

TECH 3

**TECHNICAL
ASSIGNMENT**

3



Grand View
AT ANNAPOLIS TOWNE CENTRE AT PAROLE

ANNAPOLIS, MD

Matthew Karle
Construction Management
Dr. Chimay Anumba
Friday, November 21, 2008



Matthew Karle
 Construction Management
 Faculty Advisor
 Grandview at Annapolis Towne Centre
 1915 Towne Centre Blvd
 Annapolis MD 21401

Technical Assignment #3

Table of Contents

- 1. Executive Summary..... 1
- 2. Project Manager Interview..... 2
 - a. Constructability Challenges..... 2
 - b. Schedule Acceleration Scenarios..... 4
 - c. Value Engineering Topics..... 5
- 3. Observations..... 6
 - a. Problem Identification..... 6
 - b. Technical Analysis Method..... 7

Executive Summary

TECH 3 is the opportunity to discover and define potential thesis topics that would be both interesting and challenging to analyze. The report is split into two main sections in order to help identify these potential topics. A project manager interview is performed in order to view the project as it was being built as the leader. Real problems and solutions are discussed that help to understand the building more as a whole. During this discussion, constructability challenges such as restrictions on delivery, constrained construction timeframes, accelerated slab pouring schedules, and poor manufacturer choices are explored. Because tenants and retailers are already leased out and expect to move in on a certain date, it is crucial that the project be completed on time. Accelerated schedule practices such as 10 hour work days with 6 day weeks help the project meet its fast approaching deadline. Other techniques include double shifts and 'parade of trades', which help to streamline production and keep the project on target.

Value engineering is something that almost every project team and owner strives for in order to save money and design a better building. In GrandView's case, a more schedule-oriented V.E. approach was taken in order to ensure that the owner knew and got exactly what he wanted. This also prohibited contractors the luxury of 'fudging numbers' due to uncertain material choices by the owner. There were a few other areas where V.E. was considered but never implemented, such as precast façade elements and green roof systems.

The final section of the report deals with observations and how they can be applied to future technical and management analysis of the building. Flaws or problems in the building construction or design are listed and discussed. In this section, key areas such as building envelope, acoustic design, re-design of architectural features, and superstructure are analyzed and goals for research are laid out. These guidelines will serve as the foundation on which the final proposal will be built off of.

Project Manager Interview

Constructability Challenges

Problems with constructability in the case of GrandView are more a scheduling and labor problem than that of any structural or mechanical glitch. There were no unforeseen conditions or errors in the design that the team needed to overcome. Most of the hiccups occurred in deliveries and scheduling conflicts. A short period of construction is the main source of the problematic issues that will be discussed in the upcoming section

In order to erect the concrete structure in the allotted timeframe, large one- day slab pours were necessary in order to keep the deadline. To do this, crews were brought on at 2:00 am to start the concrete placement using two simultaneous pumps. This allowed enough cure time for the column formwork crews to start working by 10:00 am. Long hours and hiccups in production combined with short timeframes proved to be quite overwhelming for some of the workers and the schedule was delayed slightly.

A poor choice of manufacturer led to the second big constructability issue. The façade of GrandView is very complex and has unique custom made GFRC (Glass Fiber Reinforced Concrete) cornices that run around the perimeter on every third floor. With such a large amount of prefabricated material, it would be assumed that a local large prefabrication manufacturer would be selected. However, in GrandView’s case, a small pre-fab plant which was located 4 hours away was chosen. Not only was distance an issue, they were also overwhelmed by the order and did not have the manpower of logistic capabilities to ensure prompt delivery and production time. As a result, Gilbane had to send a Project Engineer over to the plant once a week for 7 weeks in order to help out with production scheduling, delivery deadlines, and logistics planning. Without the work of the young engineer, schedules would have been drastically delayed which would have ultimately lead to loss of money.

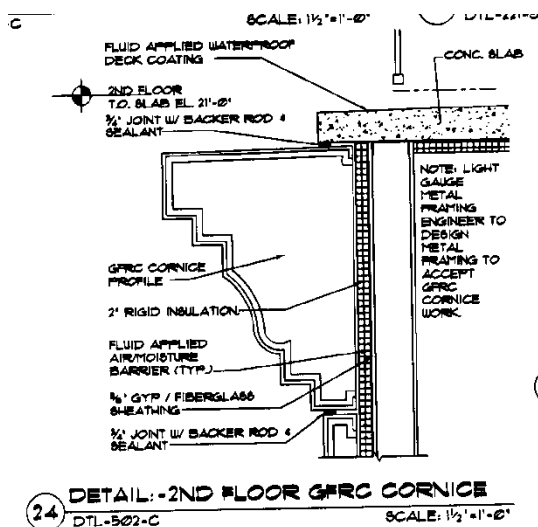


Figure 1: 2nd Floor GFRC Cornice Detail

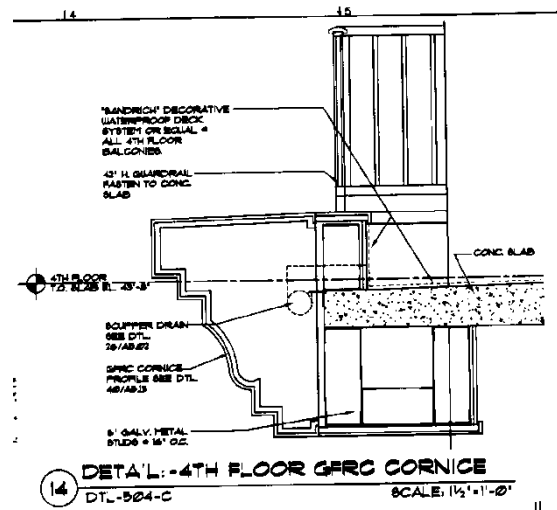


Figure 2: 4th Floor GFRC Cornice Detail

Since GrandView is only one part of the Annapolis Towne Centre, other buildings and stores around it will be completed at different times. The adjacent Target retail store and its early opening date posed another constructability issue that needed to be resolved. The deliveries to GrandView needed to be re-routed and work needed to be hidden from view of Target customers. Because of this, 53 ft. trailers were not allowed per Target's request. Therefore, logistic scheduling and deliveries needed to be performed between 3:00 am and 7:00 am. as well as on the weekends. To make planning even more difficult, Target needed to be notified 1 week in advance. To overcome this new obstacle, staff was needed onsite during the delivery times and extra scheduling was needed in order to ensure timely and proper deliveries.

There is often talk about a 'learning curve' and how it affects constructability. The new Henry air/moisture barrier system that GrandView was implemented is a new technology that no-one on site had yet to install. Therefore, the learning curve was much larger than that of a 'conventional' air barrier system. Since the façade is a major factor in the schedule, it was critical that the work was done on time. In order to complete this, laborers were working 10 hour days and on weekends. Plus, a third party inspector was on-site once or twice a week to check on the quality of the installation.

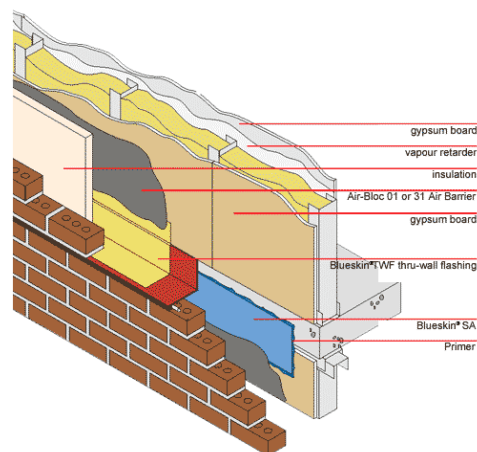


Figure 3: Henry Moisture/Air Barrier System

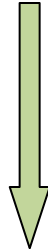
GrandView is unique in the fact that it is the largest project the owner has ever taken on. Because of its size and residential status a situation arose in which residential contractors are working in commercial conditions. This put extra strain on safety monitoring and common construction practices found in commercial industry. In order to deal with this situation, each worker was drug tested 3 days prior to being on site and was required to watch a 20 minute safety video and pass a short written test. Although these are small measures that still helped out in the long run.

While GrandView does not have much 'technical' constructability issues, management issues are plentiful. Streamline management is ultimately what will make or break the success of the project.

Schedule Acceleration Scenarios

The critical path of GrandView's project schedule is very generic for a residential building. However, because the lower section is designated for early commercial leasing, it had top priority over the rest of the building. The main critical path is as follows.

- Foundations
- Superstructure
- Moisture Barrier
- Façade
- Roof
- Finishes



There are just a few things that needed to be tweaked in the schedule that affect the critical path. First, a section of the southern façade needed to remain open in order to accommodate the material hoist for deliveries. Once the interior elevators were permitted for material transport, then the hoist could be disassembled. This left a large 13 story hole in the side of the building that needed to be closed before the interior finishes of that section could be started. The residential finishes started at the top of the building and progressively worked down and out as to reduce waste and ensure a clean work area. However, the top two floors (penthouse suites) were left unfinished until the end due to roof and pool leakage testing. This was done to protect any drywall or other finishes in the event that there was a failure in the roof's water-tightness. Therefore, the top two floors could not begin until the commissioning of the roof was completed.

Risks

The biggest risk to project completion time is the façade. With its intense details and time consuming barrier system, schedule management in this area was critical. Between the weather, site access, delivery of materials, and labor hours, an accelerated schedule needed to be implemented in order to make sure that the façade did not push back the completion date. Laborers worked 6 days a week and 10 hours a day to ensure that the completion did not fall to far behind. But as in any project this may not have been enough. A key area that has the potential to make up for this time lost on the façade would be finishes. Gilbane has reserved the option of working double shifts on the interior finishes. Although this would clutter some of the work areas, a 'parade of trades' method would be used to help reduce congestion.

The costs of these methods would obviously be overtime and some early delivery costs. However, it would ensure that the project is accelerated to its proper point and would help to deliver the project on time so that residence would not need to wait. If tenants were pushed back, a liquidated fee per day would be implemented by the owner.

Value Engineering Topics

The Value engineering process associated with GrandView is somewhat different than other similar projects. GrandView was a hard bid scenario, which means that after the winning bids were announced the owner, Gilbane, and the contractors held multiple meetings to fully understand every scope of the project. During these meetings, the owner was asked what certain areas he wanted to focus on. In Grandview's case, the owner opted to have the most high end finishes in the common social areas while downgrading finishes in other less used areas.

These meetings definitely eliminated any grey areas in the scopes of work so there was no 'Fluff' in the numbers that the contractors provided. In the long run, this saved money and helped build necessary relationships between the owner and Gilbane, which eased the communication and decision process.

Two main systems that were Value Engineered were the addition of single unit HVAC (Magic-Pak) and PEX plumbing systems. Although the material is more expensive than the common systems used today, large amounts of time were saved due to the ease of installation and flexibility of the systems. PEX plumbing systems are extremely easy to install because of its flexible tubing and the fact that it has minimal labor time put into connections. Single unit HVAC systems allowed smaller amounts of duct work to be installed and eliminated penetration coordination between units. This system also allows tenants better control of the climate in their dwelling.

Although there were not many Value Engineered areas of GrandView, I have compiled a list of some areas that were analyzed yet never put into commission:

- Addition of a Green Roof terrace: The thought process was that with the addition of the terrace, insulation properties as well as a water retention system could be implemented. However, through further analysis of the structural system, this proved to be inefficient.
- BIM was talked about in the early stages of design to help with clashes in the mechanical and structural portions of the building, thus eliminating schedule delays. However, with the introduction of single unit HVAC systems and PEX plumbing, there was almost no need for detailed clash detection due to the ease of installation and flexibility of these systems.
- Pre-cast façade units were discussed in order to save money on installation costs. However, the owner did not like the idea of large panels and preferred the more detailed approach. This may have saved money but the owner has priority over material selection.

Observations

Problem Identification

Coordination is very important on the GrandView site due to the fact that it is shared by multiple CM firms with multiple jobs all being built simultaneously. Laydown space, traffic logistics, crane operation times, and utility planning are all just part of some cohesive elements that must be considered when constructing in what is to be the Annapolis Towne Centre at Parole.

Some problematic features that can be seen in the GrandView Project are the following:

- Crane swing coordination with adjacent residence building and picks
- HVAC acoustic vibration transmission
- Normal window systems detract from high quality envelope system
- Site logistics are poorly planned and not cohesive to the site growth
- Trouble with cornice erection time and bracket system
- Slab hanger coordination with HVAC systems below
- Penthouse Finishes and Roof Leak Detection
- Section of façade needed to be left open in order to accommodate material hoist
- Extreme façade detail and long man hours require excessive funding
- Acoustic barriers between residential and commercial sections of the building
- Labor intensive air and moisture barrier compared to normal barrier systems
- Unused space under the massive cupola domes
- No use of post tension concrete slabs creates more confined spans

There are some areas of the building that I wish would have been more problematic so an analysis could be done on them. For the most part, the structure was excellently designed. Trade work was logically planned out and implemented a highly effective use of 'parade of trades'. The plumbing system is extremely new, highly flexible and easy to install (PEX and Manibloc Plumbing). The following section discusses the most influential and promising analytic problems.

Technical Analysis Methods

LEED Analysis

GrandView has implemented a very high cost and efficient moisture and water barrier system coupled with highly efficient insulation. By doing this, the building will be able to save on heating and cooling costs in the future as well as prevents any damaging water infiltration. However, standard windows were used in the envelope, which lead me to wonder why go through such lengths with the façade when windows are the most energy conscious element of a building. I intend on running a cost benefit analysis of higher efficiency windows, since the windows make up a large percentage of the façade and the fact that large full height glass curtain walls are in every corner bedroom. Contacting window retailers and researching U-factors will be the primary basis for the analysis. Heat transfer and retention of spaces will also be calculated.



Figure 4: Curved Glass Facade

Site Logistics

As each phase of construction changes, so should the site layout plan. In order to obtain maximum efficiency with deliveries, construction, and waste removal, a site plan should implement all necessary aspects of each phase to accommodate its new setting. An analysis of each critical phase of GrandView may prove highly beneficial when dealing with site logistics and production. The layout for superstructure, building envelope closure, and finishes will all be taken into account and designed for maximum layout room and efficiency. Multiple layouts will be designed for each phase and sent to project managers for feedback on which is the most logical and efficient. An additional 4d model will also be created to show movement of trades and deliveries as the project progresses.

Acoustical Analysis

Residential complexes put an emphasis on privacy and noise reduction. Living in such close proximity to each other requires certain mechanical measures that would otherwise not be needed. An example of this would be wrapping each electrical box and plumbing penetration in vibration-reducing putty in order to eliminate sound transmittal. There is also the fact that each unit houses its own HVAC (Magic-Pak) System in 'the bedroom' of all places. In order to reduce noise, a large amount of noise reduction and insulation was needed in order to ensure proper decibel levels. An analysis of how a multi-unit, single floor HVAC system would impact cost savings on vibration control and duct installation will be carried out. Research in the field of heating and cooling units would be done by contacting multiple manufactures and asking for specs and guidelines for residential installation.



Figure 5: Magic-Pak HVAC unit in Bedroom

Prefabricated Glass Fiber Reinforced Cornices

While visiting the site I noticed that there was an extraordinary amount of pre-fabricated cornices that needed to be attached to the façade at almost every third floor. With such a large perimeter and the fact that the sections were relatively short in length, a large amount of man power was needed. I also was told that the hanging brackets used to mount the cornices were pre-installed in the façade prior to the GRFC's arriving on site. This proved to have major coordination issues because they did not always line up or some were just missing. The manpower that was needed to correct these situations could be drastically reduced if the brackets were installed in the prefabrication process and delivered to the site

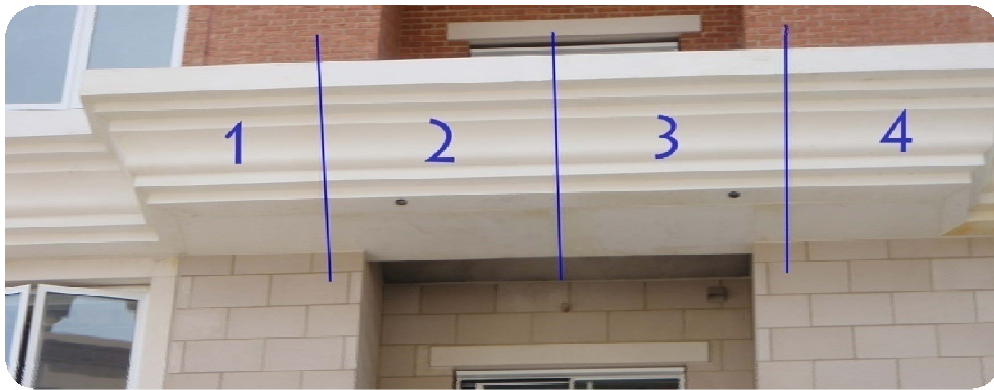


Figure 6: Cornice Detail and Section Length

as-built. I would like to look into a system that would allow easy installation of the cornices to reduce the man hours that were wasted trying to correct pointless installation errors. In order to do this, research would need to be done in lightweight pre-fab concrete as well as the bracing system used. 3D models of how each piece would be installed would most likely be the best way to depict the design process. The main tools in this area of re-design would be Autocad and VIZ, which will hopefully be later introduced in video format in the final presentation.

Post-Tensioned Concrete Slabs

Post tensioned concrete slabs allows for longer and thinner spans. It is my intention to look into how much the building could be reduced in height in order to save on material and labor and how wider spans would help in the design of the interior space and flow of production. In order to do this, a structural analysis would need to be done in order to determine feasibility and cost. Although this is an area that I would love to look into, I was told that the structural engineer on the project is highly efficient and very good. However, it never hurts to look into it anyway.