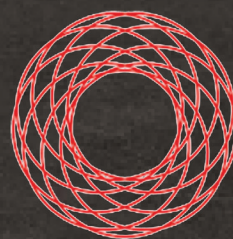




Lucas Schindlar, Micah Holdsworth,
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Devro
Studio 2LR





Figure 1 | Devro Entrance

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Figure 2 | Devro Security

Abstract

Devro, an international collagen casing production company, has had a production facility in Columbia, South Carolina since 1975. Despite producing a fantastic product, the machinery, programmatic assembly, and spatial organization was antiquated and short-sighted necessitated a labor intensive process – so much so that Devro couldn't afford to run it any longer. The lessons learned from the old production space laid the foundation for a framework to be developed for a completely new construction in the same place. This new Devro production space would need to have a production process flow that followed a straight line, from back to front, and stayed entirely on one level. After 24 months of design and construction, this new Devro plant was finished in July 2015 and began 24/7 production immediately.

Project Significance

Consequently, the program of the building is organized from back to front in alignment with the production assembly line. Trucks bring in raw materials into the very back and receive the final product

from the front, and all of this program in between is organized along a long, wide corridor that connects them all. This very practical yet highly coordinated spatial organization allows for optimized access – not only for the product but also for the machines, employees, and even waste management.

Devro, as represented by the plant Director of Engineering Robert Ralston and Project Engineer Garth Turpen, immediately brought Fitts & Goodwin into the project, knowing them to be a general contracting firm that manages projects well and delivers high-class expertise in food-production construction. Thomas M. Goodwin was involved as Project Manager along with Justin Poore, Development Director at Fitts & Goodwin. As a relationship-focused contractor, Fitts & Goodwin recommended the architecture firm Studio 2LR due to their existing relationship and familiarity with food-production architecture. Wes Lyles, AIA, LEED AP President of Studio 2LR was the contact point and architect for the

project, and worked weekly in tandem with Robert and Garth, Thomas Goodwin and structural engineer Al Stevens of Mabry and Associates.

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Project Challenges

The largest challenges that the Devro plant faces is the inherent humidity of Columbia, SC, due to it being in a geographical "bowl". The process of producing collagen casings requires the use of a high volume of completely dry air, necessitating a massive dehumidification plant on site to produce this hot air. This is such a large operation that this dehumidification process is by far the largest consumer of energy in the Devro plant. This case study reveals

the importance of site sensitive design as well as the energy and efficiency cost of not researching site conditions in the front end of the design process.

Devro, having learned the cost of inflexible, crammed programming from the past plant on-site, intentionally had the new plant account for future growth via large, adaptable spaces with an especially reinforced roof for hanging further equipment from. Additionally, Studio 2LR pitched an extra unprogrammed space to be built so that when the time came for an addition to the plant, it could operate as the connector space between the new construction and the existing plant. This innovative, growth-considerate design is predicted to save $\frac{2}{3}$ of costs in undeterred production and ease of structural continuity as compared to an unconsidered addition.

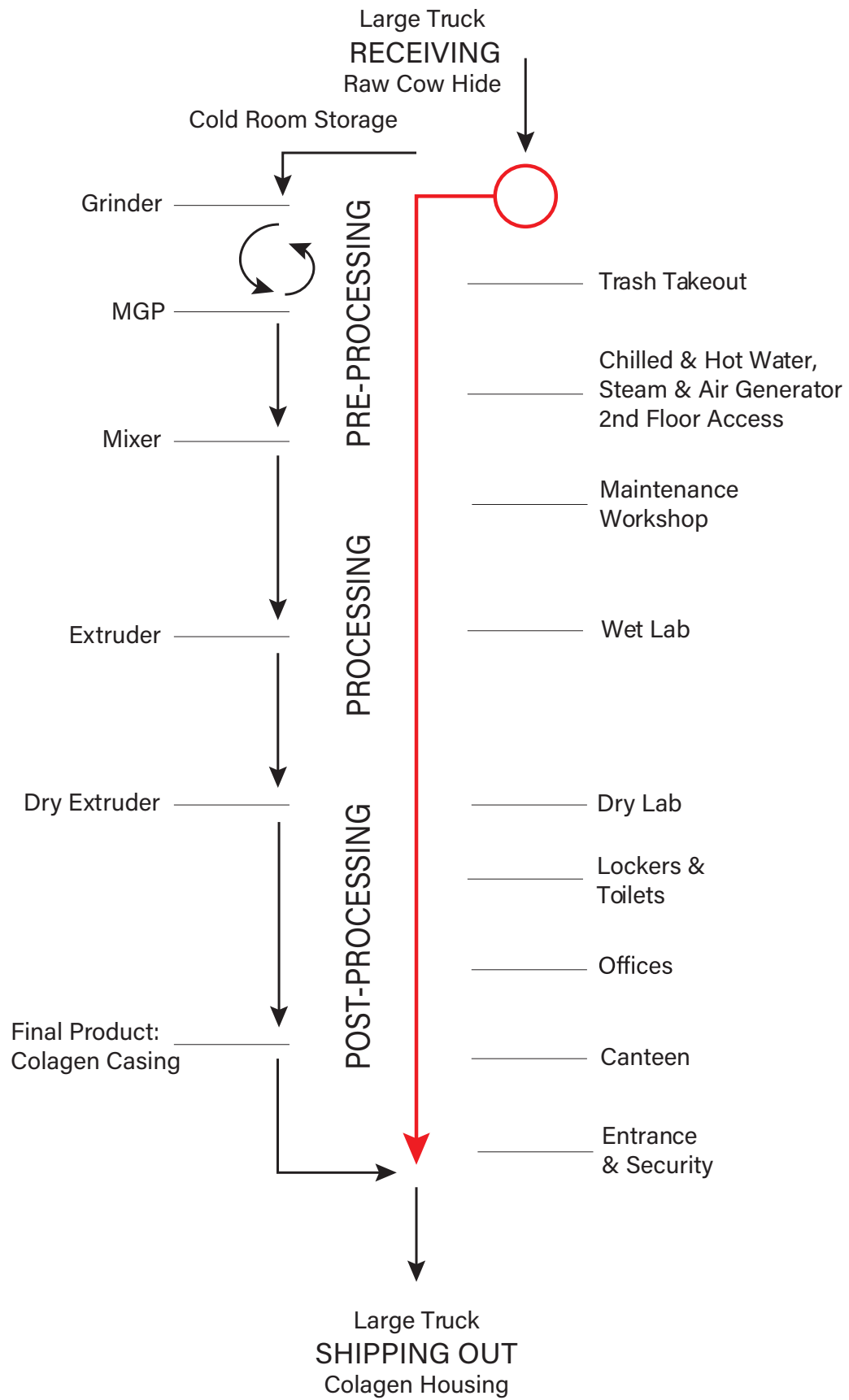


Figure 3 | Floor Plan Spatial Analysis



Figure 4 | Main Corridor

Project Description

Client

Devro

The client, Devro, Inc, is represented by the Plant Owner Moir P. Donalson and Engineering Director Robert Ralston. As a food adjacent production plant, Devro is focused on industrial efficiency and profitability while being subject to rigid food, safety, and security restrictions.

The two “golden rules” for the construction of the plant were that all production should be along a straight, chronological line in accordance with the processes, and that all production should be limited to one level. These rules sought to be a foundation for achieving the aspirations of producing precisely consistent collagen products and creating a production facility that adapted to reinvestment and expansion.

In designing a space that would fit those expectations, Robert Ralston expressed many values as lessons learned from the previous plant. Laborer safety and spacious simple programmatic layout go hand in hand; whereas the previous

plant had intersecting assembly line paths leading to dangerous congestion and desperate coordination, this new plant needed a wide, central circulation space that allowed for production in a single direction. As an engineer, Robert’s paramount value is efficient and workable machinery placement, where the product could easily move from one stage to the next in a highly passive system. In addition, Robert advocated for high-quality equipment to avoid having to periodically replace machinery like a sister Devro plant built in China was systematically having to. However, Robert and his team were self-aware enough to realize that engineer values weren’t enough; they needed locally specialized contractors and architects who would advocate for employee and visitor-suitable architecture. Fitts & Goodwin, being a highly reputable general contractor with local South Carolina expertise and international connections were preferable over a

massive contractor like Jacobs. Studio 2LR were recommended by Fitts & Goodwin as architects who understood the food production process and plant construction while designing for human needs and tendencies. Thus, through Studio 2LR's involvement, the project values extended to include having ample break space for employees, easily accessible bathrooms, a streamlined trash collection and disposal process, and having a contemporary aesthetic that proudly expressed the production processes of the plant through clear graphics and branding.

Devro, Inc, being the overarching client that funded this plant's construction, is very disconnected from the using clients, the workers at the plant that run its everyday operations. Therefore, having Robert Ralston as a mediator between the plant employees and the Devro, Inc board of directors was crucial to the successful and suitable design of the new plant. As the Engineering Director of the plant he is a using client and advocated for the conditions of the workers while also understanding the values of Devro leadership due to his direct working relationship with them. Through Robert Ralston's guidance, Thomas Goodwin's expertise and Wes Lyles's leadership, the design and construction of the Devro plant was coordinated to be both productively organized and humanely programmed. A vibrant red, branded front facade with an adjacent outgoing truck garage welcomes employees, visitors, and truckers alike. The entry lobby space connects to a spacious break room,

both of which are vibrantly painted with graphics explaining the plant processes and lit by natural sunlight. The production spaces all along the wide circulation corridor are kept impressively clean and have clear safety and process graphics to remind employees and inform visitors. Hand cleaning stations are periodically placed across from sensitive production spaces, and sleek bathrooms are placed to be easily accessible from both ends of the building. Overall, the design of the Devro plant reflects a thoughtful approach to catering the primary using client, the plant workers.

Architect

Studio 2LR

Studio 2LR is a multidisciplinary architecture firm in Columbia, South Carolina, and was started in 2005 with 3 partners: Wes Lyles, Gretchen Lambert, and Trip Riley. Their goal and vision when starting the firm is to create distinct and original designs for each client they work with. They want each design to be tailored directly to their clients and make sure that every piece is purposeful and useful, while still creating a great appearance for the project. To create this personal touch with clients, Studio 2LR operates as an office with 10 members that include licensed architects, designers, and interior designers. All 3 founding members are licensed and work collectively to ensure each project is done to meet the standard of their firm's vision. They all share the same strengths and values, but specialize in

different areas of the firm's process. Wes is described as the project manager and focuses on the construction aspects. Gretchen handles the business side as the main business manager. Tripp is called the design specialist as he "creates 100 different ideas for each project in Revit", according to Wes. With these members in charge, Studio 2LR operates as a corporation to provide them the flexibility in their leadership and partnership with one another.

While Wes, Gretchen, and Tripp lead tasks, they work very collaboratively with their employees. They strive to have input from each of their designers on every aspect of their projects. This allows them to be flexible in their work structure and always put the best people on each project to make it a success. Lyles describes this structure as "Ad Hoc". Each project has different problems and Studio 2LR wants the best possible team on each project when needed. They use each other's strengths to balance the project's demands. This allows them to be flexible with the work they take

in different disciplines that range from manufacturing facilities, medical offices, restaurants, libraries, and some residential projects. As projects become more developed, designers will be assigned certain return clients and be able to understand future needs based off of their experience on the project.

Studio 2LR's flexible office structure gives them more opportunities to become successful on this wide range of



Figure 5 | Wes Lyles, President



Figure 6 | Gretchen Lambert



Figure 7 | Tripp Riley, AIA

projects. With most of the projects being located around Columbia, it gives them the ability to stand out in Columbia's architectural community. They allow their portfolio and experience to speak for itself when meeting with potential clients. This creates a large outreach in the Columbia area, where their projects have become a major part of the Main Street development of the city. Studio 2LR has designed many modern storefronts of retail and restaurant in the area to coincide with Columbia's growing community. Their core values on design and purposeful projects allow them to connect with their clients easily. Studio 2LR shows their values along with their focus on thinking about people in the space, keeping the project on time and under budget, and having an attitude of "Let's Do It" to create connections with clients. They receive 80% of their work from returning clients and they are able to retain these clients based on their principles.

Architects: Wes Lyles, AIA, LEED AP + Tripp Riley, AIA

Wes Lyles and Tripp Riley took the lead together on the project's design, however, for this project, Lyles is considered the Project Architect. Through the process, they continued the formula of Tripp handling design aspects and working with Wes to incorporate the construction. Tripp's expertise in Revit allowed multiple iterations to be investigated within Studio 2LR and Devro to create the desired design. Early design decisions were often made

together, but overall, the entire Studio 2LR team had input of the design over time. This included the Interior Design team, who played an integral part in the details of the Break Room (Figure X.X). Over the course of the project, Tripp and Wes changed segments of the design to incorporate the mechanical systems that were being imported from Europe. This caused aspects of the manufacturing facility's design to be altered when specifications were brought up. However, whenever alterations were made, Wes and Tripp continued their "Let's Do It" attitude and made sure the changes were made to Robert and Devro's needs.

Studio 2LR's aspirations for the project revolved around Devro's needs for the facility. While Studio 2LR was the architect, Wes credits Robert and his team at Devro for being the lead behind the design as it was formatted to fit every single detail Devro needed in their manufacturing process. "Devro became a great client for us as they were easy to work with. They had goals in mind for their facility with most of it revolving around what they did not want in it from their older facility. They told us what worked and what didn't, which made our job a lot easier," Wes stated. Studio 2LR wanted this to fit Devro's goal of this facility being the face of Devro in North America.

Studio 2LR and Devro

Studio 2LR became involved in this project through Fitts & Godwin, the project's contractor. In the past, Studio 2LR has worked with Fitts & Godwin on many food service and manufacturing projects in the past and built a relationship with them on a Design Build level, according

to Wes. The studio never turns down the opportunity to work with Fitts and Goodwin due to the way they run their business and the trust they have working with them. After hearing about Devro's manufacturing process and aspirations for the project, Studio 2LR could not resist the challenge it offered. The complexities of the service Devro provides along with the opportunity to work with an international company



Figure 8 | Devro Canteen

Additional Design Participants

Fitts & Goodwin General Contractor

The General Contractor for this project was Fitts & Goodwin located in Columbia, SC. According to Justin Poore, Fitts & Goodwin were selected by Devro and linked their success in acquiring contracts because of their commitment to clients and delivering on their project. With over 1500 projects, 30 million square feet built, and numerous name brand clients, Fitts and Goodwin has the repertoire to complete complex manufacturing projects (fittsandgoodwin.com). Their business planning is primarily based on repeat clientele. Long-term

pursuits are not turned down based on people-centered values. Fitts and Goodwin will find a way to do Devro's future projects as often as possible.

At the end of the day, the true marketing team is the project managers that work in the field. They do a great job at taking care of the client and at leaving a great impression as a form of grassroots marketing. Again, Trust is paramount to Fitts and Goodwin's continued success.

Thomas Fitts Served as project manager to ensure construction was completed efficiently and on budget. As General Contractor, they brought Studio 2LR on to be the architects because of a trusted history of working together.



Figure 9 | Thomas Fitts

Justin Poore also served as a project manager for Fitts and Goodwin and stated that trust was essential in how they approach their work. This belief is reinforced by Fitts and Goodwin's commitment to the client.



Figure 10 | Justin Poore

Jones, Lange and Lasalle Owner's Representative

For such a complex project, Devro felt confident that Matt Rizzo of JLL could represent the goals of the project as a professional linkage between the design team and Devro itself. JLL was responsible for being a liaison between the two, but also budget and design reviews to ensure on time project delivery. JLL is a global commercial real estate services company, founded in the United Kingdom with offices in 80 countries. They help clients buy, build, occupy and invest in a variety of assets including industrial, commercial, retail, residential and hotel real estate (jll.com). Matt Rizzo operates locally in Columbia to retain knowledge and awareness of laws, regulations and compliance that can hamper project development if improperly handled.

Matt Rizzo of Jones, Lange, and Lasalle was brought on near the end of the design phase as the owner's representative. His local knowledge and

expertise helped Devro mediate design challenges and keep the project running smoothly.



Figure 11 | Matt Rizzo

MECA Mechanical, Plumbing, and Fire Protection Engineer

MECA is a multidisciplinary engineering firm established in 1979 located in Columbia, SC. They were contracted by Fitts and Goodwin to work with Studio 2LR to design and deliver Devro's intricate building systems. Without precise coordination with the design team, any major mistakes on their end could have had major consequences for the entire project. Their core values are rooted in "the unique ability to combine building system expertise with an excellent level of client service" (mecainc.com)

Jeff Howell of MECA served as lead engineer for the design and installation of Mechanical, Plumbing, and Fire Protection

Systems. Robert Ralston noted that the design of the drains for the product line, if done improperly, had terrible outcomes for other Devro production facilities.



Figure 12 | Jeff Howell

GWA Electrical Engineer

GWA was added to the design team by Fitts and Goodwin to execute the design of many electrical systems required for Devro's manufacturing facility. They are located in Columbia, SC and without their commitment to collaboration with Studio 2LR, Devro's facility may well have been much less "state of the art". This notion is further reinforced by their firm profile: "We believe that skilled engineering can be provided by those who strive to keep abreast of changing construction technology while at the same time attending closely to the needs of the project so that the client's requirements

may be incorporated into designs and budgets. We know that systems maintenance and energy expenses are substantial contributors to total building cost and make a conscious effort to incorporate them into our designs as well" (gwainc.com).

Dickson O'Brien of GWA undertook the critical role of lead electrical engineer to guarantee the proper design and installation of the many high-voltage electrical systems and power supply/distribution of the facility.



Figure 13 | Dickson O'Brien

Mabry & Associates Structural Engineer

Al Stevens of Mabry and associates worked with Studio 2LR and Cox and Dinkins to design and deliver a structural system capable of supporting the immense support systems on the second floor and providing capabilities for expansion.

Cox & Dinkins Civil Engineer

Cox and Dinkins was contracted

by Fitts and Goodwin to fulfill all civil engineering requirements throughout the project. Cox and Dinkins was established in Columbia, SC as a survey and mapping company in 1963 but has grown to become a regional leader in civil engineering, transportation, land surveying, and landscape architecture services. Like so many of the other parties of the design team, they are local and committed to building relationships with clients based on trust.



Figure 14 | Darren Holcombe

Darren Holcombe was the lead civil engineer for the project. He along with Studio 2LR and Fitts and Goodwin made certain that Devro was provided with a state of the art manufacturing facility capable of expansion.

WO Blackstone Mechanical and Plumbing Contractor

WO Blackstone was contracted by Fitts and Goodwin to fulfill all mechanical and plumbing installations. Located in Columbia, WO Blackstone offers full mechanical contracting services for clients within various markets throughout South Carolina. We help building owners, general contractors, property managers, and design engineers provide effective solutions for HVAC systems. Without their efficient installation processes, the intricate dehumidification systems that keep Devro climate controlled would have been much more expensive. They are all about "Absolutely.

Without A Doubt." and their late president and co-owner Steve Caswell coined this phrase to describe their "do what it takes" focus on helping our clients (woblackstone.com).

Jay Moras of WO Blackstone was the point of contact for the mechanical and plumbing contractor, responsible for the efficient installation of many complex mechanical and plumbing systems for the production facility.

S&ME Environmental Engineer

Josh Quattlebaum was the lead environmental engineer responsible for ensuring site conditions and geotechnical requirements were met.

S&ME was contracted by Fitts and Goodwin to provide all necessary environmental engineering duties for the project. Although a large regional firm, their office in Columbia conducted all the work.



Figure 15 | Jay Moras

Their responsibilities in geotechnical considerations were important to understand the often undesirable soil conditions near the Congaree River. With thousands of projects completed, they state that: "S&ME understands the challenges and has expertise in the application of environmental and health/safety regulations that drive your business concerns" (smeinc.com).

Gregory Electric Electrical Contractor

Jerry Branham and Sam Mccaw oversaw the electrical work to be done and coordinated with GWA and the rest of the design team to execute construction efficiently.

Located in Columbia, SC, Gregory Electric was contracted by Fitts and Goodwin to provide electrical

contracting services. Gregory Electric made sure that all electrical systems were installed properly and able to run efficiently at all times, which is a major consideration for a plant that operates at all times. With over 60 years of experience, they proudly state: "Our promise of effective planning, knowledgeable expertise and collaborative agility extends to every project engagement from start to finish. It's a level of expertise most contractors are simply unable to deliver" (gregoryelectric.com)

SurveyOne

Rusty Owens served as the professional land surveyor for Devro.

SurveyOne was responsible for establishing the new construction survey on the greenfield site, but also maintaining the accuracy of such a large construction footprint. Located in Columbia, SC, Surveyone has decades of surveying experience.



Figure 16 Devro Can'ten

Project Design

Design

Client's Design Intent

Robert and the rest of the Devro team had a clear understanding of how they wanted the building to operate. This building was meant to replace the original Devro Factory in South Carolina. This factory was operated for around 30 years with Robert operating and working the facility for most of this period. Due to the age of the building, the facility was lacking features that the company needed to properly manufacture their product. The original facility lacked simple features that aid in their manufacturing process such as drains in correct areas, while also giving less room for the facility to grow as the company grows. Robert and Garth equally stated how they wanted the new building to increase productivity, aid in the manufacturing process, and have the capability to grow as needed. In addition, Devro wanted this building to represent their European based company in North America, becoming the face of the country on this

side of the pond.

Architect's Design Intent

Studio2LR's design intent was to provide Devro with the manufacturing facility they needed to run their business. There were two points that Wes and Tripp wanted to highlight: the process of manufacturing the product and the people doing it. They wanted the building to represent the assembly line process the product goes through from the time it starts a raw material to the time it is shipped to the customer. This design could only be successful if the employees had the proper spaces that they needed to work. Studio 2LR made it a point to design around the users and not just the machinery, which Robert admittedly said he did not think about in his needs for the facility.

Process

Timeline

Studio 2LR wanted the design process to be a collaborative effort and

intended to meet with the client weekly throughout the design phase. Robert credits the communication between Studio 2LR to why the project was such a success, even through the challenges of the early construction phase later in the project. We wanted the process to be this way as communication between his studio and the client allowed them to look through every option and include all the necessary design details needed for the facility. There were few revisions made to the original timeline and all of them were contained to the shop drawing and fabrication process and

location of the facility had less access to the main road, which would cause issues with shipping. Studio 2LR proposed a new entrance off of State Road South-9-353, which would bring in a new entrance and parking, as shown in Figure 18. This design addition would also allow the shipping to take place right in the front of the building, which caused an interesting feature of giving guests the opportunity to see the trucks pull out of the facility and onto their destination.

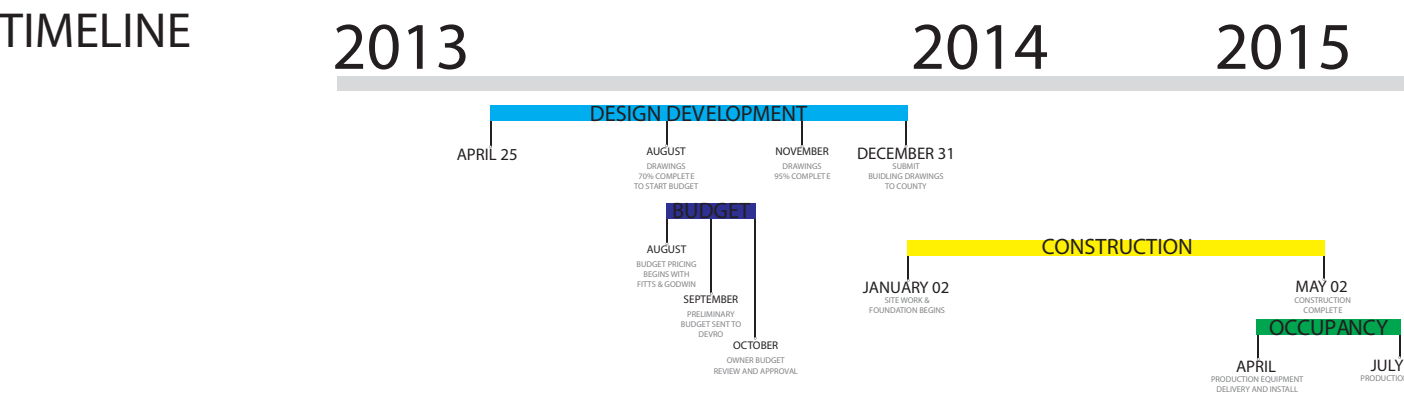


Figure 17 | Project Timeline

the intended completion date was met in May 2015. This allowed the facility to be open for business in July the same year.

Site

Devro’s original facility sat on a large plot of land in a heavily wooded area. Their campus size allowed them to keep the production going in their original plant, while the new one was being constructed. However, the new

Materials

With the Devro facility creating collagen casing for sausage, they have to follow all USDA and FDA guidelines in regards to their cleaning process of the plant and the plant itself. This created a lot of limitations for the Studio 2LR team. They needed materials that could be easy to clean and wash down during the facility’s cleaning process. Insulated Metal Panels (IMP) became

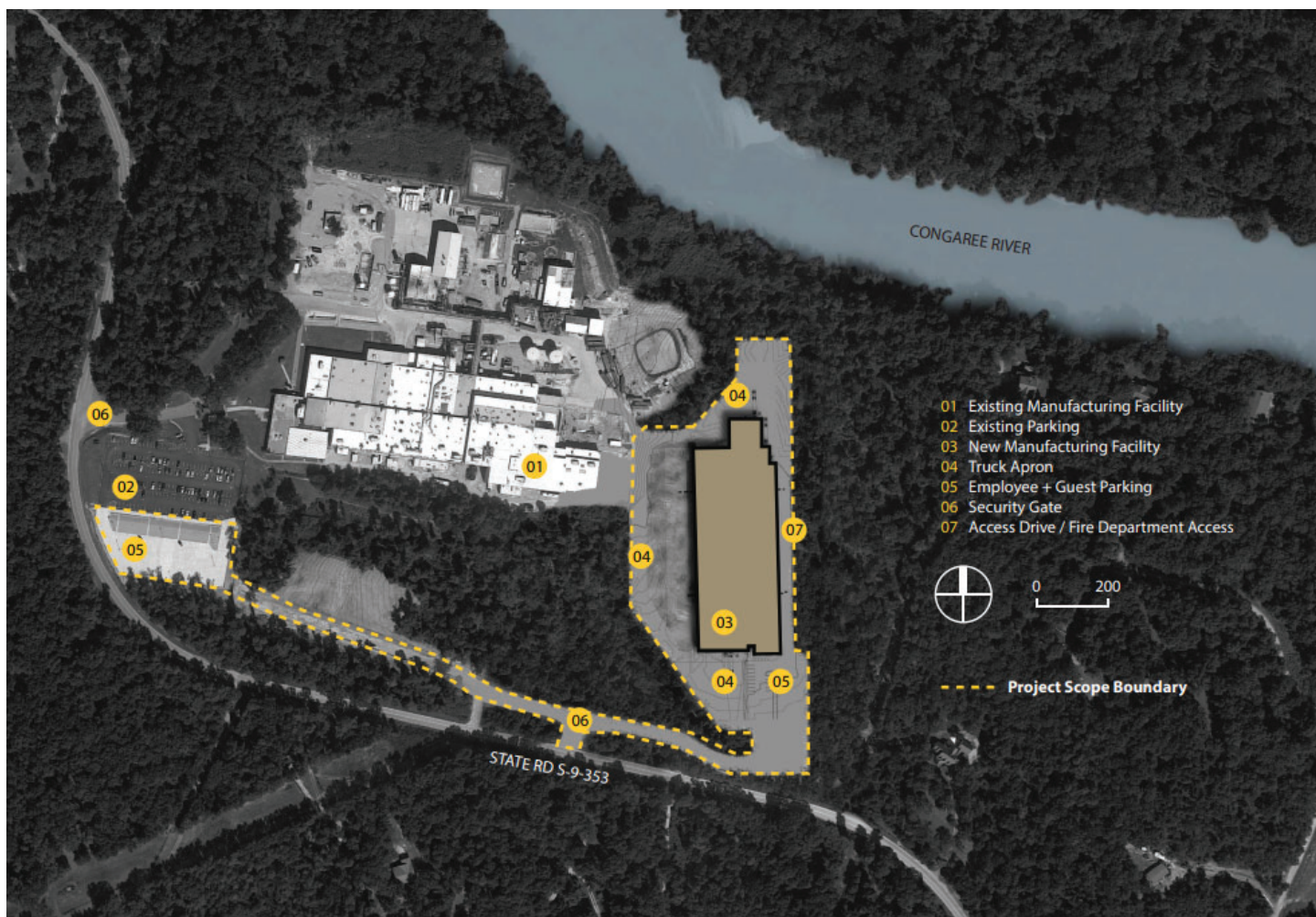


Figure 18 | Site Plan

the most efficient material for this and cost. This material also meets the standards for USDA guidelines and come recommended by the organization for food processing facilities. The wall section shows the assembly of a typical production wall in the facility. It shows the typical assembly of the IMP on the metal framing.

To incorporate the concept of the expanding building, walls within the production area contain precut warehouse door openings that are covered with IMP until the facility is ready to expand. These panels will be

easily removed so the new areas can be accessed by workers.

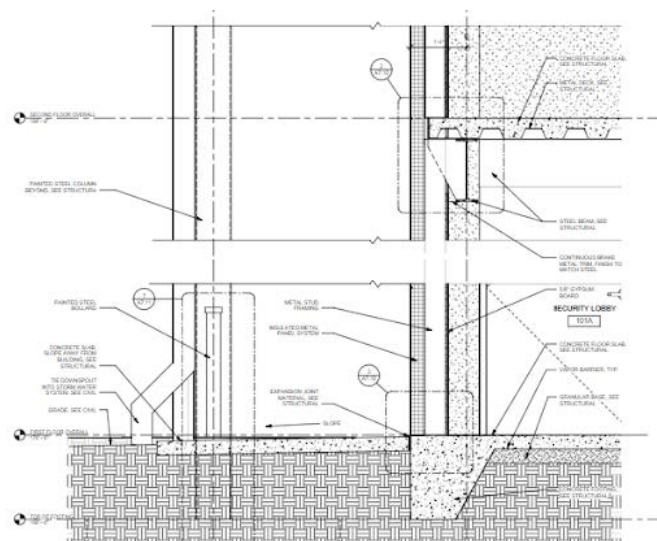


Figure 18.5 Production Area Wall Section

Costs

The costs of the building construction for the total project is \$33,000,000. This includes all parts of the process including site work, materials, services, and utilities. However, the total cost of the building is around \$67,000,000. This is after including the machinery and equipment used for the processing plant.

Completed Design

The completed design was deemed a success from all parties, especially Robert. The overall layout included 3 main programmatic areas: the production floor, the support areas, and the circulation that connects them. As shown in the plan (Figure 20), the red areas highlight the main production floor. This includes all the necessary space based on Devro's recommendations and industry standards for the machinery Devro utilizes. The spaces in the production area follow Studio 2LR's concept of the assembly line. Starting from the Dry Good Storage (20) and ending with the Shipping and Storage Units (28 & 29, respectively). Each area in between is the part of the necessary process from the raw material to the finished product and this layout allowed easy placement of the machinery during the Installation Process in April 2015. Studio 2LR also made sure to make the spaces to be focused on people and not just the machines. Large glass facades and open spaces are involved to help



Figure 19 | Mechanical Room

with moving materials, but also moving people. During the design phase, Wes wanted to make sure users were properly represented in the project and for the workers to have a comfortable environment to walk through and take breaks in when not working in the closed off production area. This resulted in the window heavy facade when possible to provide comfort through exterior views.

The other major feature in the design is the future expansion zone. This was a major issue with the original facility and Robert wanted this to be included in the new design. An area was allotted for future expansion and was built into the design. The expansion zone was a constructed part of the building fit to meet all the necessary spatial requirements for future machinery. It allowed Devro to be ready to expand when the time needed and they are reaping the benefits of this today. By preparing for the future expansion, they have space ready to be habited by employees and machinery. This made

their current expansion process a lot easier by having this space pre-made, rather than planning on building at a later date, with issues like inflation or supply chain issues playing a role in future building uncertainty.



Figure 20 | Floor Plans

Graphic Overview

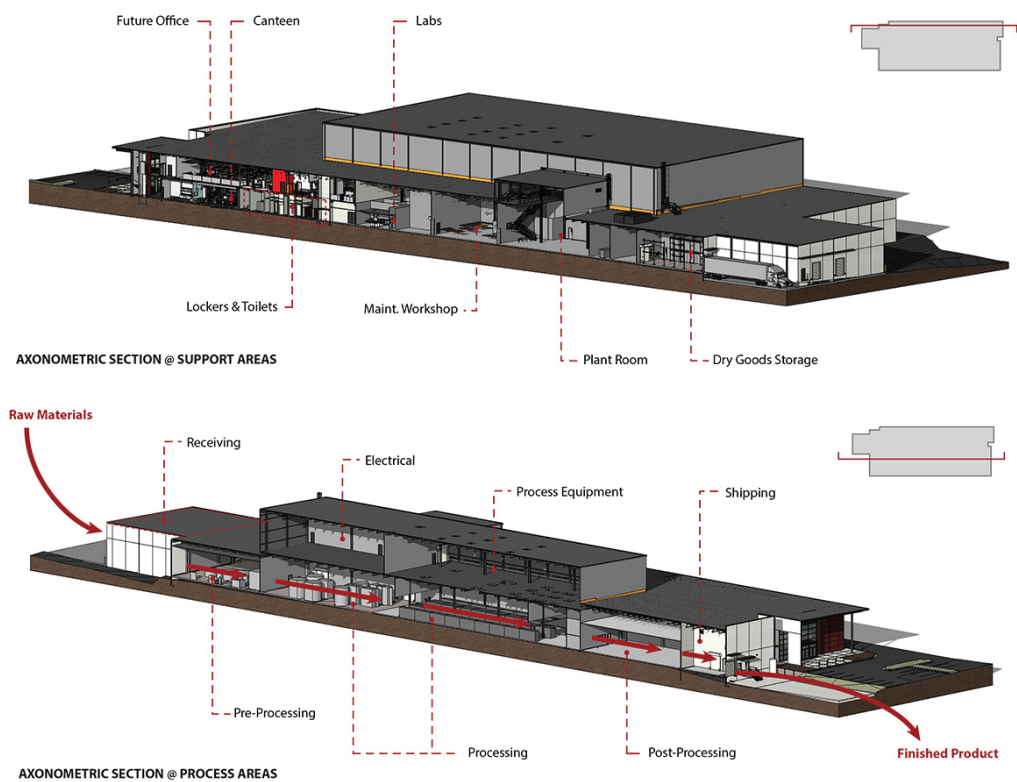


Figure 21 | Axonometric Sections

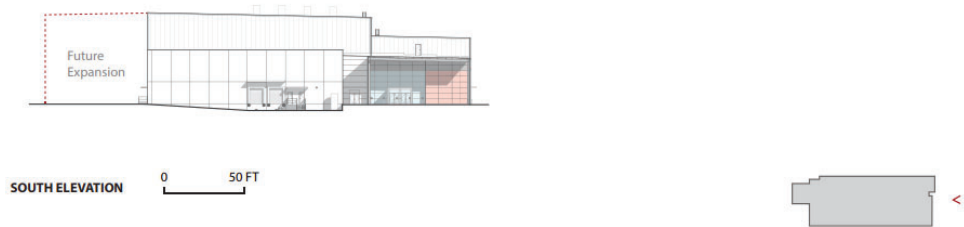


Figure 22 | South Elevation

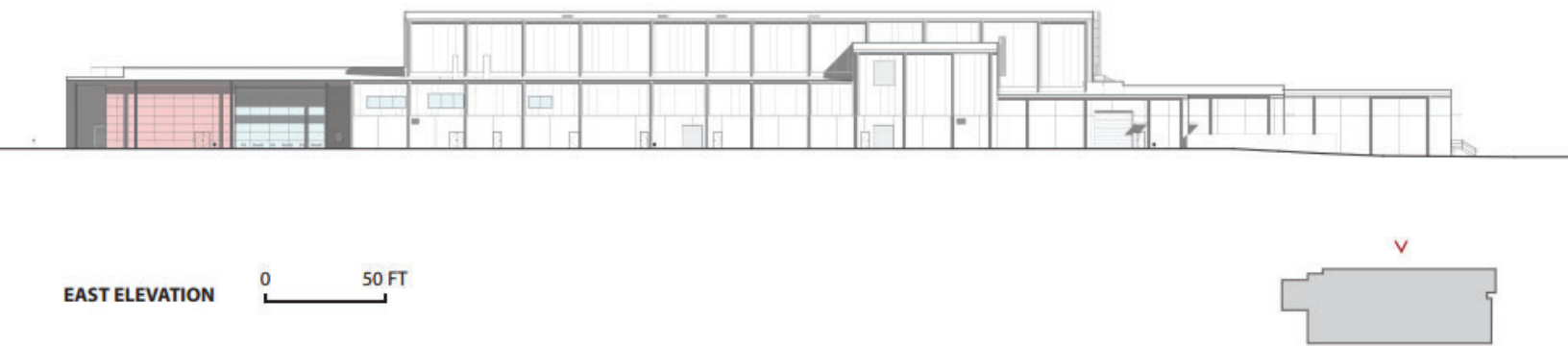


Figure 23 | East Elevations



Figure 24 | Devro Canteen

Analysis and Synthesis

Protocols

Through the development of the project, the constant communication between the parties made the process run smoothly. Studio 2LR communicated often with both Devro and Fitts & Godwin in the beginning of the design phase and continued when the construction began. The scheduled weekly meetings with Devro and their owner representative, Matt Rizzo at JLL (Jones, Lange, LaSalle) helped both the design and budget run easily. The primary decision makers were Wes Lyles, Robert Ralston, Matt Rizzo, and Thomas Fitts, when construction began. Wes explained that constant communication and transparency with Devro and all leading roles of the project created this easy and open environment for the project to be a success.

Services and Schedule

The development of the Devro Manufacturing Facility required services through pre-design, design, construction, and post construction. The pre-design services required a survey of the site, which was done by Rusty Owens at

SurveyOne. Many of the typical pre design services, such as programming or concepts were not entirely needed due to Robert and Devro having an already established facility with needed programs. However, the design process required in depth meetings of schematic design based on the new features that Robert wanted and the design choices Studio 2LR wanted to incorporate. This also included production equipment documentation from the Devro headquarters to fully understand the size and needs of the equipment going in these spaces. Lastly in this phase, Studio 2LR's budget, construction documents and shop drawings were created for Fitts and Godwin to start their phase of budgeting. Fitts and Godwin handled much of the construction phase with Wes handling any site visits or issues that arose during construction. In the post- construction phase, the equipment was moved in order to get the facility operational based on the design layout Studio 2LR provided.

PROJECT SERVICES

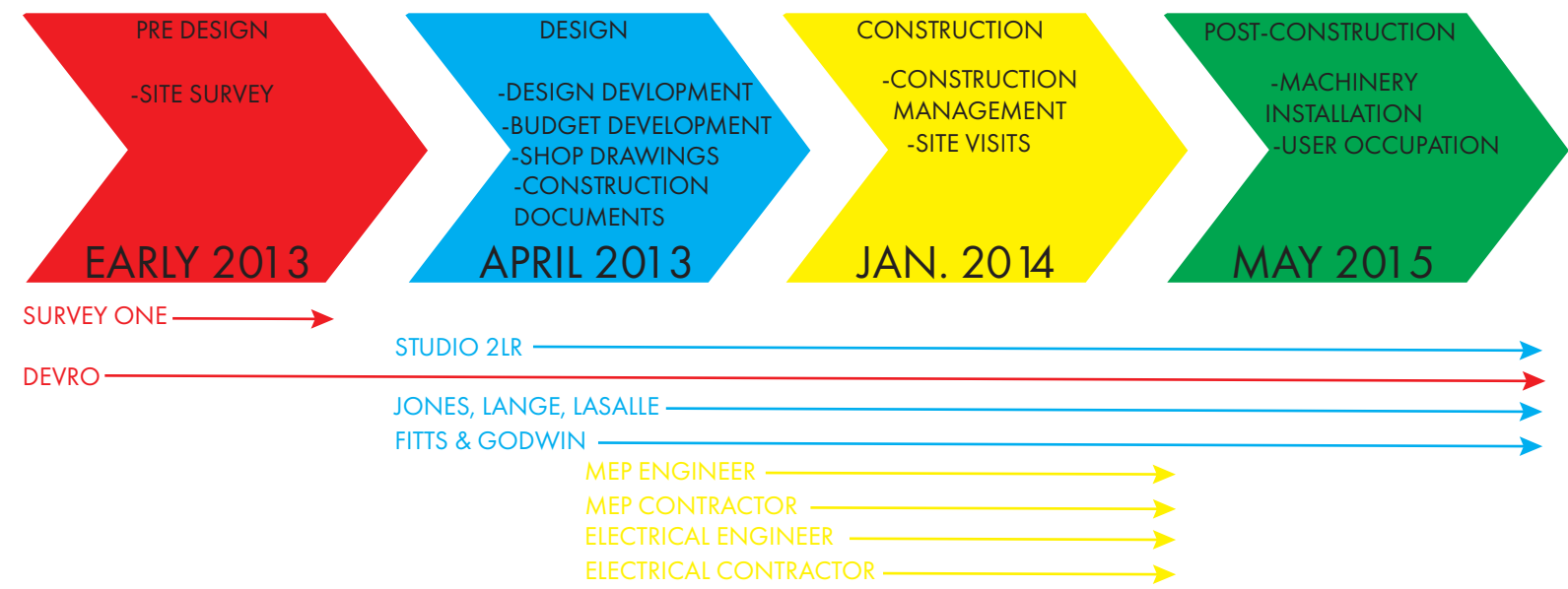


Figure 25 | Project Services

Project Delivery

Studio 2LR has a master contract agreement with Fitts and Goodwin and Devro that is customized, when a new project comes up they create a letter of agreement outlining scope, deliverables, and fee for the project that references the master agreement to the owner. This is signed and incorporated as an attachment to the master agreement. Under their contract scope are the following services: Architecture, Interior Design, MEP/IT, Structural, and Civil engineering. Studio 2LR utilizes their own File Transfer Protocol. They upload all documents related to the project that are shared to the contractor and any other party that needs the documents. Studio 2LR also utilizes file sharing with consultants to share Revit models needed

for project coordination. While working with the other design participants, such as the numerous engineering firms engaged with the Devro facility design, Studio 2LR is able to share construction documentation and 3D models for collaboration on this project. Revit is the main form of BIM for Studio 2LR, however they will utilize other modeling software as needed such as AutoCAD. On this project, the architecture team consisted of Wes Lyles (Project Manager and Design Lead) and Tripp Riley (Design Lead) All other members of Studio 2LR at the time had input towards the project.

The primary points of contact for the client and the owner's representative were Wes and Tripp. They met weekly with Matt Rizzo of JLL to review budget

and project management starting near the end of the design phase. This project is considered a Construction Management, Constructor Project Delivery type because the design and construction overlapped. Construction began before the design was complete, The construction manager and the general contractor were the same entity, and the construction cost agreement happened in early design development documents. Wes Lyles was the Project Manager on the team. He managed contracts between the client and the other design participants, he consulted with clients on the development of the project, he monitored the schedule and budget, financial roadmap, and documentation time and progress.

By disseminating the work to the entire Studio 2LR team, he was able to manage the project effectively and without major setbacks. The entire Studio 2LR team is made up of seasoned architects that have combined decades of experience in the industry. Quality is assured by consistent teamwork and standardization of BIM practices. During weekly intervals of the design process, the design team reviews the drawings and discusses opportunities for improvement in areas of code/life safety, well-being, equipment concerns, climate control, budget, construction times, sub-contractors, schedules, and specifications.

Financial And Risk Management

Devro had operated a facility on the project site since the 1970s, but needed to modernize production to remain competitive globally. The financial implications of establishing new manufacturing facilities have high financial risks associated therein. The program of the factory was specifically designed around the product manufacturing line.

The challenge of integrating support systems and facilities was solved by separating the staff accommodations, offices, and laboratories from the facility equipment to increase safety and well-being. Designing for change was a critical decision to invest in the future of the Sandy Run facility, as the final design enables Devro to double its operational output. The total construction costs totaled around \$33 million dollars. The primary risk factors for construction became the tight design/build schedule (~24 months) and materials for food grade production (per USDA). All parties at the onsite meeting agreed that this facility would be impossible to build right now as the current economic conditions for building materials make it totally infeasible. This is due to the fact that while the construction costs totaled 33 million dollars, the additional \$67 million in manufacturing equipment equated to the largest risks for the project.

Without clear coordination and open discourse within the design team, there may have been many more mistakes. Robert Ralston noted that having a design team of local companies made all the difference in precise delivery

of the final design. He noted that another Devro facility was constructed using an international firm, and that equated to massive design mistakes and financial losses for Devro. The extremely high cost and risks incurred by the facility equipment was mitigated by dedicated teamwork and planning. There were no major design disputes or delays largely because many of the design challenges were resolved during design development where the team could openly express concerns. The extreme tolerances and sensitivity of the equipment called for careful considerations by Studio 2LR and the engineers during the design process. For example, the angle in which the equipment is installed, if done improperly, can cut production efficiency by over 40%. Matt Rizzo of J.L.L. was brought on around the end of the design phase as an owner's representative. His presence ensured clear understanding (especially of budget) between the client and all other parties.

Other than that, there were environmental considerations to be made in regards to the adjacent Congaree River, but the facility met all building codes and regulations without many complications. Meeting and exceeding all codes and regulations did not hinder or determine the design of this facility, allowing Studio 2LR and the project team to focus on creating an efficient, productive, and unique manufacturing facility

Resources

Two governmental organizations that were important to the design and construction process of the Devro plant are USDA and DHEC. The USDA has a specific set of regulations relating to food health and safety for food grade production facilities, including building materials used. Insulated Metal Panels (IMP) are a standard, and the production areas in the facility are made up of 4" IMP panels. Studio 2LR had to submit civil drawings to the Department of Health and Environmental Control of Calhoun County for review before issuing the final construction documents and beginning construction.

For the plant's construction to succeed, much coordination was needed between the Scottish management, European-sourced custom machine manufacturers, and the South Carolina engineers and design-construction team. Like a complex jigsaw puzzle, machinery and equipment had to be custom built & measured in the Metric system, which was then translated to the Empirical system to inform the dimensions and layout of the plant. With the U.S.'s largest discus processing transported from Sweden, a massive grinder from the Netherlands, an MGP from the Czech Republic and a custom-built mixer across states in the U.S., a high level of precision was required in coordination among various players. Fitts & Goodwin and Studio 2LR navigated this complex communication effort with a high level of sophistication, leading to a successful

plant with a fairly easy start. Wes Lyles' talent in marrying technical detailing with bigger picture programming, Robert Ralston's knowledge of the collagen production process and machinery, Thomas Goodwin's decades of experience in food production facility construction, and Al Stevens' warehouse structural know-how all came together during weekly design meetings over trace paper plans and sections. The end result was a simply yet very effectively programmed building that housed complex processes working in concert to maintain 24/7 production.

Stories

The generative concept of Devro's manufacturing facility was the desire to create a factory that highlighted the sole purpose of a production factory. With a plan that was easy to navigate and a factory that welcomed change, the design team sought out ways to highlight the manufacturing process, seeking design decision that questioned how quickly can the product get out the door. First came understanding how the manufacturing process works and how the architecture can support this process. Resulting from this understanding is a piece of architecture that works with the factory and not against it. In this sense the design of the factory was rooted in three underlying concepts that aided the architects and engineers in making design decisions—Architecture, machines, and people—and how these three things worked together. The design team needed to make important decisions around the machinery and the people and how the architecture would respond to this. The way to look at this concept is understanding that the machines are primary. The people that occupy the space are secondary and the "skin" being what houses both of these is tertiary. As a result, the factory was given a character that made it different from other factories, it made it the "golden child" of production plants.

The need for a new approach to the design of the west campus was rooted in the issues faced in the former plant,

the east campus. The conditions of the east campus lacked the innovation and technology that was needed for the company to be successful. The lessons that came from the project was the need to think outside the box to create an innovative space that spoke to the desires of Devro. The ability to work through problems was another facet of the project that influenced many of the design decisions as well as the team's ability to commit to their own parts. International relationships was another lesson that was made known.

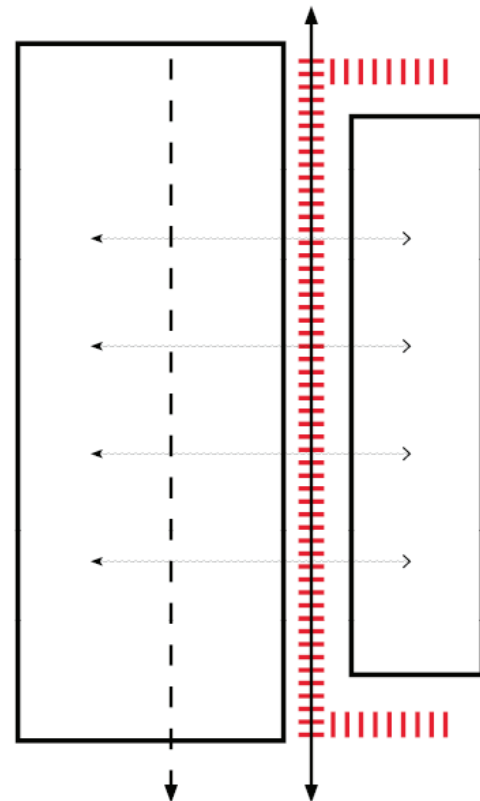


Figure 26 | Floor Plan Spatial Analysis

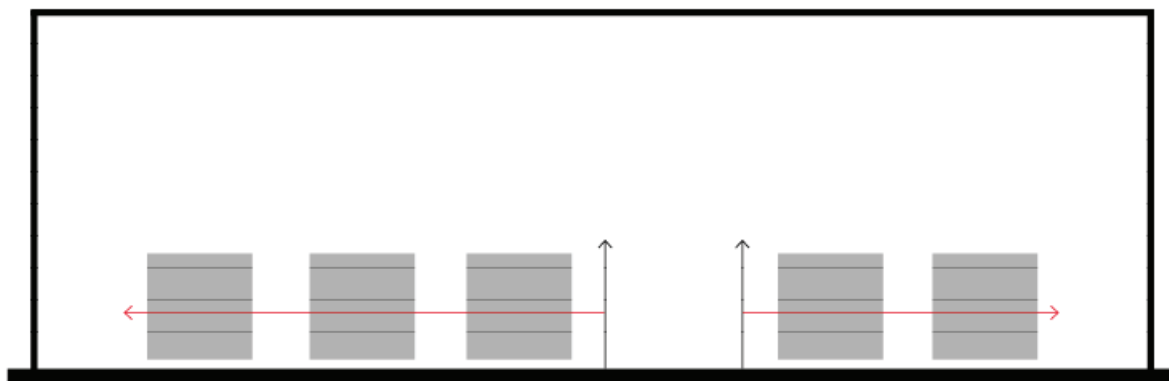


Figure 27 | Section Spatial Analysis

Ideas

Many questions were raised at the start of Design for Devro. The architect and the client desired a facility where the need for growth did not hinder the production of their product. Questions on how to “future proof” the building were asked to address plans to expand the facility. The main goal was to design features that are easy to change and require little effort. The expansion of Devro’s west campus was innovative in the methods in which the project was designed. The organizational layout is innovative in itself. Governed by a central corridor, the factory is divided into two distinct areas that make the plant what it is. To the left of the corridor are the production spaces and to the right of the corridor are the support spaces. The thought that went into the design by Devro and the Studio 2Lr team was that the layout would be easier for employees to access their work with ease and navigate the space without it causing problems with getting

the product out as soon as possible and navigating the space. The facade of the architecture is also a fascinating part about the building that ties back into its initial concept. As it responds to the spatial organization of the building, the left side of the building is where the production line ends and the trucks are loaded and sent across the country. On the same facade, is the entry to the factory. What this illustrates is the company’s desire to remain transparent and highlight the sequence of Devro’s production system. Innovation has been encouraged in the project. The need to “future proof” the building is addressing the change that may come about from the success of the factory.



Figure 28 | Devro Red Ribbon Event

Conclusion

Measures and Success

The Devro Manufacturing Facility has been opened and operated for over 7 years and currently they are in transition to expand into the future expansion zone. From the beginning, Devro needed a facility that was able to keep up with their growth over time, along with the machinery advancements that were taking place over the last 30 years. In doing so, Robert and Garth gave high praise to Studio 2LR in their incorporation of all the needs of Devro, while including aspects that were being overlooked. The design for the expansion of the building has now become a very important piece of their business model. With current issues of inflation and supply chain, their choice back in 2015 to spend extra money to add more space for the future has paid off. Devro is prepping the area to add new equipment into these areas to boost production of the facility even further.

Wes' team at Studio 2LR deemed this project a success from the way they

were able to make their client happy and proud of their new design, while overcoming the complexities of the project. Wes made it clear that he wanted to make the project about Devro and did not expect to receive any recognition from this, but said "when you make your client happy and a design that you are proud of, you are bound to be successful." Studio 2LR searches for complex projects to build skills they want to learn in the field and this project allows them to manage an international company's needs, USDA requirements, and typical building codes. Despite these limitations, the team was able to develop a design that encompassed the ideas Devro wanted and be able to make a space for employee and machinery comfort.

Overall, the design of the Devro Manufacturing Facility does meet the definition of "Excellent Practice" as described by Dana Cuff. Excellent practice is described as "a practice

perceived as excellence by consumers or the public at large, participants in the design process, and the architectural profession” (Cuff). During conversations with Studio 2LR, Fitts and Godwin, and Devro, it was apparent the project was a success for all parties. Observing the interactions between Wes, Robert, and Justin, the camaraderie was easily seen and shows that each of them valued the job done. Wes made it clear that their

job is to make a successful project for Devro and create a relationship that each party would want to work together again if the time came. This coupled with the recognition received from third parties shows the excellent practice run by Studio 2LR and Fitts & Godwin for their client.

Lessons Learned

Perhaps the main lesson to learn from the Devro Manufacturing Facility is how strong relationships between the client, the architect, and all other design participants can lead to a successful and award winning project. From the beginning, Cooperation was absolutely critical in the timely execution and delivery of the project to minimize financial risks as well as ensuring that Devro would have a state of the art manufacturing facility for their casing products. It was often repeated between all participants how rare it is to have such a collaborative and efficient project team/delivery. The key to maintaining these relationships according to Wes Lyles, Justin Poore, and Robert Ralston is building trust and reliability.

Robert Ralston was a critically important member of the design team in lending his expertise to help design the facility to be highly productive but also future-proofed. Much of the manufacturing equipment in use by Devro and

their competitor’s manufacturing facilities are underprepared for future demands/developments. The Machinery used to produce collagen casings have extremely tight tolerances that, if improperly designed, could lead or have led to bankruptcy in this industry sector.

The overall design process that Studio 2LR and Fitts and Goodwin undertook was due largely to the idea that the identity of Devro as a leading manufacturer could be embodied in the design. From start to finish, the design process and finished facility reflect Devro’s ideals of efficiency, transparency, and opportunity. Robert had a strong sense of what the facility required because he oversaw the operations of the outdated existing facility. Using the client’s knowledge and experience to inform the design should be standard practice for successful projects. Again, Collaboration was critical throughout to sift through the complexities of integrating systems of multiple engineering disciplines and people. Justin of

Fitts and Goodwin noted that construction and design mistakes were mitigated through open discourse between the design participants. The balance between the concern for machines and humans was always at the forefront of design discourse. Devro's design allows for maximized safety on the workfloor and clearly delineates between manufacturing and staff while also enticing employees with designed accommodations for employee well-being. Due to the fast pace and complexity of design, Matt Rizzo of Jones, Lange and Lasalle was brought on by Devro towards the end of the design phase to be an owner's representative. Matt was able to ensure client satisfaction with budget reviews and was a constant line of communication for the design team.

One major mistake that Robert and Wes pointed out was inconsequential but a major contributing factor to the complexity of the project: South Carolina's often rampant humidity. Being in proximity to the Congaree River, Devro needed to make certain that the facility be climate controlled at all times and protected from insects. The entire second floor is dedicated to electrical controls and massive dehumidifiers above the product line. This design challenge did not surpass the benefits of South Carolina's industrious policy making in favor of more manufacturing and additional jobs. Nevertheless, the feat of architectural and engineering project design and delivery has allowed Devro in Sandy Run to become the face of North American operations and one

of the most productive (and expandable) casing facilities globally.

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Works Cited

Riley, Tripp. "Devro - Portfolio." Studio 2LR Architecture + Interiors. Accessed November 28, 2022. https://studio2lr.com/portfolio_page/devro/.

Digital, BECK. "Devro." Fitts & Goodwin, December 10, 2021. <https://fittsandgoodwin.com/projects/devro/>.

"Devro ." MECA, inc., March 9, 2020. <https://mecainc.com/project/mid-century-remodel/>.

"Devro Project Details." MECA, inc., March 9, 2020. <https://mecainc.com/project/mid-century-remodel/>.

