WestEnd**25**

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1229-1231 25St. NW

Charles Miller – Construction Management

Consultant – Dr. Riley

Final Proposal

Penn State Architectural Engineering

12/12/08

WestEnd25

Charles Miller ■ Architectural Engineering ■ Construction Management

■ Project Overview

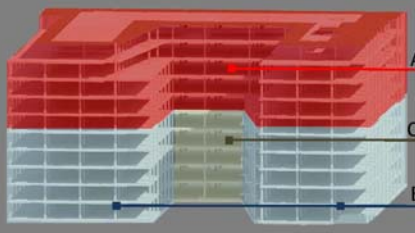
Owner: Vornado-Charles E. Smith
Location: 1229-31 25th St. NW
Washington D.C. 20037
Total Square Feet: 323,380 sq. ft.

General Contractor :
James G. Davis Construction Corp.
Project Delivery: Negotiated GMP
Project Cost : $76 million

■ Architecture

Architects: Shalom Baranes Associates Architects
The architectural design of WestEnd**25** developed from the two existing office buildings. The footprint of WestEnd**25** resembles a U shape facing the adjacent NW 25th Street. West End 25 stands ten stories tall and contains 283 luxury apartments. The two prime landscaping features of WestEnd**25** are the entrance courtyard and the roof top. The courtyard features an entrance colonnade and a water fountain. The roof features a pool, terraces and vegetation.

■ Structural



Structural Engineer: Tadjer Cohen Edelson Assoc.
WestEnd**25** is supported by spread footings. The existing superstructure of WestEnd**25** consists of conventionally reinforced concrete with a 20' by 20' column grid. The 1229 and 1231 buildings are connected by a 7" post-tensioned concrete slab. The additional floors maintain the 20' by 20' column grid and primarily have a post-tensioned concrete slab thickness of 6".

■ Mechanical, Electrical and Lighting

MEP Engineers : GHT Limited
The apartments of WestEnd**25** are conditioned by water cooled heat pump unit. To increase efficiency for the public conditioning system, two enthalpy wheels transfer heat between exhaust air and outdoor air. Power will enter WestEnd**25** from two locations. The high power, 3 phase 460 Volt, will enter the 1231 building and the low power, 3 phase 240 volt, will enter 1229 building. Apartment lighting utilizes track lighting for kitchens and living areas and recessed fluorescent lighting for bedrooms, bathrooms and walk-in closets.

Note: Pictures and rendering were created by Shalom Baranes Associates and have been provided for the use on Senior Thesis



WestEnd25

■ www.engr.psu.edu/ae/thesis/portfolios/2009/cmm5035 ■

Executive Summary:

WestEnd**25** is a conversion of two six story office buildings to residential rental apartments. The project will add four post tensioned concrete stories to the top of the existing buildings, and will fully connect the two buildings. This report contains proposed analyses dealing with several issues on WestEnd**25**. The four proposed analyses are an investigation of spatial planning to better establish work flow, an investigation of different façade type, an investigation of different concrete placement method, and an investigation of more owner involvement in LEED certification.

The trade flow analysis will develop a plane that determines where trades should be working for each day. The conditions of WestEnd**25** create congested interior working spaces. A plan that can be given to subcontractors that shows where they should be working to avoid other trades will lessen delays and maintain productivity. This task will use the project schedule in conjunction with the space requirements of the trades to create a 4D sequence of how the trades will move throughout the building.

The inspiration of the alley wrap analysis comes from the issues that have occurred on WestEnd**25** during the brick installation. This analysis investigates the cost and productivity of installing a brick façade. Since the existing façade was precast it is to be expected that the precast panels will function better as a façade on the existing structure. Also, the precast installation is not susceptible to weather delays as much as brick. Further analyses will include the structural effects, the thermal effects, and the acoustical effects of using precast panels over brick.

The placement of concrete is being completed with a crane and bucket. An analysis will be completed to determine if the use of a pump would be a better choice. The cost difference and schedule difference will be compared between the systems to determine the best choice. Crane and bucket data will be gathered from the subcontractor. Pump costs will be gathered from local vendors and productivity data will be obtained from R.S. Means.

The final analysis attempts to determine the need for more owner involvement in the LEED certification process. This inspiration of this analysis comes from the 2008 PACE Roundtable discussions. It appears that the industry wants owners to be involved during the certification process. This analysis will obtain the opinions of a greater number of professionals than were a part of the PACE breakout discussion. Both owners and project personnel will be surveyed to see if there are similar opinions. This data will be used to show and help convince, if necessary, the U.S. Green Building Council to look into credits or owner accreditation as part of the LEED certification process.

This proposal is a starting point for a semester of research and analyses that surround WestEnd**25**. Productivity and spatial planning are two primary features of this proposal and developed from graduate level classes that have been completed at Penn State. The LEED analysis developed from a small group discussion and intends to determine if the views of the small group discussion are the same across the industry.

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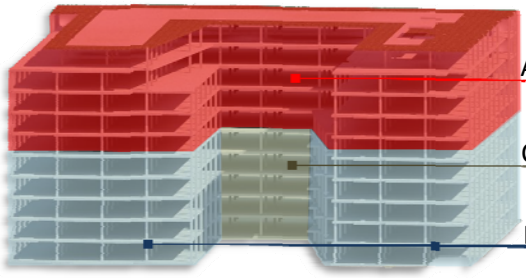
A. Background:

WestEnd**25** involves the conversion of two existing office buildings into a connected residential rental apartment building. The project will add four post-tensioned concrete stories to the top of the existing buildings, and will fully connect the two buildings which stand on an existing two-story underground parking garage. The figure below provides visualization of the added concrete structures.



Areas of Cast-in-Place Concrete

Concrete will be placed via crane and bucket. The crane is located in a central position of the site, the courtyard. WestEnd**25** will be marketed as luxury apartments that include a rooftop pool, fitness center and a resident lounge. The architecture of WestEnd**25** is combination of a park wrap façade comprised of glass and metal curtain wall and an alley façade containing masonry and punched windows. The park wrap is a curtain wall is a panelized system that is installed from the interior of the building. A hydraulic mast climbing scaffold system will be used to install the alley façade.

Designs of WestEnd**25** was initiated in March of 2007 and lasted approximately a year. Mobilization and demolition started before the final competition of construction documents. Demolition of the existing façade and interior building systems commenced on February of 2008 and lasted until early June 2008. Work on the superstructure is sequenced by floors and starts with the first floor and continues to the roof/penthouse. The project will be water tight by 7/8/09. Interior work is sequenced to flow from the west side of the north building in a clockwise direction to the south building. This progression is followed for all activities of construction creating a substantial completion date of 12/24/09.

Figure show work flow for each floor.

B. Analysis Description:

Trade Flow:

Trade flow is always a critical issue on a construction site. Inadequate trade flow is a problem on WestEnd**25** worsened by the urban location and small footprint. If this problem is not addressed it may cause project delays and in turn lawsuits. Therefore, proper planning of trades and spaces for the duration of the project needs to occur to avoid the stacking of trades.

Problems Addressed:

The curtain wall on WestEnd**25** is a unitized system that will be installed from the interior of the building. This method will occupy the majority of the footprint perimeter. This prohibits storage of material, interior framing and rough on floors that have not been enclosed. Therefore the installation of the curtain will affect the other trades also working inside the building. To minimize the negative effects a plan to designate space at different times of the project must be developed and communicated to the subcontractors.

Analysis Description:

Spatial planning is important to minimize the amount of congestion, and to assign adequate working locations to the trades. The plan will contain information determining the sequence of activities along with the necessary space for trades. Then potential conflicts will be determined and resolved. In order to effectively communicate this plan it will be shown with a 4D simulation.

Task and Tools:

Material information will be used to determine the necessary storage areas in the building footprint. This information in conjunction with the floor plan will be used to determine the required storage spaces per floor. The sequence of work will be taken from the project schedule. Critical activities will determine the flow of trades. A layout will be made that diagrams the floor plan throughout the duration of the project. This diagram will be in a 4D format and will show the crew movements. This sort of planning is necessary in order to avoid trades working wherever there is an opening and causing delays or slow productivity. A 4D simulation will show the movements of trades throughout the building and where they should be working on any particular day. This is important because the project is multiple stories, is located in an urban environment and the footprint is small. The complexity of the situation warrants an analysis. The plan will be evaluated by observation for any interference between trades.

AutoCAD will be used to layout floor layouts and create a 3D model for trade flow. NavisWorks will be used to combine the 3D model and the project schedule to create a 4D flow of work. This visual will be used to determine clashes of trades. Any such clashes will be evaluated and fixed.

Brick v. Precast Façade:

The existing façade for WestEnd**25** consisted of precast architectural panels. Brick will replace this façade. Brick is an aesthetically pleasing choice that has a relatively simple installation. The brick option is causing problems because the slab edges do not run in straight lines in certain locations. In order to solve this problem extra work must be completed before installation can happen. If the existing precast was removed and replaced with an architectural precast brick façade the slab edges would not be an issue. An analysis will look at the cost and schedule impacts of altering the façade type.

Problems Addressed:

Installation of brick is a labor intensive activity. The masons are limited to the height they can place in a day. Therefore the amount of work, per crew per scaffold is limited per day. Precast would allow for more production and faster enclosure of floors. Furthermore, the existing structure is better suited for precast architectural panels since they were also the original façade. Precast would eliminate the need of extra work to correct the slab edges.

Analysis Description:

This analysis will compare the current installation of the brick façade with precast. Time, cost and the ability to accelerate the installation will be considered as part of this analysis. Time comparison will be made with the current duration for the installation of brick. Costs comparisons will include the material, labor and equipment. In order to complete this analysis all the information pertaining to time and cost of the precast system will be gathered and compared to the estimates of the current design. Also, included in the cost comparison will be the extra cost of demolition for slab edges. After discussion with Mark Taylor of Nitterhouse Concrete Products, it has been determined that if precast panels were being installed as the new façade then the extra demolition would not be needed.

Part of this analysis will be an investigation of the changes to the thermal envelope, structural loads and acoustics. The changes in the thermal envelope and the acoustic changes are important to the residents of the building. The changes in structural loads are important to determine to assure that extra support is not needed for changing the façade.

Tasks and Tools:

To begin this analysis the cost data for the labor and equipment for the current facade will be gathered. Installation data will be gathered to determine the productivity. Surveys will be used to record daily installation, weather conditions, and any delays. This method has been conducted to collect similar productivity data for the curtain wall façade of the Lewis Katz building as part of a CE 533 Construction Productivity Analysis. Theoretical productivity data for a precast façade will be determined and compared to the brick facade. Precast productivity will be gathered from R.S. Means. Microsoft Excel will be used to document and analyze project installation data. This analysis will go further to determine the effects on labor and project space that will change due to the change in façade. A

thermal envelope breadth will be completed to quantify the affect a change in the façade will have on the residents. The amount of energy that could be saved or lost will be determined by the changes in heating/cooling requirements. Another breadth will look at the structural loads applied by the precast façade. If the loads are greater than what can be support by the original structural system then added support would be needed. This is extremely important because the main purpose of this system is to best utilize the existing condition. Finally, an acoustical breadth will determine the difference in the façade's ability to reduce outside noises entering the living area.

Concrete Placement Analysis:

The concrete placement technique used on WestEnd25 is crane and bucket. Another option that can be researched is the placement of pumping the concrete in place. Pumping concrete is quicker and requires less labor. In fact, Associated Construction Publications states that contractors find a 50% savings in labor costs compared traditional methods1. A possible analysis can look at the cost difference and time difference between each system, including the necessary planning needed for placement via a pump.

Problem Addressed:

The placement of concrete with crane and bucket is a time consuming process. This analysis will look at how the four additional stories could benefit from the use of a concrete pump.

Analysis Description:

In order to illustrate the difference between the placement of concrete via crane and bucket verses a concrete pump all the cost and time data for the crane and bucket method will first be gathered. Then costs and times for placement with a concrete pump will be gathered and compared. Judgment on the best system will include the overall cost compared with the placement duration.

Task and Tools:

This analysis will need the production of the concrete placement using the traditional crane and bucket method. Costs for the equipment and the labor needed will also need to be calculated. This information can be obtained from daily reports and actual project data. Then the production rate for a concrete pump will be estimated utilizing an industry average. Cost of the pump and the amount of labor to place the concrete with the pump will also be calculated. The data will be analyzed to

[1] Hayes, Kelly. *Why Pump Concrete? - Tips on Knowing When to Select Concrete Pumping Over Tradition Placement Methods.* Associated Construction Publications. 11/1/2008. http://www.acppubs.com/article/CA6606409.html?industryid=48572

determine if the pump placement will be better. R.S. Means will be needed to estimate productivity all other data will be gathered from subcontractors, compiled and analyzed with basic Microsoft programs.

LEED Analysis:

Problems Addressed:

The PACE seminar breakout session, LEED Evolution, addressed how the changing of green building requirements will affect future projects. One of the main concerns from the PACE discussion is the owner's ignorance of the certification process. This analysis will look at finding a method to have documented owner involvement in their building's certification process.

Analysis Description:

Industry members strongly feel that owners need to take a more prominent role in ascertaining LEED certification. One of the consensus ideas created at the PACE seminar is that a LEED point should be awarded for involvement in the LEED certification process. Therefore an analysis would look at the necessary documentation to prove adequate owner involvement and the willingness of the U.S. Green Building Council to implement. This analysis will also include a survey of experienced owners to ascertain the willingness to put their personnel through LEED training and take the exam to become LEED Accredited Professionals.

Tasks and Tools:

The steps that will be taken to accomplish this analysis will be to first send a questionnaire to several industry members in order to verify the desire for more owner involvement is indeed an industry issue. Then another questionnaire will be sent to owners and developers to determine their interests in LEED. With this feedback this analysis intends to seek involvement of the, U.S. Green Building Council, USGBC, to develop documentation or procedures so that owner involvement can be awarded. Expectations for this analysis are that the project managers and owners will fill the survey. It is expected that the data from the surveys will be in line with the results of the PACE discussion. Difficulties may arise with gaining the interest of the USGBC. Previous attempts to initiate conversation about their interest in this topic have been futile. It is the intention of this analysis that the collected data will create USGBC involvement.

Below is a sample of question that will be included in the questionnaires. The purpose of these questions is to establish the needs and interests of the industry.

Questions for Owners and Developers:

- Would you become a LEED accredited professional?

- Do you think there needs to be more involvement on the owner's side during the certification process?
- Are facility personal trained on how to take care building equipment?
- Is the training repeated at regular intervals for new hires?
- Is the training repeated at regular intervals for knowledge retention?

Questions for Contractors:

- Do owner representatives need to be LEED accredited?
- Do owners need to be more involved in the LEED certification process?
- Would accredited professionals make the project start up easier?
- Would accredited professionals make the construction process easier?
- Would accredited professionals make the project turn-over easier?
- How would credit for owner involvement be tracked?
- Additional comments, esp. your interest in having owners more involved with LEED.

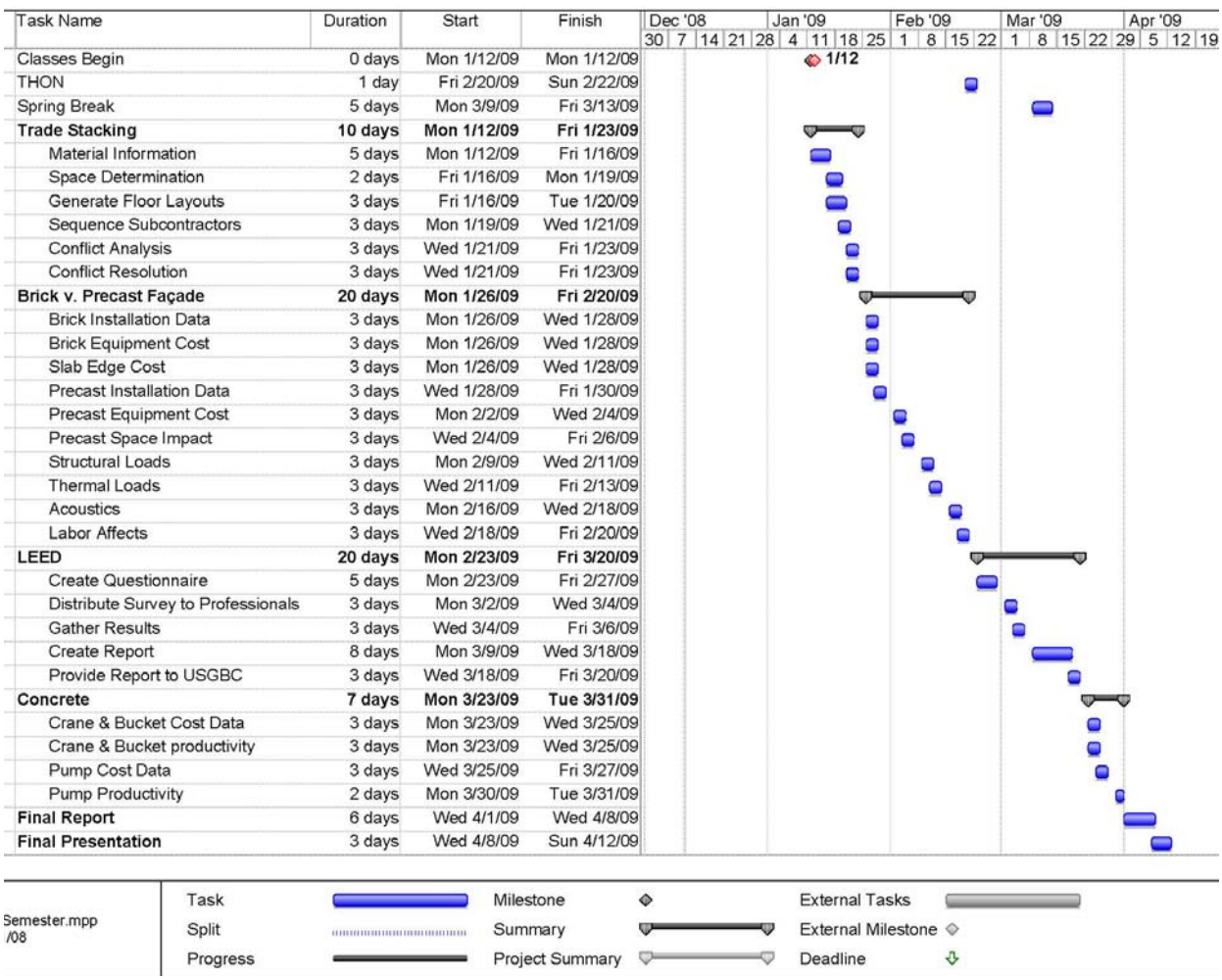
The tasks that will need to be completed for this analysis to be successful start with the completion of the survey to send out to industry members. After the survey data has been collected the data will be analyzed and illustrated with graphs. This data will be put into an independent report to give to the USGBC in order to show an industry need for more owner involvement. The surveys can be complete with paper questionnaires and envelopes. However, the limitation of this method is the possibility of the questionnaires being lost or not returned. A better solution is the use of an electronic survey, such as, surveymonkey.com.

C. Conclusions:

In order to complete the several analyses proposed in this report adequate planning is necessary. A schedule has been developed in order to track progress. The data from the schedule has been put into a tracking log that will further help track progress. A weight matrix has also been completed in order to show the effort distribution among the different analyses.

Time Table:

Task Name	Duration	Start	Finish
Classes Begin	0 days	Mon 1/12/09	Mon 1/12/09
THON	1 day	Fri 2/20/09	Sun 2/22/09
Spring Break	5 days	Mon 3/9/09	Fri 3/13/09
Trade Stacking	**10 days**	**Mon 1/12/09**	**Fri 1/23/09**
Material Information	5 days	Mon 1/12/09	Fri 1/16/09
Space Determination	2 days	Fri 1/16/09	Mon 1/19/09
Generate Floor Layouts	3 days	Fri 1/16/09	Tue 1/20/09
Sequence Subcontractors	3 days	Mon 1/19/09	Wed 1/21/09
Conflict Analysis	3 days	Wed 1/21/09	Fri 1/23/09
Conflict Resolution	3 days	Wed 1/21/09	Fri 1/23/09
Brick v. Precast Façade	**20 days**	**Mon 1/26/09**	**Fri 2/20/09**
Brick Installation Data	3 days	Mon 1/26/09	Wed 1/28/09
Brick Equipment Cost	3 days	Mon 1/26/09	Wed 1/28/09
Slab Edge Cost	3 days	Mon 1/26/09	Wed 1/28/09
Precast Installation Data	3 days	Wed 1/28/09	Fri 1/30/09
Precast Equipment Cost	3 days	Mon 2/2/09	Wed 2/4/09
Precast Space Impact	3 days	Wed 2/4/09	Fri 2/6/09
Structural Loads	3 days	Mon 2/9/09	Wed 2/11/09
Thermal Loads	3 days	Wed 2/11/09	Fri 2/13/09
Acoustics	3 days	Mon 2/16/09	Wed 2/18/09
Labor Affects	3 days	Wed 2/18/09	Fri 2/20/09
LEED	**20 days**	**Mon 2/23/09**	**Fri 3/20/09**
Create Questionnaire	5 days	Mon 2/23/09	Fri 2/27/09
Distribute Survey to Professionals	3 days	Mon 3/2/09	Wed 3/4/09
Gather Results	3 days	Wed 3/4/09	Fri 3/6/09
Create Report	8 days	Mon 3/9/09	Wed 3/18/09
Provide Report to USGBC	3 days	Wed 3/18/09	Fri 3/20/09
Concrete	**7 days**	**Mon 3/23/09**	**Tue 3/31/09**
Crane & Bucket Cost Data	3 days	Mon 3/23/09	Wed 3/25/09
Crane & Bucket productivity	3 days	Mon 3/23/09	Wed 3/25/09
Pump Cost Data	3 days	Wed 3/25/09	Fri 3/27/09
Pump Productivity	2 days	Mon 3/30/09	Tue 3/31/09
Final Report	6 days	Wed 4/1/09	Wed 4/8/09
Final Presentation	3 days	Wed 4/8/09	Sun 4/12/09



Weight Matrix:

Description	Critical Issue Research	Value Engineering Analysis	Constructability Review	Schedule Analysis	Total
Trade Stacking	10		20		30
Brick Facade	5	5	5	15	30
Concrete Placement		10	5	10	25
LEED	15				15
Total	30	15	30	25	100

D. Appendix 1 – Breadth Studies

Precast:

Breadths will be completed as part of the Brick v Precast Analysis. This analysis will look at several construction management related issues of utilizing an architectural precast brick façade instead of the traditional brick façade. With this new façade there are several breadth topics that can be researched. These topics include architectural differences, structural load differences, thermal conductance differences and acoustic difference. Architectural differences will not be looked at as a breadth.

Added Loads:

The use of precast panels will apply a different dead load to the structure of WestEnd**25**. This load will be calculated and determined whether the existing conditions can support the load. If extra support will need to be added the benefits of the precast panels are greatly reduced. It is anticipated that the existing structure will be able to support the loads of an architectural precast brick panel façade since the existing façade was also precast.

In order to complete this analysis the loads from the precast panels, gathered from manufacture, will be applied to the building. Calculation will be completed to ensure the structure will be able to carry the loads of the precast panels. The loads will be carried and checked to the foundation. No structural software will be used for this analysis.

Thermal Characteristics:

A change in the thermal characteristics of the wall may have a positive or negative effect on the residents. If the thermal resistances of the walls are reduced then the residence will have to pay more to condition their apartments. Therefore, changes will be computed to determine if there is load condition that is beyond the compactly of the mechanical system.

In order to complete this analysis the thermal characteristics of the wall will be gathered from a manufacturer. It will then be used to determine if the precast system will create a load condition beyond the capabilities of the existing mechanical system.

Acoustic Characteristics:

For a residential building the noise reduction characteristics of an exterior wall are extremely important. To analyze this condition research will be completed to determine the outside noise level in an urban residential environment and the desired noise level inside a home. Then this analysis will determine if the precast panels provide this reduction in noise.