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# A Case Study in Lean Construction: Rosendin Electric

By  
Robert M. Leicht  
John I. Messner  
Elnaz Asadian

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Architectural Engineering  
University Park, PA 16802  
USA

# Summary

The successful adoption of lean into Rosendin’s company culture and implementation into operations appears to stem from two primary sources. First, the similarity of lean principles with Rosendin’s core values creates a natural alignment. The alignment allows the use of lean methods and techniques to be easily grounded in the way Rosendin does business, treats people, and makes money. Many elements are needed to sustain that success, but the grounding of the principles in Rosendin’s core values provides the guidance for all the company personnel to adopt the behaviors. The second key to success lies in Rosendin’s unbundling of the often-complex methods and techniques to simple and easily understood concepts.

These two main strategies, along with the standardization of work processes, result in the successful implementation of lean initiatives and principles. Rosendin put high emphasis on training, mentoring and team building within their crews, in conformity with the lean principle of “respect for people” and continuous improvement. The latter is an important aspect of their lean journey, considering lean implementation as an “ongoing” process that requires buy-in and attention from all employees rather than considering it as a one-time adoption. This aspect was highlighted by different personnel, demonstrating that the continuous improvement culture is embedded in their mindset.

Standardization and prefabrication are other important avenues of their lean implementation, which they combine with visual management. Although working on projects where the schedule has frequent changes was noted as a challenge for scaling upr their prefabrication procedure, Rosendin seeks to prefabricate or kit as much as possible in their shop facility.

# Company Overview

Rosendin Electric began as a small family-owned business in 1919. Since then, it has grown, and today, Rosendin is one of the nation's largest electrical contractors with approximately \$2B per year in revenue. The firm has been successful at growing into a large organization for a construction trade contractor, with their headquarter in San Jose, CA, and 16 other offices across the US.



Rosendin defines their core values as:

- **We Care:** We are an organization built on integrity. We create an environment that empowers people to work safely, to be at their best, and to respect one another.
- **We Listen:** Our success is based on hearing and understanding the objectives of our customers. We build relationships.
- **We share:** We collaborate, we inspire, we challenge one another.
- **We Innovate:** People will remember us for the solutions we provide. Entrepreneurial ideas are encouraged and promoted continuously raising industry standards.
- **We Excel:** The quality of our work will represent us for years to come. We take pride in what we build.

## Delivery methods

Design-Bid-Build (DBB) is the most common project delivery method that Rosendin is usually engaged. However, they are engaged through design-assist, design-build, and IPD work as well. They also have the experience of direct work for certain repeat owner organizations (e.g., tech-driven projects). They consider IPD as the best environment through which collaboration and cooperation among involved parties are best achieved. However, given the relatively sparse use of IPD contracts, most projects function through more traditional top-down contracts and decision-making. Therefore, Rosendin needs a high level of commitment to continue their tasks based on lean principles.

## Construction scopes

Rosendin has many years of experience in all scopes of electrical works, from underground, to interior and exterior electrical systems across various project types. They primarily concentrate on building and manufacturing, especially high-tech manufacturing, data centers, and healthcare sectors, with less work in transportation, industrial, or residential sectors. They also engage in renewable energy projects, such as utility-scale solar, distributed generation solar, wind generation projects, and battery energy storage systems. They provided clients with design-build and turnkey EPC deliveries for these types of projects. Their services include project feasibility and energy performance analysis, procurement, construction, commissioning, operations, and maintenance.

Rosendin is a union contractor, they are actively engaged with the IBEW, noted for their boot camp initiatives to help attract workers to electrical construction and help feed the local union hall through privately financed training and education to help prepare potential workers.

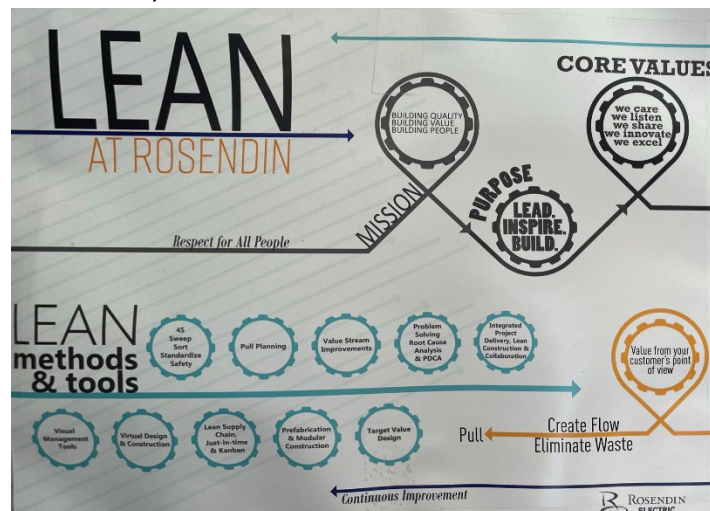
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# Case Study Process

In late July 2021, the investigators of the Penn State Research Team conducted a site visit, interviews, and observed the operations at two construction projects for Rosendin Electric’s office in Tempe, AZ. The notes from the interviews and observations were reviewed to identify themes and the alignment of observed practices with lean principles. Following the visit, the case study was documented and shared with personnel at Rosendin for validation. The case study document contains the description for how the behaviors and approaches to lean are implemented at Rosendin to support their construction operations.

## Overview of Lean Construction Implementation

The goal of the case study is to attempt to understand what it means to successfully implement lean methods and principles within a trade contractor. Each company or organization is unique, and thus no two companies will implement principles and methods in precisely the same fashion. Thus, the depth of the research is in understanding how the principles of lean can be framed or aligned to any trade contractor and how that framework can be operationalized to support the elimination of waste and continuous improvement in delivering customer value. How can the methods and behaviors be instituted and supported in a sustainable way?



### Respect for people

The lean tenet, “Respect for People,” is embodied directly in Rosendin’s core values “We Care,” which Rosendin defines as balancing integrity with empowering people to be their best, be safe, and respect one another. Rosendin’s recognition of the importance of people has been fundamental to their success. They invest heavily in their people but balance the need for technical training with the personal development and support of the individuals. Several examples of this were observed during the visit and raised by the Rosendin personnel regularly during interviews. It was evident that Rosendin put a strong emphasis on the value of training, mentoring, and team building. This was both observed in field visits, and office tours and identified through interviews. For example, it was noted that they prefer to hire ‘team players’ first, with the understanding that they can train and develop technical skills for the role or position.

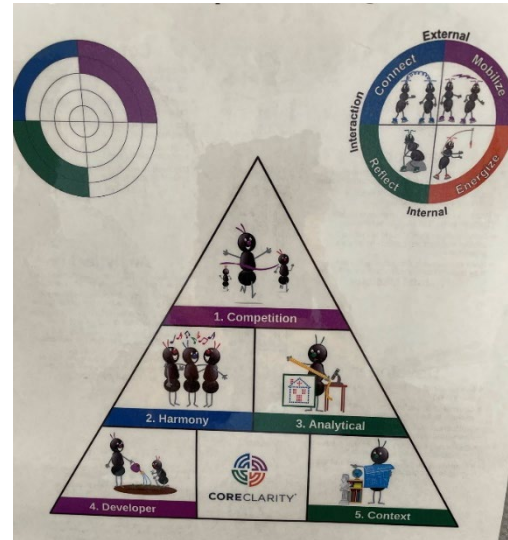
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## Core Clarity

Rosendin invested heavily in a program titled ‘Core Clarity’ to support the personal and team development of all their full-time employees. There are many approaches, tools, consultants, and resources available to support personal and professional development initiatives – the intent is not to focus on the specific benefits of the Core Clarity model. Rather, the key observation was how Rosendin implemented the use of Core Clarity, its development into a sustainable program, and its continued use to support and empower project teams.

Core Clarity is used to help Rosendin personnel better understand themselves, both personally and professionally.

While first piloted with a consultant, the initial success was used to move the pilot into a standard initiative for all full-time personnel. In addition to scaling the initiative, Rosendin invested in having multiple internal staff trained in the assessment and coaching for the Core Clarity program. These coaches then deployed the program company-wide over an approximately two-year period, and continue to engage with project teams, new personnel, and other efforts on an as-needed basis.



One of the primary benefits and uses that supported Rosendin’s resounding success was the value of the program in helping team members better understand how to engage with others from across Rosendin. The profiles for personnel are posted in offices and provide a quick, visual, and insightful glance into the ‘why’ and ‘how’ when understanding the behaviors of co-workers. These insights appear to reduce common misunderstandings, as well as encourage all of Rosendin’s team to consider how their team members will perceive the information or message they are trying to communicate. As communication requires both the effective sending and receiving of the message, this awareness is critical to the success of any team.

## Ongoing assessment and training of craft

As a union contractor, Rosendin both supports and benefits from the training provided to union craft workers in their careers, moving from apprentices to master electricians. In their support of continuous improvement, as well as building things right the first time, Rosendin invests in fully understanding the skills and capabilities of each worker sent from the union hall to work for them. Rosendin asks each worker to engage in a skill test to understand each worker’s capabilities and strengths and then supports further training and mentoring above and beyond the high standards the union has already set. This helps instill the value of continuous improvement that is created through the union apprenticeship mentoring model, as well as provide value back to the workers directly by helping them grow their skillset and enhance their craft – regardless of which electrical contractor they may work for on the future projects. They also prepare in-house, brief recorded videos on fundamental lean concepts to share with their employees, as well as other partners.

## Creating pull for IBEW (image of training story from NECA?)

Rosendin’s Tempe office has piloted an initiative, creating a ‘boot camp’ for training future electricians. Rosendin recruits and hires workers with little to no experience in electrical construction and pays them,

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similar to the union apprenticeship model, to be trained in a support role to help with tasks such as material handling and some construction tasks that do not require a fully trained electrician. As these CECWs work and grow in their knowledge, Rosendin supports each worker's interest and desire to then enroll in the IBEW apprenticeship programming – essentially creating demand for union membership.

### **Mentoring and team building**

In addition to craft training, Rosendin has extended the mentorship model in creative ways throughout the company. New hires receive thorough onboarding into Rosendin culture, processes, and standards. Once personnel moves into their roles, they are mentored in those roles by their supervisors. The culture in the field operations is well established and almost intuitive through the union participation. The extension of this approach and culture has been accomplished through a combination of crossovers of electricians into project management and other 'office' roles, as well as through an organic approach to succession planning that has encouraged all company leaders to consider their mentees as their future replacements. This compels leadership to use an empowerment model that encourages the mentees to more quickly and more thoroughly develop the capabilities and competencies needed for these future roles. In addition, it was clear that the team competencies are often a focal point of hiring, developing, and promoting people into leadership roles. As one leader pointed out, through the union engagement, there is extensive access to technical knowledge and skills. The leadership has plenty of resources for getting that knowledge and support, but they need to be a team player to use it well.



### **Empowering people through guidance, standards, and flexibility**

As noted, leadership development was considered of critical importance, but the 'how' of leadership development is ever challenging. Rosendin takes a three-fold approach to balance the empowerment of their people with standards and structure that provide both guidance and flexibility. To empower your people means, in simple terms, that you allow them the authority and flexibility to make their own plans, decisions and, at times, mistakes. Starting with guidance, as previously noted, Rosendin encourages onboarding, ongoing training, and the use of company standards. These provide structure and guidance in terms of roles and responsibilities, reference checklist for tasks such as starting up a new project, and standard processes, such as model planning at the start of projects.

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One example method Rosendin employs that helps exemplify this approach was the use of Project health checks. A project health check is a review process conducted through Rosendin's QA/QC group to engage with each project over \$3M at set intervals based on project timing, typically 10%, 25%, 50%, 75%, and they are in the process of developing a close-out check as well. The general process for the health check is to have the project team respond to a series of questions regarding their processes, use of standards or resources, and current progress. All answers require support with evidence of how the processes are being conducted and if they differ from the standards, explanation, or justification for why. Thus, teams are expected to use standards, but enabled to try new things regarding how they can mold or fit the company's processes to the unique projects requirements and team approaches that permeate the construction industry. In many cases, these reviews serve as timely engagements to catch projects or teams that may be having trouble and provide the necessary resources and support before the problems escalate. Further, the creative solutions that emerge serve as an opportunity for continuous improvement of company standards and resources.

### **Cross-training and cross-functional teams**

Rosendin applies mentoring and team-building strategies to help their project teams create a collaborative environment, which empowers everyone through guidance, standards, and flexibility. They spread this culture to the lower organizational level, where Assistant Project Manager (APM), general foreman and BIM coordinator work together through the whole project. This strategy requires APM to be responsible for the mini-project for everything, including submittals, change orders, and close-outs. However, to support them, four APMs are paired in teams to exchange knowledge and information through communication and cooperation. Each of them might know how to do some assigned activities in a better fashion so that they can have access to a broader pool of knowledge and expertise. Therefore, Rosendin tries to train them to act as cross-functional team members by preparing them in different aspects of a real project, rather than concentrating on unique features. Mentoring is a critical point when they are in the process of learning.

It should be noted that Rosendin provides a good balance between training employees to be cross-functional while at the same time focusing on reaching a certain point of expertise in related tasks. The training and mentoring program is established in a way that it keeps each employee on the same task to the point that they reach a certain point. As a result of these strategies, we saw a very young team working collaboratively in one of Rosendin's challenging projects, which are open to new things and make changes under a continuous improvement culture.

### **Standardization**

Rosendin employs standardization as a solution to reduce variation, which was mentioned as one of the significant challenges of adopting lean principles. In their prefabrication shop, they prepare components in kitting packages for their field personnel. However, they usually need to balance the components and kits for each specific project, based on the project circumstances.



### **Prefabrication success and challenges**

Rosendin has prefabrication facilities at the shop adjacent to their main office in Tempe, as well as in most of their offices across the country. In addition, due to special constraints and project needs, they also have the capability to set up field prefabrication facilities in special circumstances. Due to the specific nature of electrical construction, large-scale or large modular assemblies are at times impractical or challenging to implement for building construction. Rosendin has found, through some challenges in early piloting, that the scale and specific scope of prefab are directly affected by the project GC's approach to managing the schedule. High levels of uncertainty in the flow of work reduce the benefit of using prefabrication and often lead to either rework of the materials or increased inventory at the project that slows down production.



Rosendin has slowly evolved their approach to prefab to support the field electricians as their internal clients. However, each project has unique constraints and needs, so the specific approach to prefabricating systems, components, and assemblies is custom-tailored. Regardless of the specifics, common elements this use of prefab has created include reducing the number of pieces an electrician needs to handle for each task, grouping and carting the assemblies or parts to reduce worker time moving or finding the necessary pieces, and focusing on the enabling tasks to streamline field install.

**Reducing number of pieces** – to make the core value-adding tasks for the electrical installation simpler, the shop often puts together small assemblies, such as wall boxes. If field installed, a worker would need the junction box, mud ring, strap(s) to attach to the adjacent studs, screws to connect them, conduit coupling(s), the conduit or MC cable for the raceway and possibly other pieces depending on the wall assembly. By assembling these in the shop, the field installation simply requires one component and the screws to connect that assembly. The worker is thus better able to focus on quality and location needs of that project when setting the box. This also removes waste simply by reducing the number of pieces and tools the worker needs to manage while completing the task, as well as removing scenarios where one of these pieces is missing that would require the worker to return to the material laydown area to collect the necessary item(s). These assemblies also reduce the amount of trash generated at the project site – saving field labor valuable time.

**Grouping parts and assemblies** – when sending the assemblies out to projects, the shop groups assemblies by area and puts the assemblies onto wheeled carts or cages. By grouping the assemblies or supporting pieces or materials, workers are able to quickly gather the items they need to work continuously in a room or section of a building without having to frequently pause to get more materials. It also saves them time and effort by keeping their materials for current, and future tasks close at hand. The use of wheeled carts provides ergonomic benefits,



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workers do cut down their need to handle and carry heavy materials. The carts can be easily shifted between areas to keep them close at hand, and they are wheeled and easily movable – so if they happen to be in the way of another trade or group, it does not take much time or effort to move them.

### Organization of material storage and visual management

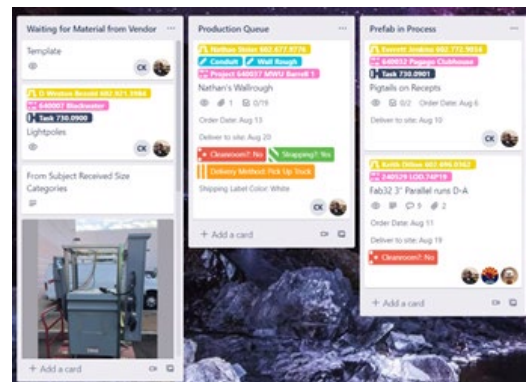
They organize and store typical or prefabricated parts, such as Unistrut cut to typical lengths. This helps the materials to be sorted at their shop facility in a more organized manner and ease the delivery process to the sites.

Their job boxes are usually organized, which are combined with visual management technique. Different parts are sorted under categories, making the finding process much easier for the installer.

They also establish a “Grab and Go” kits for the installation process on the job site. Under this strategy, all necessary tools and small parts for a specific electrical task, such as running  $\frac{3}{4}$ ” conduit, will be sorted in a kit so that workers on a given task can grab the corresponding kit and have all the necessary items.



**Trello as a virtual Kanban board:** The shop uses the Trello board to manage the day-to-day production. The prefab shop receives orders through email and posts them to the Trello board so that the people engaged in the process can see what parts have been done, what parts are currently being assembled with specific dates. They also include pictures, drawings, and any other data related to each prefabricated part in the Trello platform to have complete info on each part. The board further serves as institutional memory with past examples of prefab requests, examples, and scopes.



# Concluding Thoughts

Throughout the visit, interviews, and discussions, there were practices and supporting ideas that personnel and project team members noted as barriers and enabling concepts to the use of lean. The following sections capture a few of these items:

## Practices that support lean

- The use of integrated delivery methods was noted as invaluable for encouraging collaboration between trade contractors and the GC, along with increasing the opportunity for more widespread adoption of lean principles.
- Terminology – many of the conversations showed that the specific lean method terminology was not critical to the implementation of the concepts. In many cases, the concepts were kept in simple terms, such as reducing number of times materials are handled or reducing walking distances, to help field personnel quickly relate the concepts to making their tasks simpler and less onerous.
- Unbundling – often lean method discussions engage in ‘full’ use of a method or system, such as implementing all of the elements of the Last Planner System. Our observations found the opposite to be of significant value in supporting adoption. By unbundling the pieces, conversations can focus on the specific techniques that are applicable to a very specific task or area of waste.

## Common challenges and barriers

- Reliable plan and schedule – it was commonly noted that shifts or last-minute communication about design, construction plan or schedule changes reduce opportunities for the flow of work, specifically for methods such as prefabrication.
- Jumping to the next “shiny method” rather than getting a little better – there were several discussions about initiatives being put in place that institute ‘new’ tools, methods, or processes as being disruptive. Some of these instances were driven by clients on specific projects, but other examples included software rollouts or processes changes.

## Other Observations

**Knowledge sharing** - an ongoing challenge of any construction firm is how to best harness the array of knowledge distributed throughout its people and then find and apply that knowledge when and where it is needed. As a construction company grows, this challenge grows exponentially. Rosendin does a great job with training, standards, and ongoing efforts to identify when project teams need support or resources, but effective knowledge sharing, similar to continuous improvement, is about the constraint pursuit of perfection with the recognition that it is a journey rather than a destination. Companies are, in some senses, a network of people. In project-based industries, like construction, that network is often pooled into project teams. Knowledge sharing occurs through these networks and connections. Finding methods to increase the interconnections in meaningful ways creates the ‘infrastructure’ and expands the capacity for knowledge sharing when and where it is needed. Some examples or possible methods could include:

- Rotation in the participation of project health reviews – while the hosting of the project health reviews within the QA/QC group is logical, it inherently shields the lessons and experience of

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seeing and understanding many indicators of both success and failure in projects from the majority of Rosendin's personnel.

**Documentation** – There is an opportunity to refine what is documented and how, especially for internal documents and deliverables. Documents rarely generate value and can easily lead to a great deal of waste either on the part of the person creating the report or by the person reviewing it when the key information or details are missing. In reviewing internal processes and standards, internal deliverables should focus on capturing the key information in a simple but effective format, as well as reducing the scope and length.

While much documentation should be streamlined, there are a few areas where documents should be created were not observed. For example, when project teams experiment with new tools, processes, approaches to prefab, or other ideas – these need to be captured and shared. If an idea works, you want to be able to share it quickly and easily, as well as make sure methods or processes that do not work are not repeated by others.

**Transparency and continuous improvement through health checks** – the capture of the information from the health checks appears to only flow up the ladder to company leadership. This is an extremely rich source of information from which continuous improvement efforts could be well-grounded, and the progress of the company overall could be better understood and shared. In addition, the data could be used to help characterize and teach project teams what the 'good, bad, and ugly' of each stage of a project looks like. If you had a score of 73, what were the teams doing slightly better doing that you could learn from? In the specific areas that a project team was having difficulty with - what do those documents or processes look like? Who were the teams doing these things well, and how can we connect with them to learn how to fit those approaches to our project?

**Expand use of visual management** – The organization of materials was strongly demonstrated. The next step in improving the flow of materials is making the need for their purchase/delivery obvious. Visual management can be employed to put simple visual indicators into common stock items that would provide a yellow or red flag when available materials recede below a certain point or amount of future work.

## Acknowledgments

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