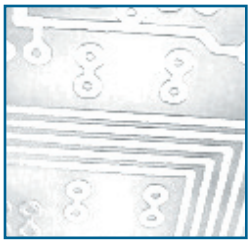

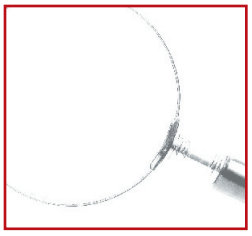

INDUSTRIAL FORENSICS LABORATORY

NORTH DAKOTA STATE UNIVERSITY RESEARCH AND TECHNOLOGY PARK

A SENIOR DESIGN THESIS PREPARED BY K.C. KRUMWIEDE

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PROJECT ABSTRACT:

The design thesis is an advanced, industrial forensics laboratory to be located in the North Dakota State University research and technology park. The project will examine the inherent relationships of industrial processes, specifically determining what makes the process a success or failure based on research results. The laboratory will enhance both Fargo's and NDSU's reputation as a leader in developing technology.

PREFACE:

One of the most important things we as designers are continually learning as part of our architectural education is the ability to solve problems in an efficient way. The ability to constructively solve a problem goes far beyond the walls of architecture and is something we encounter on a daily basis. The aptitude for intuitive problem solving is something I have come to value and is thus an underlying goal in the type of project I have chosen for my senior thesis project; an industrial forensics laboratory located at the North Dakota State University research and technology park.

THEORETICAL PREMISE:

The thesis will examine the inherent relationships of industrial processes, specifically determining what makes a process a success or a failure. More specifically It will provide analytical testing, technical consultation, and investigation services for clients seeking an understanding of the nature of a mechanical, chemical, or industrial complication. It will literally be a facility designed for the intuitive art of problem solving. The combination of research and physical examination provides a dynamic, technical laboratory capable of performing a wide range of studies that support technology and innovation. The forensics laboratory possesses tremendous design opportunity in that it has allowed for the metaphorical incorporation of 'problem solving' as a holistic entity into the building's specific typology. In addition the project lends a probable relationship between the building's interior function and its exterior representation. Often times, research facilities inherit a cold, industrial appearance, however I intend for NDSU's forensic laboratory to be an architectural expression that creatively represents technology while up-

holding functional qualities within the building's envelope. The building will provide a broad spectrum of inter-related spaces for students, faculty and employees. In addition, it is also intended to accommodate the general public in that a portion of the building will be accessible to sanctioned tours. Thus, providing exposure to the exciting world of industrial forensics, for anyone who seeks interest in the subject.

PROJECT JUSTIFICATION:

The facility will enhance Fargo's existing technology base and will augment North Dakota State University's reputation as a leader in advanced research and technological development. The existing research and technology park, located at the northwest corner of NDSU's campus has already begun to establish Fargo as an up and coming community, with international notoriety. The addition of another technology based-facility will invariably amplify the community's reputation and continue its progression to the next level. Especially considering the industrial forensics laboratory has opportunity to be the most sophisticated building within the technology park, because of its implicit nature. The addition of the facility will underpin the university's decision to establish themselves as a regional leader in research and development.

PROJECT EMPHASIS:

Throughout the design process, I plan to draw several metaphorical and tectonic conclusions based on the inherent successes or failures as they relate to industrial processes. An obvious point of emphasis in an industrial forensic laboratory is technology and all its entities. Researching similar facilities has helped develop a better understanding of spatial (and operational) functions of a forensics laboratory, and has provided

the intuition necessary to develop a sensible and well designed facility that represents a by-product of my theoretical premise and underlying project goals. In addition, the strong technological emphasis placed on surrounding facilities yields proper justification for the incorporation of an industrial forensic laboratory into the existing NDSU research and technology park. The community of Fargo takes great pride in its facilities and my thesis intends to complement and solidify those feelings of communal camaraderie.

MAJOR PROJECT ELEMENTS:

**Site Conditions :: ** 100 total parking stalls (10 metered) will provide adequate parking space for clients and/or faculty members. Site lighting conditions will be an architectural focus as it lends a metaphorical relationship to the concept of technology. In addition, a design emphasis on facility signage as a response to NDSU is an important design issue.

Chemical & Biological Laboratory/Testing :: The chemical laboratory is a restricted area in which only staff members are allowed access. Its spatial function is sophisticated in that the complex mechanical systems within the laboratory must correlate with the rest of the facility. (i.e. - the placement of ventilation stacks and their aesthetic impact on the building's exterior.) Spatially, the laboratory must have flexibility in layout with the potential to add equipment in the future.

Mechanical Laboratory/Testing :: Also a restricted area, only accessible by staff members. Both the chemical and mechanical research laboratories have such tight access restrictions, that entrance to within the space can be denied to anyone if there is a forensic operation in progress. Spatially, the mechanical laboratory must pro-

vide adequate space for large mechanical equipment, while lending a sense of flexibility in order to accommodate the whole spectrum of forensic cases it may encounter. In addition, this space will invariably produce noise pollution and vibrations, affecting its relationship to adjacent spaces. Mechanical system design will be a primary design concern for all laboratory spaces because of occupant safety and the proper disposal of hazardous by-product.

Additional Research & Investigatory :: The supporting research spaces are intended to be a 'quiet space' where information can be interpreted and/or recorded based on recent findings, etc. Also a highly restricted area, this space is flexible and provides amenities such as computers, publications, and other pertinent literature. The quiet nature of this space will affect its placement within the building envelope because noise/vibrations will jeopardize the quality and integrity of these research spaces.

Public Spaces :: The public lobby and gallery space will be one of the most aesthetically important spaces in the facility, because it will be observed by every occupant. The building metaphorically references technology and is a representation of NDSU. Thus it is imperative that the building (specifically the public lobby) be well designed and detailed towards its underlying concept. It too will require significant design attention in its relation to nearby spaces, due to noise and/or operational implications.

Educational :: The education spaces are intended to be 'hands on' working environments. Access to the actual laboratory equipment will be strictly enforced, however the opportunity to observe the forensic processes will be a wonderful learning tool for students and faculty alike. Place-

ment of educational spaces within the building are directly dependent on security parameters and noise diffusion from adjacent space. Faculty offices will be in or nearby the primary educational facility.

Office/Business Administration :: Similar to the educational space, the business administration space's placement within the building is inherently dependent on security, noise, and employee safety. Mostly just offices, the business administration spaces will be flexible in order to accommodate future expansion, and/or desirable spatial layouts within its designated venue.

HISTORICAL CONTEXT:

The industrial forensics laboratory and the site form a relationship that is historically congruent with the nature of the thesis project. Throughout history, the term 'laboratory' has always been synonymous with technology. Regardless of a laboratory's nature, it likely contains the most sophisticated technologies relevant to its particular field of research and development. The North Dakota State University research and technology park embodies a variety of characteristics that relate to the physical and social context deemed desirable for a technology-based building. For example, the surrounding facilities are technology-based buildings creating direct physical relationships between facilities and uniform social constraints. The laboratory's site once was rich farmland whose harvesting was made possible by advancements made in technology. The rich historical integrity of the area affirms the incorporation of the industrial forensics laboratory, because as agricultural advancements once attributed to the areas reputation, research and technology now endorse the community's character. Affiliation with NDSU supports the project's historical

social ties to the university's storied history as a leader in technological development.

12 STEP PROGRAM FOR THESIS RECOVERY:

A large part of creating a plan to proceed, is knowing what to do when you complete the initial plan. Thus, the following is a fifteen week program (12 step) I have created to make this thesis project a reality; starting in January 2006.

Step One (Weeks 1 & 2) :: program interpretation, detailed case study analysis, establishing and implementing vehicles of design, preliminary concepts

Step Two (Weeks 3 & 4) :: site development, physical contour model, parking accommodations, access points, site analysis implementation

Step Three (Week 5) :: spatial planning and organization developing functional and efficient relationships, relating to contextual issues

Step Four (Week 6) :: massing & volumetric studies, relating spatial planning three dimensionally

Step Five (Week 7) :: structural system relating to vertical space, circulation studies, building function at X,Y, and Z vectors

Step Six (Week 8) :: material application, elevation and section studies focusing on interior/exterior materiality

Step Seven (Week 9) :: construction & assembly, exploring unique details, corner axon physical model

Step Eight (Week 10) :: week reserved for midterm reviews, resolve any remaining key design issues

Step Nine (Week 11) :: implementation of mid-term review, minimizing changes, preparation for final push

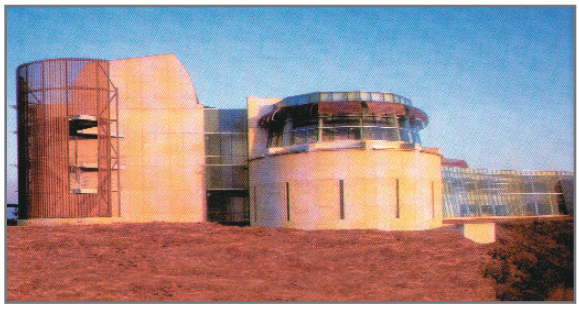
Step Ten (Week 12) :: character expression of interiors, relating interior & exterior, start final graphics

Step Eleven (Week 13) :: continuing final graphics, documenting clear story board, purchase mediums for printing and mounting

Step Twelve (Weeks 14 & 15) :: finish final presentation (oral and physical), this is the best project I have even done and it will be reflected by a quality presentation

start (week 1)

finish (week 15)



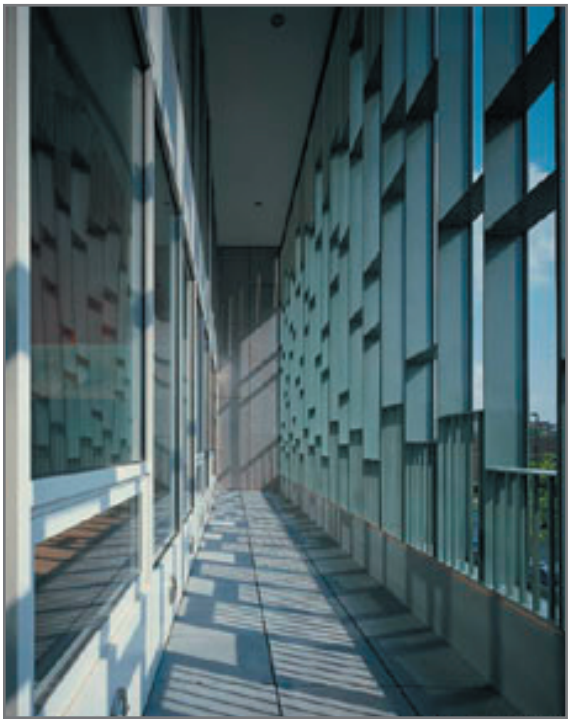
INDUSTRIAL

Building :: U.S. Food and Drug Administration's Laboratory & Research Facility

Location :: Irvine, California

Architect(s) :: R. Doss Mabe & Dusty Rhoads of Zimmer Gunsul Frasca Partnership

This 133,000 square foot facility is a great example of an industrial building that has used architecture to create a warm, beautiful facility whose building type often renders cold aesthetic implications. The material palette (concrete, copper, stainless steel, and curtain glass) summons a metaphorical image of laboratory function inside the building. "Like a piece of lab equipment its appearance reflects no more than the exigencies of the functions within." (Sullivan) The concept of relating the building's function with its exterior physical appearance is an inherent characteristic of this building type that I intend to explore throughout my thesis. In addition, an underlying goal of the building's spatial layout is to provide flexibility in order to accommodate the changing research environment, typical of the industry. Spatial flexibility is also a pertinent design attribute of my industrial forensics laboratory. The FDA's Laboratory and Research Facility appears expensive, however, at $255 per square foot, it is actually the least expensive of comparable federal projects.



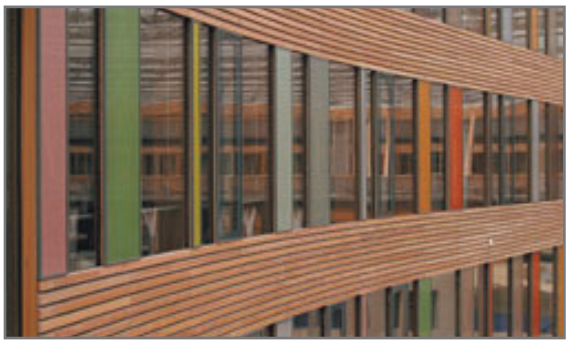
VERNACULAR

Building :: Chinese American Service League Community Center

Location :: Chicago, Illinois

Architect(s) :: Studio Gang Architects

The Chinese American Service League (CASL) located in the Chinatown sector of Chicago is a great example of vernacular architecture in that the architects evoked Chinese inconography through the use of materials and shapes in an attempt to uphold nearby cultural ideals. The main level of the building is granulated concrete application, and the decorative titanium panels fastened to the upper two levels are cut in diamond patterns and layered like shingles to represent the scales of a dragon. The building's staggered motif used in it's window openings/sunscreens and the Chinese Fu Dog also reference familiar Chinese architectural patterns. The 38,000 square foot building has five different programs/functions that relate within one building shell, which is a similar spatial issue I will face in developing a functional industrial forensics laboratory. I ask myself the question, how do we as designer's combine several spatial functions within one shell to create a harmonious overall composition? Studio Gang viewed the tendency of the Chinese cultural to live with extended family as a design opportunity by bringing the generations together to interact within designated zones of the building.



ORGANIC

Building :: German Federal Environmental Ministry

Location :: Dessau, Germany

Architect(s) :: Sauerbruch Hutton Architects

The 400,000 square foot German Environmental Ministry is a very sustainable federal building located in Dessau, Germany. The building occupies a site that was once heavily polluted, but has since been re-established as home to the wonderful facility. Considered by many to be a 'sustainable' case study, I feel it is also a very 'organic' building because of its footprint and contextual relationships. The awkwardly shaped site was the guiding factor to the building's snake-like plan, which circumvents an atrium used for temperature manipulation. The Environmental Ministry building is an "environmental structure displaying ecological themes" (Matthias Sauerbruch). The wonderful obligation and commitment that Sauerbruch Hutton has shown to their building's site is something I intend to model my thesis after, because a site often lends applicable design opportunity that sometimes gets overlooked.

PLAYFUL

Building :: Metro Hollywood Low-Income Apartments

Location :: Hollywood, California

Architect(s) :: Kanner Architects

The Metro Hollywood Apartment building is a very unique mixed-use residential project. The building's target market is family based and being located directly above the metro transit subway system encourages convenient, environmentally conscious travel. The bright colors and material palette make this project very playful which manifests images of warmth and comfort, rather than the intrinsic feelings usually associated with low-income housing. The principle of congenital characteristics relative to a specific building type is a design issue that I will have to resolve when handling the exterior of my industrial forensics laboratory. Playing with the exterior treatments of a building allows significant freedom to manipulate certain characteristics by down playing or highlighting specific attributes. In regards to my thesis, this idea poses the question, what design attributes do I want to underpin/celebrate as a representation of my underlying goals of the industrial forensics laboratory? Kanner Architects decided to highlight color and geometric patterns on the apartment's exterior, creating a sense of place that engages occupants and observers .

SUSTAINABILITY

Building :: Houston Medical Center School of Nursing & Student Community Center

Location :: Houston, Texas

Architect(s) :: BNIM Architects & Lake/Flato Architects

This $41 million dollar facility owned by the University of Texas sits eight stories tall and incorporates a beautiful building into the world's largest medical campus. The building's dynamic assembly collocates reclaimed bricks, plentiful daylighting, windows, and an innovative gray water system. In addition, the incorporation of atriums, balconies, a breezeway, and two roof gardens create a sustainable building that engages its occupants. The designers did a great job of cladding the building in materials that metaphorically represent their design intentions while maintaining a sustainable demeanor by reclaiming several material palettes; including the wood panels (old cypress logs from the Mississippi River) and the masonry used at the facility's base. This building truly 'pulled' me in with its distinctive exterior appearance, and continued to intrigue me with its sustainable characteristics. Based on my observations, I imagine experiencing the interior of the facility would be something everyone would appreciate. The distribution of natural light via atriums is a definitive characteristic of the School of Nursing and is something I plan to explore in my industrial forensics laboratory as a way of creating warm space in which occupants will enjoy.

MATERIALITY

Building :: Shaw Center for the Arts

Location :: Baton Rouge, Louisiana

Architect(s) :: Schwartz/Silver Architects (Boston)

The Shaw Center for the Arts is an excellent example of how material juxtaposition and geometric articulation can affect the architectural impact of a building. The facility reiterates the old cliche that less is sometimes more, with its minimalistic assembly of materials. The primary exterior treatment is a single-glazed rain screen of channel glass with a series of stainless connectors and architectural accents creating an implied horizontal allusion. Sitting atop a large curtain glass system, the channel glass contrasts marvelously creating a false impression that the curtain glass structurally supports most of the building. Additionally, the cantilevered volume hovers above an Art-Deco era building that has been assimilated into the arts complex creating a divergent juxtaposition of materials, that work very well together. The Shaw Center is aesthetically appealing because of its exterior simplicity. Material application is an architectural virtue I highly value and is usually where I attempt to apply my 'signature' to a design. The minimalistic approach the designers used in the Shaw Center for the Arts is a wonderful example of using less to create more...architectural expression.

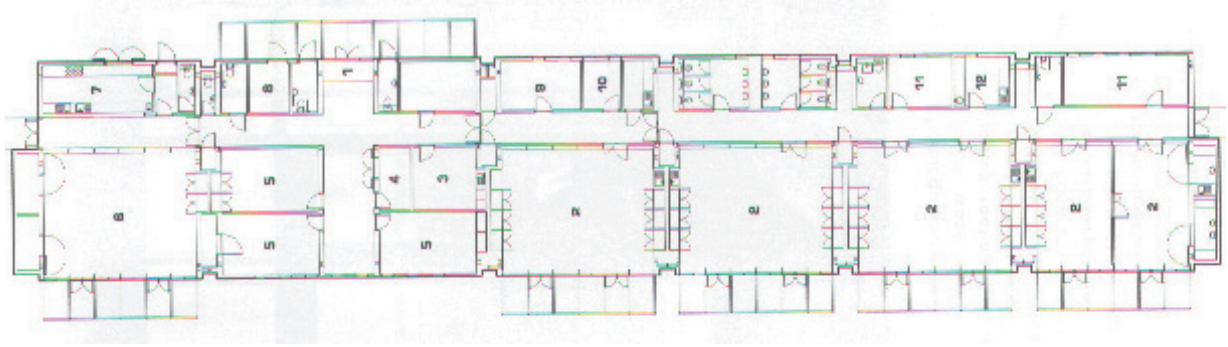
MODULARITY

Building :: Lavender Sure Start & Children's Centre

Location :: Mitcham (South London), England

Architect(s) :: John McAslan & Partners

A defining characteristic of modularity in regards to architecture is the desire to be spatially flexible. John McAslan's Lavender Project epitomizes modularity by creating flexible, individual spaces within a larger volume that have the capacity to accommodate a broad spectrum of functions. The Children's Centre combines facilities for over 90 children together with offices, training rooms, and a cafe'. The modular layout allows parents to leave children in the intermediate activity spaces while they enjoy the cafe' environment, attend counseling sessions, or participate in their own training courses. The spatial pattern used in this building conferred design opportunity to establish an architectural pattern. After studying Lavender's facade, it is clear that the modular elements read as individual spaces but have been layered to create a beautiful, harmonious facility. Spatial flexibility will be an underlying goal of my industrial forensics laboratory, because of the industry's diverse range of problematic inquiry.



GEOMETRY

Building :: Perimeter Institute for Theoretical Physics

Location :: Waterloo, Ontario

Architect(s) :: Saucier & Perrotte Architects

The Perimeter Institute's design concept was inspired by "nebulous spaces occupied by the subjects of theoretical physics, at once micro and macro-cosmic, rich in information, and of indeterminate form and substance" (Perimeter). This premise is clearly represented in the arbitrary placement of windows, mullion patterns, and geometric volumes. Theoretical physics is an abstract subject matter that tends to have unresolved, and at times chaotic components. The unique assembly of shapes and patterns contrive a direct metaphorical relationship between the building's exterior and the activities/studies occurring within. I anticipate the Perimeter Institute's program will be one of the primary models for which my forensics laboratory will resemble, because of the facilities' similar programmatic requirements and spatial obligation. Both require special consideration to private versus public venues, as well as specialized research facilities with optimal working conditions. Saucier & Perrotte did an excellent job of using metaphor and tectonics to produce a facility that is aesthetically pleasing, while still functioning at the highest level.

ECONOMICS: INDUSTRIAL ESPIONAGE

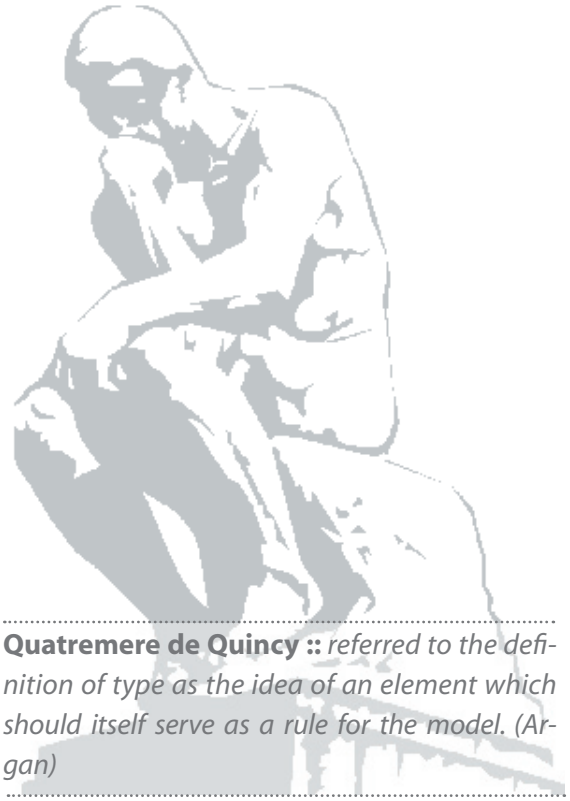
Industrial and/or economic espionage can best be classified as "the theft of economic information, also known as 'trade secrets', from an industry, company, or individual." (Naef) Industrial espionage has exponentially grown in the last fifty years and been directly supplemented by advancements made in technology. It is a common yet harsh and corruptive method of unethically staying competitive in today's ever changing business world. As computers become the primary tool for most businesses, manufacturers, and industries, the ability to successfully combat industrial espionage and provide counter measures becomes even more important. In today's corporate world, security doesn't just mean having a security guard sit by the main entrance of a facility. Rather, it also requires having advanced computer software, fire walls, and digital systems that are impermeable to outside infiltration.

In regards to the concept of industrial espionage, "The United States spends nearly $300 billion a year on basic research, making it 'the test lab for the world' and natural target of U.S. competitors." (Economic) With this in mind, it becomes very important as architects to design with this in consideration. Particularly when designing facilities whose building type lends direct relationships to classified, research-based conclusions. Organizations that handle classified of other sensitive information need to have deliberate programs for employees and management to protect particular information from outside viewing. Employee awareness of potential problems, paying attention to indicators of suspicious activity, and a willingness to report those indicators to management are keys to the successful protection/ safety of corporate information.

espionage :: *the act of obtaining information clandestinely. The term applies particularly to the act of collecting military, industrial, and political data about one nation for the benefit of another. Industrial espionage; the theft of patents and processes from business firms. (Answers.com)*

TYPOLOGY: THE TYPOLOGY OF ARCHITECTURE

Typology can be interpreted as the intrinsic structural and formal order which allows architectural entities to be grouped together, distinguished from one another, or repeated throughout history. (Argan) Typology is one of the most basic tools we as designers use for our analytical studies of buildings and architectural form. It provides a practical basis of design by comparing buildings of similar nature and develops comparative relationships through historical reference. An underlying determinate in designing credible architecture within a culture is embracing historic precedents and re-incorporating desirable characteristics into new designs. A culture becomes familiar with their vernacular architecture and it becomes important to incorporate specific architectural types to create a legible built environment.

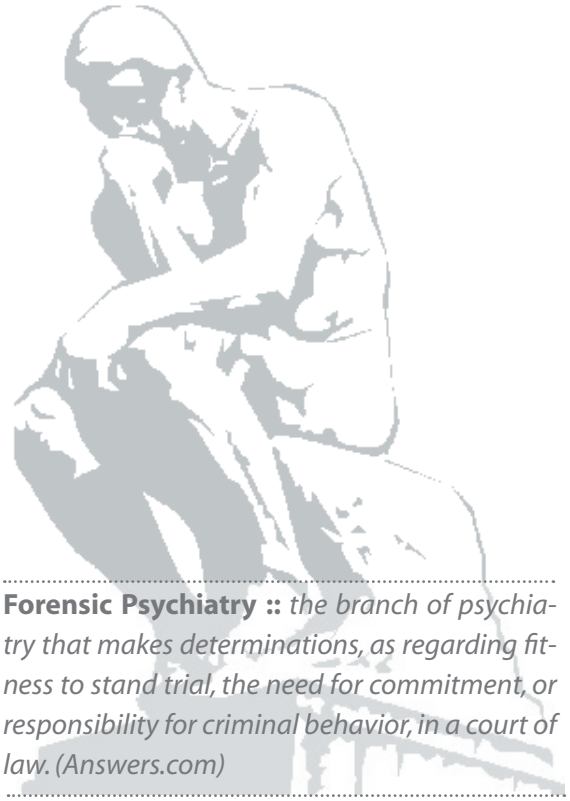


Quatremere de Quincy :: *referred to the definition of type as the idea of an element which should itself serve as a rule for the model. (Argan)*

Giulio Carlo Argan's famous study of types declared that "types (referring to typology) are regressed or reduced to a common 'root form' from specific works in a particular culture, which have obvious analogous formal and functional properties" (Argan) To support this idea, he felt that type was more a principle that allowed for variation than a fixed set of architectural entities. More specifically, Argan's studies of type operate at 3 levels/components; formal configuration, structure, and decorative elements. Typological studies are used by architects in nearly every architectural design. References are constantly being made to context and architectural styles. Our job as designers is to exercise judgment in the selection of types to model/reference specific design attributes. We can then work to convincingly solve the problems of imitation and affect.

PSYCHOLOGY: FORENSIC PSYCHIATRY

Forensic psychiatry is classified as a subspecialty of psychiatry in which clinical and scientific ideals are directly applied to legal issues. More specifically, it may be applied in several fields including civic, criminal, correctional, or legislative matters. Forensic psychiatry and clinical psychiatry are sometimes used interchangeably. However, forensic typically deals with legal issues while clinical deals with individual therapies and diagnosis. A wide spectrum of legal issues is invariably addressed within the realms of forensic psychiatry and behavioral science. A forensic psychiatrist can assist individuals and institutions, plaintiffs and defendants, attorneys, federal agencies, and the courts to evaluate claims ranging from medical and mental health malpractice to disability and sexual harassment. "Organizations can (also) benefit from psychiatrist consultation by evaluating the authenticity and response strategy to employment, supervisory responsibility, or maintenance of health care claims. Public safety and criminal justice professionals can also find forensic psychiatry consultation effective in analyzing and preventing potential threats." (Muth)



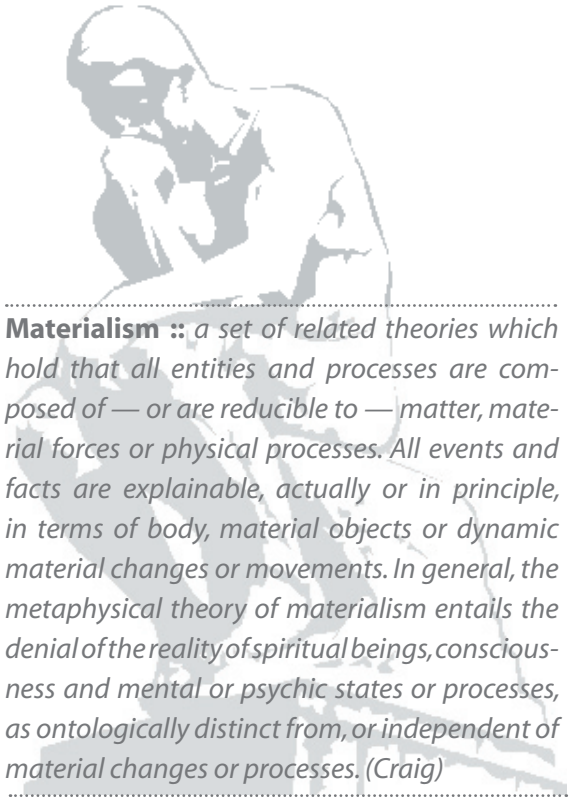
Forensic Psychiatry :: *the branch of psychiatry that makes determinations, as regarding fitness to stand trial, the need for commitment, or responsibility for criminal behavior, in a court of law. (Answers.com)*

Family and domestic relations is one of the most common case types for which the science is applied. In these cases, one must consider such issues as child custody, juvenile delinquency, parental fitness, abuse, neglect, and additional problems of similar nature. On the other end of the spectrum lies criminal law where issues such as individual competence, mental health, and responsibility are typically the basis for psychological analysis in regards to a criminal act. Regardless of the case's nature, psychiatrists must draw conclusions based on these physical and mental conditions and specifically determine relevance to a particular case. More specifically, what facts/attributes are applicable towards the success or failure of a particular case (or design in architecture), usually relevant to lawful prosecution.

MATERIALISM:

Generally speaking, materialism is described as the theory that the ultimate components of reality are physical entities, elements, and/or processes. More specifically, materialism upholds the idea that everything in existence is reducible to what is material or physical in nature. Belief in higher power, and spiritual phenomena is typically neglected and a focus on physiology is embraced. "An implication of materialism is that the diverse qualitative experiences we have are ultimately reducible to quantitative changes in objects or in our physiological functioning." (Stack) For example, terms referring to a mental process such as feelings, beliefs, intentions, conscience, and desire mean nothing from a cognitive-based viewpoint to a materialist. Rather, a mental process or thought is considered to be nothing more than a physiological change/alteration to our brain through a complex system of nerves.

Materialism has grown in popularity as advances have been made in technology, particularly in recent years. Science has produced large amounts of data that lend direct relationships to certain ideals associated with materialism. The holistic simplicity of the theory and incorporation of scientific breakthrough has made materialism an attractive ideology to philosophers. In regards to architectural design, a materialistic view point would invariably emphasis that visual characteristics/images of everything that exists is extended in space, and that nothing non-spatial exists. In addition, every space you occupy creates a complex transition into motor images and associates physical relationships to certain entities.



Materialism :: *a set of related theories which hold that all entities and processes are composed of — or are reducible to — matter, material forces or physical processes. All events and facts are explainable, actually or in principle, in terms of body, material objects or dynamic material changes or movements. In general, the metaphysical theory of materialism entails the denial of the reality of spiritual beings, consciousness and mental or psychic states or processes, as ontologically distinct from, or independent of material changes or processes. (Craig)*

MARXISM: THE ALIENATION THEORY

Karl Marx's nineteenth century theories have been the controversial basis for many theoretical discussions. His theory-based demeanor and interest in economics were the underlying premise for his arguable theories, particularly the alienation theory. In regards to his alienation theory, Marx believed that people were intelligent beings that were capable of transforming the world. However, he believed that technology was so advanced that the world had developed into something beyond our control. Marx contended that the free market was anarchic and that the relentless antics of supply and demand "blocks our ability to take control of our individual and collective destinies." (Prychitko)

Marxism :: *The political and economic philosophy of Karl Marx and Friedrich Engels in which the concept of class struggle plays a central role in understanding society's allegedly inevitable development from bourgeois oppression under capitalism to a socialist and ultimately classless society. (Answers.com)*

Marx felt that capitalism was a system that alienated the general masses. Generally speaking, he felt that people were working directly for Capitalists who had undeniable control over the workplace and its means of production. As Marx so eloquently put it, "Work becomes degrading, monotonous, and suitable for machines rather than free, creative people." (Prychitko) Consequently, he believed that people became stagnant, robotic beings that had totally lost touch with human nature and based their decisions strictly on business rather than for human need and personal fulfillment. Realistically, Marx's alienation theory is relatively irrational considering the perpetual success of free market. However, in theoretical terms it is very engaging because it metaphorically applies to so many things, including architecture. The thought of alienated masses working degrading jobs inspires designers to create elegant, alluring space that contradict Marx and promote individual satisfaction upon spatial occupancy.

BUSINESS ETHICS AND ARCHITECTURE:

Ethical integrity is an important aspect of every business decision. In regards to architectural business, ethics become an integral part of the design process. For example, it is relatively easy to design a building that aesthetically looks good. However, to create a harmonious composition that is aesthetically pleasing, enhances public safety, minimizes pollution/waste, respects fundamental human rights, and promotes civic satisfaction is an art that can spend a lifetime to master.

Within this art, ethical dilemmas inherently arise because of the nature of architectural design processes. In a perfect world, we would be able to allocate as much time as possible depicting a solution that represents the best of our (as designers) ability and is in the best interest of society-at large in every aspect. However, so many aspects of a successful business are contingent upon money and time, that rarely are we able to apply such diligence toward a specific phase of design. Rather, quality is usually sacrificed in order to meet a deadline/budget and the design simply becomes adequate or sufficient. I feel it then becomes the designer's responsibility to design accordingly by 'knowingly' making ethical and rational decisions, which attribute to a final product that best suits society-at large. It truly is a very thin line between being ethical, and simply being naive in regards to architectural business. However, with strong morals and ideals, and a desire to satisfy clients/communities with quality architecture, one can produce high-quality designs in an ethical manor despite the harsh realities of the business world.

Ethics: *(eth'iks) n., the principles of conduct governing an individual or a profession (Dictionary.com)*

view from site looking west

view of site looking southeast

view from site looking east

SITE SELECTION:

A building's site often gets overlooked and/or neglected during the design process, both at a micro and macro level. As a designer, it is sometimes easy for us to focus too extensively on the final physical structure, rather than taking a step back and analyzing the function of a building in relation to the existing context and site characteristics. After hours of site and city exploration, I have concluded that the North Dakota State University research and technology park is the best solution to serving as home for the industrial forensics laboratory, because the building's primary function as a laboratory directly relates to the processes occurring within the confines of nearby buildings. As a NDSU sanctioned facility it will promote both the university's advancements and Fargo as an up and coming community with global implications. Being a facility whose primary function is directly associated with technology, the logical setting for a building of this character would be within the functional realm of a technology park. With the addition of an industrial forensics laboratory to the existing research and technology park, it becomes a 'campus' of technology-based facilities whose reputation will herald international notoriety.

SITE INFORMATION:

The industrial forensics laboratory's site is located on the northern edge of the existing NDSU research and technology park. More specifically, it is bordered to the west by 18th Street and on the north and east by NDSU Research Park Drive. The site's close proximity to NDSU and the existing park make it an ideal location for a building of this type, because nearby arterial routes and campus facilities allow for easy access by people seeking facility usage. The empty lot to the north

view from site looking northwest

view from site looking north

view from site looking southwest

lends design opportunity to function as a parking lot with access points off 19th Avenue, 18th Street, and NDSU Research Park Drive; whichever proves to be most desirable. The allowable square footage within this land plot is suitable for the laboratory's anticipated parking demands. (Approximately 100 parking stalls) In addition, the parking lot will act as the building's security buffer from 19th Avenue vehicular traffic, which has developed into an arterial route for the city of Fargo. Another reason this site endorsed so much opportunity is its close proximity to several methods of transportation. For example, the park is only a one minute drive from Hector International Airport by car. Fargo is also at the intersection of two Interstate highways, I-29 and I-94, just four miles south of the park.

QUALITATIVE ASPECTS:

The proposed site has several nearby contextual issues needing consideration throughout design exploration. First and foremost, the airport to the north will produce inherent noise pollution which poses design concerns for several spaces within the facility. However, the nature of the facility itself requires noise attenuation because it too could potentially produce sizeable noise pollution. With meticulous space planning and resolution, these noise issues will be alleviated and should not pose much threat to the integrity of the laboratory. The surrounding research facilities are accustomed to the already high noise levels, and the addition of the industrial forensics laboratory should not impede existing conditions.

Physically, the site is very desirable for a project of this magnitude. Its flat nature will require minimal grading and cut/fill operations, which in turn allows for increased design flexibility. Minimal

grading to alleviate any surface water issues will be required. Currently, there is no significant vegetation within the realms of the site. However, the incorporation of landscape and vegetation is vital in creating an architecturally engaging space. The indigenous 'prairie' setting for which the laboratory will embrace, is one of many possibilities for landscape design opportunity.

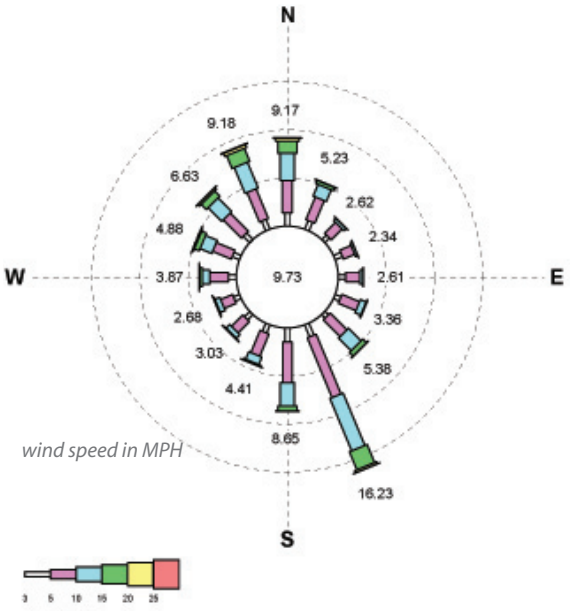
The research and technology park's underlying grid is orthogonal in nature and corresponds almost directly to the absolute directions. Nearby buildings are typically built in direct relation to the underlying grid, although several divergent characteristics have been incorporated to alleviate the monotony sometimes implicit of orthogonal buildings. The material textures of surrounding buildings are consistent with those of typical laboratory environments. Precast concrete, steel, plastic and EIFS constitute the basis for the park's material palette.

The industrial forensics laboratory will obviously have to account for the infamous winds of the Red River Valley. The flat terrain tends to permit high winds unless an artificial barrier acts as a blockade/shelter. The site's wind patterns will invariably be accounted for and will directly affect the placement of certain building characteristics. (i.e.- the placement of ventilation stacks and their affect on entrances and/or surrounding context) The variance in seasonal wind patterns will be an integral factor in the design process because they vary drastically between seasons.

QUANTITATIVE ASPECTS:

The climate of the upper midwest is very harsh and endures many extremes on an annual basis. The temperature range is one of the largest in the world and requires a significant amount of atten-

tion in order to produce high quality designs that will efficiently function through either extreme. The rate at which the weather varies from one extreme to the other, is usually an attributing factor to our region's climate-based design problems. The following table is several yearly averages that will be accounted for in the design of the industrial forensics laboratory. Thus, creating a building that is energy efficient and capable of withstanding the region's harsh seasonal variance.



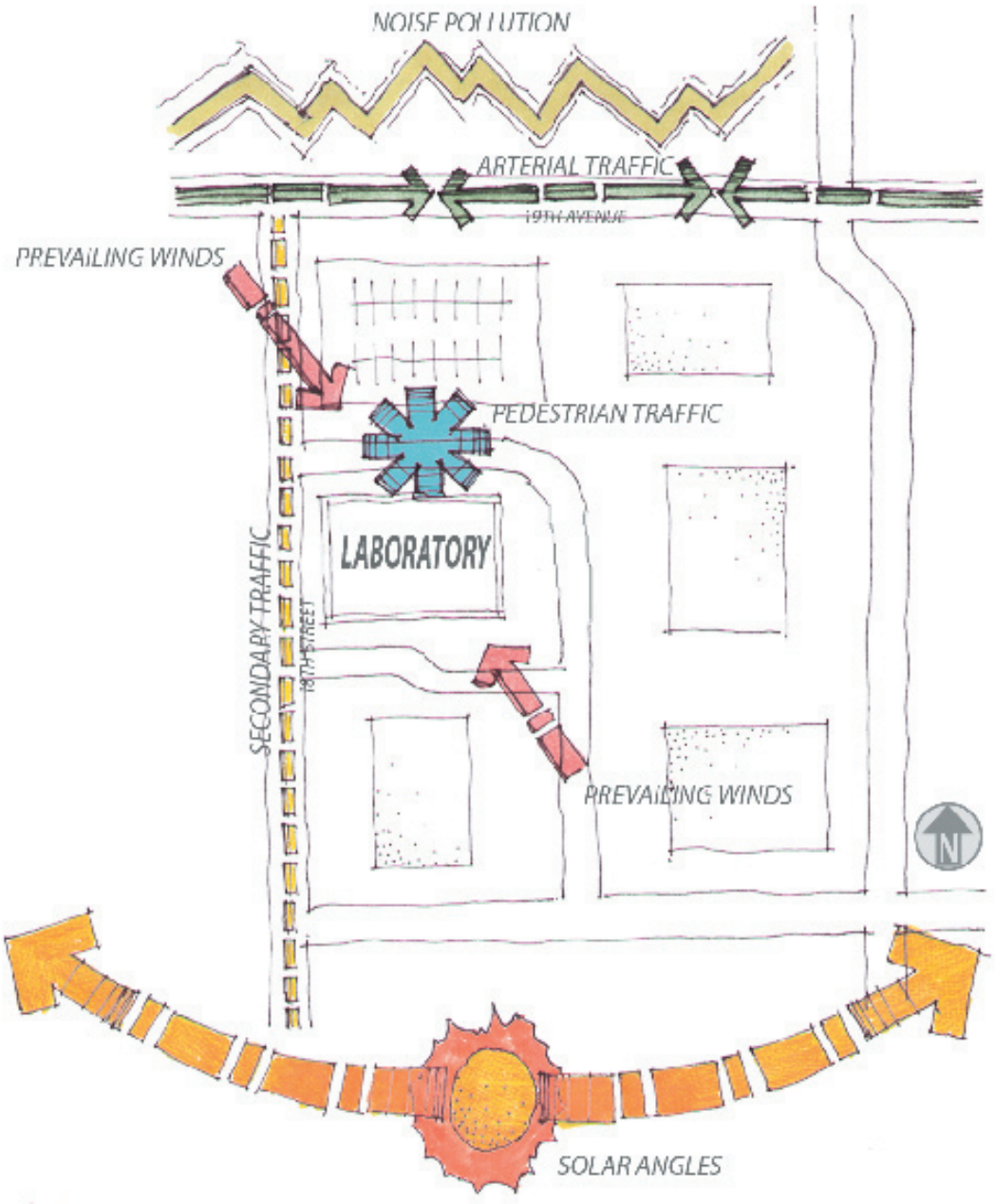
PREVAILING WINDS:

Throughout the design process, constant attention will be given to the prevailing winds, because of their potential implications on several issues. The most difficult aspect in designing for the upper midwest wind patterns is their seasonal variance. Generally speaking, the winter months produce north/northwest winds that are typically quite frigid. During the summer months, a much warmer southeast breeze is common. Each produce specific design obligations that must be resolved in order to produce a quality design.

ANNUAL AVERAGES: FARGO, NORTH DAKOTA

	YRS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Temp: Highest on Record	52	52	66	78	100	98	100	106	106	102	93	74	57	106
Temp: Lowest on Record	52	-36	-39	-23	-7	20	30	36	33	19	7	-24	-32	-39
Avg. # of Days Over 90 F	45	0	0	0	0	1	2	5	5	1	0	0	0	13
Avg. # of Days Below 32 F	45	31	28	27	16	4	0	0	0	2	13	27	31	179
Avg. Snowfall in Inches	62	9.5	6.1	7.6	3.4	0.1	T	T	T	T	0.7	6.1	7.4	40.9
Avg. Wind Speed in MPH	62	12.6	12.4	13.1	13.6	12.9	11.6	10.5	11.0	11.8	12.5	12.8	12.2	12.2
Avg. % Sunshine	54	50	56	58	60	61	62	71	69	60	54	40	43	57
Avg. Daily Max. Temp.	30	15.9	22.8	35.3	54.5	69.5	77.4	82.2	81.0	69.9	56.1	35.2	20.8	51.7
Avg. Daily Min. Temp.	30	-2.3	5.4	19.0	32.4	45.3	54.5	59.0	57.0	46.1	34.4	18.7	4.2	31.1
Normal Precip. in Inches	30	0.76	0.59	1.17	1.37	2.61	3.51	2.88	2.52	2.18	1.97	1.06	0.57	21.19

QUANTITATIVE DIAGRAM:



INTRODUCTION:

The industrial forensics laboratory will invariably use a strategically-planned material palette, complicated mechanical systems, and properly articulated structural systems. Modern laboratories require many special design considerations, because of the activities occurring within. Particularly in regards to heating, ventilation, and air conditioning systems. The proper integration of utility and mechanical systems into the architectural process is imperative in designing a successful research facility. Designing a building of this type would require significant communication and understanding between the architect and mechanical designers as the systems will undoubtedly create substantial design implications within the facility. The following factors play key rolls in the design of modern day laboratories: modular planning, adaptability/flexibility, proficient understanding of spatial requirements for ceiling space and shafts, envelope integrity, planned location of exhaust and air intakes. Typically, research objectives endure significant changes in laboratory function and project objectives. Thus, they are typically designed with spatial flexibility in mind, and with an underlying goal of being able to accommodate additional equipment, etc. for varying research projects.

MATERIAL APPLICATIONS:

To begin with, the selection of materials that are to be used in the design of the facility will be a direct representation of what is occurring within a particular space. As an industrial forensics laboratory whose building type lends a diverse activity base, specific materials will be applied to individual areas in an attempt to create a quality environment that is both safe and appealing to occupants. For research and testing spaces, concrete and steel applications lend a practical and safe material solution because of their 'clean' and

low maintenance nature. Materials should be selected and applied with staff/occupant safety in mind as the predominate justifying factor, followed by architectural/aesthetic considerations. The variant spatial functions occurring within the building provide a unique opportunity for material juxtaposition. For example, the public spaces of the laboratory will use a material palette whose predominate goal is to engage its occupants and render architectural expression, while upholding occupant safety. Wood, steel, glass, and masonry units are all potential materials for a well designed public space. In addition to the specific materials used, several coating and sealant applications will be administered to concrete and steel products in order to enhance occupant safety. Regardless of the space and material application, the laboratory will be well detailed and its underlying technology theme will be legible in nearly every facet of the project.

VENTILATION SYSTEMS:

The HVAC and ventilation systems for the industrial forensics laboratory will be a network of equipment requiring a tremendous amount of design attention. More specifically, system routes, materials, and public/environmental safety will attribute to the complex HVAC system of the laboratory. The most difficult issue in designing a complex system of this nature is making sure it functions as a unit and not as individual systems. Laboratories of this nature typically use 100% of outside air, which consequently creates additional design complexity in that the overall system will have to expand its operating range. An additional design consideration is the idea of system flexibility. Most laboratory facilities will be modified at some time, which means I must consider the extent to which laboratory systems could be adaptable. The facility's ventilation stacks will be strategically placed for aesthetic reasons, and to ensure the proper ventilation of exhaust and by-

product. Additionally, the harvesting of geothermal energies lends the most design opportunity for a building of this type. The facility will invariably use substantial amounts of energy because of a laboratory's functional nature. Geothermal wells have a performance and environmental quality suitable for a project of this type. Their innovative qualities are another extension of the complex technology occurring within the facility and are considered to be an environmentally conscious method of artificially manipulating temperature. The complex HVAC and ventilation systems occurring within the forensics laboratory will make up approximately 30-50% of the overall construction cost. While the geothermal wells are initially more expensive than alternate energy sources, they are much more economic (and environmental) in the long run. The primary objective of the laboratory's HVAC and ventilation systems is to ensure occupant safety. With several lab procedures potentially occurring within the facility, and the possibility of hazardous by-product, it is very important that all HVAC and ventilation systems function at the highest level in order to provide a safe environment for all personnel.

INTRODUCTION:

The industrial forensics laboratory will provide research and employment opportunity to North Dakota State University while integrating public interaction by providing limited access to specific building entities. The exposure gained through public observation and university affiliation will not only promote the university as a leader in technology, but will also encourage an engaging relationship between building occupants and the forensics laboratory.

The facility will provide services for a diverse clientele/staff base including: students, university faculty, technicians, research professionals, maintenance, marketing/management, security services, and general public. It will be owned by North Dakota State University. The following compilation is a breakdown of the facility's users/clients and is intended to describe each group's respective expectations in regards to occupying the industrial forensics laboratory.

CLIENT DESCRIPTION & EXPECTATIONS:

Students :: 40

All students who occupy the building will have restricted access to highly specialized and professional areas, but will have direct access to all educational facilities during operational hours. Considerations may be made in regards to accessing specialized areas if properly sanctioned with laboratory staff. The facility's close proximity to nearby campus parking lots means the need for on site student parking is minimal, however several metered stalls will be available for student use. Students can expect the physical environment of the educational spaces to possess the most current technologies while maintaining a working environment similar to existing campus laboratories. Peak usage will be between 8:00am and 5:00pm, Monday through Friday.

University Faculty :: 3

The university faculty will also have restricted access to highly specialized and professional areas, but will have the opportunity to observe certain "behind the scenes" processes as part of their continual education. The number of faculty working within the facility will vary, although rarely will more than 3 professors be in session at any given time. The faculty can expect a similar working environment to existing science-based buildings on campus. More specifically, a public venue reserved for teaching with private offices, etc. for preparation and confidential obligations. 4 parking stalls will be suffice for faculty parking needs. Peak usage will be between 8:00am and 5:00pm, Monday through Friday.

Technicians :: 20

Laboratory technicians will have access to the entire facility. The technicians will both conduct and assist in research and analytical studies. The facility supports a 20 person technician staff with room for future expansion. 26 parking stalls provide adequate parking requirements for current staff technicians and will accommodate future and/or adaptive use requirements. The technicians' working environment will vary depending on a project's nature, but will inevitably involve all technological aspects and venues of the facility. Peak usage will be 8:00am to 5:00pm, Monday through Friday.

Professionals :: 12

The laboratory professionals will also have access to the entire facility. The professionals lead research and analysis teams on most forensic cases. Analytical teams typically consist of at least 1 professional and several assisting technicians. The laboratory supports a 12 person professional staff with room for possible future expansion. Their physical working environment will be simi-

lar to the technicians'. 18 parking stalls have been devoted to the professional staff because of daily outsourcing. Peak usage will be between 8:00am and 5:00pm, Monday through Friday.

Maintenance :: 4

Maintenance staff will have access to the entire building 24 hours a day. The maintenance staff is highly specialized in that the equipment in which they have to maintain and be familiar with is state of the art. The industrial laboratory will have the assistance of 2 maintenance engineers and 2 custodial engineers. The maintenance staff can expect working throughout the entire facility, however, they will have their own private office spaces and workshop. 5 parking stalls have been devoted to their department. Peak usage will be 24 hours a day, Monday through Friday.

Marketing and Business Administration :: 15

The marketing and business staff will have access to the entire building's amenities unless a specialized laboratory experiment/analysis is in progress. 15 staff members provide the business services for the facility and are responsible for communications, marketing, accounting, and business administration. The business staff can expect to work in an office environment while occasionally interacting with laboratory-based spaces and workers. 17 parking stalls have been allotted to business services. Peak usage will be between 8:00am and 5:00pm, Monday through Friday.

Security Services :: 3

Security services will invariably have access to the entire building, unless a forensic analysis is in progress. 3 staff members provide adequate security with the assistance of NDSU police. Security services can expect to have a designated space within the building, although a significant part of

their time will be spent patrolling the building's parameters. 2 parking stalls provide adequate space for security team parking. Peak usage will be 24 hours a day, 7 days a week.

General Public :: 15

The general public will have restricted access to nearly the entire building, unless on a sanctioned/guided tour in which permission has been granted by higher authority to enter restricted spaces. 15 person tours and informational sessions are preferred in order to maintain ease of security and group interaction. The general public can expect a very engaging, definitive architectural space upon entering the facility. 17 parking stalls have been allotted for their use. Peak usage will be between 8:00am and 5:00pm, Monday through Friday.

EXECUTIVE SPATIAL SUMMARY:

Research & Laboratory	Biology Laboratory	3,100 sq ft
	Chemical Laboratory	3,100 sq ft
	Mechanical Laboratory	10,000 sq ft
	Laboratory Preparation	600 sq ft
	Biological Vestibules	300 sq ft
	Tools & Storage	1,200 sq ft
	Hazardous By-product Storage	200 sq ft
	Electrical Systems	150 sq ft
	Mechanical Systems	1,000 sq ft
	Emergency Back-up	200 sq ft
		19,850 sq feet
Business Administration	Offices	1,800 sq ft
	Breakout Space	400 sq ft
	Conference	850 sq ft
	Storage & Archives	1,000 sq ft
	Technology & Production	1,000 sq ft
	Toilets	500 sq ft
	Lounge/Kitchenette	600 sq ft
		6,150 sq ft
Educational	Classrooms	1,000 sq ft
	Faculty Offices	450 sq ft
	Computer Kiosk	250 sq ft
	Faculty Preparation	300 sq ft
	Educational Storage	450 sq ft
	Small Group Breakout Space	600 sq ft
	Lecture Hall	1,500 sq ft
	Toilets	500 sq ft
		5,050 sq ft
Public Based	Lobby	500 sq ft
	Gallery	800 sq ft
	Information Center	250 sq ft
	Lounging Area	250 sq ft
		1,800 sq ft

Service & Misc.

Locker Rooms	1,100 sq ft
Researcher's Lounge	600 sq ft
Research Library	1,400 sq ft
Research Technology & Prod.	1,000 sq ft
Service Entrance & Loading Dock	800 sq ft
Security	250 sq ft
Electrical System Storage	150 sq ft
Observation Deck	150 sq ft

5,450 sq ft

Total Spatial: 38,300 sq ft
30% Mechanical, Circulation, Toilets: 11,490 sq ft

Total Square Footage :: 49,790 sq ft

RESEARCH AND LABORATORY:

Biology Laboratory

Spatial Description :: research based explorations involving several hands-on methods and equipment operations

Net Area (Per Space) :: 3,100 square feet

Number of Spaces :: 1

Spatial Relationships :: laboratory will produce sufficient noise, must maintain a spatial relationship with shared research spaces

Equipment :: technologically advanced mechanical equipment located throughout space

System/Design Considerations :: space must be flexible, complicated HVAC & ventilation systems

Chemical Laboratory

Spatial Description :: research based explorations involving several hands-on methods and equipment operations.

Net Area (Per Space) :: 3,100 square feet

Number of Spaces :: 1

Spatial Relationships :: laboratory will produce sufficient noise, must maintain a spatial relationship with shared research spaces

Equipment :: technologically advanced mechanical equipment located throughout space

System/Design Considerations :: space must be flexible, complicated HVAC & ventilation systems

Mechanical Laboratory

Spatial Description :: research based explorations involving several hands-on methods and equipment operations

Net Area (Per Space) :: 5,000 square feet

Number of Spaces :: 2

Spatial Relationships :: laboratory will produce sufficient noise and vibrations, maintain spatial relationship with shared research spaces

Equipment :: technologically advanced mechanical equipment located throughout space

System/Design Considerations :: high ceilings, sophisticated mechanical systems, large service area with exterior access

Laboratory Preparation

Spatial Description :: preparing equipment, personnel, and work plan prior to research and experimentation

Net Area (Per Space):: 200 square feet

Number of Spaces :: 3

Spatial Relationships :: must maintain a spatial relationship with nearby research spaces, centrally located between lab environments

Equipment :: tables, chairs, storage cabinets

System/Design Considerations :: designate an area within preparation to each specific laboratory

Biological Vestibules

Spatial Description :: properly eliminates hazardous by-product upon entering or exiting laboratories

Net Area (Per Space) :: 100 square feet

Number of Spaces :: 3

Spatial Relationships :: must be adjacent to laboratory's entrance and/or exit

Equipment :: technologically advanced mechanical equipment located throughout space, specialized ventilation system

System/Design Considerations :: ventilation system's relationship to nearby systems, placement of vestibules in relation to exits/entrances

Tools and Storage

Spatial Description :: tools, supplemental equipment, general storage

Net Area (Per Space):: 600 square feet

Number of Spaces :: 2

Spatial Relationships :: maintain a spatial relationship with nearby research spaces, these storage rooms are intended strictly for laboratory environments

Equipment :: standard and misc. tools, biological and chemistry equipment

System/Design Considerations :: designate an area within preparation to each specific laboratory

Hazardous By-Product Storage

Spatial Description :: proper storage of hazardous by-product, until proper disposal can be administered

Net Area (Per Space) :: 200 square feet

Number of Spaces :: 1

Spatial Relationships :: adjacent to laboratories in order for direct access from research environments

Equipment :: biohazard storage containers

System/Design Considerations :: ventilation system's relationship to nearby systems, safety of facility's occupants

Electrical Systems

Spatial Description :: electrical equipment and systems overflow

Net Area (Per Space):: 150 square feet

Number of Spaces :: 1

Spatial Relationships :: maintain a uniform spatial relationship with all laboratories

Equipment :: specialized electrical equipment inherent of laboratories, computer servers/data, additional digital media

System/Design Considerations :: direct access from a sterile environment to allow maintenance staff access

Mechanical Systems

Spatial Description :: mechanical equipment and systems overflow

Net Area (Per Space) :: 1,000 square feet

Number of Spaces :: 1

Spatial Relationships :: relatively close to laboratories for specialized equipment overflow, produces significant noise

Equipment :: HVAC, ventilation systems, biohazard systems

System/Design Considerations :: produces noise and vibrations for adjacent space and will invariably have biohazardous mechanical systems within

Emergency Back-up

Spatial Description :: storage area for facilities back-up generator and supporting systems

Net Area (Per Space):: 150 square feet

Number of Spaces :: 1

Spatial Relationships :: centrally located in order to service entire facility

Equipment :: diesel generator, battery operated sump pumps, power to flood/fire lighting

System/Design Considerations :: will need access to exterior ventilation when operating diesel generator

BUSINESS ADMINISTRATION:

Offices

Spatial Description :: space allocated for business personnel, marketing representatives, and financial figures

Net Area (Per Space) :: 225 square feet

Number of Spaces :: 8

Spatial Relationships :: maintain relationship with nearby business spaces, distance from laboratories is dependent on noise

Equipment :: desks, tables, chairs, computers, file cabinets

System/Design Considerations :: space must be flexible to accommodate the business's desirable working environment

Breakout Space

Spatial Description :: an engaging space intended for small group interaction and discussion

Net Area (Per Space) :: 400 square feet

Number of Spaces :: 1

Spatial Relationships :: maintain relationship with nearby business spaces, distance from laboratories is dependent on noise

Equipment :: tables, chairs, computer, overhead projection, presentation board

System/Design Considerations :: space must be flexible to accommodate the business's desirable working environment

Conference

Spatial Description :: capable of accommodating medium-sized groups, professional in physical and aesthetic nature

Net Area (Per Space) :: 850 square feet

Number of Spaces :: 1

Spatial Relationships :: maintain relationship with nearby business spaces, minimize distance from public lounging/waiting area

Equipment :: conference table, executive chairs, overhead projection, presentation board

System/Design Considerations :: space should be easily accessible to visiting consultants, while maintaining relationship to business spaces

Storage and Archives

Spatial Description :: accommodates storage of laboratory records, professional documents, and additional physical information

Net Area (Per Space) :: 1,000 square feet

Number of Spaces :: 1

Spatial Relationships :: maintain relationship with nearby business spaces, security more restricted than adjacent business spaces

Equipment :: file cabinets, shelves, computers

System/Design Considerations :: space must restrict direct penetration of natural sun-light and requires 'secure' placement within facility

Technology and Production

Spatial Description :: a primary digital production space, capable of accommodating ample amounts of employees

Net Area (Per Space) :: 1,000 square feet

Number of Spaces :: 1

Spatial Relationships :: maintain relationship with nearby business spaces, avoid noise confliction of mechanical rooms/laboratories

Equipment :: tables, chairs, computers, working tables, supplemental lighting

System/Design Considerations :: space will require significant HVAC and/or ventilation load to accommodate abundant digital media

Toilets

Spatial Description :: private toilets and lavatories intended for business personnel only

Net Area (Per Space) :: 250 square feet

Number of Spaces :: 2

Spatial Relationships :: maintain relationship with nearby business spaces, preferably on outer realms of 'business' designated space

Equipment :: toilets, urinals, lavatories, garbage cans

System/Design Considerations :: relate toilet's plumbing to nearby facilities of similar nature, stacking vents and pipes from floor to floor

Lounge and Kitchenette

Spatial Description :: relaxing environment intended to provide hospitality and convenience within the facility

Net Area (Per Space) :: 600 square feet

Number of Spaces :: 1

Spatial Relationships :: optimal location to provide easy access for education and business personnel

Equipment :: tables, chairs, oven, sink, microwave, couches, television

System/Design Considerations :: space should be easily accessible to all staff members

EDUCATIONAL:

Classrooms

Spatial Description :: interactive learning environment consistent with at typical classroom/ lab environment

Net Area (Per Space) :: 500 square feet

Number of Spaces :: 2

Spatial Relationships :: classrooms should be nearby lecture hall and breakout space

Equipment :: lab stations, desks, lab tables, sinks, overhead projection, podium, standard laboratory equipment

System/Design Considerations :: space will require additional plumbing for lab stations, ventilation systems will link with laboratories'

Faculty Offices

Spatial Description :: typical office environment with flexible layout

Net Area (Per Space) :: 225 square feet

Number of Spaces :: 2

Spatial Relationships :: maintain relationship with nearby classrooms, lecture halls, and staff preparation areas

Equipment :: file cabinets, computer, desk, chairs

System/Design Considerations :: space should be private from classroom environment, a place to properly handle student/faculty confidential issues

Computer Kiosk

Spatial Description :: an interactive information hub intended for any occupant's use

Net Area (Per Space) :: 250 square feet

Number of Spaces :: 1

Spatial Relationships :: centrally located in order to bestow to all personnel, typically an aesthetic architectural entity that lends design opportunity for public space

Equipment :: desks, computers, chairs

System/Design Considerations :: space will require some monitoring by staff to ensure proper use of computers

Faculty Preparation

Spatial Description :: similar to laboratory preparation, provides a space for faculty to administer work plan, assemble necessary equipment

Net Area (Per Space) :: 300 square feet

Number of Spaces :: 1

Spatial Relationships :: maintain relationship with nearby classrooms, lecture halls

Equipment :: tables, chairs, storage cabinets

System/Design Considerations :: space should be private from classroom environment, ample storage and book space required

Educational Storage

Spatial Description :: dedicated to storage of educational equipment, books, and interactive media

Net Area (Per Space) :: 450 square feet

Number of Spaces :: 1

Spatial Relationships :: maintain a relationship to classrooms and faculty preparation spaces

Equipment :: shelves, file cabinets

System/Design Considerations :: restriction of direct natural light

Small Group Breakout

Spatial Description :: intended to promote group interaction through small group discussion and audiovisual presentation

Net Area (Per Space) :: 600 square feet

Number of Spaces :: 1

Spatial Relationships :: maintain relationship with nearby classrooms, lecture halls

Equipment :: tables, chairs, storage cabinets

System/Design Considerations :: space should be nearby adjacent education spaces, but should not interfere with classes if in progress

Lecture Hall

Spatial Description :: an interactive environment consistent with the newest lecture halls on campus

Net Area (Per Space) :: 1,500 square feet

Number of Spaces :: 1

Spatial Relationships :: located on the edge of the overall education space to allow easy access from public space

Equipment :: auditorium seating, overhead projection, podium

System/Design Considerations :: noticeable, easy access for first time occupants

Toilets

Spatial Description :: private toilets and lavatories intended for business personnel only

Net Area (Per Space) :: 250 square feet

Number of Spaces :: 2

Spatial Relationships :: maintain relationship with nearby business spaces, preferably on outer realms of 'business' designated space

Equipment :: toilets, urinals, lavatories, garbage cans

System/Design Considerations :: relate toilet's plumbing to nearby facilities of similar nature, stacking vents and pipes from floor to floor

PUBLIC BASED:

Lobby

Spatial Description :: metaphorical representation of building type and overall function

Net Area (Per Space) :: 500 square feet

Number of Spaces :: 1

Spatial Relationships :: centrally located, the facility's node for relating laboratory, business, and educational spaces

Equipment :: front desk, display cases, supplemental lighting

System/Design Considerations :: underlying aesthetic implications, serve as dynamic vehicle for accessing specific branches of facility

Gallery

Spatial Description :: summarize what the facility does through display and visual stimulation

Net Area (Per Space) :: 800 square feet

Number of Spaces :: 1

Spatial Relationships :: centrally located, predominate public space that bespeaks supplemental spaces

Equipment :: public art, display cases, supplemental lighting, television, high top tables, chairs

System/Design Considerations :: underlying aesthetic implications, serve as dynamic vehicle for accessing specific branches of facility in association with main lobby

Information Center

Spatial Description :: provide a clear description of the facility's realm of operations

Net Area (Per Space) :: 250 square feet

Number of Spaces :: 1

Spatial Relationships :: centrally located, the facility's node for relating laboratory, business, and educational spaces

Equipment :: digital signage, facility index, display tower

System/Design Considerations :: space will have underlying aesthetic implications, serve as dynamic vehicle for accessing specific branches of facility in association with lobby and gallery

Lounging Area

Spatial Description :: a serine environment offering privacy and relaxation to all occupants

Net Area (Per Space) :: 250 square feet

Number of Spaces :: 1

Spatial Relationships :: centrally located, adjacent to all public amenities

Equipment :: couches, tables, chairs, television, beverage cooler

System/Design Considerations :: space will require visual separation from nearby public spaces in order to fulfill its 'private' intentions

SERVICE AND MISCELLANEOUS SPACE:

Locker Rooms

Spatial Description :: a private space for employees to bath, change clothes, etc, particularly laboratory technicians and professionals

Net Area (Per Space) :: 550 square feet

Number of Spaces :: 2

Spatial Relationships :: located within the realms of laboratory space to provide easier access for target users

Equipment :: showers, lockers, lavatories, toilets, urinals, benches

System/Design Considerations :: space will be strategically placed to provide privacy for all users

Researcher's Lounge

Spatial Description :: relaxing environment intended to provide hospitality and convenience within the facility

Net Area (Per Space) :: 600 square feet

Number of Spaces :: 1

Spatial Relationships :: optimal location to provide easy access for laboratory professionals and technicians

Equipment :: tables, chairs, oven, sink, microwave, couches, television

System/Design Considerations :: space should be easily accessible to all staff members of facility, specifically laboratory personnel

Research Library

Spatial Description :: a private space for laboratory personnel to explore and derive analytical conclusions

Net Area (Per Space) :: 1,400 square feet

Number of Spaces :: 1

Spatial Relationships :: located within the realms of laboratory space to provide easier access for target users

Equipment :: computers, book shelves, tables, chairs, desks, cubicles

System/Design Considerations :: space will be oriented in accordance with adjacent spatial functions, minimizing the relocation of noise

Technology and Production

Spatial Description :: a primary digital production space, capable of accommodating ample amounts of employees

Net Area (Per Space) :: 1,000 square feet

Number of Spaces :: 1

Spatial Relationships :: maintain relationship with nearby research space, avoid noise confliction of mechanical rooms/laboratories

Equipment :: tables, chairs, computers, working tables, supplemental lighting

System/Design Considerations :: space will require significant HVAC and/or ventilation load to accommodate abundant digital media

Service Entrance and Loading Dock

Spatial Description :: secluded for aesthetic reasons, intermediate space provides large scale entrance for laboratory environments and cargo docks

Net Area (Per Space) :: 800 square feet

Number of Spaces :: 1

Spatial Relationships :: adjacent to all laboratories, direct access to outside and service drive

Equipment :: heavy duty shelving, fork-lift

System/Design Considerations :: space will require outside access, service drive creates aesthetic implications for buildings exterior

Security

Spatial Description :: a stationary environment for security personnel providing digital surveillance of site

Net Area (Per Space) :: 250 square feet

Number of Spaces :: 1

Spatial Relationships :: centrally located for sufficient access to entire facility, secluded for aesthetic reasons

Equipment :: televisions, chair, desk, computer

System/Design Considerations :: complex digital systems will require increased HVAC and ventilation load

Electrical System Storage

Spatial Description :: electrical equipment and systems storage

Net Area (Per Space):: 150 square feet

Number of Spaces :: 1

Spatial Relationships :: maintain a centrally located spatial relationship with all spaces

Equipment :: specialized electrical equipment inherent of laboratories, computer servers/data, additional digital media

System/Design Considerations :: central location for efficient electrical wiring to the facility's extensive electrical and digital network

Observation Deck

Spatial Description :: an engaging, safe observation platform directly overlooking mechanical laboratory

Net Area (Per Space) :: 150 square feet

Number of Spaces :: 1

Spatial Relationships :: adjacent to mechanical laboratory, within public realms of the facility

Equipment :: safety glass, prefabricated railing

System/Design Considerations :: occupant safety

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BUILDING TYPOLOGY:

A highly specialized, industrial forensics laboratory to be located in Fargo, North Dakota at the North Dakota State University research and technology park.

THEORETICAL PREMISE:

The design thesis will examine the intrinsic relationships between success and failure as they relate to industrial processes while deriving design metaphors, analogies, and or tectonics throughout the examination.

PROJECT JUSTIFICATION:

The facility will enhance Fargo's existing technology base and will augment North Dakota State University's reputation as a leader in advanced research and technological development.

PROJECT ABSTRACT:

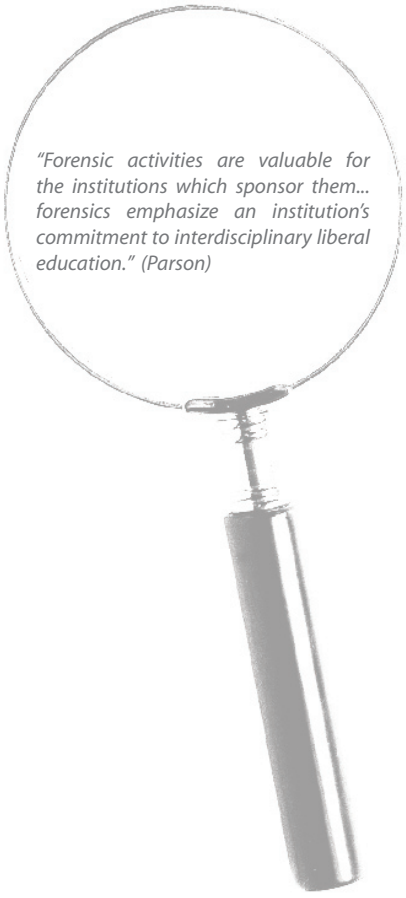
The design thesis is an advanced, industrial forensics laboratory to be located in the North Dakota State University research and technology park. The project will examine the inherent relationships of industrial processes, specifically determining what makes the process a success or failure based on research results. The laboratory will enhance both Fargo's and NDSU's reputation as a leader in developing technology.

PROJECT NARRATIVE:

The freedom to design any type of building for my senior design thesis is a tremendous opportunity. It marks the capstone to four wonderful years of studying design in a studio environment and is the springboard into my career as a practicing architect. Determining what typology of project to design for a thesis project is a difficult process because for the first time in my life, I am not required to follow a predetermined project program. Rather, I have the freedom to design any building type and do so in a process which is tailored to my ideals and beliefs. One of the most important things I have learned during my architectural education is ability to solve problems in an efficient way. The ability to constructively solve a problem goes far beyond the walls of architecture and is something we encounter on a daily basis in everyday life. This ability is something I have come to value and is thus an underlying goal in the type of project I have chosen for my senior thesis project; an industrial forensics laboratory located at the North Dakota State University research and technology park.

The thesis will examine the inherent relationships of industrial processes, specifically determining what makes a process a success or a failure. It will provide analytical testing, technical consultation, and investigation services for clients seeking an understanding of the nature of a mechanical, chemical, or industrial complication. The combination of research and physical examination provides a dynamic, technical facility capable of performing a wide range of studies that support technology and innovation. The forensics laboratory poses tremendous design opportunity in that it has allowed me to metaphorically incorporate problem solving as a holistic entity into the building's specific typol-

ogy. I also foresee a metaphorical relationship between the building's function and its exterior representation. Often times, research facilities inherit a cold, industrial physical appearance, however I intend for NDSU's forensic laboratory to be an architectural expression that creatively represents technology while upholding functional qualities within the building's envelope. The facility will also accommodate the general public in that a portion of the building will be accessible to guided tours and provide exposure to the exciting world of technology. to be an architectural expression that creatively represents technology while upholding functional qualities within the building's envelope. The facility will also accommodate the general public in that a portion of the building will be accessible to guided tours and provide exposure to the exciting world of technology.



CLIENT DESCRIPTION:

The industrial forensics laboratory will provide research and employment opportunity to North Dakota State University while integrating public interaction by granting limited access to specific building entities. The exposure gained through public observation and university affiliation will not only promote the university as a leader in technology, but also encourage the clientele base. The facility will provide services for a diverse clientele/staff base including: students, faculty, technicians, research professionals, maintenance, marketing/management, security services, and general public. It will be owned by North Dakota State University.

Students - All students who occupy the building will have restricted access to highly specialized and professional areas, but will have direct access to all educational facilities during operational hours. The facility will be able to support approximately 30 students. Because of the its close proximity to nearby campus parking lots, the need for on site student parking is minimal. Peak usage will be between 8:00am and 5:00pm, monday through friday.

Faculty - Faculty will also have restricted access to highly specialized and professional areas, but will have the opportunity to observe certain "behind the scenes" processes as part of their continual education. The number of faculty working within the facility will vary although rarely will more than 2 professors be in session. 4 parking stalls will be allotted for faculty needs. Peak usage will be between 8:00am and 5:00 pm, monday through friday.

Technicians - Laboratory technicians will have access to the entire facility. The technicians will

both conduct and assist in research and analytical studies. The facility supports a 20 person technician staff with room for future expansion. 26 parking stalls provide enough parking for cur rent staff technicians and accommodates for future use. Peak usage will be 8:00am to 5:00pm, monday through friday.

Professionals - Laboratory professionals will have access to the entire facility. The professionals lead research and analysis teams on most forensic cases. Analytical teams typically consist of at least 1 professional and several assisting technicians. The laboratory supports a 12 person professional staff with room for possible future expansion. 18 parking stalls have been devoted to the professional staff because of daily outsourcing. Peak usage will be between 8:00am and 5:00pm, monday through friday.

Maintenance - Maintenance staff will have access to the entire building 24 hours a day. The maintenance staff is highly specialized in that the equipment in which they have to maintain and be familiar with is state of the art. The laboratory will provide the assistance of 2 maintenance engineers and 2 custodial engineers. 5 parking stalls have been devoted to their department. Peak usage will be 24 hours a day, monday through friday.

Marketing and Business Administration - The office staff will have access to the entire building's amenities unless a specialized laboratory experiment/analysis is in progress. 12 staff members provide the business services for the facility and are responsible for communications, marketing, accounting, and business administration. 16 parking stalls have been allotted to business services. Peak usage will be between 8:00am and 5:00pm, monday through friday.

Security Services - The security service will have access to the entire building. 3 staff members provide adequate security with the assistance of NDSU police. 2 parking stalls provide adequate space for security team parking. Peak usage will be 24 hours a day, 7 days a week.

General Public - The general public will have restricted access to nearly the entire building, unless on a sanctioned/guided tour. 12 person tours and informational sessions are preferred in order to maintain ease of security and group interaction. 14 parking stalls have been allotted for public use. Peak usage will be between 8:00am and 5:00pm, monday through friday.

MAJOR PROJECT ELEMENTS:

Site Conditions - 95 total parking stalls (10 metered) will provide adequate parking space for clients and/or faculty members. Site lighting conditions will be an architectural focus as it lends a metaphorical relationship to the concept of technology. In addition, a design emphasis on facility signage as a response to NDSU is an important design issue.

Chemical Laboratory/Testing - The chemical laboratory is a restricted area in which only staff members are allowed access. Its spatial function is sophisticated in that the complex mechanical systems within the laboratory must correlate with the rest of the facility. (i.e. - the placement of ventilation stacks and their aesthetic impact on the building's exterior.) Spatially, the laboratory must have flexibility in layout with the potential to add equipment in the future.

Mechanical Laboratory/Testing - Also a restricted area, only accessible by staff members. Both the chemical and mechanical research laboratories have such tight access restrictions, that entrance to within the space can be denied to anyone if there is a forensic operation in progress. Spatially, the mechanical laboratory must provide adequate space for large mechanical equipment, while lending a sense of flexibility in order to accommodate the whole spectrum of forensic cases it may encounter. In addition, this space will invariably produce noise pollution and vibrations, affecting its relationship to adjacent spaces.

Additional Research and Investigatory Space - The supporting research spaces are intended to be a 'quiet space' where information can be interpreted and/or recorded based on recent

findings, etc. Also a highly restricted area, this space is flexible and provides amenities such as computers, publications, and other pertinent literature. The quiet nature of this space will affect its placement within the building envelope.

Public Lobby - The public lobby and gallery space will be one of the most aesthetically important spaces in the facility, because it will be observed by every occupant. The building metaphorically represents technology and is a representation of NDSU; thus it is imperative that the building (specifically the public lobby) be well designed and detailed towards its underlying concept. It too will require significant design attention in its relation to nearby spaces.

Educational - The education spaces are intended to be 'hands on' working environments. Access to the actual laboratory equipment will be strictly enforced, however the opportunity to observe the forensic processes will be a wonderful learning tool for students and faculty alike. Placement of educational spaces within the building are directly dependent on security parameters and noise diffusion from adjacent space. Faculty offices will be in or nearby the primary educational facility.

Office/Business Administration - Similar to the educational spaces, the business administration space's placement within the building is inherently dependent on security and noise. Security to the office area will be moderately enforced.

-view from site looking northwest

-view from site looking north

-view from site looking southwest

SITE SELECTION:

Selecting a site for which to develop the industrial forensics laboratory is a huge design opportunity and challenge. A building's site often gets overlooked and neglected during the design process, both at a micro and macro level. As a designer, it is sometimes easy for us to focus too extensively on the final physical structure, rather than taking a step back and analyzing the function of a building in relation to the existing context and site characteristics. Determining which site best accommodates my industrial forensic laboratory has been a challenge in that the most obvious solution for a site (in my mind's eye) has been right in front of me since site exploration began. After hours of site and city exploration, I have concluded that the North Dakota State University research and technology park is the best solution to serving as home for the industrial forensics laboratory, because the building's primary function as a laboratory directly relates to the processes occurring within the confines of nearby buildings . As a NDSU sanctioned facility it will promote both the university's advancements and Fargo as up and coming community. As a facility whose primary function is directly based off technology, the logical setting for the building would be within the functional realm of a technology park. With the addition of an industrial forensics laboratory to the existing research and technology park, it becomes a 'campus' of technology-based facilities whose reputation will herald international notoriety.

SITE INFORMATION (CONTEXT AND ANALYSIS):

The industrial forensics laboratory's site is located on the northern edge of the existing NDSU research and technology park. More specifically, it is bordered to the west by 18th Street and on

-view from site looking west

-view of site looking southeast

-view from site looking east

the north and west by NDSU Research Park Drive. The site's close proximity to NDSU and the existing park make it an ideal location for a building of this type, because nearby arterial routes and campus facilities allow for easy access by people seeking facility usage. The empty lot to the north lends design opportunity to function as a parking lot with access points off 19th Avenue, 18th Street, and NDSU Research Park Drive if desirable. In addition, it will act as a security buffer from 19th Avenue vehicular traffic.

The proposed site has several nearby contextual issues needing consideration throughout design exploration. First and foremost, the airport to the north will produce inherent noise pollution which poses design concerns for several spaces within the facility. However, the nature of the facility itself requires noise attenuation because it too could potentially produce sizeable noise pollution. With meticulous space planning and resolution, these problems will be alleviated and should not pose much threat to the integrity of the laboratory. The surrounding research facilities are accustomed to the already high noise levels, and the addition of the industrial forensics laboratory should not impede existing conditions.

Physically, the site is very desirable for a project of this magnitude. Its flat nature will require minimal grading and drainage development, which in turn allows for increased design flexibility. Currently, there is no significant vegetation within the realms of the site, however I am eager to explore my landscape architecture abilities in further developing the site into a harmonious composition of landscape and building.

PREVIOUS STUDIO EXPERIENCE:

Fall 2002 - Vince Hatlen
Reed Lane Lounge
Prairie Images Design Studio
Geometric Spatial Study

Spring 2003 - Bakr Aly Ahmed
Kurtis Hotel & Convention Center
Low-Income Housing Competition
Trinity Lutheran Church

Fall 2003 - Shannon McDonald
Spider Design Studio
Woodhaven Elementary
Great 'Planes' Bus Stop

Spring 2004 - Steve Martens
Steelbody Fitness Center
Minn. Valley Masonry Resource Center

Fall 2004 - Cindy Urness
Dayton's Bluff Urban Redevelopment
Roman Forum Analytical Project
Urban Design Case Study Analysis

Spring 2005 - Darryl Booker
200 Folsom Mixed-Use High Rise

Fall 2005 - Steve Martens
Valley City Auditorium Adaptive Use

PROJECT EMPHASIS:

Throughout the examination of my senior design thesis, I plan to draw several metaphorical and tectonic conclusions based on the inherent successes or failures as they relate to industrial processes. An obvious point of emphasis in an industrial forensic laboratory is technology and its entities. As research progresses and I develop a better understanding of spatial (and operational) functions of a forensics laboratory, it will provide opportunity to develop a sensible and well designed facility that represents a by-product of my theoretical premise and underlying project goals. In addition, the strong technological emphasis placed on surrounding facilities yields proper justification for the incorporation of an industrial forensic laboratory into the existing ndsu research and technology park. The community of Fargo takes great pride in its facilities and my thesis intends to complement and solidify those feelings.

PLAN FOR PROCEEDING:

The primary research for my senior design thesis will focus on design principles of similar forensic laboratories. The facility has a very specialized program in that mechanical equipment and security parameters will require detailed analysis in order to design a building that is functional and efficient. An emphasis will be placed on spatial relationships and how they systematically effect the overall integrity of the building. The integration of public amenities within the facility creates a third dimension in the complexity of the program. Once conclusions have been interpreted from specific forensic laboratories, the same level of quality will be implemented in resolving the remaining design issues. Case study analysis will provide proper insight into innovative material applications and construction assemblies suit-

able for a forensic laboratory that will serve as a vehicle for my thesis. Through detailed research and understanding of similar space, all design issues will be resolved at a very high level of quality, making NDSU's industrial forensic laboratory the new optimal case study.

12 STEP PROGRAM FOR THESIS RECOVERY:

A large part of creating a plan to proceed, is knowing what to do when you complete the initial plan. Thus, the following is a fifteen week program (12 step) I have created to make this thesis project a reality; starting in January 2006.

Step One (Weeks 1 & 2) - program interpretation, detailed case study analysis, establishing and implementing vehicles of design, preliminary concepts

Step Two (Weeks 3 & 4) - site development, physical contour model, parking accommodations

Step Three (Week 5) - spatial planning and organization developing functional and efficient relationships

Step Four (Week 6) - massing & volumetric studies, relating spatial planning three dimensionally

Step Five (Week 7) - structural system relating to vertical space, circulation studies, building function at X,Y, and Z vectors

Step Six (Week 8) - material application, elevation and section studies focusing on interior/exterior materiality

Step Seven (Week 9) - construction & assembly, exploring unique details, corner axon physical

model

Step Eight (Week 10) - week reserved for mid-term reviews, resolve key design issues

Step Nine (Week 11) - implementation of mid-term review, minimizing changes, preparation for final push

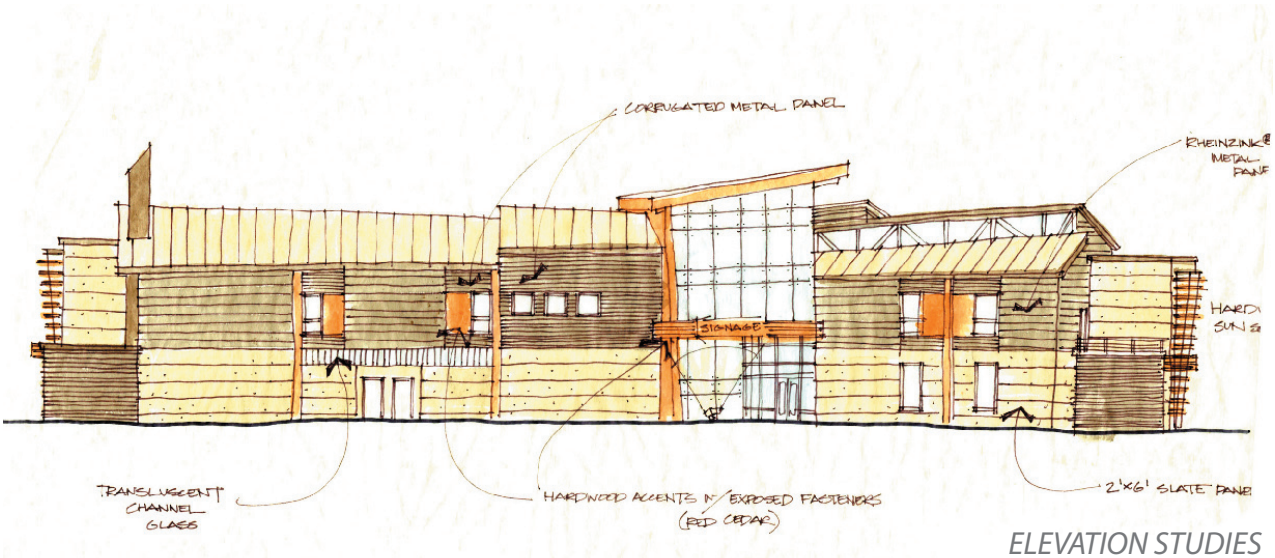
Step Ten (Week 12) - character expression of interiors, relating interior & exterior, start final graphics

Step Eleven (Week 13) - continuing final graphics, documenting clear story board, purchase mediums

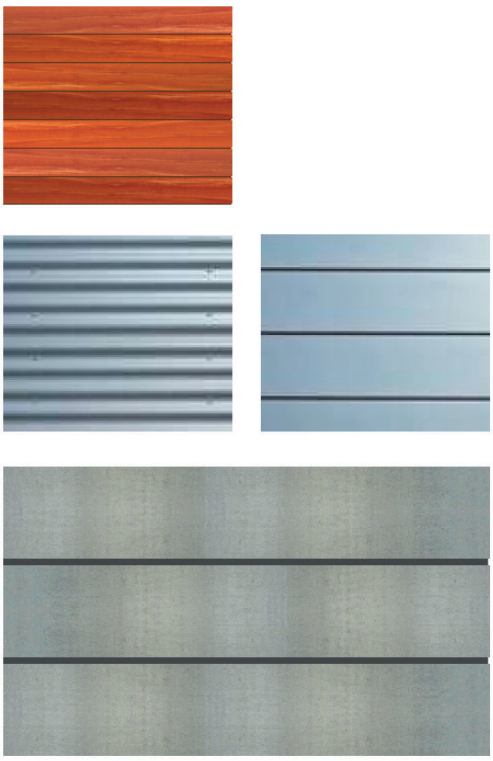
Step Twelve (Weeks 14 & 15) finish final presentation (oral and physical), this is the best project I have even done and it will be reflected by a quality presentation

START (WEEK 1)

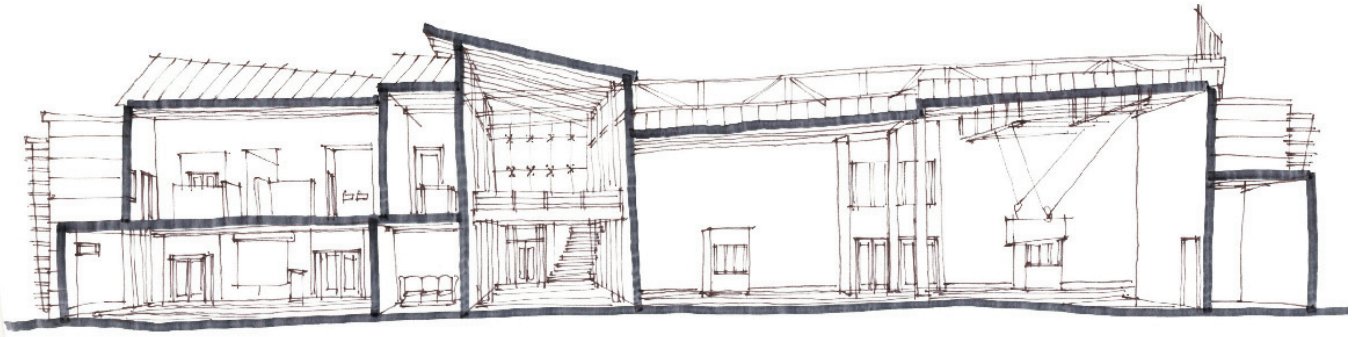
FINISH (WEEK 15)



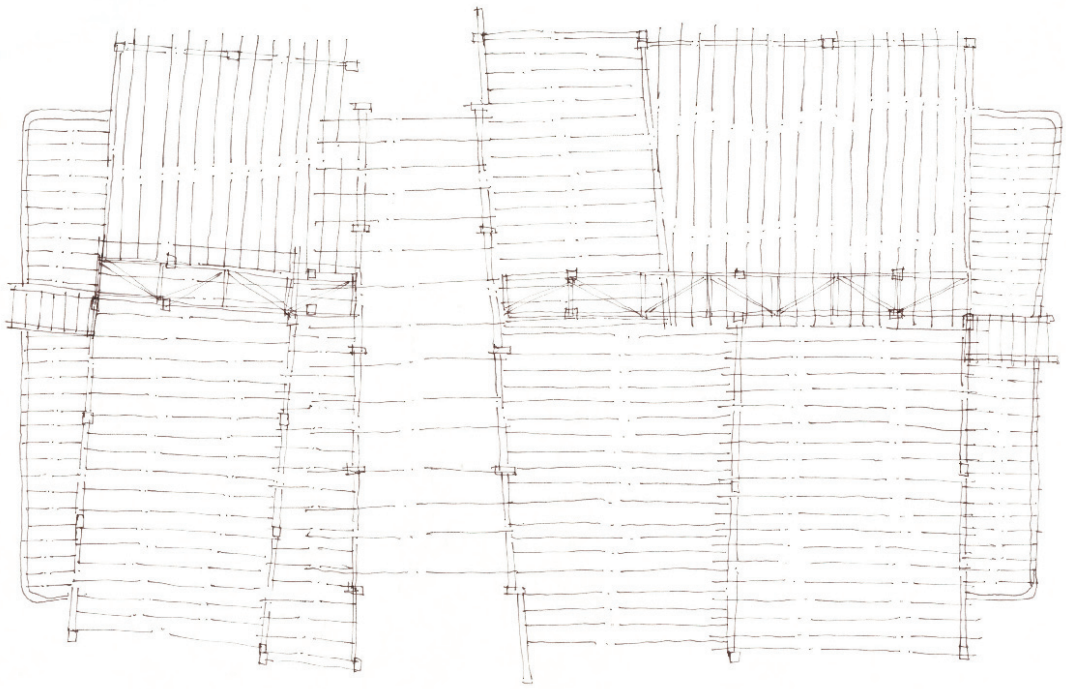
ELEVATION STUDIES



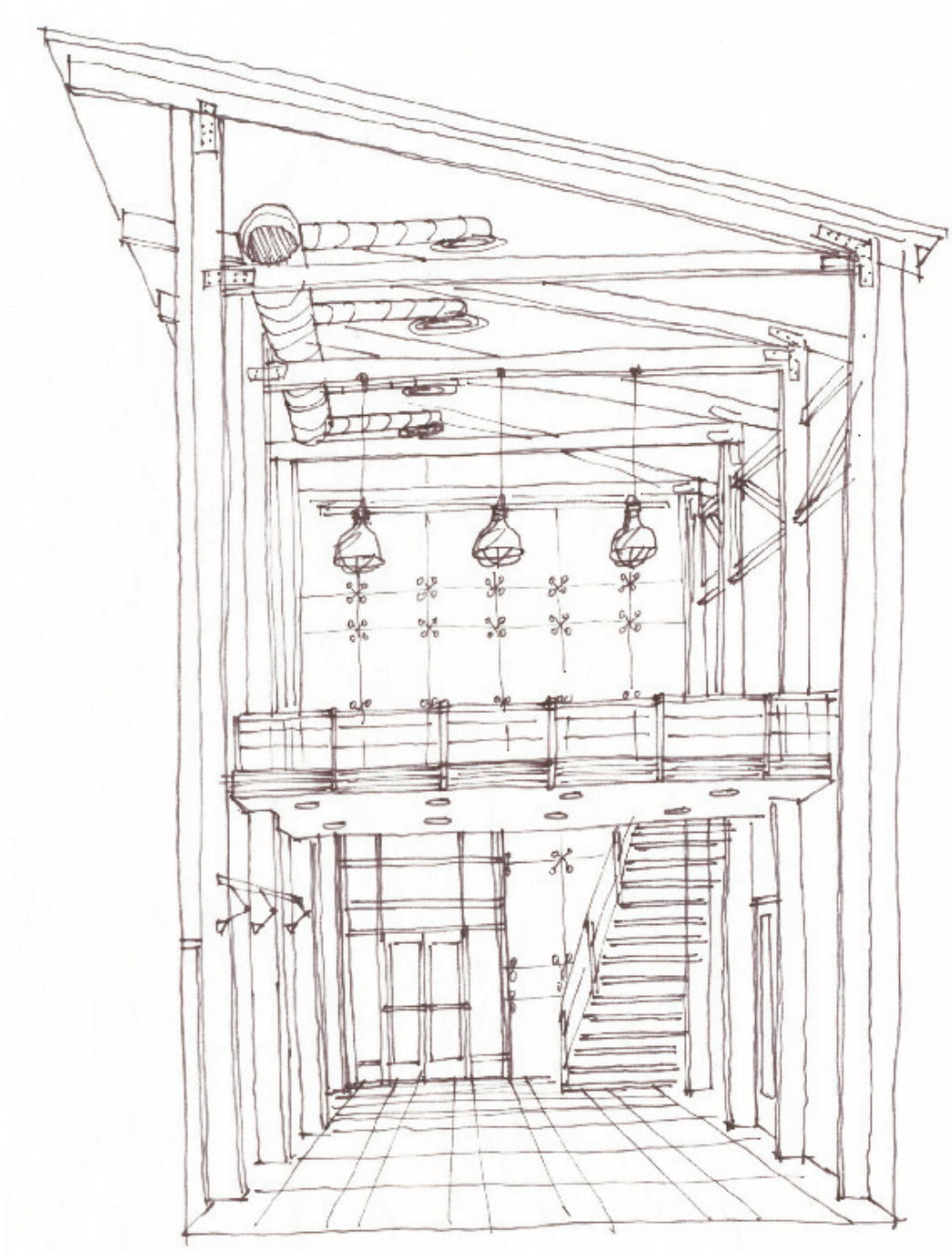
MATERIAL PALETTE



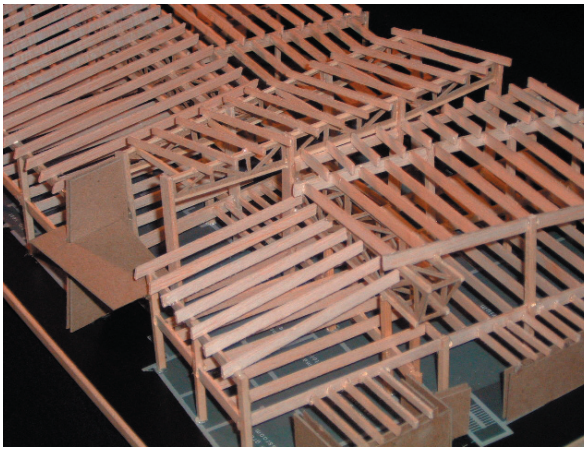
SPATIAL RELATIONSHIPS

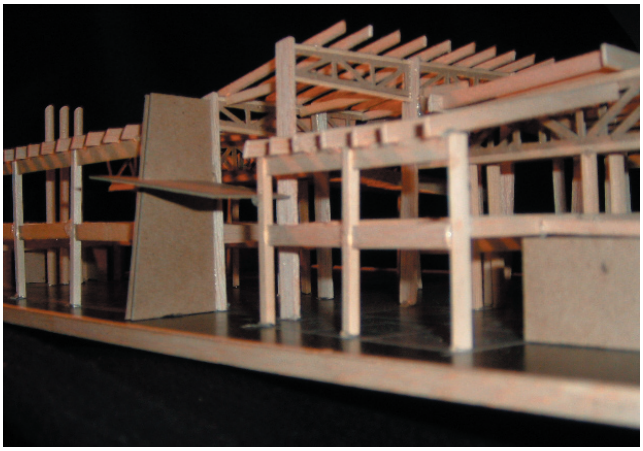


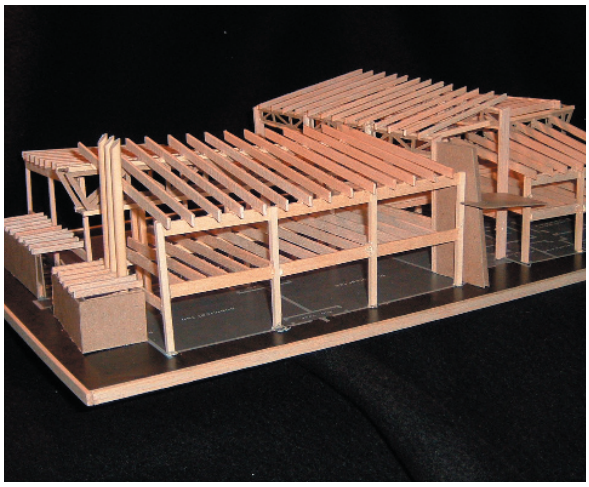
STRUCTURAL DEFINITION

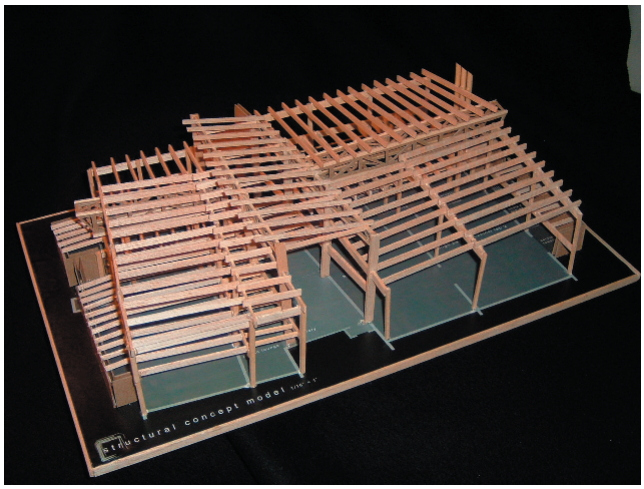


SPATIAL CHARACTER









STRUCTURAL MODEL

"I want to say 'thanks' to Steve Martens for all the wonderful insight you have given me over the years. I have really enjoyed my time in your studios, particularly this year for thesis. I also want to thank my family and friends who have supported me in every decision I've made over the years (good or bad). I must say, I have had a blast over the past five years and will most definitely miss it. However, I am very excited for the next hurdle of life and look forward to applying what I have learned in my education to real world experiences. Thanks again to everyone...now let's go have a beer!"

SECTION A

PROJECT INTRODUCTION

SECTION B

CASE STUDIES

SECTION C

THEORETICAL STUDIES

SECTION D

SITE ANALYSIS

SECTION E

MATERIAL PERFORMANCE

SECTION F

BUILDING PROGRAM

APPENDICES

REFERENCES, PROPOSAL, PROCESS, BOARDS