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Murur Mixed Use Complex
Ajman, United Arab Emirates

Technical Report 3

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Project Team:

Owner: Ajman Traffic Department
A/E: AJ Design
G/C: Ali Moosa & Sons Contracting
HVAC: AMS Contracting-MEP Division
Super-Structure Designer: Freysinnet
Landscaping Works: Lea

The Buildings:

The project has a shopping mall and 2 towers
The residential tower is 20 floors + penthouse
The office tower is 26 floors
The shopping mall is 3 floors
Total parking spaces are 1,357 spaces
3 Basement Parking + 2 upper level parking

The Project:

History: The Site was previously occupied by Ajman Traffic Department, and this is where the name comes from, since Murur means Traffic.

Size: 2,300,000 Square Feet

Delivery: Design-Bid-Build

Cost: 600 million AED = 164.4 million USD

Structural and MEP Systems:

Structure: Reinforced Concrete Building, 280 mm slabs, columns range from 300 mm to 1600 mm

Foundation: 2000 mm thick R.C.C. raft on friction pile foundation

MEP Systems: Power delivered by FEWA at 240/415V, 3 phase, 4 wires, 50 Hz.
Chilled water HVAC system



A. Executive Summary:

Technical Report 3 addresses the areas of the project that are good candidates for further research. Alternative methods, schedule acceleration, and value engineering ideas are to be investigated through the report.

The first part of the report is based on an interview with the project planning engineer of Ali Moosa and Sons Contracting. Several topics were discussed during the interview concerning major challenges and implemented solutions on the Murur Complex project.

The first issue discussed was Constructability Challenges. The planning engineer mentioned the top three challenges that they have faced, or are facing in the project, and how they overcome those challenges. The three challenges were:

- a. Project Coordination
- b. Fast Track Material Storage
- c. High Water Table

The second topic was about schedule acceleration. With the structural work and the interior work being on the critical path of the project schedule, the best way to accelerate the project is by increasing the required resources to meet the target. Value Engineering was the last topic the planning engineer talked about. With no limited budget from the owner, value engineering was not taken into consideration.

The last two parts of the report are about my observations on the project. The first section was the problem identification and the second section is about developing analyses that address the problems in the last section. The identified problems are:

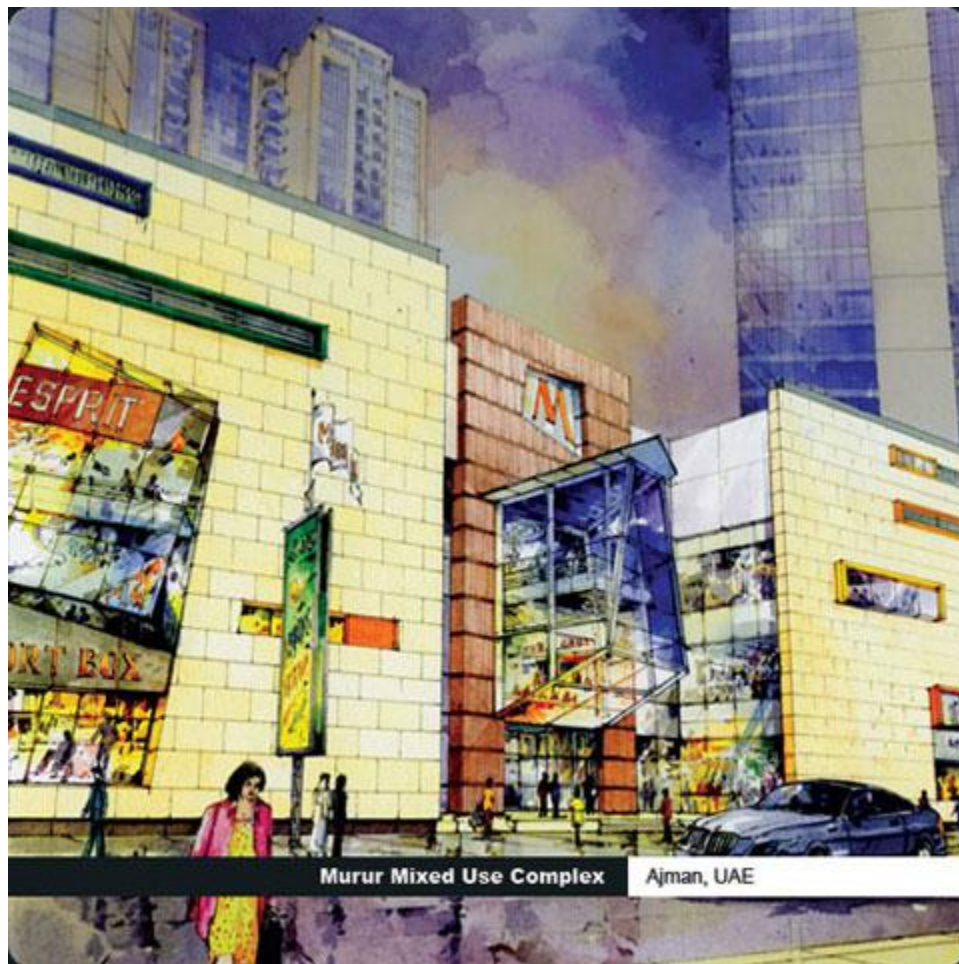
- a. Energy Efficiency
- b. Safety and Material Delivery
- c. Structural System

B. Constructability Challenges:

There is almost no project that gets constructed without any constructability challenges. The larger the project is, the more challenges there are for each member of the construction team.

The top three constructability challenges in the Murur Mixed-use Complex are:

- Project Coordination
- Fast Track Material Storage
- High Water Table



1. Project Coordination

The Murur project is a very complicated job since it's a mixed used development project. Various facilities are within the boundary of one project, which makes project coordination among various departments working on the job like the design consultant, the supervision consultant, and the sub contractors is the one of the top challenge for Ali Moosa and Sons. More than 100 subcontractors are already working on the project along with the general contractor, Ali Moosa and Sons, and it that number will increase as the work advances. Ali Moosa and sons are using a special team of engineers as well as specialist subcontractors to execute the job by crafting all the amenities to perfection.

Dividing the construction site into different stages is one of the most effective ways to help coordinate and arrange the work between the different contractors working at the same time on the site. **Figure 1** shows the staging of the Mall area floors in the Murur Complex. Ali Moosa and Sons adopted staging throughout the whole project to ensure better coordination between different trades and a smoother job overall.

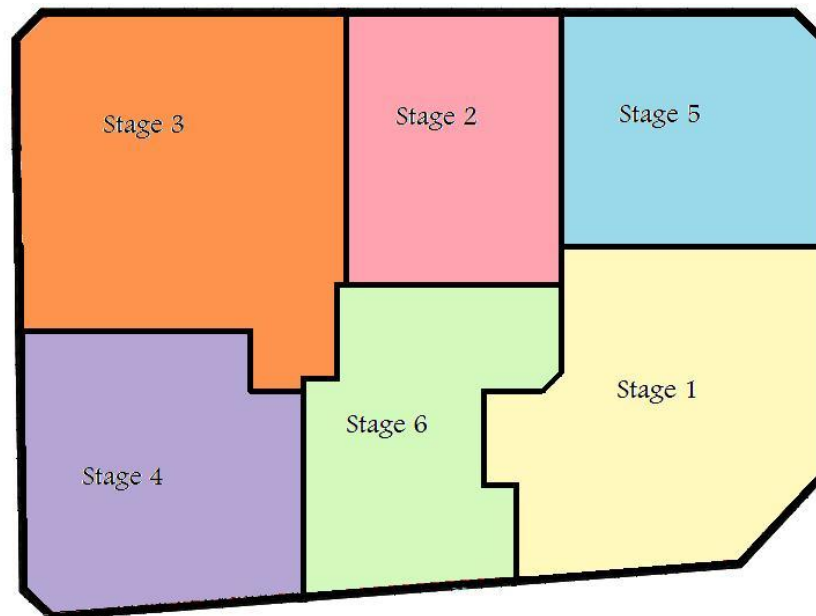


Figure 1. Parking and Shopping Mall Staging Plan

2. Fast track material storage

The Murur Mixed-use Complex is located in the heart of Ajman city, and surrounded by populated area and with major roads all around the construction site. In such cases, the construction of a high-rise tower is always a challenge for the contractor. The biggest challenge for Ali Moosa and Sons in this particular aspect was the material storing yard for the project. Since the Murur Complex is a fast track project, the contractors need to have all required material on regular basis on time in order to ensure the project to be on schedule. Storing yard cannot be far away from project site, because all bulk item need to carry on big trailers. Since the project is located in a high populated and heavy traffic area, the movement of trailers is only allowed during specific times, which may adversely affect the progress.

Luckily, Ali Moosa and Sons was able to get a plot adjacent to the project location on the other side of main road (**Figure 2**). The plot is rented for the entire duration of the Murur project construction. This plot will resolve the material storing problem and will allow an easy and fast access to the material whenever it is needed by the contractor.

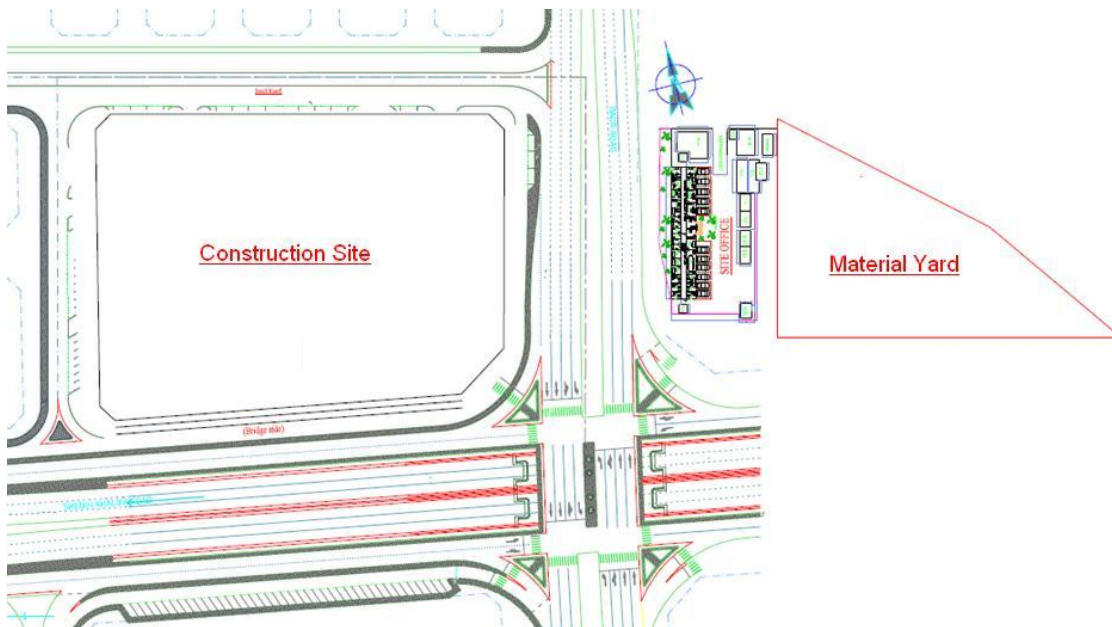


Figure 2. Material yard across the road

3. High water table

In United Arab Emirates, water table is generally high and soil has a low bearing capacity, which is also the one of the biggest challenges for any contractor to proceed with foundation design and work execution. Water table at the Murur Mixed-use Complex site is around 2 Meters below ground level, that is only 6.5 Feet under the ground. Murur Mixed-use Complex has 3 basement car parking level which is around 12 Meters (40 Feet) below the ground. The contractor carried out the dewatering for around one and half year and R.C.C shoring piles were used in order to protect the side earth from falling during the foundation work. The foundation consists of around 851 piles and 2000mm thick heavy reinforced cement concrete raft over it.

C. Schedule Acceleration Scenarios:

The large size of a construction project can be either beneficial or harmful to the original construction schedule. Delays caused by 1 mistake, or 1 late material arrival, can be very harmful and cause a big delay on the completion date. But time can also be saved on large construction projects since many different activities can be going at the same time to accelerate the schedule.

The critical path of the Murur Mixed-use project passes through the structural work of both the Office and the Residential towers, external cladding works, and interior works. The project is currently running ahead of schedule of works. The project planning engineer says that there are no big risks to project completion date. The only risk possible will be if any delays occur to any of the activities that are on the critical path of the project.

The key areas that have potential to accelerate the schedule if needed are internal finishing works for both towers and the shopping mall. And the cost of the acceleration would be within the budgeted cost, by increasing the required resources to meet the target.

D. Value Engineering:

Value Engineering is a main key to increase the value of the project without adding any cost, or to decrease the cost of the project without lowering any of the required standards.

As far as value engineering in the Murur Mixed-use project, the project planning engineer says that none of the items used in the project were considered under value engineering. This project has a scenario that is totally different. Since the client has somewhat of an open budget, getting the project done with certain standards within a limited budget is not an issue that the engineers or the designers have to face.

One of the items that I consider is an item of value engineering is the double glazed windows used all over the project which has a great effect in insulating the extreme heat from the indoor building areas. The project uses excessive glass exterior and if energy efficient type of glazing was not used it could affect the indoor comfort severely.

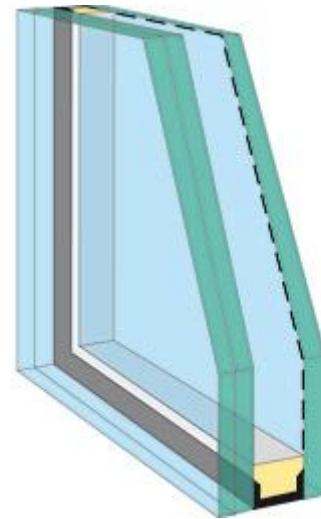


Figure 3. Double glazed window

E. Problem Identification:

- Energy Efficiency:

While there are many opportunities nowadays to save on energy in many aspects of each building, the Murur Mixed-use Complex has barely taken advantage of any. With the project located in a very hot climate area, it is very beneficial to take advantage of any possible way to reduce any wasted energy.

- Safety / Material delivery

With the project located in the heart of Ajman city, and with the heavy pedestrian and vehicular traffic around the site, it is extremely important to take every safety procedure into consideration. The Murur project is huge and any small mistake could result in hurting many workers and public around the site.

Murur Mixed-use Complex is located in the heart of the city. With heavy traffic during regular hours, larger delivery trucks are only allowed to access the roads in a short period of time during the night. This could cause delays in delivering needed material and possible delays in the project schedule.

- Structural system:

The structural system of the Murur project is on the critical path. The whole structure is cast in place concrete. Cast in place concrete requires a long time to cure not allowing additional work to be done until it reaches acceptable curing levels. Any problem with any of the concrete bays could risk delaying the project schedule.

F. Technical Analysis Methods:

- Energy Efficiency:

- a. The Murur project is located in a region of the world that is sunny almost all around the year. With so many sunny days, and with the high intensity of the sun irradiance, solar panels would be a great way to generate clean energy. Solar power systems still has a high initial price, but with the high sun irradiance in the United Arab Emirates, the payback of the system can be shorter than anywhere else in the world.

I will start my analysis by researching solar panels, I should first know how much energy they produce and what is the cost of the solar panel system and what are the parts of a complete system. Secondly, studying the climate and the sun in the United Arab Emirates will help me know how much energy a system can produce in such region. Cost and energy analysis should be completed to know if the system is worth installing.

- b. Solar shades are another way to reduce the heat entering the building from direct sunlight. With windows all around the buildings, heat can be gained all day long and it will cause discomfort to the tenants of the buildings. This will also dive the energy bill up since more cooling is needed to keep the indoor area at the desired temperature.

This method will require calculating the amount of heat that could be gained from the direct sunlight all year long. Researching the sun angles at all directions of the buildings should be done to accurately know where solar shades are required and most effective.

- Safety / Material delivery:

Safety is one of the biggest concerns of any job. No one wants any of the workers or public to get hurt or possibly lose their lives. Material delivery and unloading can be one of the most dangerous activities on a job site since it includes trucks and material which are outside the construction site perimeter, and cranes which are moving over the heads of many lives carrying tons of material.

I will be researching what are the best ways to increase the safety standards, and how to do so without affecting the project schedule or changing the cost. Some of the ideas to achieve that are by increasing the manpower at certain times when there is less public traffic, or using different locations of delivery and unloading.

- Structural system:

With the structural system being on the critical path, changes may reduce the required time to complete the job and save the owner time and money.

I think that the most effective change in the structural system of the Murur Complex is to change the cast in place slabs of the parking floors and use precast concrete instead.

The analysis should begin by researching precast concrete for parking decks and see if they meet the requirements of the Murur project. Calculating the time saved and probably the cost saved on the project will be the next step to see how effective this change is.