Understanding the Process of Design

An Honors Thesis (ARCH 401)

by

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Abstract

Design is a part of our everyday lives. Design is not limited to the specialized fields of architecture or artistry but extends well beyond. Even with the creation of an idea, a design must be developed with a process as the foundation. That process drives designers to refine and complete their best works. It is a set of guidelines reworked to develop an efficient method. This process is special and unique to each person, and in regards to architects and designers, shines light onto their passions and goals. My design process has grown and matured over my four years of studying architecture thanks to the numerous projects and competitions I have completed. This thesis explores my design process, explains the specific fundamentals that encompass how I design, and gives a detailed account of how I worked out my final competition and capstone project of my undergraduate career.
Acknowledgements

I would like to thank Geri Strecker for her great advising through my thesis project. She has always been dedicated to helping any student who needs it and I cannot express my gratitude and appreciation for her hard work.

I would like to thank Wes Jans, my project professor in the Cripe Competition. He had a significant role helping me develop my design process and ideas throughout my first semester as a senior.

I would like to thank all of my past professors from the last four years in the Architecture program. They have had a great impact on my growth as a designer and as a person. Without these individuals, I would not have had the successes I have experienced.
Design is a significant part of everyday life; whether it is an architect designing a new building or a child drawing a fairytale castle. Either way, this creative process involves solving challenges. My favorite architect Ludwig Mies van der Rohe always took the stance of “less is more”\(^1\) and applied that to his design. Another definition of design is “to create, fashion, execute, or construct according to plan” and “to conceive and plan out in the mind.”\(^2\) These describe design both as a physical and mental ideology. Design directly encompasses both the mind and the body, and almost always at the same time. Thus, the design process is extremely important, molding and transforming ideas from the mind into the physical prosperities we see all around us in the world: offices, schools, homes, bridges, lights, and many other built structures. This process varies immensely from designer to designer, and each person has something to learn from others’ methods.

**Education**

Architecture is a branch of design specific to the development and organization of buildings and other structures. As a student of architectural design, I have had the privilege to learn and practice this design process through school and professional projects. From my first year in our architecture studios at Ball State, we were taught the meaning of design and how to develop our own design process style. As our studio projects have increased with program size, complexity, and difficulty, my design process

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has developed to complete the best solutions that I could. As a senior in the undergraduate architecture program, I can confidently say my process has been refined to establish a strong foundation for my future as a practicing architect.

Architecture outside of school has also influenced my design process. Interning with a small firm in Anderson, I developed skills with computer programs that we did not learn in our architecture studios. These programs are integral to professional practice, how firms design, and how the individual architects interact with clients when presenting their ideas. Another great aspect of the office is learning practical skills for future jobs. The Anderson firm allowed me to work on a high school renovation project using the new computer program I was learning. The renovation project was smaller in scale, but important to the school and needed to be completed before the summer ended. This gave me a real deadline and taught me some great lessons. First, I learned how to interact with a client in a pressure situation, which I had never done before. Second, this was the first project I had ever worked on from start to completion. Seeing my design built was the greatest feeling of accomplishment I have had working on any project. It taught me that my design process can stand up to the pressures of time, but also that the clients will be satisfied with how my work turns out using that process.

Architects are problem solvers. Clients present needs and problems that architects solve with design. Trying to find the best possible solution for the client becomes a challenge, so architects must possess certain strong characteristics and qualities to perform their profession well. A strong ear for listening to clients’ specific ideas is extremely important. Without listening skills, significant details can slip past designers’ ears unnoticed. A creative and innovated mind is the second most important
characteristics for any architect. If designers lose their creative inspiration, all of the
buildings, houses, and schools would look almost identical. A disciplined work ethic is a
valuable asset I have learned over the years, not only as an architecture student but as
an honors student as well. The amount of work increased from high school to college,
and I needed to develop this work ethic to finish projects well. Lastly, strong social and
problem-solving skills are necessary to communicate and find solutions for clients. All
these characteristics are important to develop great relationships with clients,
contractors, and other designers.

My Design Process

A “best solution” is the desired outcome for the client’s needs and an architect’s
design. This solution involves more than just what the designer thinks. First, it
encompasses the immediate client who is hiring the architect or firm for their designs.
The client must be the architects’ primary concern, not their own personal aspirations.
Today, too many architects tend to push for their own design ideas and goals because
they want to make a name for themselves. Architects like Frank Gehry are most notable
for this undesirable characteristic. He often designs forms he enjoys then forces his
clients’ program and wants inside that form. One Gehry building that stands out this way
is the Guggenheim Museum with all its apparent random curves. The building does not
follow any coherent design for the program. The curves and angles are arbitrary. This is
not what architects should practice. Instead, they must listen and give knowledgeable
advice that transforms the clients’ dreams and ideas into a viable reality.
Beyond their clients, architects must also consider potential users of the facilities they design. Although users' and clients' needs and aspirations are often similar, they can differ for any number of reasons. Users include anyone who will be in contact with a building or structure. While the design may work well for the client, it could be unpleasant for the users. Furthermore, architects should consider secondary clients and users not directly involved in the negotiations of the design. This includes, but is not limited to the community and surrounding neighborhoods, local businesses, parks, residential units, and other sites adjacent or nearby. These all are affected, directly or indirectly, by architects' designs. The "best solution" includes all of these users or clients and should address each with respect and attention.

I have developed a system to address design challenges over the course of four years studying architecture at Ball State University. When starting my design process, I look at four main sets of information: clients' needs and wants, program and square footage, site, and mechanical/structural aspects of the building. To form my design, I use these guidelines plus other more specific details. The most important rule I have learned is that the client comes first. I love listening more than talking to anyone because I learn more when I listen and understand before speaking my own ideas. A phrase I often use is "seek to understand before being understood." My first set of design ideals are based solely on what clients say they want or need. Unless I am meeting directly with the client, this almost always involves some sort of research either through the internet or books. These ideals become my guiding principle while integrating the rest of my processes.
Next, I start to break down the program and square footage of the entire project and explore the "big picture" of what the building is to become. I like to make paper squares or rectangles of the exact square footage of the program and sort them out logically. Once I have two or three sets of layouts I like, I plug them into a modeling program and make the spaces three-dimensional. The plans that do not make sense and start to develop an idea of how organized and how the form the building will take shape. Also, spaces I am dealing with helps with the arrangement of which spaces need to be adjacent or separated. Understanding what each space is and the activities going on inside can give hints and clues to where the space should be located. Once I am comfortable with the square footage and the program, I lay out possible building plans on the site.

The site and its parameters are important and may force the building to rise up in stories instead of spreading out. Things like alleys, important landmarks, and protected spaces all fall under this category. Even though some of these parameters could be removed or relocated, a lot of cities have laws to protect these areas. The site could also have geographical or climatic characteristics that provide opportunities for sustainable solutions. For instance, a very rainy climate has advantages with water collection and reuse. Other places are very hot and sunny where photovoltaic panels would be a great way to capture and reuse the energy. Some other parameters are the orientation of the site and location of other adjacent sites and landmarks.

Then once my building starts to develop, the last phase of my design process is working out the structural, heating and cooling, sustainable collection and/or distribution...
systems, and more detailed specifications. The first few parameters are critical in making the building as efficient and environmentally friendly as possible. The last stages of the entire project are making sure everything is detailed and finished properly. This is one of my favorite stages, especially in the three-dimensional model. Designing in three dimensions shows architects what the building would look like if built. I like to start my concepts in plan, refine and develop those to the digital three-dimensional model, and then transform the digital model into a physical model. This stage completes the project. Fine-tuning all the systems, windows, doors, and interiors makes the project ready for presentation.

The Cripe Competition

Every year, AIAS Kawneer and Cripe Architects and Engineers sponsor and administer the Cripe Competition. This is the last competition for Ball State undergraduate architecture students and the Capstone project for their college education. A new panel of professional jurors comes together every year to evaluate students’ projects based on completeness, craft, graphics, and adherence to the project guidelines. The jurors select ten to twelve finalists and award three to five monetary prizes. This year, the competition was to design an elementary school in a U.S. location of our choosing. The location had to show a strong need for an elementary school and have a vacant site with no existing buildings. The competition called for this school to use technology and building systems to reduce economic and environmental impact, allow students to demonstrate creativity, be simple in functions for the young students, provide a modern workplace for faculty, and promote the spirit of the community. The
sponsors also established objectives for students to learn from the competition and then a set of guidelines.

The objectives for this project were to teach students about materials, products, and daylighting techniques mainly designed by Kawneer. Also, students were to research, respond to, and highlight the unique aspects of designing an elementary school that serves a specific site and community. Sustainability and utilization of the physical environment for teaching purposes were unique objectives of this competition. Sustainable design in itself is easy to add at the end or even at the start of the project. All it takes is research and application of sustainable systems on the site. The real challenge of sustainable design is using the system as a teaching tool for students and community members. This requires more than just having an efficient rainwater collection system to reduce wastewater or seamlessly integrating it into the school design. For an elementary school, everything should be centered on education. The rainwater collection system must teach students and the community about why collecting water is important and how it can be done. This is just an example of the objectives that this Cripe competition strove to teach architecture students. Learning this was the most challenging lesson by far, but also the most rewarding at the closing stages of the project.

All of the students designing for this competition had a set of guidelines and set of needs from the proposed client. The project sponsors had a “wish list” of sustainable systems that they wanted integrated into the project. They called for designing a modern and creative elementary school for students ranging from kindergarten through sixth grade. The school needed to respond to and serve the selected site and
community, become a sustainable facility based on LEED standards (see Appendix A), be attractive and pleasing to the surrounding community, and use the physical environment to support the learning process. The ideals of sustainability, security, and community integration were important for the selection committee's decisions. Selecting a site was a unique challenge that we had not encountered before as designers. For previous projects, our professors had assigned us all the same location, so we had identical sites but individual designs. Selecting where to locate the school was an important part of researching my design, and inevitably led to certain distinguishable features of my design, namely my roof structure.

I chose Seattle, Washington, partly because of needs expressed by families looking to move to the newly created residential units located nearby. When visiting this area on an architecture field trip, I noticed a lively, active community around the site, as if Seattle's inner city was spilling out into the surrounding districts. There was a constant flow of pedestrians, the hustle and bustle of traffic, and business people and families eating lunch in the park across the street. The vitality of the area surrounding the vacant site was amazing. A private school had existed in the area for a while, but because of costs and location issues, it could not meet the needs of all residents. The site is in the South Lake Union district, which has a park bordering the marina. This growing community already has existing commercial and industrial buildings, and is adding more residential to accommodate incoming families. On site, one residential project was currently underway and two or three more are being proposed because of the expected growth. The lake and marina also provide a great place for students to learn outside the classroom about wildlife and biological systems in their neighborhood. Bordering the
site, a free public transit system is accessible and would be available to students and their parents. These are the reasons I chose Seattle as my site for the proposed school.

The Tower

I called my first design “The Tower.” When I browsed through the program and started forming an idea of what this school might look like, I wanted to try something new. The surrounding site had some four to five-story buildings but nothing like downtown Seattle. I immediately was interested in finding out if a vertical school was a realistic idea. Because of security, heating and cooling, and utilizing daylight as a sustainable system, my professor told me this schematic design had not been built before and would not work. Even though I knew it would be tough, I wanted to keep pursuing this vertical design. Everything has its first attempt, and I knew some positives could come from a vertical school if designed right. For instance, a taller school has a smaller footprint and less of an impact on the site than a lower, horizontal design. I chose to start here and work through the challenges that a vertical school offered.

The “Tower” consisted of nine floors which included all of the grade levels, the cafeteria, supporting classrooms, and administrative offices. The first floor held the administrative offices, the second floor the preschool and kindergarten, third floor the first and second graders, and so on up to the ninth floor, which housed the cafeteria, which would be open to the community and the students as a lunchroom and a restaurant. The gymnasium was located at the northeast corner, and two bioswales linked the site together, giving the whole area a campus feel while also mitigating the ample storm water runoff from Seattle’s rainy climate. They soak up the excess water to
avoid overflowing the sewers. Although quite a few things did not work well in this
design, it had some strengths. First, the vertical design minimized the footprint of the
entire school. Even though shading would have a different effect on the area, I knew
that cities like Seattle had precedents of tall buildings that shaded different parts during
the day. Since my first year in CAP, we have been taught that a small building footprint
is one of the most important parts of sustainability. This is why I developed the vertical
school concept.
The second strength I took away from this first design was that each floor was unique and had exterior learning spaces. The floors and classrooms were all organized differently, giving students a new feel at every grade. I organized each floor differently, giving students a different view of Seattle as they move up into the next grade level. In many elementary schools, all rooms are exactly the same with identical seating. Students show an interest in the classroom if they are proud of what their school looks like. My favorite part of this design was the terraces that served as learning spaces for each grade. Being outside and involved with the environment when learning is key to
educational development at an early age. I wanted to give students every chance to take advantage of Seattle's mild climate. Lastly, the security of this vertical school was established by a first-floor lobby and check-in with entrances close together. I chose to have multiple entrances on the north and south of the building because of access to and from the gymnasium. In a horizontal layout, entrances are often too far spread out so security must be increased (more money) to avoid potential problems. My next design was shaped by these positives, but also by the struggles I went through trying to make this design fit my plans.

Although I would like to talk more about how the positives shaped my new design for the school, I still need to address the challenges. Even though setbacks are often regarded as negative, I learned a great lesson from them that shaped my new design. Finding a way to structure the vertical school while still allowing it to have the form I imagined was too difficult. I worked about a week and a half strictly on structural
integrity and tried every system possible. I wanted to keep the outline of the extruded classrooms and the views, but the proper structure would impede these ideas and designs. This became the biggest obstacle in my whole first vertical school design.

Another big problem with my first design was the solar heat gain from the expansive, south-facing glass façade. This glass encasement held the vertical circulation for the school and was open to the roof. Unfortunately, this enclosure would actually heat up the entire building once the sun hit the glass for an extended period of time. I had a couple viable solutions, including operable windows and clerestories that could ventilate the space, and operable openings at the roof level to release heat. Although these solutions worked in the technical scheme, I am not sure how well they would have accommodated the students' and instructors' comfort. It was a big chance to take and would have received due criticism from the jurors, so this was another setback that delayed and inevitably set aside the design for the vertical school.

Unable to successfully overcome these challenges and setbacks, I decided to try a new design instead of forcing this tower concept just to satisfy my own ambition. Challenging myself to strengthen my design and my practice of architecture was a huge step in my development as a designer and as a person. In the past, I usually went with what I wanted, even if I realized it was not the best design. This is a problem in architecture because how the architect wants the design to look or function is less important than what the clients or users specify. I believe this to be the biggest problem with designers and architects in the modern world. Thus, adjusting my mindset was an important personal step I knew I needed to take, and this project provided a perfect opportunity. Instead of pursuing a lost cause in the vertical design, I applied what I had
learned from my mistakes and successes to a brand new concept. This new design assessed the problems I encountered and sought well thought-out solutions then preceded from there. Once I figured out the structure and solar heat gain, I started to incorporate the positives from the vertical school into my new design. Elements like outdoor green learning spaces, passive heating/cooling systems, and a campus-style layout promote community involvement in and out of the school. These ideas became the foundation for the next step in my design process, which is to collect what I have learned and re-design the school.

Sailing

In the starting process of my new design, I reconsidered the program, site analysis, and the rest of my design methods. I needed to find an inspiration from my chosen location, and then develop it in a practical way. So I browsed my site photographs from when I visited Seattle and the South Lake Union district, and looked for details that caught my eye. Remembering the marina and all of the sailboats that bordered this district, I decided to break down the sailboat into form that the school could use for a roof. This inspired a unique design for a suspension roof system using wires connected to giant columns or “masts” to support the slabs. This reinforced the school's connection to the marina and lake with a visual link to the water line and to the park across the street. I used the site to connect the school to the surrounding area without giving up security and safety for the students.
The design divided the main classroom and faculty wing on the northern edge into four floors. The first floor held the main entrance, a public/student library, art and music classrooms, and health center. These are all publically accessible after school hours, so the surrounding neighborhood can interact and take part in their children’s education and security. Above the first floor, the classrooms and faculty offices populated the remaining three levels. The gymnasium and cafeteria are separated from the school but still located within sight of the offices and entrance. This allows access to other users outside of the school but still serves students as the primary users.
To further encourage families and community members to use and visit the school, the design connects to a light rail transit system that passes by the site and stops at the park across the street. The plan redesigned this transit stop to accommodate the school. The plan also adds a transit stop for the east side of the site and a suspended bridge to allow children to access the park’s outdoor marine lab classrooms to study aquatic plants and animals. These will help students experience the environment where they live, so that when they become older, they will feel responsibility and respect for their surroundings and continue to take care of them. The light rail system is a safe, reliable way to travel but also environmentally friendly. This way, students and family members could ride the same “bus” to school and work. This is an additional security measure for the school and parents, who can watch their children walk safely to school and then safely back to the transit stop to go home. This also gives working community members who do not have children in school the responsibility of watching over the kids. The whole idea of this school is to teach the community and the students the importance of one another, allowing the school to unite the area to become a safer, stronger, and more sustainable community.
The “Sailing” design incorporated many strong ideas. The best qualities from this school were exterior circulation for the kids, green learning spaces, extended campus-style layout, and marine lab classrooms located in the South Lake Union Park. First, the exterior walkways between classrooms and faculty offices minimize heating and cooling spaces while getting students and teachers outdoors. This also gives students a chance to look around and realize that they are in a city setting and not locked in their school in an artificial environment. Integrating green learning spaces into the curriculum also helps students learn self-sustainment principles. Growing and planting are key lessons to teach students where food comes from and how it is produced.

Next, the extended campus-style layout provides community members living and working around the school opportunities for direct interaction. Even though some architects might argue that this is a security risk, I believe it actually strengthens the security of the school and the community. Having everyone around involved with the neighborhood and school will make it easier to notice a stranger. Lastly, this school design reaches out and makes a physical impact on the park across the street with the installation of three marine lab classrooms. Each grade level goes out to study in these classrooms once per week to experience learning outside the normal classroom. Studying water, plants, and wildlife informs students about the reality of how our everyday lives impact our environment. Also, learning to reverse some of these bad habits and change them into good ones is vital to protecting and extending the life of our planet. These details encompass the “Sailing” design for the school. However good all this sounds, I discovered again that there is always room for improvement.
From the first design, I changed the structure to fit my form and realized I could not build a school of glass. Although I changed a great amount to make my design better, some things still needed tweaking. The scale of the school was a little large for children in kindergarten through sixth grade, fitting more the profile of a middle school or even a high school to some extents. But I was alright with finding this out, because scale is something I could easily fix - Using buffers, a drop ceiling, or separate rooms with partitions. Another improvement would have been more cleanly connecting my main structure to the cafeteria and gymnasium. A green hill sloping up the side of the café and gym could have been developed further into a garden space where the kids could plant food and crops to be used in the cafeteria. This would teach kids how to grow and care for their own food, which is an important life lesson. My commitment to the first vertical school design cut my time for the second school design, and I could have used an extra week or so to work out the kinks and further develop the total project. Even though my design was not perfect, I still liked that I was able to develop my second concept as much as I did, and implement what I had learned from my first attempt.
Conclusion

Overall, I was pleased with this project for a few reasons. First, the project itself was one of my favorites. I enjoyed designing a school for the Seattle region. Second, I was pleased that I learned an important lesson and made a huge leap with my design process. I was able to set aside my own goals and pride for the benefit of the clients and users for whom I was designing. This shows that in the future I will not have a problem with my own ego getting in the way of finding the best design solution. Also, the simple structure will allow future renovations or additions, keeping the school up-to-date. The style was fashioned from the marina across the street, which will continue to be there long after any of the surrounding buildings. Even if the district no longer needs this school at some point, the structure can be retrofitted (instead of deconstructed) to fit
a new facility's needs. The clients and users are the most important part of design and especially the design process.

In the modern world, too much is designed in the current trend instead of for functionality and long-term sustainability. We have all seen the flashy, illogical buildings being constructed in big cities like Chicago, Los Angeles, and New York. Often, architects will push for these designs because viewers will recognize their style as a "name brand." I also see it in university architecture studios; hardly anyone wants to design what is necessary and well thought out. Everyone wants their design to look the "sleekest" or "coolest" or to stand out the most. Does the world need a bunch of inadaptable, obsolete (at some age) buildings that end up deteriorating all around us? Absolutely not. But this is not to say that a beautiful unique building cannot also function wonderfully. Designers have the sobering power to control and alter the landscape of the future. We want our schools and homes to be beautifully designed, but they must make sense as well. This is not a task to be taken lightly by any means. The modern world needs courageous and skilled designers who listen to what clients and users want and need and then produce elegant, environmentally sustainable, and efficient structures.
LEED Appendix

Leadership in Energy and Environmental Design (LEED) is a certification system for buildings that points out the green and sustainable strategies being used. It is internationally known and respected as the basis for green design. LEED recognition is highly prestigious and competitively sought.

The certification system applies to commercial and residential structures, each having their own sets of checklists. The specific categories of commercial and residential cover new construction, existing buildings, commercial interiors, core and shell (of the building), schools, retail, healthcare, homes, and neighborhood development.

The system is based on points for various elements of sustainability. In order to receive these points, a checklist is required with the elements of sustainability checked off.

For New Construction, here is an example from the LEED website of the checklists that determine LEED certification:

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The points in the right-hand column are added up at the end of the checklist and determine the award. The categories are LEED Certified, LEED Silver, LEED Gold, and LEED Platinum, and projects all over the world have been awarded these certifications.

Here is a list from the LEED website describing areas where sustainability is most likely to be improved with structures:

"LEED is a voluntary certification program that can be applied to any building type and any building lifecycle phase. It promotes a whole-building approach to sustainability by recognizing performance in key areas."

**Sustainable Sites**
Choosing a building's site and managing that site during construction are important considerations for a project's sustainability. The Sustainable Sites category discourages development on previously undeveloped land; minimizes a building's impact on ecosystems and waterways; encourages regionally appropriate landscaping; rewards smart transportation choices; controls stormwater runoff; and reduces erosion, light pollution, heat island effect and construction-related pollution.

**Water Efficiency**
Buildings are major users of our potable water supply. The goal of the Water Efficiency credit category is to encourage smarter use of water, inside and out. Water reduction is typically achieved through more efficient appliances, fixtures and fittings inside and water-wise landscaping outside.

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Energy & Atmosphere
According to the U.S. Department of Energy, buildings use 39% of the energy and 74% of the electricity produced each year in the United States. The Energy & Atmosphere category encourages a wide variety of energy strategies: commissioning; energy use monitoring; efficient design and construction; efficient appliances, systems and lighting; the use of renewable and clean sources of energy, generated on-site or off-site; and other innovative strategies.

Materials & Resources
During both the construction and operations phases, buildings generate a lot of waste and use a lot of materials and resources. This credit category encourages the selection of sustainably grown, harvested, produced and transported products and materials. It promotes the reduction of waste as well as reuse and recycling, and it takes into account the reduction of waste at a product’s source.

Indoor Environmental Quality
The U.S. Environmental Protection Agency estimates that Americans spend about 90% of their day indoors, where the air quality can be significantly worse than outside. The Indoor Environmental Quality credit category promotes strategies that can improve indoor air as well as providing access to natural daylight and views and improving acoustics.

Locations & Linkages
The LEED for Homes rating system recognizes that much of a home’s impact on the environment comes from where it is located and how it fits into its community. The Locations & Linkages credits encourage homes being built away from environmentally sensitive places and instead being built in infill, previously developed and other preferable sites. It rewards homes that are built near already-existing infrastructure, community
resources and transit, and it encourages access to open space for walking, physical activity and time spent outdoors.

**Awareness & Education**
The LEED for Homes rating system acknowledges that a green home is only truly green if the people who live in it use the green features to maximum effect. The Awareness & Education credits encourage home builders and real estate professionals to provide homeowners, tenants and building managers with the education and tools they need to understand what makes their home green and how to make the most of those features.

**Innovation in Design**
The Innovation in Design credit category provides bonus points for projects that use new and innovative technologies and strategies to improve a building's performance well beyond what is required by other LEED credits or in green building considerations that are not specifically addressed elsewhere in LEED. This credit category also rewards projects for including a LEED Accredited Professional on the team to ensure a holistic, integrated approach to the design and construction phase.

**Regional Priority**
USGBC's regional councils, chapters and affiliates have identified the environmental concerns that are locally most important for every region of the country, and six LEED credits that address those local priorities were selected for each region. A project that earns a regional priority credit will earn one bonus point in addition to any points awarded for that credit. Up to four extra points can be earned in this way.
The LEED system is important in raising the energy performance and green buildings that benefit our environment. Designing more buildings that become LEED Certified will help our planet's life-sustaining capabilities. Every year, more architects and project managers are adopting the LEED system as the basis for their designs, but too many people are still unaware of the system and its benefits.