

LEAN Laboratory Design

“There is no ecological architecture, no intelligent architecture and no sustainable architecture – there is only good architecture. There are always problems we must not neglect – energy, resources, costs, social aspects...”

Eduardo Souto Moura, 2005 Pritzker Prize Laureat

Architects are being asked these days to solve questions of basic human habitat and to do it faster, more economically and smarter. Operations and maintenance budgets are getting close scrutiny, since every dollar saved goes to the bottom line. The firms that are successful in this endeavor are those who can change in order to grow and who are flexible enough to retool, rethink and reeducate in order to keep on the cutting edge. In short, we believe that smart design can and should contribute to the bottom line by making measurable improvements in how organizations optimally function.

We live in an urbanized world. We work at the intersection of architecture, technology, urbanism, culture, innovation and economics. Most of our profession view this focus as a sort of non-creative geeky specialization and forget that we too are designers of urban spaces and intense intellectual work environments. Our clients typically spend long hours in relentless pursuit of the next Big Idea or they participate in partnership with – as in the case of clinical or diagnostic labs – healthcare or environmental quality professionals. But one of the most salient characteristics of our client Type is that most of them come from Somewhere Else. For example, when we think of Munich, we think BMW, Oktoberfest, and the exquisite German Engineering of all things. But did you know that close to 40% of Munich’s residents share a migrant background – that at one recent count – Turkey with the largest is followed by Italy, Austria, France and then the US. So not only are we planning and designing spaces for research, but we are also designing spaces for folks coming from entirely diverse and different cultures.

Today a state of flux is the new normal as economic systems stagnate, people migrate and the leadership gaps widen. Debates about the future are maps of uncertainty rather than clarity. Driving this insecurity, in part, is the momentum of the Fourth Industrial Revolution and technology. At such moments, the creative and cultural industries, along with the arts, culture and heritage sectors, are positioned to play a powerful role in shaping, framing, communicating and influencing the future.

How do cities need to adapt to the incredible migration of younger generations into urban places – what will the places they work look like. And more specifically, how will the design of our workplaces unfold and respond to this massive migration? More than any other building type, laboratory facilities must be conceptualized as dynamic and well-tuned work-horse environments, and research and

analytical laboratories are some of the most complex facilities to plan and design. The overall layout, the relationships between spaces, life safety requirements, increasingly complex instrumentation utility fit-out, and supporting established lab procedures make for a very dynamic

With our clients' increasing emphases on cost and schedule, increasingly, we have been integrating LEAN design tools into our planning and design efforts. Over the last few decades, LEAN Design theory has embedded itself into the consciousness of mainstream American manufacturing as a means to drastically reduce cost while increasing value, profit and productivity. While there is a big difference between consultant service providers and auto manufacturers, the construction industry has adopted elaborate techniques for project and contract management. But the challenge remains, how do we integrate these techniques into what is essentially a iterative process of design implementation. While the design process is essentially a sort of "custom" response, the LEAN process has allowed us to retool thinking and techniques in the planning and design of laboratory facilities.

After the preliminaries of project set-up, team introductions, organization and communication procedures, we typically kick-off the design efforts with a visioning worksession in which we ferret out the goals and vision of the project. Oftentimes, our projects will have had some sort of Program of Requirements or preliminary planning document prepared in order to establish budget and get approval for the project to move ahead. However, no matter how detailed and multi-disciplinary this effort may have been, the one thing we know about laboratories is that they are always changing to responding to new research and changing technologies, and so it is critical to dust the document off for a good review. This visioning session establishes the Guiding Principles that will carry the project to its successful completion.

Many of our clients are moving from existing facilities, and so we find it is imperative – not only to establish a baseline for future conversations - but also to establish a rapport of common language and understanding. We call these Gemba Walks, and the term comes from the Japanese LEAN term for "the real place". What this translates into is just that - "being there": in-person observations, and in place discussions and explanations by the users how and where their work is done. Each group or department participates in this effort. The more observation and problem solving that happens with users on a Gemba walk, the more successful and enduring the design solutions will be.



Guiding Principles for Broomfield Laboratory Consolidation

Provide a safe, high quality, up to date laboratory that co-locates departments of Animal Health, Metrology and Biochemistry.

Invest in staff to improve morale, increase retention, drive loyalty, and boost reputation as a great place to work.

Improve the customer experience and make it easier for customers to do business with the Department.

The 3 co-located lab groups will provide synergies, efficiencies that promote a sustainable food supply, protect customers, the environment and natural resources.

Foster teamwork by creating a work culture that values collaboration, communication and transparency.

Utilize LEAN analyses to drive process improvements and increase efficiencies.

Enhance the public's understanding of Colorado agriculture.

LEAN describes an exercise in discovering “The Seven Wastes” of OverProduction, Inventory, Waiting, Motion, Transportation, Rework, and Processing. We will often take a work break and organize users into teams of 5-7 in order to bring this concept home. Each team member is assigned a specific task of preparing cards with 3 dots with a graphic image then placed precisely in the center of one of the images. The last team member is in charge of quality control. The idea is to produce as many cards as possible to specific specifications within a 3 minute period. Seems easy and kind of silly, but it is very revealing of the complexities of team work, process, production and quality.



The real intent of LEAN is “the complete and thorough elimination of wasteful practices”, and for this, LEAN identifies 3 primary wasteful practices:

- ‘Muda’ –the waste within processes (including the infamous “7 wastes”)
- ‘Mura’ –unevenness (workload volatility)
- ‘Muri’ –overburden

Mura and Muri are especially relevant in most lab situations.

The term “labs are designed from the inside out” , is fairly well understood by the lab design community. It is at this point that we focus on individual lab groups in order to understand how the individual “pieces - work groups, operations or departments - will have complementary needs or separation requirements. In that way, we build up the whole, much like composing a jig saw puzzle.

After the Gemba Walk, our next work session focuses on what we have vs. what we need and want. We prepare a Value Matrix for use at the meeting, and this exercise can very challenging to work through because we are asking users to dissect their work flow into Samples, Staff, Supplies, Equipment, Information, Public Access and Deliveries and Storage on the Y axis and their Guiding Principles list on the X-axis. To be honest, this exercise should take less than an hour and allow the worksession to flow into conceptual space planning as user groups are ready to consider some alternative futures! We can quickly move into mapping flow diagrams, “Spaghetti Diagrams”, that lead us into more effective room arrangements that will then help us derive an overall concept design.

These worksessions result in the development of our adaptation of LEAN A3s, that provide detailed room descriptions and data, utility requirements and equipment locations. In our context, we are using the A3 format a bit differently from the Lean Institute. Our purpose of A3 documents is to identify the purpose of the space, document its requirements and verify that we have captured all the information for moving forward into detailed design.

PROJECT INFORMATION

Client	Project Name	Project Number	Location	Start Date
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CONSTRUCTION SCHEDULE

Visual Gantt chart showing project phases: Pre-Design, Design, Construction, and Commissioning.

CONSTRUCTION TASKS

- Task 1: Foundation
- Task 2: Structure
- Task 3: Mechanical
- Task 4: Electrical
- Task 5: Interiors

CONSTRUCTION ANALYSIS

- Analysis 1: Foundation
- Analysis 2: Structure
- Analysis 3: Mechanical
- Analysis 4: Electrical
- Analysis 5: Interiors

PERFORMANCE

Category	Value
...	...

Based on years of experience of providing design phase services for federal, higher ed and corporate facilities, Iron Horse has developed a process that is tailored specifically to each project's unique project needs. Throughout the design process, we provide communication tools, such as equipment lists, chemical use lists, room data sheets, and utility coordination plans that help us ferret out technical design issues and identify and resolve conflicts between wants, needs, and prescribed budgets. Our cloud based websites support specific project websites that catalog the myriad questionnaires, equipment spreadsheets, chemical use, handling and location templates, worksession notes and documentation, evolving floor plans and cut sheets for easy access and consideration.



LABORATORY SUITE

For information on this project, please contact the project manager at the address below.

LABORATORY SUITE REQUIREMENTS

Equipment List

Room Requirements

Utility Requirements

Other Requirements

Notes

CELL IV LAB
137' x 132'

While building design is evident as a physical product, it is important to realize that the product is the careful result of a deliberate problem seeking/ solving process. This iterative process begins with the planning and programming of the project and includes the analysis and synthesis of myriad and often conflicting design

issues. A successful design solution thoroughly sniffs out, identifies, tests and analyzes, reconciles and synthesizes these elements throughout the Schematic, design development, and Final CD processes. Some of the fact finding is ours to complete, some of the work is our clients', and other information and materials we amass together. The intention of the process as structured by the design team is to provide all team participants with an organized and straightforward communications-based tool. The final drawings and specs will catalog decisions made and support work session reviews of options and issue resolution.



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