

Data Center Expansion

Every construction project has its own inherent risks and hazards associated with it. However, an expansion to an active, operating Data Center introduces numerous others that could be alarming to many, especially when you're doubling the size. Ludvik Electric saw these risks as an opportunity. From the start, Ludvik used extreme detail in assembling a plan to expand the active facility while maintaining the Owner's gold standard of reliability. This planning included pre-fabrication, detailed 3D BIM model, detailed "Methods Of Procedures" (MOPs) to accomplish transfers and tie-ins that were critical to the existing operations, along with innovative construction methods to meet the needs of this difficult project. In addition to the complexity of the project, the schedule was compressed from eight (8) months to three (3) months, requiring a collaborative fast-tracked construction schedule that took the entire team's input. In the end, Ludvik led a successful expansion with a satisfied Owner that experienced no interruptions. Just as the Owner's customers can depend on the reliability of their cellular data network, the Owner depends on Ludvik.

Project Scope

Shortly after Ludvik successfully completed the initial build-out, an expansion was immediately needed to meet the growing demand for wireless data storage. Project scope for this expansion started with demolishing an existing electrical room to make room for installation of new equipment. Ludvik removed all equipment in the 1,850 square foot Electrical Room consisting of (8) large switchgear lineups each averaging 8' tall x 4' deep x 15' long and weighing 10,000 pounds each, including the respective 3,000'+ of conduit and 10,000'+ of wire. Once the removal was complete, build-out of the Battery Room commenced. Ludvik installed (1,920) Lead-Acid Batteries to provide critical data back-up power for up to 2 hours during the event of complete generator failure. Ludvik then removed (2) existing UPS units that were directly adjacent to live critical load UPS equipment to make room for the installation of (4) new UPS systems to support the new battery strings and data floor. Finally, Ludvik removed an existing generator paralleling gear to install a massive 35kV Transformer (13' long x 11' tall x 8' wide x 32,000 pounds) directly adjacent to live critical load equipment. Once this new equipment was installed, there were significant cutovers to perform between existing and new Battery Strings and UPS systems. Once these cutovers were completed, all equipment was tested and

commissioned to ensure data floor reliability for the Owner. While this work was being performed, Ludvik was also installing a brand new state-of-the art Security and CCTV Camera system consisting of over (80) Card Readers and (100) Cameras along with new head-end equipment and new Security Desk. The Owner needed this Security system to protect their investment.

Compressed Schedule Pre-Planning, Pre-Fab, and Execution

To meet the Owner's compressed schedule, Ludvik pro-actively redesigned the Battery Room equipment layout in order to pre-install conduit and electrical equipment prior to demolition, using BIM coordination with other trades to maintain clearances and eliminate future conflicts.

Ludvik also recognized that once the existing rooms were demolished, standard means-and-methods would not be acceptable to meet the timeline. Therefore Pre-Fabrication was used to expedite the construction. 450' of Battery Cable Tray was pre-fabricated with cable dropouts, T's, and elbows in bundled sections that were shipped to site and quickly installed by joining sections together. Due to Ludvik's pre-planning of the Battery Layout, 4,650' of battery cable was cut and prefabbed into 44 precisely measured pieces. Compression Lug Terminations were made to each cable section, the cables were bundled and secured in 3 parallel runs, and then labeled by Battery Number to allow for fast on-site installation in the cable trays and easy terminations to the battery flags. Feeder Conduit Racks were pre-fabbed along with 360' of conduit, which was then duct-hoisted onsite into place in order to expedite the start of wire pulling.

Through sequencing and planning with the General Contractor, floor epoxy was first applied to $\frac{1}{4}$ of the Battery Room to allow the installation of Battery Disconnects and the pre-fabbed conduit, while simultaneously installing the pre-fabbed Cable Tray and Cable on the non-epoxied $\frac{3}{4}$ of the room. Battery Rack and Battery installation proceeded quickly as planned once epoxy was 100% completed. As a result of the above pre-fabrication, creative sequencing, and diligent planning, the Battery Room was completed in 6 weeks, compared to 20 weeks in the initial build-out.

Since the UPS rooms were already installed, opportunities for pre-fabrication and re-design were limited compared to the Battery Room. However, Ludvik overcame the constrictions and was able to expedite the UPS rooms as well. Pre-fabricated overhead conduit in lieu of designed underground conduit saved the time of excavation and protection of existing equipment. Pre-pulling of Feeder Wire from battery strings to the cutover UPS's was performed in order to terminate and start up UPS units during 12AM-4AM MOP windows. Ludvik also expedited the installation of the 35kV Transformer and was able to set the large gear, pull 1,000' of 35kV cable, terminate, and test in a 3-day window in order to energize the UPS and Battery Strings ahead of schedule.

Maintaining an Existing Facility

Once again, Ludvik was charged with performing this work in a "live" Data Center that does not allow any outages. Ludvik performed extensive equipment removal, large switchgear installation, battery room installation, feeder pulls and cutovers, and answered the challenge without interrupting data or power to any of the facilities. Additionally, taken into consideration by Ludvik were comfort issues for the Owner staff. Prior to the demo of the Boiler rooms in September 2013, Ludvik recognized that the new Roof Top Units (RTU's) designed to provide heat were designed to be powered from new panels that would not be energized until December 2013. Ludvik pro-actively redesigned the feeders and enacted a MOP to feed the new RTU units from energized existing panels. The RTU's were energized as planned, promoting a warm relationship with the Owner.

Technology

Technology was used to aid the planning and execution during the compressed schedule. Prior to construction, a fully coordinated computer 3D BIM model was created to eliminate installation conflicts before they occurred in the field. The 3D BIM model was also a powerful tool in creating the pre-fabrication. During construction, electricians used onsite computers with the 3D BIM model to guide their installation. Instead of using paper drawings, all documents were kept electronically. Changes were posted to electronic drawings using pdf software. iPads were used by field electricians to view these contract documents with updated changes. As the construction was completed, the iPads were used for documenting electronic as-builts, instead of red-lining a

paper drawing. This process led to organized updated drawings for an efficient field install and clean, easy-to-ready as-builts for the Owner. It was pointed out during the construction that Ludvik's substantial use of electronic data reflected the technology-reliant shift in everyday life, which was the reason for the data center expansion project itself.

Safety

In addition to Methods of Procedures (MOPs) for complex activities such as cutovers, Ludvik also built Safety into our daily work plans by using our own detailed written Pre-Task Plans highlighting and discussing any and all risks associated with each installation. Careful planning and extra precautions were taken considering that the entire installation was done around "live" electrical equipment that could not be de-energized. During the equipment removal, the electricians were trained in fall-protection and lanyard use. Routine tool box talks were conducted by all members of the crew to identify and communicate the changing hazards on the jobsite. Upper Management and Corporate Safety Directors were onsite regularly to review and plan safety with the crew members. This commitment to detail from all levels resulted in zero recordable incidents on over 60,000 man hours worked.

Bringing it Home

Once all the equipment was installed and wired, Ludvik was in charge of performing Startup, Energization, Commissioning, and Cutovers of the Electrical and Mechanical Equipment needed to energize and cool the data floor. During the initial build-out, this same effort took 20 weeks; however the project schedule for this scope only allowed 6 weeks! Ludvik was in charge of this entire scope, providing meticulous planning and creative sequencing between all of the activities, which included: Battery initialization, charging, and equalization; NETA Testing; UPS Startup & Testing; Data Floor Equipment Startup & Testing; Unit Substation Startup & Testing; Switchgear Controls; and Load Banks. Ludvik again took the lead and worked with the GC and Owner to create a day-for-day schedule and sequence that made the team successful in delivering the data floor in less than 1/3 of the time compared to the previous build-out. Ludvik's fast-tracked plan and execution allowed the Owner to install Network Racks and Servers to stay one step ahead of their customers rapidly growing needs, thus retaining their status as a leader in the

wireless industry. Ludvik once again has proven to be the reliable data center Electrical Contractor of choice that Owners can depend on.

Image 01 – Ludvik Electric Co. – Data Center Expansion



Image 02 – Ludvik Electric Co. – Data Center Expansion

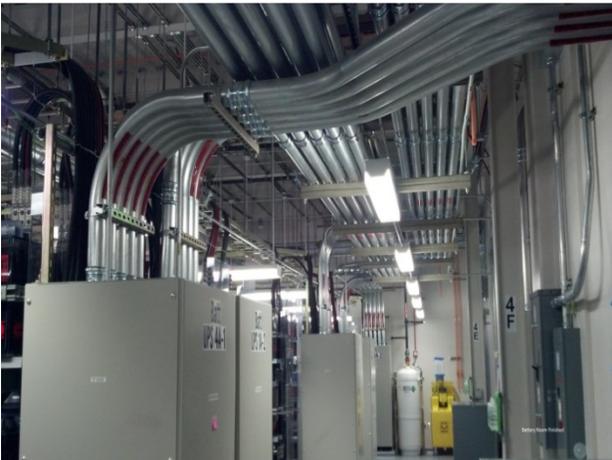


Image 03 – Ludvik Electric Co. – Data Center Expansion



Image 04 – Ludvik Electric Co. – Data Center Expansion



Image 05 – Ludvik Electric Co. – Data Center Expansion



Image 06 – Ludvik Electric Co. – Data Center Expansion



Image 07 – Ludvik Electric Co. – Data Center Expansion



Image 08 – Ludvik Electric Co. – Data Center Expansion



Image 09 – Ludvik Electric Co. – Data Center Expansion



Image 10 – Ludvik Electric Co. – Data Center Expansion

