

About the Project

With help from a U.S. Department of Transportation grant, the Massachusetts Port Authority (Massport) saw an opportunity to upgrade its 23 existing high-mast light poles that illuminate the active container yard at Boston's Conley Terminal while also improving site Wi-Fi coverage. Maritime Program Manager, Chester Myers, and his team looked forward to the ability to integrate a new modern LED lighting system with existing Wi-Fi enabled systems for enhanced control of light levels and improved energy and operating efficiency.

About 800 miles south of Boston, in Wilmington, Delaware, officials felt similarly compelled to upgrade the city's network of 1,732 lights, though the driving forces were a bit different. In addition to wanting to reduce energy use and streamline maintenance, the city and its new police chief are trying to overcome a reputation for high crime by increasing safety and security measures. Lighting that allows for better visibility would give people an enhanced sense of safety and comfort when out after nightfall.

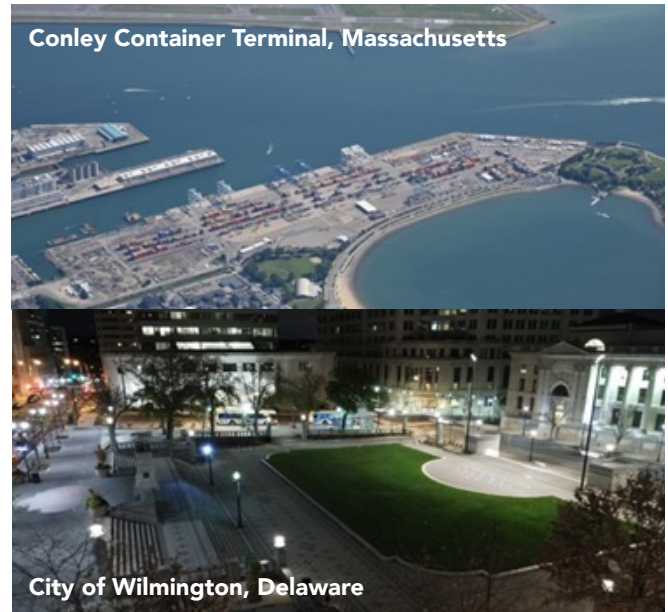
Both agencies believed new, advanced lighting system options and integration strategies could provide heightened safety and security, optimize lighting system management, reduce energy consumption and related costs while also addressing the concerns and comfort of impacted residents.

Project Goals

Conley Terminal

The main goals for completing lighting system upgrades at Conley Terminal were threefold:

- ▶ **REAL-TIME LIGHTING CONTROL.** Wi-Fi plays a critical role at Conley Terminal because it is used to track and monitor containers, gantry cranes, and trucks via the Terminal Operating System (TOS). Massport wanted to integrate the lighting system with the TOS to enable terminal operators to adjust lighting via wireless controls using real-time information about which areas were in use. Previously, this communication



PROJECT QUICK FACTS

- ▶ The Massachusetts Port Authority operates three airports and the Port of Boston, including Conley Container Terminal (top)—the only full-service container terminal in New England. Massport partnered with Jacobs Engineering to design an upgraded lighting system at Conley Terminal.
- ▶ The City of Wilmington is a relatively small urban city; however, it is Delaware's largest with a population of 70,000. The City partnered with Seiberlich Trane Energy Services to retrofit or replace all city-owned street light fixtures with LED lamps or fixtures.

KEY STRATEGIES AND OUTCOMES

- ▶ Massport and the City of Wilmington employed the following advanced lighting strategies:
 - ▶ Lighting management system, integrated with existing operating and security systems
 - ▶ Adjustable lighting intensity
 - ▶ Real-time, wireless controls
- ▶ Advanced lighting and integration strategies led to several positive outcomes for both parties:
 - ▶ better lighting with more flexible, wireless controls
 - ▶ improved safety and security
 - ▶ minimal light pollution for nearby residents
 - ▶ significantly reduced maintenance costs for the City of Wilmington
 - ▶ reduced lighting energy use resulting in annual estimated cost savings of \$31,600 at Conley Terminal and \$150,000 in Wilmington.

and response had been managed via radio and lacked a digital solution. To enable proper system integration, it would be important to upgrade the lighting and Wi-Fi coverage in tandem.

- ▶ **REDUCED LIGHT POLLUTION.** They needed a lighting system that would minimize impacts on the nearby South Boston residential community, with emphasis on reducing light pollution.
- ▶ **ENERGY SAVINGS.** They also wanted to minimize future electricity costs—which can add up to quite a bit over such a large area—and take responsibility as a state agency for reducing the terminal’s carbon footprint. This project represented an opportunity to change out old light fixtures for new, more efficient ones that could make a significant difference.

City of Wilmington

The City of Wilmington had two primary goals for their investment in lighting upgrades:

- ▶ **INCREASED SAFETY AND SECURITY.** Seeking to improve a reputation for crime, the city needed a brighter lighting solution to increase nighttime safety and security for residents. This would also likely encourage more suburban residents to visit and engage in commerce, supporting the city’s economy.
- ▶ **ENERGY SAVINGS.** In addition to minimizing energy use, the city wanted a lighting system solution that would streamline and reduce the cost of maintenance (e.g., lamp replacements). With the previously installed lighting system, this task required crews to drive around looking for burned-out lamps twice weekly before sunrise.

Wilmington also had specific challenges to navigate in meeting these goals. One was the fact that the new lighting system would need the flexibility to satisfy many constituent concerns. Another was a limitation in that the city only owns and controls 1,732 of Wilmington’s 7,000 lights—just under 25 percent. Most lights in the city fell under Delmarva Power, the local power company. While this would prevent them from implementing the solution citywide, they would be able to update key areas downtown, around parks, restaurants, and the theater.

Lighting and Integration Strategies

The TOS is used at Conley Terminal to track containers as they arrive and as they are moved around the terminal, including during vessel loading and unloading, as well as trucking drop-off and pick-up. Terminal operators use the TOS to track which areas of the terminal are in active use via Wi-Fi points located on light poles, rubber-tired gantry cranes, ship-to-shore cranes, and other critical locations throughout the terminal.

To achieve project goals, including integration with the TOS, Massport opted to replace the existing high-pressure sodium fixtures on each high-mast light pole with **LED lighting** supplied by MUSCO Products and designed by Jacobs Engineering.

Over the course of the project, the existing lowering ring devices were removed, eliminating a constant maintenance concern for the port and allowing collocation of other systems including security systems and Wi-Fi access points. The lowering ring devices were replaced with all new cross arms, internal wire harnesses, and new LED luminaires; **three lighting levels were developed:**

- ▶ High: 100 percent output, full terminal usage
- ▶ Medium: 50 percent output; passive usage, including transit locations
- ▶ Low: 20 percent output, surveillance level usage

Due to industry-specific risks at Conley Terminal, the lighting system was also integrated into Massport’s main security system. The lowest light level was set to allow active camera use throughout the terminal even when operations were stopped and only surveillance lighting was required. In addition, controls were given to port police to allow security personnel to automatically adjust lighting to high mode in the event of an emergency.

Meanwhile, the City of Wilmington relied on the expertise of partner Seiberlich Trane Energy Services to identify and present them with lighting options. In reviewing the options, they considered aesthetics, lighting function, power, unit cost, and warranty coverage. The city ultimately selected new DesignLights Consortium-qualified LED luminaires from a few different manufacturers, all of which include **advanced controls (e.g., on/off, dimming) and an interactive dashboard** with clear data visualization of lighting status.



Downtown Wilmington Street lit up at night

Seiberlich Trane helped secure a \$200,000 grant from the state to assist with the investment and handled procurement of the chosen lighting products. They also tailored the color of the newly installed lights to address concerns voiced by constituents when the project was announced, and to coordinate with the color of lights not owned by the city for visual cohesion.

Outcomes

Investing in their lighting systems resulted in all the benefits Massport and Wilmington were hoping for, and then some. For example:

► **MORE LIGHT, MORE CONTROL.** At Conley Terminal, more light can now be cast throughout the terminal and focused where it needs to be, with adjustable intensity to allow for dimming lights in areas not in use on a nightly basis.

In Wilmington, better lighting heightened people's sense of safety and security. Dimmable lighting allows the city to brighten certain areas for events and during targeted times, such as before and after a theater show or during a festival. This became particularly helpful in making people feel safe and comfortable dining outdoors during the COVID-19 pandemic, even during months with earlier darkness. This, in effect, extends the city's outdoor dining season to about 10 months of the year.

► **LESS LIGHT POLLUTION.** The more focused nature of LED lighting—coupled with the ability to reduce lighting intensity in lightly used areas of the terminal on a nightly basis—significantly decreased

light pollution for Conley Terminal's neighboring residential community. This was a key complaint from residents prior to the project.

After initially being concerned at the possibility of blue light from LEDs, Wilmington residents were satisfied with the light color, level, and reduction in light pollution offered by the city's choice of low-correlated color temperature lighting.

When complaints were reported in certain areas about glare from the new lights, residents gathered at a community meeting and arrived at a more comfortable, dimmer setting. They felt good about having input while saving money and contributing to a cleaner environment through reduced energy use.

► ENERGY AND MAINTENANCE COST SAVINGS.

The integration of the new lighting system with the operating and security systems has resulted in approximately 55 percent lower energy usage for lighting at Conley Terminal compared to the previous lighting system. Further, using wireless controls resulted in significant construction savings by eliminating wired connections to the lights

In Wilmington, installing LEDs has resulted in huge decreases in lighting maintenance costs. Street light fixtures that used to require bulb replacements every two to five years will now last 20 years, and self-reporting light status removes the need to drive around looking for faulty units.

“Maintenance is so dramatically improved that we are selling a \$450,000 bucket truck that we no longer need.”

– City of Wilmington

In terms of energy-related outcomes, the city calculated its new annual carbon dioxide emissions avoided is at 705.36 metric tons using the Environmental Protection Agency's greenhouse gas equivalency calculator.

This is equivalent to avoiding the greenhouse gas emissions of **159 passenger vehicles** or **1,823,569 miles** driven in one year, or electricity used in **112 homes** for one year, or **259 tons** recycled instead of landfilled.

Table 1. Energy and cost savings from lighting system upgrades

| Project | Annual Energy Savings | Estimated Annual Cost Savings |
|---------------------------|--|---|
| Conley Terminal | 175,680 kWh energy saved | \$31,600 |
| City of Wilmington | 999,730 kWh energy saved / 705.36 metric tons of CO2 avoided | \$150,000 in energy savings, plus the cost to own, operate, and maintain one bucket truck and fewer staff hours for maintenance activities and calls. |

The satisfaction and engagement of Wilmington residents after the lighting installations were completed was a bonus win for the project. In fact, people have requested that more lights be updated throughout town. As a result, the city is beginning a pilot with partner Exelon (formerly Delmarva Power) to update the rest of the lights over the next four years. During this process, they will also properly inventory who owns which lights to save time down the road.

Lessons Learned

One of the key challenges Massport faced at Conley Terminal was the installation of Wi-Fi access points to achieve good, even signal coverage in all needed areas. The team worked with their information technology department to make sure there were enough access points and the right level of bandwidth available. Then, they learned through trial and error at different locations throughout the terminal how high to install access points for

“Incorporating an emergency switch to bring lights to 100 percent turned out to be key to getting port police buy-in.”
– Chester Myers, Massport

best signal performance and tackled the necessary challenge of hard-wiring them.

Looking back at the light system upgrade effort, Myers sees wisdom in their decision to solicit input from port police to verify their buy-in on lower lighting levels.

For their part, the City of Wilmington was surprised at how much lighting infrastructure (e.g., wiring and boxes) needed updating due to damage from weather, road salt, and human-caused wear-and-tear as they worked their way through the city’s lighting inventory. Knowing what they know now, they would have budgeted more for the project, kept better records on lighting inventory conditions, and secured a contractor that could be ready to perform necessary updates.

About the ILC

The Integrated Lighting Campaign (ILC) is a program designed to help facility owners and managers take advantage of savings opportunities and benefits of advanced lighting controls and of integrating lighting systems with other building or business systems in their facilities. The ILC serves as a resource for relevant research regarding new advanced lighting controls and integrated lighting systems and provides a platform to recognize exemplary projects shared by ILC participants and supporters.



To learn more and join, visit <https://integratedlightingcampaign.energy.gov>

To learn about Better Buildings Technology Campaigns and join, visit <https://betterbuildingsolutioncenter.energy.gov/alliance/tech-campaigns>

ILC Organizing Partners

This effort is a collaboration between the DesignLights Consortium® (DLC), Illuminating Engineering Society (IES), the International Facility Management Association (IFMA), interNational Association of Lighting Management Companies (NALMCO), the Lighting Controls Association (LCA), U.S. General Services Administration (GSA), and the U.S. Department of Energy.

