

E. Appendices:

Concrete Pump Productivity Data:

	Total CY	Pump Productivity (Day)
Floor 2		
Center	78.24	0.49
1229	15.81	0.10
1229	2.51	0.02
1231	3.48	0.02
	<hr/> 100.04	<hr/> 0.63
Floor 3		
Center	78.24	0.49
1229	15.81	0.10
1229	2.51	0.02
1231	3.48	0.02
	<hr/> 100.04	<hr/> 0.63
Floor 4		
Center	78.24	0.49
1229	15.81	0.10
1229	2.51	0.02
1231	3.48	0.02
	<hr/> 100.04	<hr/> 0.63
Floor 5		
Center	78.24	0.49
1229	15.81	0.10
1229	2.51	0.02
1231	3.48	0.02
	<hr/> 100.04	<hr/> 0.63
Floor 6		
Center	78.24	0.49
1229	15.81	0.10
1229	2.51	0.02
1231	3.48	0.02
	<hr/> 100.04	<hr/> 0.63

Floor 7		
	601.11	3.8
		0
Floor 8		
0	601.11	3.8
Floor 9		
	648.15	4.05
Floor 10		
	631.51	3.95
Floor 11		
	602.31	3.76
Floor 12		
	178.77	1.12

Brick Productivity Data:

Workday	Date	Total sq. ft.	Workhours	Productivity
1	2/16/2009	486	83	0.17
2	2/17/2009	493	86	0.17
3	2/18/2009	472	73	0.15
4	2/19/2009	503	92	0.18
5	2/20/2009	512	96	0.19
6	2/23/2009	492	84	0.17
7	2/24/2009	476	73	0.15
8	2/25/2009	505	98	0.19
9	2/26/2009	483	76	0.16
10	2/27/2009	503	89	0.18
11	3/2/2009	342	94	0.27
12	3/3/2009	958	152	0.16
13	3/4/2009	964	196	0.20
14	3/5/2009	953	197.5	0.21
15	3/6/2009	982	208	0.21
16	3/7/2009	486	73	0.15
17	3/9/2009	945	154	0.16
18	3/10/2009	963	176	0.18
19	3/11/2009	972	185	0.19
20	3/12/2009	492	124	0.25
21	3/13/2009	886	153	0.17
22	3/14/2009	336	65	0.19
23	3/16/2009	965	192	0.20
24	3/17/2009	951	163	0.17
25	3/18/2009	968	184	0.19
26	3/19/2009	958	202	0.21
27	3/20/2009	967	176	0.18
28	3/23/2009	942	168	0.18
29	3/24/2009	450	124	0.28
30	3/25/2009	936	167	0.18
31	3/26/2009	967	192	0.20
32	3/27/2009	972	185	0.19

Baseline productivity is calculated by taking 10% of the data dates with the highest output. A total of 5 data dates were used because 10% of the collected data dates would be too small. The 5 highest outputs have been highlighted in red in the table above. The baseline productivity is calculated by dividing the summed baseline workhours by the summed baseline quantity. The baseline productivity is considered the best productivity that can be expected for the construction method and design complexity.

Baseline	Total sq. ft.	Workhours
Day 15	982	208
Day 19	972	185
Day 25	968	184
Day 27	967	176
Day 31	967	176
Day 32	972	185
	5828	1114
Baseline Productivity:		0.19

Precast Productivity:

Workday	Pieces	Workhours *	Productivity
1	8	72	9
2	10	72	7.2
3	16	72	4.5
4	15	72	4.8
5	16	72	4.5
6	14	72	5.142857
7	14	72	5.142857
8	14	72	5.142857
9	16	72	4.5
10	16	72	4.5
11	14	72	5.142857
12	16	72	4.5
13	12	72	6
14	13	72	5.538462
15	16	72	4.5
16	15	72	4.8
17	15	72	4.8
18	13	72	5.538462
19	16	72	4.5

* Assumed 1 Foreman, 7 Workers

Uniquely all the baseline data sets contain the same productivity. The baseline quantity data sets have been highlighted in red in the table above. This is because of the assumed standard labor hours. Actual hours would vary from day to day. Nevertheless, this still represents the best productivity that can be expected for precast installation.

Baseline	Pieces	Workhours
Day 3	16	72
Day 5	16	72
Day 9	16	72
Day 10	16	72
Day 12	16	72
Day 15	16	72
Day 19	16	72
	112	504
Baseline Productivity:		4.5

LEED Questionnaire Responses:

Questions were asked to find similarities across the industry and then draw conclusions that will be the basis of successful owner involvement on LEED projects.

The following are the responses of John Bechtel from Penn State's OPP.

How did you communicate your commitment to sustainability and your desire of LEED Certification to the design/construction teams? How were the end goals communicated to the design/construction team?
Penn State has a LEED policy that outlines the LEED credits and the level of their importance.
What did you know in advance about what you wanted implemented on your project? What were the design/construction teams able to bring to the table to further your mission and goals of the project?
The OPP provides design and construction standard available to contractors via the web.
What sort of involvement did you take on this project to assure its LEED Certification?
The OPP has in house design professionals that attend schematic design meetings with project leaders to assure building use and sustainability goals are being met.
How were decisions on system types made?
Team approach with in house professionals.
What considerations were made to determine if a system should be made more efficient?
Level of certification and levels of energy efficiency.
How important is the selection of a design professional that has experience and expertise with sustainable design?
Extremely critical because they have more lessons learned.
Were there checkpoints or a system of benchmarking to make sure that the sustainability goals were being met? If so, how did it work?
Responsibility of A/E to monitor LEED credits and submissions.

The questions and answers below are from Ken Hamilton from the National Audubon Society who served as a project manager during the interior renovation of their new New York Headquarters.

How did you communicate your commitment to sustainability and your desire of LEED Certification to the design/construction teams? How were the end goals communicated to the design/construction team?
As an environmental organization, and as the owner of the first "green" building in New York City (700 Broadway), we had a firm commitment to a green home office - the highest possible level of certification within our budget was part of the selection process for the architect, for the site, etc. - it was made clear from the beginning and as the owner, Audubon was the driver for this...
What did you know in advance about what you wanted implemented on your project? What were the design/construction teams able to bring to the table to further your mission and goals of the project?
We had very specific ideas about the materials and design; as well as the overall goal of "walking the walk" in relation to our mission. As an owner and, personally having managed a green building for the past 15 years, we worked closely and on much the same page as the design team throughout D&D and construction. The team brought innovative suggestions and were a great help in doing the legwork for our choices - an example was finding a "used" (read 'recycled') source for the raised flooring used in our office - increasing the amount of recycled material we utilized and saving about 55K in the process...
How important were your missions and goals to the design and construction teams?
Obviously integral - "walking the walk" - and being consistent with our new construction projects throughout the country (we have the first Platinum-NC building in CA, other platinum rated centers and mane at varying levels...)
What sort of involvement did you take on this project to assure its LEED Certification?
As the project manager/owner, I was the "driver" - watching budget expenses as well as ensuring we made the smartest 'green' choices we could along the way.
How did your understanding of the LEED points and LEED certification process help during the design and construction phases of the project?
Very much - and I came to this with a fairly detailed understanding of the process and the "scorecard"...
How were decisions on system types made?

By the design team suggesting several alternatives, and balancing cost with point achievement as well as working with the landlord.....complex matrix but, in all, enthusiasm for the goal and attention to the process on all sides.
What considerations were made to determine if a system should be made more efficient?
Cost, life-cycle analysis (we have a 20 year lease), efficiency and points gained - as well as impact on the working environment we were providing for our staff.
How important is the selection of a design professional that has experience and expertise with sustainable design?
We looked at design professionals with and without LEED experience - in the end we decided that a LEED-experienced professional would be better able to give us better "bang for the buck" - and contribute to achieving more with less -
How much did you know about the 'green' systems you wanted? What was left up to the design professionals to decide based on desired outcome?
We did know a lot - we had preferred some more efficient systems that proved impossible because of cost or lease/space restrictions - designers steered us to FF&E, lighting controls, etc. - but we had many of these systems in place on a primitive scale in our previous offices....
Were there checkpoints or a system of benchmarking to make sure that the sustainability goals were being met? If so, how did it work?
Working with a LEED consultant - like an 'official scorekeeper" - we reviewed our standing for LEED as the project progressed and various decision points were reached....

The following section contains questions and answers from contractor within the industry that have had experience working with owners on LEED projects. For the purpose of privacy the names and companies will not be indicated.

Respondent 3:

What problems do owners typically run into when trying to get their project LEED Certified?
Not understanding the process, starting the process late in the evolution of the project.
What do owners need to do differently?
Make the decision to go LEED at the initiation of the project when the cost to implement is minimized.
If you have had positive experiences with owners seeking a LEED Certification what did they do that was successful and helped the overall project?
Set clear objectives and goals for the project.
Typically, how are the owner's mission and goals communicated to the design and construction team and how does having sustainability and LEED Certification part of those goals affect the project?
LEED recommends the Owner be responsible to develop and document the project "Owner's Project Requirements" this is best relayed to the design team through a series of design meetings. LEED Cert. as part of the goals requires numerous design approaches that are intricate to the design and should be recognized in the initial design phase to minimize cost.
How do projects differ in terms of ease of successfully reaching a desired certification limit when sustainability goals are clearly defined during the conceptual and schematic phases of the project compared to when such goals are wanted later in a projects life?
Cost and schedule are the major variables. Throw enough time and money at a problem and you can resolve it. LEED cert. is no different. Clearly defined goals minimizes time and cost!
What mistakes do owners typically make that cause problems for the design/construction professionals for a project attempting a LEED Certification?
Changing their minds.
What design decisions are typically passed over without early owner commitment to LEED?
Site issues. Owners typically already own a property so site selection as well as most of the Sustainable Site credits are out of reach.
What experiences have you had where the owner knew what they wanted (in terms of LEED) and was proactive in receiving a certification rating? What did they do different from other

owners?
No experience.
How important is the selection of a design professional that has experience and expertise with sustainable design?
Helpful but this is all a new process for all disciplines. LEED is really just a variation of Code requirements that design professionals design to. Give them standards to follow as well as follow good architectural practices and LEED cert. will be achieved.
How often do owners have a very specific idea about the materials and design to reach their LEED Certification goals?
Typical owner starts with, "I want solar panels" that is a typical statement from an owner who wants to go green but does not understand LEED.
For a LEED project how is the responsibility for obtaining LEED Credits distributed amongst the trades? Do trades try to value engineer for the most sustainable materials?
Very little, LEED specs. are typically a tighter and trades to date are still learning the credits. Manufacturers are starting to drive alternates but to date very little.
How much does a subcontractor understanding of LEED credits and LEED Certification help during the design and construction phases of the project?
In our area the trades are just getting involved in their first LEED project so they are just along for the ride so far.
How are decisions made to determine if a system should be made more efficient?
Efficiency of systems is locked down during design modeling. Once work starts on site it is typically too late.
Who plays the biggest role in a successful LEED Certified project? (Owner, Designers, Contractors...)
Owner, but LEED is best achieved with an integrated team working together.
How important is it to work with a designer that had experience with sustainable design?
Same as anything else if you have been there before it is much faster and more efficient.
Typically what is the system of checkpoints of benchmarks used to make sure sustainability goals are being met?

LEED credits are typically submitted at the completion of the design phase and again at the completion of the construction phase. During construction the submittal process is the key to assuring materials are as specified. Waste handling is typically tracked and documented, etc. LEED projects are not that different from other projects during implementation, follow the Specification requirements.

Respondent 4:

What problems do owners typically run into when trying to get their project LEED Certified?
Justifying the cost.
What do owners need to do differently?
Accept the financial responsibility.
Typically, how are the owner's mission and goals communicated to the design and construction team and how does having sustainability and LEED Certification part of those goals affect the project?
Through discussions at monthly meetings.
How do projects differ in terms of ease of successfully reaching a desired certification limit when sustainability goals are clearly defined during the conceptual and schematic phases of the project compared to when such goals are wanted later in a projects life?
The earlier the goals are developed and incorporated into the design, the better the project fairs.
What mistakes do owners typically make that cause problems for the design/construction professionals for a project attempting a LEED Certification?
Waffling. Meaning "considering" pursuing a certain LEED credits too long, and not committing to the investment.
Is there extra responsibility put on certain contractors on LEED projects, if so, how can owner involvement spread the responsibilities?
The Owner has to take the lead and provide vision/direction to the Architect/CM during the earliest stages of design.
How important is the selection of a design professional that has experience and expertise with

sustainable design?
*Supremely important. A designer that has no "real" LEED experience drags the process down. LEED must be clearly incorporated into the documents for success.
How often do owners have a very specific idea about the materials and design to reach their LEED Certification goals?
Seldom.
For a LEED project how is the responsibility for obtaining LEED Credits distributed amongst the trades? Do trades try to value engineer for the most sustainable materials?
Trades have even less LEED experience than Owners. Aside from providing LEED materials that vendors suggest, trades are relatively uninitiated with regard to LEED.
How much does a subcontractor understanding of LEED credits and LEED Certification help during the design and construction phases of the project?
Mechanical involvement would help, but most other material information should and does come from vendors and/or suppliers.
How are decisions made to determine if a system should be made more efficient?
Typically, the final decision falls to the Owner, but lacking information, he/she would defer to the Architect. The CM guides the process.
Who plays the biggest role in a successful LEED Certified project? (Owner, Designers, Contractors...) How important is it to work with a designer that had experience with sustainable design?
Designer, followed shortly by Owner. See above * regarding Designer experience.
Typically what is the system of checkpoints or benchmarks used to make sure sustainability goals are being met?
Monthly meetings and on-board design reviews work.

Respondent 5:

What problems do owners typically run into when trying to get their project LEED Certified?

<p>Front end costs. We've run into issues about the cost of more energy saving equipment for both mechanical and electrical equipment. Landscaping, usually the first cost to get cut, contributes to about 6 LEED credits. Other materials may cost more, here the cheapest steel came from Arkansas, well beyond our 500 mile limit for regional.</p>
<p>What do owners need to do differently?</p>
<p>Look at the long-term \$\$\$ savings, the SROI (sustainable return on investment; and pay attention to surveys about Evidenced Based Design. EBD has show that office workers with access to daylight and views are more productive and take less sick days. Patients with a view to the outdoors leave the hospital 40% faster than those without a view. Children in schools constructed with increased ventilation, a more rigorous filtration system, no VOCs, access to daylight and views have less health problems (asthma) that those in other older schools. I questioned the daylight part and was told it's a Vitamin D issue.</p>
<p>If you have had positive experiences with owners seeking a LEED Certification what did they do that was successful and helped the overall project?</p>
<p>All new construction over \$7.5M must achieve LEED silver, either through certification or proof positive that the project has assessed the correct number of points to qualify. Other municipalities also have the same rules, as does the Federal Government. Arlington County requires that ALL new construction reach Silver, including private development. Then again, North Carolina has none.</p>
<p>Typically, how are the owner's mission and goals communicated to the design and construction team and how does having sustainability and LEED Certification part of those goals affect the project?</p>
<p>I wasn't here from the very beginning but this is a design-build project. The architect, HDR, came in with a clear vision of what they wanted to do. This project was envisioned in 2001, designed in terms of 2001 dollars but repeatedly delayed. Much has changed since 2001. HDR has done a tremendous amount of hospital work, and a lot of other LEED projects.</p>
<p>How do projects differ in terms of ease of successfully reaching a desired certification limit when sustainability goals are clearly defined during the conceptual and schematic phases of the project compared to when such goals are wanted later in a projects life?</p>
<p>MUCH! The early design decisions, using an already developed site or remediating a brownfield, access to public transportation, connectivity to community services to encourage pedestrians, building on an east-west access, fenestration, open space....all these are decisions that take place early in the project.</p>
<p>What mistakes do owners typically make that cause problems for the design/construction</p>

professionals for a project attempting a LEED Certification?
Changes, budget. Not understanding what a “sustainable” design is....”green” is a concept. One of the worst questions on the LEED test is “If your Owner decides not to build the smoking pavilion, what credits are affected?” Better question is which ones are not. My brain automatically goes to cost impact, schedule impact. Here the green roof was reduced in a value engineering exercise to about 30% from 75%. This cost us 100% potable water reduction for irrigation. Because this used to be a golf course, it did not affect Open Space.
Is there extra responsibility put on certain contractors on LEED projects, if so, how can owner involvement spread the responsibilities?
Purchasing and documentation. Many products we’ve used before we can’t use now, VOCs in particular. PUT IT IN THE SPECS. I worked with the spec writer here to ensure that there was a submittal requirement for regional/recycled/VOC/etc in the specs so I can tie that to the Schedule of Values. No ticket, no laundry. The Owner needs to be clear about his intentions, be open-minded. Sometimes a little knowledge is a bad thing, the owner needs to be willing to honestly consider the AE’s suggestions. Contraction waste recycling is a huge issue, it’s all about educating the workforce. This is the bane of my existence. I have become the Garbage Czar. This needs to trickle down from the top, the supers and foremen need to be vigilant. More on this later.
What design decisions are typically passed over without early owner commitment to LEED?
Site ones. Daylight/Views. Depending on how far into the project the energy ones, the water efficiency ones, some of the IEQ ones. Once you start building the building, it’s hard to get points and stay within budget.
What experiences have you had where the owner knew what they wanted (in terms of LEED) and was proactive in receiving a certification rating? What did they do different from other owners?
I’m fortunate that the Contracting Officer is on board and understands that LEED cannot take a back seat to budget. The VE decisions we make have to consider the LEED impact. The AE is committed to making this a LEED Silver project. The Owner understands early on what must be incorporated into the design. Usually, what the Owner wants, the Owner gets.
How important is the selection of a design professional that has experience and expertise with sustainable design?
HUGE. This is the person who guides the design to include specific equipment and materials. This is the person who stands up in meetings and says, No, you can’t cut that and here’s why.

How often do owners have a very specific idea about the materials and design to reach their LEED Certification goals?
This is the first Army hospital to go for LEED. Most of the hospital personnel have very specific ideas about what goes where and how it works, and aren't open to much change. Our Owner understands that this will be a "world class facility" and the standard to which all future Army hospitals will be held to. We replace Walter Reed.
For a LEED project how is the responsibility for obtaining LEED Credits distributed amongst the trades? Do trades try to value engineer for the most sustainable materials?
Specs. Everyone tries for regional. The ones who can, try for recycled. So far, the only thing I've found that contains NO recycled material is sealants. Some specs list the requirement to the % of recycled material. Specs say no VOCs, no urea-formaldehyde in the composite wood, all wood must be FSC. We bid out per specs and plans. Purchasing is responsible for ensuring we use local labor, local labor means they know the local market. Regional is cheaper for them, too.
How much does a subcontractor understanding of LEED credits and LEED Certification help during the design and construction phases of the project?
From what I've seen, not much. They will build what's on the contract documents. The electrician doesn't really care about anything but performing his specific scope of work. But there needs to be someone in the office who understands the documentation requirements, what needs to be added to the submittal package besides the usual product data, installation instructions and MSDS.
How are decisions made to determine if a system should be made more efficient?
Here we really tried to be more energy efficient and reduce water use. We're hampered because it's a hospital, 24/7 with infection control issues. We have more toilets, showers, sinks, washing machines than the typical office building and we can't just turn the lights off at 5 and have them come back on at 7.
Who plays the biggest role in a successful LEED Certified project? (Owner, Designers, Contractors...) How important is it to work with a designer that had experience with sustainable design?
The designer is huge, that's the point of most impact. It's the designer who makes the decisions, who provides the contract documents that building will be built from. An owner that understands what he wants and that the AE can get him there. The LEED team meets every other Thursday.

Typically what is the system of checkpoints of benchmarks used to make sure sustainability goals are being met?

We have a bunch. There's the Checklist and the Matrix. The Checklist is what we are working towards, some the designer is responsible for, some the contractor. Since there is a 2-part review, the design team can get a good idea of what in the design works, what doesn't and how to tweak it. The contractor does the things the contractor has control over, which for us is 11 of the 34 credits we believe we'll achieve; and I think we'll get some of the "maybe" ones, like FSC wood and VOC agrifiber/composite wood.

Respondent 6:

What problems do owners typically run into when trying to get their project LEED Certified?

Lack of understanding of the LEED scoring system prior to writing it into their contracts. Results in unrealistic expectations.

What do owners need to do differently?

Become more knowledgeable in sustainable design/construction so that they can make better decisions during the concept and design phases.

If you have had positive experiences with owners seeking a LEED Certification what did they do that was successful and helped the overall project?

My clients thus far have been Federal. The single biggest positive is their commitment to sustainability. As said above, now they just need to understand it better.

Typically, how are the owner's mission and goals communicated to the design and construction team and how does having sustainability and LEED Certification part of those goals affect the project?

Regarding lump sum design-bid-build, it is communicated via the contract. Little to no input is received from the contractor and can result in conflict at the job level for contractors that don't fully understand what they are expected to deliver. Regarding negotiated design-build, it tends to be communicated in a performance document. This is acceptable as problems only occur when the owner wishes to do more than the RFP indicated and decisions are made late in design. It becomes challenging to demonstrate to the owner why a particular feature may increase contract costs and not simply be absorbed into the design-build process.

How do projects differ in terms of ease of successfully reaching a desired certification limit when sustainability goals are clearly defined during the conceptual and schematic phases of the project compared to when such goals are wanted later in a projects life?

As with so many design changes, early decision making is critical. Many of the sustainable

features necessary to attain a LEED certification are not surface deep. In other words, they impact site selection, installed materials, MEP systems, etc.
What mistakes do owners typically make that cause problems for the design/construction professionals for a project attempting a LEED Certification?
Simply said, not taking the evaluation process needed for sustainable construction seriously. Putting it on the back burner as an add-in that can be selected at anytime along the design-construct continuum.
Is there extra responsibility put on certain contractors on LEED projects, if so, how can owner involvement spread the responsibilities?
Many of the subcontractors burden the responsibilities on a LEED project. This is and should be controlled by the GC, not the owner.
What experiences have you had where the owner knew what they wanted (in terms of LEED) and was proactive in receiving a certification rating? What did they do different from other owners?
In general, Just knowing what they want is a huge plus.
How important is the selection of a design professional that has experience and expertise with sustainable design?
Critical. Many of the points lie fully in decisions made by the designer. If the project is not designed with LEED in mind, it can become nearly impossible to make it up with construction controlled points.
How often do owners have a very specific idea about the materials and design to reach their LEED Certification goals?
I have not experience this yet. Federal contracts are limited in how specific they can be so as not to sole source.
For a LEED project how is the responsibility for obtaining LEED Credits distributed amongst the trades? Do trades try to value engineer for the most sustainable materials?
For the projects I have been on to date, we have taken on the responsibility to guide this process. We have found the majority of our subcontractors to have very limited working knowledge of LEED. Hence, they don't have the expertise to take the on these responsibilities without our leadership.
How much does a subcontractor understanding of LEED credits and LEED Certification help during the design and construction phases of the project?
Again, very limited.
How are decisions made to determine if a system should be made more efficient?

This is one of the first things we review with our designers on design-build projects.
Who plays the biggest role in a successful LEED Certified project? (Owner, Designers, Contractors...) How important is it to work with a designer that had experience with sustainable design?
It depends... on a design-bid-build job, the designer needs to sit in the driver's seat and drive the process. On a design-build project, the contractor needs to take the leadership role while supporting and listening to the designer
Typically what is the system of checkpoints or benchmarks used to make sure sustainability goals are being met?
This is still be proven by our company. The LEED score card is a good base. Outside of that, we are simply folding the LEED score system into our standard business practices so that it just becomes a normal part of business allowing us to impart the same control techniques on our subcontractors as we do for all aspects of the construction process.

Respondent 7:

What problems do owners typically run into when trying to get their project LEED Certified?
I think that owner still tend to run into the cost obstacle. LEED certification starts off as a great idea and has a great "feeling" associated with it. However, I think that certain credits still come at a first-cost premium, that some owner struggle to want to pay. This, in turn, may cause them to shy away from certain points that my help them achieve the certification that they are pursuing, simply due to cost.
What do owners need to do differently?
Related to my response above, owners should try to separate their sustainable construction goals from their financial goals. It has been our experience that LEED certification still comes at a premium. This includes added cost of construction and added administration cost associated with the certification process. If owners accept this, up front, and separate their expectations for LEED certification from expectations for minimizing cost, I believe they may have a more pleasant experience in getting their project certified. The construction industry has embraced sustainable construction, and in doing so, I believe that many of the materials and methods that are currently used in LEED projects, at a premium, will soon be equal to or less costly than standard materials and methods. When this happens, it should make the cost premium much less an issue.
Typically, how are the owner's mission and goals communicated to the design and construction team and how does having sustainability and LEED Certification part of those goals affect the

project?
In the cm business, we always preach "getting the whole team involved early." With sustainability and LEED as part of the project goals, this is even more critical. I don't think you can have a successful LEED project without the full-team cooperation very early in the project.
What design decisions are typically passed over without early owner commitment to LEED?
I think that many of the site selection criteria are decided prior to pursuing a LEED design. Most owners have their site selected prior to designing their project, not the other way around.

Respondent 8:

What problems do owners typically run into when trying to get their project LEED Certified?
There usually is a perceived cost to certifying a project. For example, the project must be registered with the USGBC and an outside commissioning agent needs to be hired.
What do owners need to do differently?
Make the LEED effort more of a team effort. If the points are distributed amongst the team, the perceived burden is a lot less. Owner who participate and show by example their commitment to the sustainable approach have the most successful projects.
If you have had positive experiences with owners seeking a LEED Certification what did they do that was successful and helped the overall project?
Owner who attended LEED meetings and celebrated LEED milestones (e.g. Design submittal) were most successful.
Typically, how are the owner's mission and goals communicated to the design and construction team and how does having sustainability and LEED Certification part of those goals affect the project?
Usually the BOD communicates the owner's goals for the project. Having LEED part of the BOD really helps the team understand the commitment of the owner.
How do projects differ in terms of ease of successfully reaching a desired certification limit when sustainability goals are clearly defined during the conceptual and schematic phases of the project compared to when such goals are wanted later in a projects life?
If the goals are identified early, the owner can take advantage of integrated design and possibly

save money on the project.
What mistakes do owners typically make that cause problems for the design/construction professionals for a project attempting a LEED Certification?
The look at first costs instead of the life cycle of the building.
What design decisions are typically passed over without early owner commitment to LEED?
Integrated design decisions that will allow for example, a smaller HVAC system because the skin of the building has been designed at a much higher R value.
What experiences have you had where the owner knew what they wanted (in terms of LEED) and was proactive in receiving a certification rating? What did they do different from other owners?
They instructed the Design Team early to do the “right” thing and not worry about first costs.
How important is the selection of a design professional that has experience and expertise with sustainable design?
I actually think that a good design professional already incorporates a lot of the sustainable features into a project. I think a balance between doing LEED and not LEED projects is essential. I have worked with Designers that only do LEED projects and I think they are sometimes guilty of “greenwashing”.
How often do owners have a very specific idea about the materials and design to reach their LEED Certification goals?
I think most owners rely on the Design Professionals to make decisions about material selection.
For a LEED project how is the responsibility for obtaining LEED Credits distributed amongst the trades? Do trades try to value engineer for the most sustainable materials?
The heaviest burden falls about the MEP contractors because there are specific guidelines for the prefunctional, functional and commissioning. I am not sure material selection creates a burden because most manufacturers are becoming more sustainable to survive.
How much does a subcontractor understanding of LEED credits and LEED Certification help during the design and construction phases of the project?
Contractors who have had experience with the process are much less likely to put extra money into the project for the LEED burden.
How are decisions made to determine if a system should be made more efficient?

I think if you are talking about HVAC design, I think energy modeling is employed.
Who plays the biggest role in a successful LEED Certified project? (Owner, Designers, Contractors...)
I actually think all three play an equal role. Without enforcement from the top (the owner) the team loses momentum. If the Designer does not do their homework, the credits are difficult obtain. If the contractor does not buy into the design, the documentation for the credits will be difficult.
How important is it to work with a designer that had experience with sustainable design?
As I mentioned before, I think experience is very helpful but I also think designers who only do LEED projects are not sensitive to market conditions.
Typically what is the system of checkpoints of benchmarks used to make sure sustainability goals are being met?
The easy benchmark is LEED points. Projects that are sustainable but not LEED certified can use building occupant satisfaction and reduced operating costs as benchmarks.

Respondent 9:

What problems do owners typically run into when trying to get their project LEED Certified?
They either decide to pursue a certification too late and scramble to find the available points without proper planning and advice or hire a consultant to advise them and that consultant does not take the proper time to evaluate existing conditions, design, etc or relies on what they achieved in the past.
What do owners need to do differently?
Proactive involvement in the planning for success in achieving the goals and the impacts of pursuing each achievable rating point.
If you have had positive experiences with owners seeking a LEED Certification what did they do that was successful and helped the overall project?
Define the points early, define responsibilities for achieving each point, incorporating the items to achieve the points into the Contract Documents.
Typically, how are the owner's mission and goals communicated to the design and construction team and how does having sustainability and LEED Certification part of those goals affect the project?
The design team and CM should be part of the planning for defining and documenting the planned points. When defined and documented the design team must plan for appropriate execution, budgeting and who to assign those efforts to. For example defining when air systems

must be run for removing VOC's or building you loading dock for recycling dumpsters.
What mistakes do owners typically make that cause problems for the design/construction professionals for a project attempting a LEED Certification?
Deciding to apply for certifying too late and not buying enough administration time for the LEED professional to monitor and document LEED rating points.
What experiences have you had where the owner knew what they wanted (in terms of LEED) and was proactive in receiving a certification rating? What did they do different from other owners?
Hire appropriate consultants to document required points and gather documentation during the construction process.
How important is the selection of a design professional that has experience and expertise with sustainable design?
I feel that each discipline hold have an awareness in LEED processes in order to understand what is required of each member of the team.
How often do owners have a very specific idea about the materials and design to reach their LEED Certification goals?
Usually they have an awareness but use consultants, the design team and the CM for specific applications.
For a LEED project how is the responsibility for obtaining LEED Credits distributed amongst the trades? Do trades try to value engineer for the most sustainable materials?
A consultant defines the plan with each team member buying into the goals and doing their part to define and document the process. Usually, the trade contractors only need to be told what is required and what is defined in the Contract Documents so they can fairly price the necessary labor, time and materials.
How much does a subcontractor understanding of LEED credits and LEED Certification help during the design and construction phases of the project?
Awareness is key but when key elements are defined, the CM must incorporate the means and methods into the budget and the logistics plans and schedules.
Who plays the biggest role in a successful LEED Certified project? (Owner, Designers, Contractors...)
The client plays the largest role since they set the vision and tone for the project.

What issues of constructability are important in LEED Certification?
This usually will impact the start up and commissioning processes.
Typically what is the system of checkpoints of benchmarks used to make sure sustainability goals are being met?
Define the points to achieve and responsibility for each point. Monthly meeting should be held to monitor the documentation and planning efforts of the design team and the CM. During purchasing of the trades a review should be held prior to award so that the appropriate sub knows what is expected and what impacts they will have during the project. Quarterly meetings should be held during the construction phase to document progress and verify necessary documentation is being gathered and formatted.

Respondent 10:

What problems do owners typically run into when trying to get their project LEED Certified?
One issue is expectation for various levels and cost and deciding the return on investment and what they want to spend. i.e. what is worth it to them to go for silver, gold etc.
What do owners need to do differently?
When it is possible they should get contractors involved during the design phase to help give material selection and cost input.
If you have had positive experiences with owners seeking a LEED Certification what did they do that was successful and helped the overall project?
On projects where it is possible to get contractor input early owners benefit as does the project but the typical job these days does not allow for this so in lieu of that the owners getting the architect/design team to be the LEED managing agent helps coordinate the process.
Typically, how are the owner's mission and goals communicated to the design and construction team and how does having sustainability and LEED Certification part of those goals affect the project?
Typically it is communicated in the documents and emphasized to the team during construction in project meetings and the submittal process. The affect on the project is an additional administrative burden and depending on the credits that are being pursued burden in the field to maintain and plan for certain material delivery and treatment requirements. So in the end it requires additional resources on the construction team's end to facilitate.
What mistakes do owners typically make that cause problems for the design/construction

professionals for a project attempting a LEED Certification?
My experience is the owners seem to be fairly hands off once they decide to go for it and leave the managing up to the design and construction team. They need to get more educate in the process.
How important is the selection of a design professional that has experience and expertise with sustainable design?
This is crucial they have to be knowledgeable or the process is hindered from the start and their ability to know what is needed during the construction process is very valuable in terms of helping to monitor the process.
How often do owners have a very specific idea about the materials and design to reach their LEED Certification goals?
I have not seen owners being very aware they seem to typically depend on the design team for this knowledge.
For a LEED project how is the responsibility for obtaining LEED Credits distributed amongst the trades? Do trades try to value engineer for the most sustainable materials?
The specifications formulated by the design team dictate what the trades provide. Yes the trades will typically try and VE if there is room to do so in the documents. But the LEED requirements tend to make this a lot more limited than it has been in the past.
How much does a subcontractor understanding of LEED credits and LEED Certification help during the design and construction phases of the project?
Typically the trades don't get much input in the design phase but if allowed the input would be very helpful and head off problems that are encountered when material are spec but not available because the design team is not intimately aware of material availability.
Who plays the biggest role in a successful LEED Certified project? (Owner, Designers, Contractors...)
Design team and establishing realistic expectations and goals.
Typically what is the system of checkpoints of benchmarks used to make sure sustainability goals are being met?
Design credit check is done, material tracking is done over the course of the project and during the submittal process, regular documentation of material handling, commissioning check list.

Respondent 11:



<p>If you have had positive experiences with owners seeking a LEED Certification what did they do that was successful and helped the overall project?</p>
<p>The owner employed both a design and construction team that was knowledgeable and committed to the LEED process and concepts. The owner had a clear vision as to the project goals and was committed from the onset to achieving those goals.</p>
<p>Typically, how are the owner's mission and goals communicated to the design and construction team and how does having sustainability and LEED Certification part of those goals affect the project?</p>
<p>The goals are typically communicated at the proposal or bidding phase. Having those goals at the onset of the project is critical in the success of the LEED process. It allows for the design team to properly incorporate the concepts into the initial design and allows the contractors to base their initial pricing on the materials and equipment that is necessary to achieve those goals.</p>
<p>How do projects differ in terms of ease of successfully reaching a desired certification limit when sustainability goals are clearly defined during the conceptual and schematic phases of the project compared to when such goals are wanted later in a projects life?</p>
<p>It is much easier to achieve the desired goals when they are clearly established at the beginning of the project. If an owner decides to pursue LEED certification later in the project life, it is more difficult to make the design adjustments necessary and can add significant additional cost that was not originally incorporated into the project.</p>
<p>How important is the selection of a design professional that has experience and expertise with sustainable design?</p>
<p>Extremely important. The ability to achieve a LEED certification is very dependent on the incorporation of those design concepts early on in the process. An experienced LEED design profession will have an understanding of what design elements are critical in achieving the owner's project goals, as well as provide valuable advice throughout the construction process.</p>
<p>For a LEED project how is the responsibility for obtaining LEED Credits distributed amongst the trades? Do trades try to value engineer for the most sustainable materials?</p>
<p>It is the trades' responsibility to meet the intent of the project design. The work of some trades effect of the overall LEED outcome more than others. Many of the common construction materials today meet the minimum requirements LEED asks for. If a specified sustainable material adds a great deal of cost to the project, the construction team will evaluate the benefit of using a certain sustainable material over using a traditional material.</p>
<p>How much does a subcontractor understanding of LEED credits and LEED Certification help during the design and construction phases of the project?</p>

It is very helpful, both in terms of knowing the materials and processes required and the documentation necessary.
How are decisions made to determine if a system should be made more efficient?
Typically by an evaluation by the design and construction teams along with the owner.
Who plays the biggest role in a successful LEED Certified project? (Owner, Designers, Contractors...)
It has to be a total team effort. Each party plays a significant role in meeting the requirements.
Typically what is the system of checkpoints of benchmarks used to make sure sustainability goals are being met?
An initial LEED checklist is developed at the beginning of the project to identify the LEED credit goals. This checklist is continuously evaluated throughout the project to make sure all parties are aware of the credit goals.

The following are answers from SmithGroup who were the architects of the Chesapeake Bay Foundation's Philip Merrill Environmental Center.

What worked well compared to other owners on other projects? Where do other owners on other projects fall short?
<p>LEED Certification has moved from what was a voluntary action to a mandated one in many jurisdictions. CBF still remains one of the best examples of an Owner who's Organizational Mission and thus, their project goals for their new headquarters, aligned quite well with the initiatives embedded within the LEED Rating System. They were doing "right" for all the right reasons.</p> <p>Organizational Mission: in short, to Save the Bay!</p> <p>Project Goals:</p> <ul style="list-style-type: none"> ▪ Create the best workplace for staff while supporting on-site education and volunteer training; ▪ Develop the most environmentally sensitive building possible; ▪ Establish an example for others to create equally "green" buildings; ▪ Be the best neighbor possible; and, ▪ Shape a workplace and environment from which to monitor and investigate the state of the Bay <p>When an Owner is pursuing LEED because of external forces or because they "have to", it often leads to what we term in the industry as "point chasing". Point chasing can still yield the LEED</p>

<p>Certification Level necessary, but oftentimes has the following negative outcomes:</p> <ol style="list-style-type: none"> 1. Tasks are done out of sequence and are done to validate or confirm rather than inform decision making processes; 2. Synergies are not properly explored that may have led to greater overall performance and economy; 3. Limited or potentially no (may be applicable to projects registered before June 26, 2007) improvement in energy performance.
<p>How was the owner's mission and goals communicated to the design and construction team?</p>
<p>The Owner's mission was well known and documented. During predesign, the U.S. Green Building Council's LEED Rating System was used in setting goals for the project before the design commenced. Benchmarking tours of other green projects and CBF's educational centers were also influential.</p>
<p>How were decisions on system types made? What considerations were made to determine if a system should be made more efficient?</p>
<p>A peer review of the concept design was organized by the Sustainable Building Industries Council (funded by the Department of Energy) and included reviewers from the Maryland Energy Administration, Maryland Department of Natural Resources, World Wildlife Fund and National Renewable Energy Laboratory. The peer review tested the design from various angles and recommendations were further studied and some incorporated. An integrated approach to design was used, and in-house engineers worked closely with architects.</p> <p>The litmus test as to whether something was incorporated or "pushed" to higher levels of efficiency or performance was often the answer to this question - does it meet the goals of the project?</p>
<p>How were the end goals communicated to the design/construction team?</p>
<p>The goals for the project were developed in concert between the design team and the Owner and were based on their Organization Mission, the purpose for constructing a new HQ building, the context of the site, benchmarking studies of green projects, etc. They were documented for all to know.</p>
<p>What did the owner know about the 'green' systems they wanted? What was left up to the design professionals to decide based on desired outcome?</p>
<p>Perhaps one of the most important considerations for the building and site was water. Given their mission and proximity to the Bay, it was obvious from the start that water conservation and control of quantity and quality of storm water runoff was paramount. For example, CBF had</p>

experience using composting toilets at various sites for 20 years. It took some education on behalf of the design team to embrace and design for this strategy in a commercial building. On the other hand, the design team was faced with an inadequate supply of well water in the event of a fire. Rather than extend municipal water service to the site, we integrated a rainwater catchment system with a fire suppression holding tank to serve multiple purposes.

In one case, the design team advised the Owner against PV because of its poor life-cycle cost, but the Owner wished to have it simply to demonstrate the technology to others, particularly visitors.

In general, much of the process was iterative. There were a few sacred cows so to speak, but the final outcome was born out of the process.

What design decisions would typically be passed over without early owner commitment to LEED? e.g. would the architectural site placement have been considered if the owner did not understand the effects of a solar gain on a south facing façade and the owner never voiced a desire for LEED Certification?

In short, optimization. Oftentimes, we use minimum standards to guide us along with good industry practice. An Owner who is committed to sustainable design and/or who has clear goals for the project is often more willing to pay for additional simulation and analysis to optimize the design (e.g., orientation, fenestration, shading, daylighting, envelope performance, HVAC system selection, etc.). They are interested in long-term benefits rather than first cost alone.

What did the CBF do right that other owners need to do differently? Where there checkpoints or benchmarking strategies?

1. Set goals early and never strayed;
2. Supported an integrated design process;
3. Organized a peer review team to further inform the design;
4. Reiterated and prioritized goals in the face of value engineering efforts;

What could other owners learn from the CBF's involvement on the project?

Truly become a member of the team. CBF was as much a part of the design team as were the design professionals. They often had as many good ideas to contribute as anyone in the architecture and/or engineering disciplines. No one knows the Owner's needs, dreams, and culture better than the Owner himself.

What mistakes do other owners typically make that cause problems for the design/construction

professionals for a project attempting a LEED Certification?
<ol style="list-style-type: none"> 1. Believing the hype that you can do a LEED Building and it won't cost you any more than doing a conventional building. 2. There are a lot of tradeoffs when designing/constructing a green building; the Owner needs to identify a decision maker on their end who will not only help the design team make important decisions, but assist their own various constituents in aligning goals and prioritization.
How important is the selection of a design professional that has experience and expertise with sustainable design?
<p>I believe that a LEED-experienced design professional can benefit the project in the following ways:</p> <ol style="list-style-type: none"> 1. They understand the LEED Certification and design process and can ensure that certain milestones are met and that decisions are made at the right time; 2. They are able to provide lessons learned and share information on previous projects with current clients; <p>While experience with LEED is important, it doesn't necessarily guarantee an innovative and integrated solution that meets all the client's goals. Similarly, experience with sustainable design (process and technologies) is also quite helpful, but if the end result doesn't meet the client's needs, it too cannot be relied upon for the key to success. It really requires a combination of skills.</p>
How well did CBF understand the LEED points and the LEED certification process? How much did this help? How much would this hurt if the owner did not?
<p>CBF was part of the LEED NC V1.0 Pilot Program so no one was familiar with LEED prior to this project. Furthermore, under the Pilot Program, the requirements for Credit submission and acceptance were not well defined as they are today. Generally speaking, there was a level of subjectivism that was used both on the part of the A/E and USBGC in interpreting whether the documentation adequately supported the intent of the credit.</p>