and south sides of the building which will present the feeling of spaciousness.

Main DNA Lab

The lab is located on the second floor in the southwest corner of the building. This is where the majority of labwork is done. With the south and west walls consisting of glazing, a lot of daylight fills the space. The lab will be split into zones and the fixtures will have daylight sensors to dim properly when there is adequate light.

The lab is to be brightly illuminated, much like the physical features of a suspect's profile. In the space, pendants that are direct/indirect will be placed throughout the lab to create a uniform layer of light for the task plane. Wall-washers will provide light for the counters on the north and east walls. This creates a visually clear environment for the technicians to work in.

Multipurpose Room

In the northeast corner of the second floor is the multipurpose room, where lectures and meetings occur. The room has a sloped wood-paneled ceiling and composite panels on the walls.

When investigating a case, the subject will take on the identity of the victim or the suspect. The victim is often, naïve, pure and innocent. The multipurpose room will have linear fixtures that stretch from the back to the front of the room, basking the task place in light. The perimeter walls will have wall-washers to embrace the participants with light. This is to create the feeling of a public space, one that is spacious and safe. For the presentation mode, the room will take on the concept of the suspect. Controls will allow most of the linear fixtures to be turned off, but two fixtures will remain on. An angled downlight will shine light on the presenter, illuminating their features. This lighting design creates a dark atmosphere with the majority of light being on the presentation board. This allows the employees to focus on their lecture and lecturer.

Lighting Depth

South Plaza

Right outside the south entrance to the building is the plaza. The area consists of lightly colored concrete tiles, foliage, and stone benches. The lighting objective here is to create a relaxing environment for the employees to enjoy.

A fingerprint is a symbolic piece of someone's identity, and the plaza will be as unique as one. In-ground linear fixtures will weave between the tiles and cross through the foliage and stone benches. The light lines will never cross each other, creating an interesting pattern for the eye to follow. The low emitting fixtures will provide the psychological impression of relaxation for the employees that come in for the night shift.

Professional Feedback & Personal Review

Lee Waldron

- Did not understand how the lighting is moving people through the spaces
- Placement of pendants in lab
- Confused by concept for multipurpose room
- Letting architecture rule design in multipurpose room, render correctly
- Consider focus on floor and south entrance in lobby instead of wood wall
- Go more literal with fingerprint idea in south plaza, use tape or rope

Helen Diemer

- Interesting concept in lobby, but need to improve on it
- Did not understand concept or imagery for multipurpose room
- Cove fixture for wall wash
- Why apply tension in multipurpose room

Shawn Good

- Did not have overview to show how spaces relate

Personal Review

- Explain relation of criteria to design better during presentation
- Consider creating a different lighting design in the lobby
- Rework concept for multipurpose room
- Consider making south plaza more literal in terms of design

Lighting Depth

Tasks and Tools

Schematic

Use a combination of hand sketches and Photoshop for the conceptual design in all spaces
Make changes based on professional feedback

Design Development

Select all preliminary luminaires and model custom fixtures in AutoCAD or Revit
Locate all IES files
Create 3D models of all the spaces in Revit
Utilize Revit Elumtools and AGI 32 for lighting calculations
Modify layout and luminaires based on calculations

Construction Documents

Final renderings in Revit
Gather fixture cutsheets
Produce reflected ceiling plans and fixture schedules from Revit
Touch up renderings in Photoshop as necessary

Submittal

Final report
Powerpoint Presentation

Electrical Depth

Branch Circuit Redesign

The installation of new fixtures and lamp types will result in new loads on the panelboards. This change in load means that a redesign of the branch circuits is necessary for the lobby, lab, multipurpose room, and south plaza. There will be a study of how this will affect the feeders for the system as well.

Fire Alarm System Integration

The current security system incorporates PoE, or Power over Ethernet, which combines data and electrical power. By switching the fire alarm system from two separate wires, to one combined cable makes the system more reliable and requires less labor for installation. The integrated system can also interact with the access doors in the building, ensuring that they will be unlocked in the event of a fire hazard.

Photovoltaic Array

Denver, Colorado receives about 300 days of sunshine each year. This provides the perfect opportunity to install a photovoltaic array. The array will supply energy to the crime lab and reduce the cost of peak power during the day. Not only does it decrease electricity use, but it also lessens the amount of carbon-dioxide emissions into the atmosphere. With a battery-powered storage system, it can save power as a resource for when there is an outage. An addition of a PV array on the roof of the lab will be great for the environment and the potential energy savings.

Breadths

Structural

Since the electrical depth will be exploring the addition of a photovoltaic array, a structural breadth will be performed on the roof. A study will be performed on the existing roof structure to see if it would be able to support the weight. If unable, the framing will be redesigned to take the additional weight from the array. The building's location in downtown Denver means that the impact of wind and snow loads must be observed.

Construction

The second breadth will be a cost analysis and construction schedule study. The analysis will include the implementation of the new fixtures and sensors versus energy savings. It will also take into account the photovoltaic array installation on the roof. Quotes and estimates will be collected for the panels. In addition, the impact of the photovoltaic array on the construction schedule will be analyzed.

Appendix A | Spring Semester Schedule

