



**TECH REPORT 2
SANTA ROSA JUNIOR
COLLEGE STUDENT
CENTER**

Cost and Schedule Analysis

**Dan Vallimont
2009 SENIOR THESIS**

TECH REPORT 2

SANTA ROSA JUNIOR COLLEGE STUDENT CENTER

EXECUTIVE SUMMARY

Mobilization for the Santa Rosa Junior College Student Center began in December of 2007. Work on the geothermal field was the first thing started on the project followed by excavation for footings, structural steel placement, along with slab on grade placement. This work was completed in September of 2008 and was followed by exterior envelope construction which was completed in December of 2008. The exterior envelope construction was followed by framing, interior finishes, landscaping, and irrigation which is scheduled to be completed in late November of 2009 (originally September but the project was delayed about 2 months). The SRJC Student Center is schedule to be completed on November 24, 2009, and be ready for students for the 2010 spring semester.

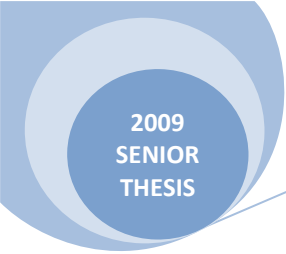
The construction sequence on the building flows from east to west in three different sections. Construction begins on the East Building section and then moves to the Center Building section and ends with the West Building. Clean and punch is scheduled for November 24, 2009 and the building turnover will be just in time for the Spring 2010 semester.

This technical report contains a site plan for the superstructure phase of construction. The plan shows locations of the two construction entrances, material storage locations, office trailers, crane location, and many other items that make up this phase of construction.

The structural system of the building costs about 3.5 million dollars and \$52.52 per SF. The estimate for the SRJC student center comes from RS Means Costworks and the unit costs have been adjusted for time and location. The complexity of the center made it nearly impossible to do an entire takeoff, so the estimate is based on a typical bay in the center and is then multiplied out through the rest of the building.

The general conditions estimate is derived using RS Means Costworks. While being given very limited information I was able to put together the most accurate general conditions estimate possible. Where information is lacking, general assumptions are made. The prices obtained are adjusted for time and location. Although I am unaware of what the exact estimate obtained for the project was, I am confident in the effort put forth on this estimate with what information was given.

The PACE Roundtable began with a dinner on Wednesday night and continued on Thursday with discussion about the state of the construction industry, communication patterns of the “now” generation, continuous personal growth, and breakout sessions highlighting energy and the construction industry, business networking, and building information modeling (BIM). Overall the roundtable seminar was a great experience that I was able to come away from with a great amount of knowledge and useful contacts from the industry who may be able to help me in the future with my senior thesis project.



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DETAILED PROJECT SCHEDULE

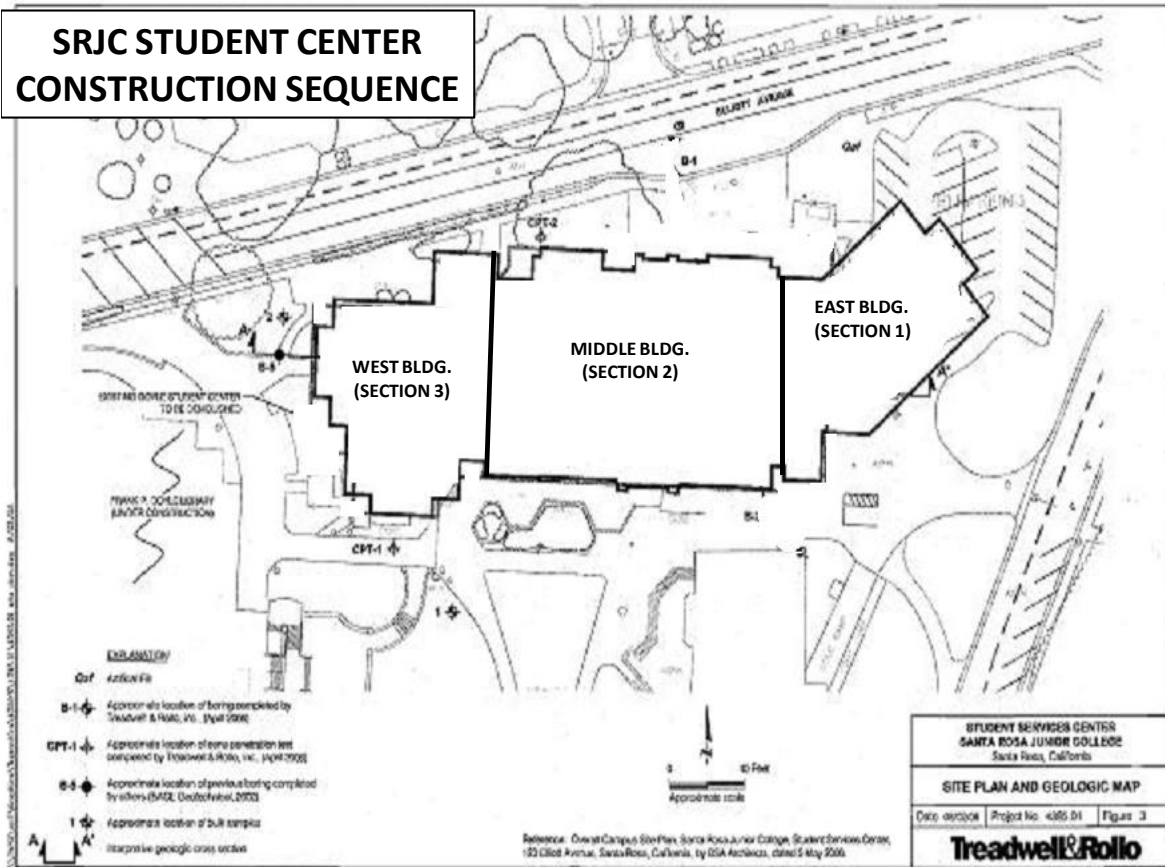
Summary of Schedule:

Construction on the Santa Rosa Junior College Student Center began with the Notice to Proceed which was granted on December 7, 2007. Mobilization soon followed on December 13 of 2007. After mobilizing work began on setting structural concrete, steel, SOG's and metal decking. Construction throughout the project was set up in three phases (East Building, Middle Building, West Building). Construction started on the east side of the site and finished up on the west. Work on the building began with excavation for footings and grade beams and was followed by placement of embeds, rebar, anchor bolts and finally inspection before the placement of concrete. Next steel columns and beams were set in place by the use of a mobile crane where they were then plumbed up and welded in place. Following the columns and beams was the erection of stairs and placement of metal decking. After the placement of steel the SOG was formed, reinforced and poured. Construction then moved to the second and finally third floor where concrete slabs were placed on metal decking. This process of setting steel and pouring concrete for the East Building section was completed in June of 2008. The Middle and West sections of construction which started while construction was still being done on the East section would finish in October and September of 2008 respectively.

Once the steel and concrete placement was completed, work then moved on to the exterior envelope of the SRJC student center. The sequence of work would again move in three sections from east to west. Envelope construction began on the second floor and then moved to the third floor before coming back to finish the first floor up last. Exterior envelope construction began in June of 2008 and was completed successfully in December of the same year. Framing/Rough-in was next on the schedule followed by interior finishes, fixtures, and trim. This work is scheduled to be done November 24, 2009 which would allow the student center to open its doors to students and faculty for the first time at the beginning of the 2010 spring semester at SRJC.

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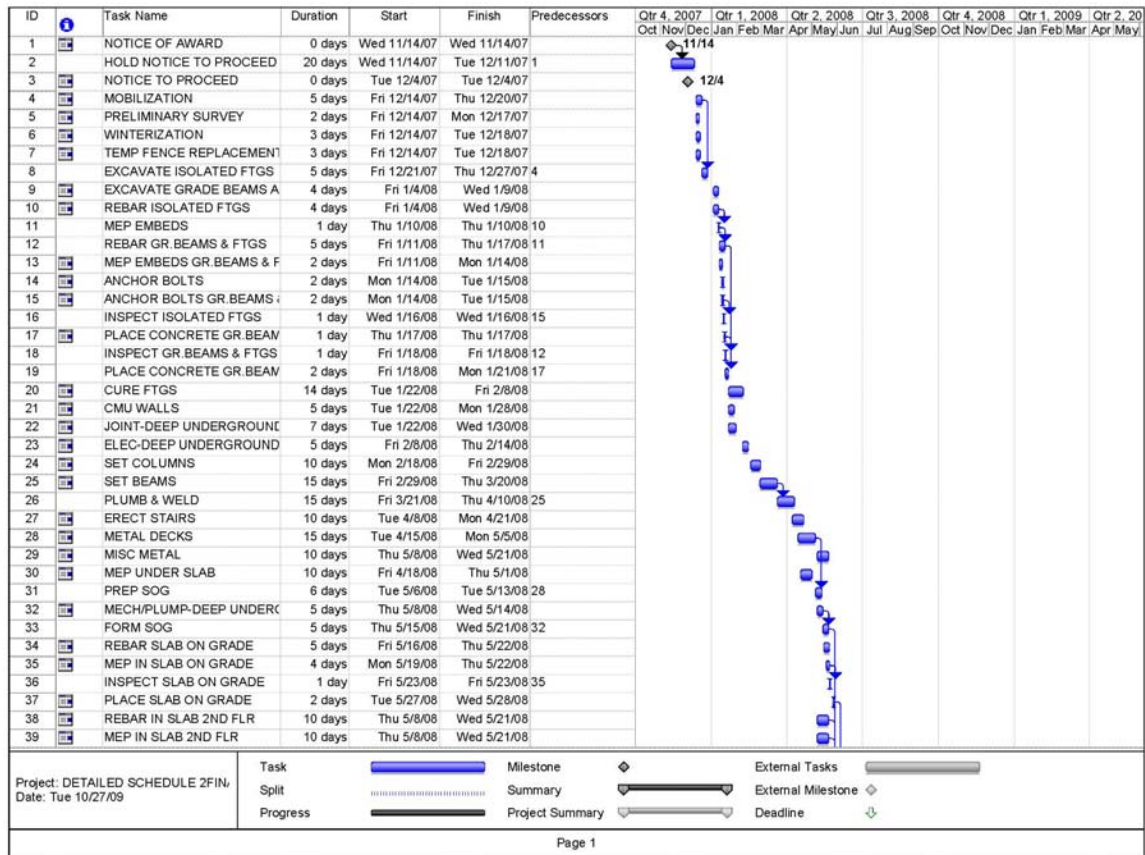
This image illustrates the construction sequence of the student center. Work began at the east side of the building and worked across to the middle and finally west side (right to left on site plan).

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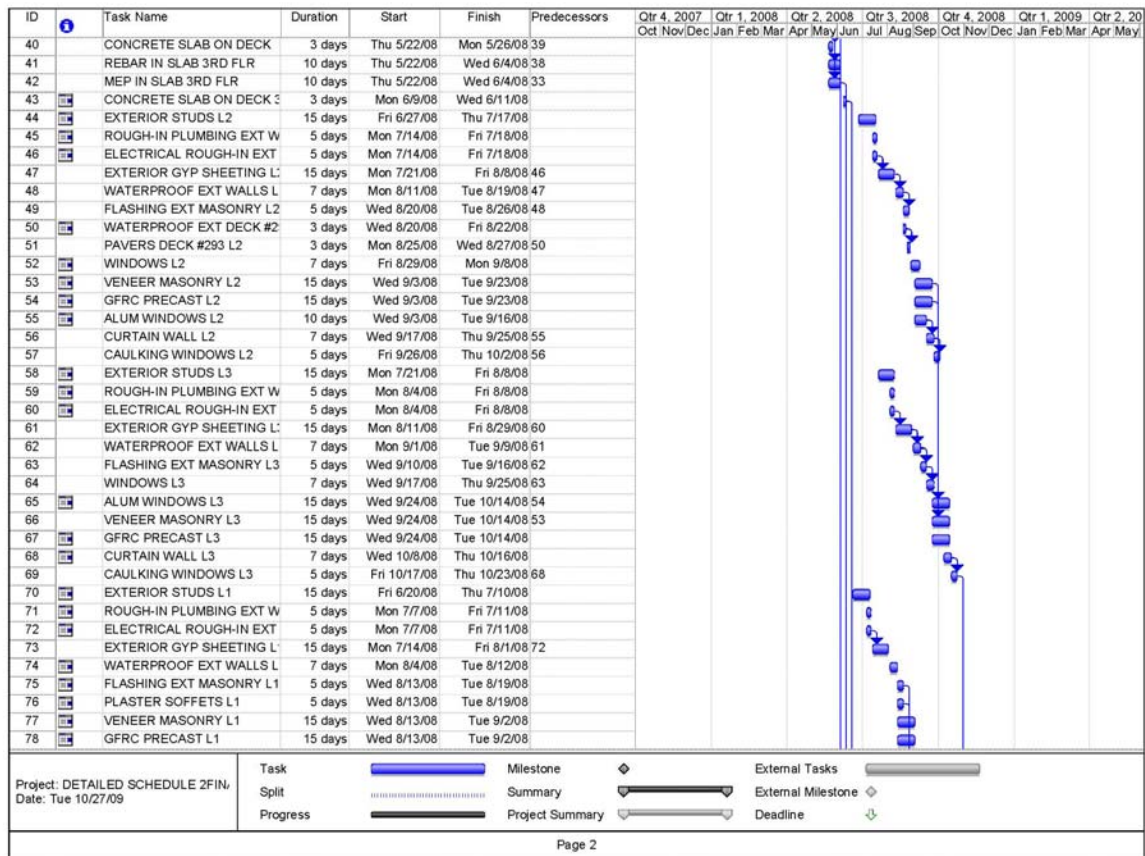
Detailed Project Schedule:

The detailed schedule that I put together for the SRJC Student Center focuses on one of the three sequences of construction on the building. All of the activities and durations are taken from the East Building (section 1) part of the schedule. The middle and west parts of the schedule contain nearly identical activities and are only a few months behind the East Sequence, which was the initial sequence of construction.



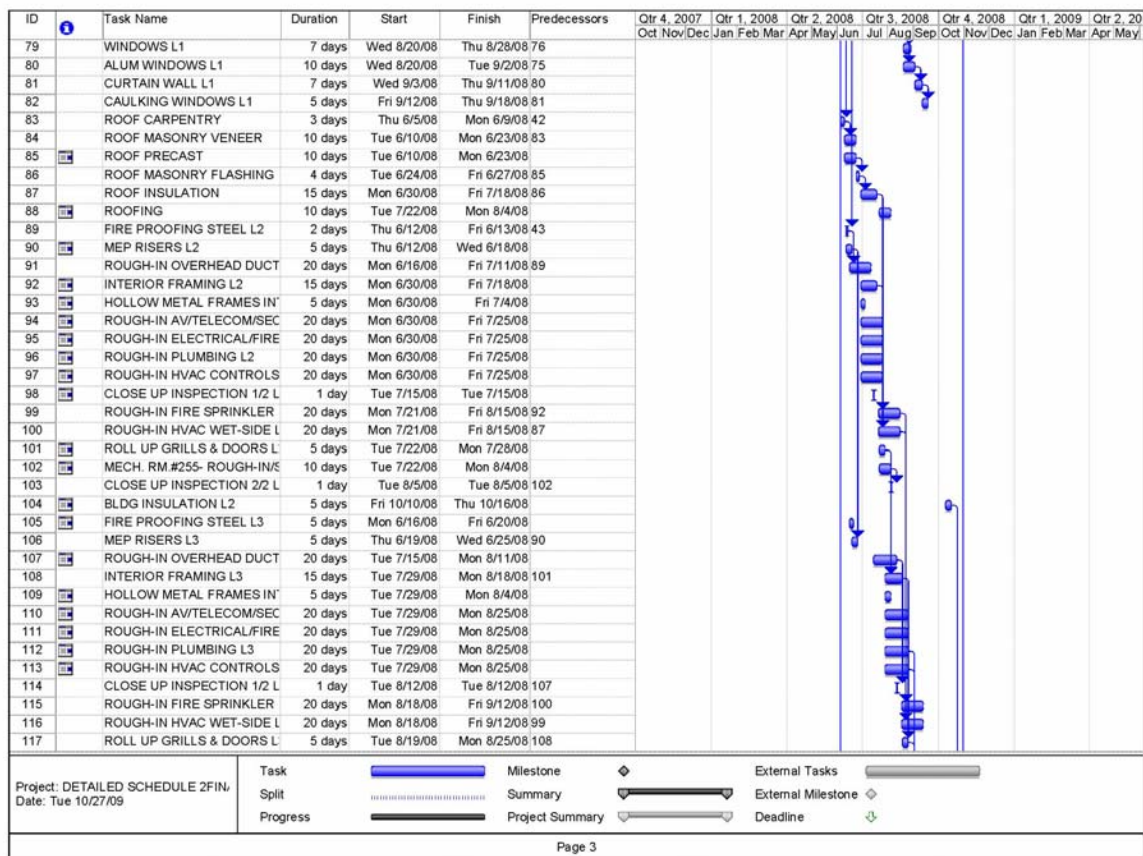
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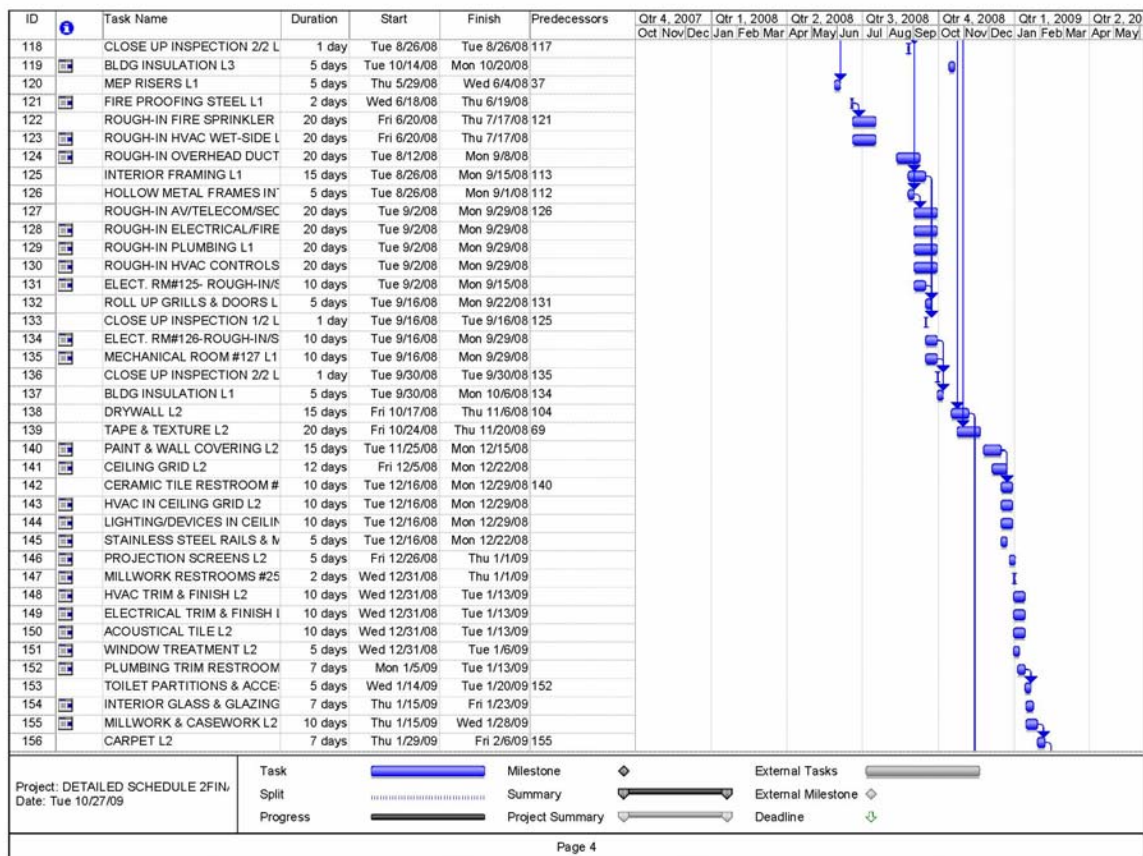
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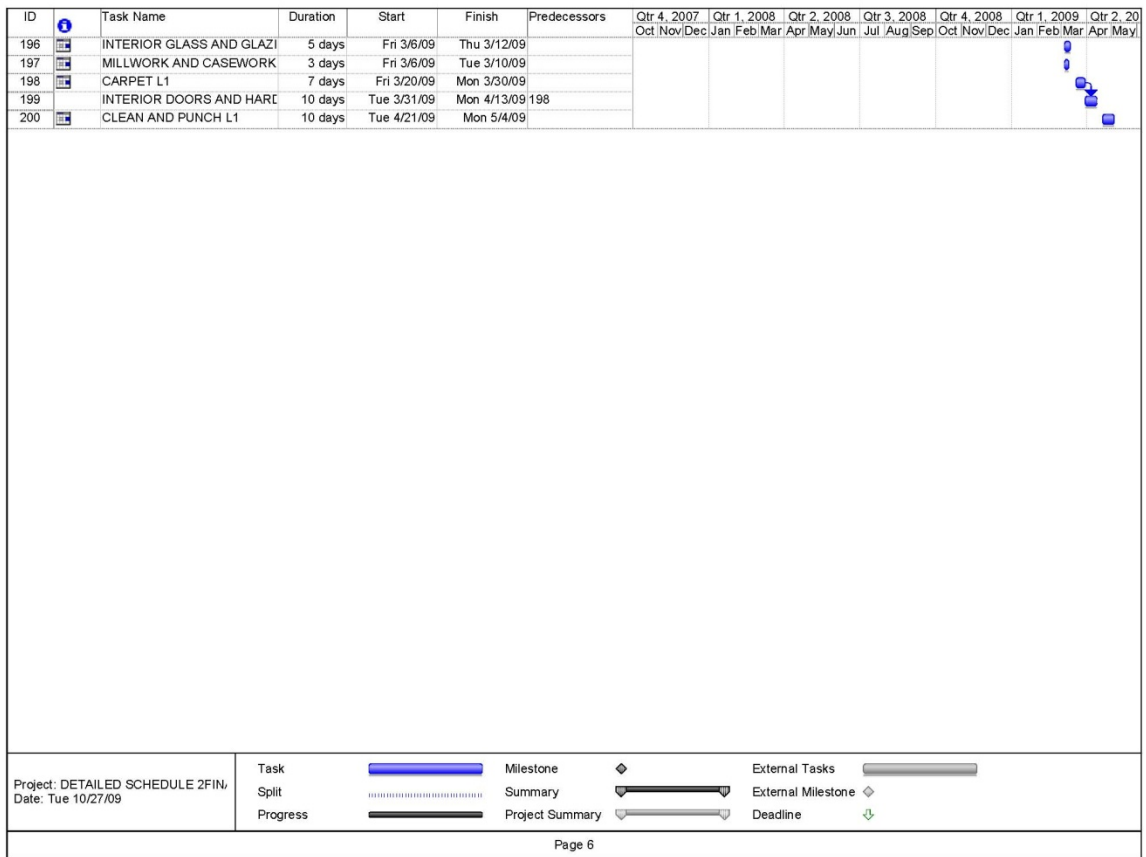
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SITE LAYOUT PLANNING

Summary of Site Layout Plan:

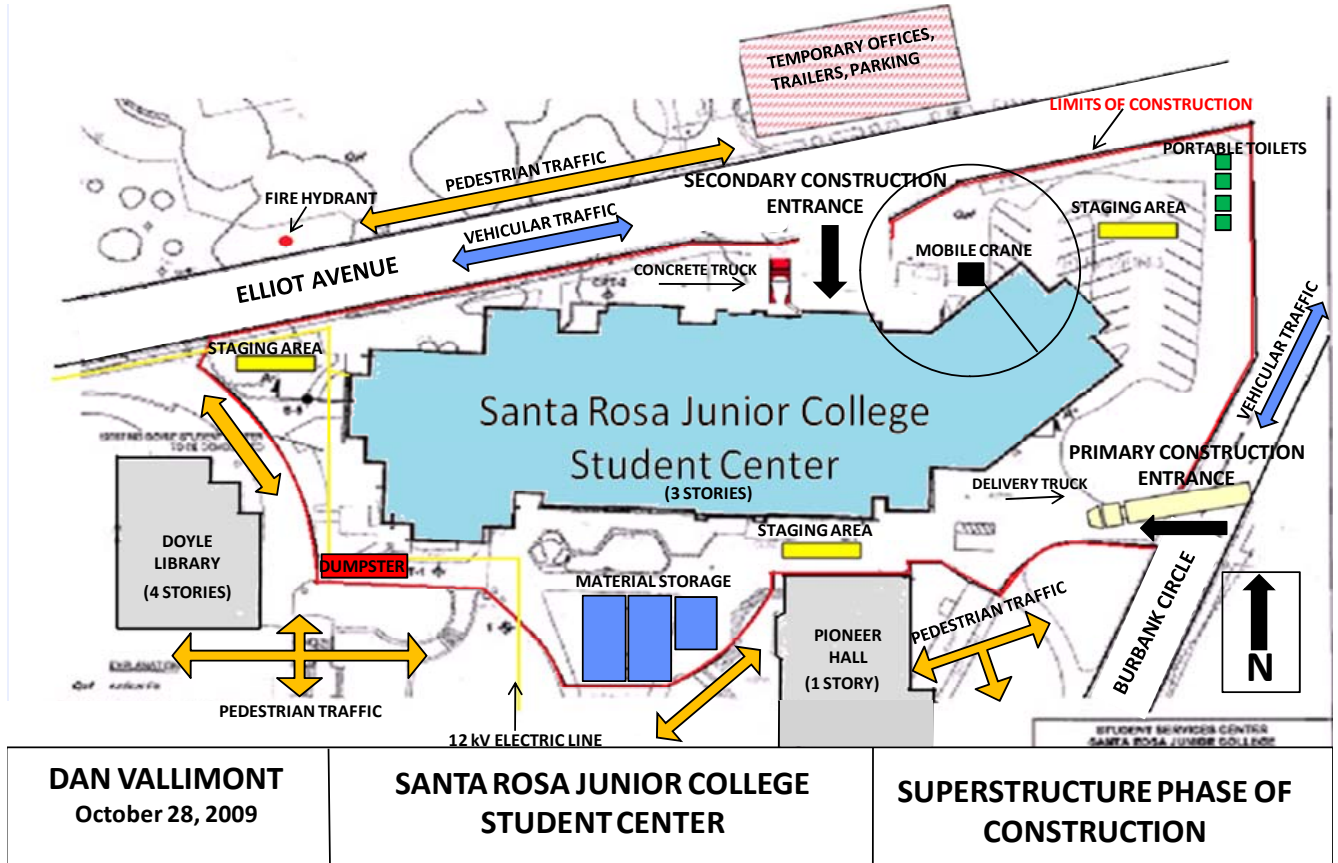
The construction site has two entrances, the primary entrance being located on Burbank Circle on the east side of the site, and the secondary entrance being right off of Elliot Avenue on the north part of the site. The primary entrance will continue to serve as a permanent entrance once construction is completed at the end of November 2009. Job trailers are located off site, across Elliot Avenue due to the limitation of space on the actual site. Portable toilets can be located at the north-east part of the site near the corner of Burbank Circle and Elliot Avenue. The main dumpsters are located in the same area as the job trailers but there is also a dumpster located on site for easy accessibility. The student center construction site has three main staging areas located in areas that are easily accessible by the crane or forklifts regardless of what part of the site they are working on at that time. These staging areas are located at the east, south, and west locations of the site which makes sense due to the fact that construction takes place in three sequences, each sequence basically having its own lay down area for materials. A single mobile crane was used to erect steel and worked from east to west erecting steel in sequence with the rest of construction. Material storage trailers are located on the southernmost part of the site, out of the way of construction. Although the site is small in comparison to the size of the student center, it does not pose any problems logistically. Everyone on site has plenty of room to move around the site without getting in anyone else's way. This is an amazing fact in itself considering the constant traffic of students and other pedestrians on all sides of the site.

Evaluation of Contractors Layout Plan:

Overall I think that the way that the site was laid out was a success. I do not believe that there is any better way to lay out so much on such a small site. The contractor was able to do this successfully while keeping delays to a minimum. One thing I would have changed if granted more space for the site would have been to have the job trailers and dumpsters located on site for easier accessibility. Due to the small site though, an empty lot across Elliot Ave. offered the best alternative. Overall I believe that the way the site was laid out has offered for a successful project that could not have been handled any better. This success will be evident when the project is completed in the upcoming month.

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The image below was taken during the phase of construction that is illustrated above by the site plan.



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DETAILED STRUCTURAL SYSTEMS ESTIMATE

Detailed Structural Estimate Summary:

The estimate performed below was done using RS Means Costworks and represents the structural system estimate of the Santa Rosa Junior College Student Center. The estimate includes foundation, footings, Slabs, decking, and structural steel. Although a full takeoff for the structural steel would have been ideal, I was forced to resort to estimating a typical bay in the building which was repeated throughout the entire structure. The reason for this was due to time constraints and the complexity of the project. Upon asking the project estimator for advice on alternatives I was met with the response of:

“We would never try to do a complete takeoff (going through the plans and counting everything) on a building the size of Bertolini. Especially with steel, the estimates are way too complicated for a general contractor to do accurately in house. You would need to figure in the number of bolted connections (cheaper) vs. welded, all of the miscellaneous bracing, stiffener plates, etc...plus adding up all of the beams, columns, and brace frames.”

Upon receiving this response I decided to go with the typical bay estimate method and then multiplied my findings out through the rest of the building. Although it is not as detailed as a full takeoff it is still a good representation of the structural estimate on the Bertolini Student Center at SRJC.

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Images of construction of structural system of SRJC student center:



Left: workers placing formwork for an early concrete pour



Right: Immediately after concrete has been placed



Left: Erection of steel columns by use of mobile crane

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Assembly Detail Report

Year 2009

Prepared By:

DAN VALLIMONT

Date: 28-Oct-09

DETAILED STRUCTURAL ESTIMATE

psu

Assembly Number		Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
10 Non-CSI						
10201241255	U	Concrete Reinforcement	40,000.00	L.F.	\$0.00	\$115,000.00
10 Non-CSI Subtotal						\$115,000.00
A Substructure						
A10102102200		Spread footings, 3' - 0" square x 12" deep, 3 KSF soil bearing capacity, 25 K load	24.00	Ea.	\$199.42	\$4,786.08
A10102104800		Spread footings, 9' - 6" square x 24" deep, 3 KSF soil bearing capacity, 250 K load	15.00	Ea.	\$2,364.57	\$35,468.55
A10102105600		Spread footings, 12' - 0" square x 28" deep, 3 KSF soil bearing capacity, 400 K load	15.00	Ea.	\$4,535.30	\$68,029.50
A Substructure Subtotal						\$108,284.13
B Shell						
B10102084600		Steel column, W10, 200 KIPS, 10' unsupported height, 45 PLF	1,200.00	V.L.F.	\$108.94	\$130,728.00
B10102085000		Steel column, W12, 200 KIPS, 20' unsupported height, 58 PLF	2,995.00	V.L.F.	\$118.00	\$353,410.00
B10102087000		Steel column, W12, 600 KIPS, 10' unsupported height, 120 PLF	1,130.00	V.L.F.	\$271.54	\$306,840.20
B10102251500		Floor - ceiling, concrete slab, 4000 PSI, reinforced, 7" thick, no columns	20,000.00	S.F.	\$26.00	\$520,000.00
B10102411600		W beam and girder, 20'x15' bay, 40 PSF superimposed load, 14" deep, fireproofing .659 SF/SF, 50 PSF total load	29,000.00	S.F.	\$8.36	\$242,440.00
B10102412650		W beam and girder, 20'x20' bay, 40 PSF superimposed load, 14" deep, fireproofing .746 SF/SF, 50 PSF total load	40,400.00	S.F.	\$9.45	\$381,780.00
B10102481200		Floor, concrete, slab form, open web bar joist @ 2' OC, on W beam, 15'x20' bay, 17" deep, 40 PSF superimposed load, 83 PSF total load	50,000.00	S.F.	\$12.74	\$637,000.00
B10102581170		Floor, metal deck, 18 ga, 3" deep, concrete slab, 11' span, 5.5" deep, 150 PSF superimposed load, 194 PSF total load	50,000.00	S.F.	\$9.10	\$455,000.00
B10201341250		Steel deck, cellular, single span, 14' span, 3" deep, 5 PSF, 30 PSF TL	30,000.00	S.F.	\$18.56	\$556,800.00
B20101082100		Concrete block (CMU) wall, 12" thick, slump	6,200.00	S.F.	\$35.75	\$221,650.00
B Shell Subtotal						\$3,805,648.20

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GENERAL CONDITIONS ESTIMATE

General Conditions Estimate Summary:

The Conditions Estimate was derived using RS Means Costworks. Going into this estimate I was given very limited data. I was given only an approximate value of the general conditions and a list of a few items that were included, but no specific information. The reason for this is that Midstate Construction considers general conditions to be a very sensitive area. A common belief at Midstate is that winning or losing bids is often a result of how general conditions and fees are priced. They also believe that making some of that information available to the public (through my thesis project) creates a risk that it may also become available to competitors in the market which puts very real jobs and very real money at stake. Due to this I formulated my estimate using all of the data that was available to me while also making some general project assumptions in some areas of the estimate. Having stated all of this, I believe that my estimate of the general conditions on the Santa Rosa Junior College Student Center is as good a representation of the actual estimate as I was able to develop with the information made available to me.

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Unit Detail Report



Year 2009

Date: 26-Oct-09

gen conditions

LineNumber		Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
Division 01 General Requirements						
013113200180		Field Personnel, project manager, minimum	102.00	Week	\$2,550.00	\$260,100.00
013113200260		Field Personnel, superintendent, average	102.00	Week	\$2,750.00	\$280,500.00
013113200265	U	Assistant Superintendent	102.00	week	\$0.00	\$230,000.00
014523500100		Field Testing, for building, costing \$10,000,000, minimum	1.00	Project	\$37,369.90	\$37,369.90
015113200185	U	Construction lay-down areas	1.00	project	\$0.00	\$95,000.00
015113500140		Temporary electrical power equipment (pro-rated per job), underground feed, 3 uses, 600 amp	1.00	Ea.	\$3,496.13	\$3,496.13
015113500140	A	Contingencies, for estimate at preliminary working drawings stage (Design Development)	1.00	Project	\$349.61	\$349.61
015113500140	A	Contingencies, at conceptual design stage	1.00	Project	\$699.23	\$699.23
015113500560		Temporary electrical power equipment (pro-rated per job), temporary feeder cords, 100 amp, 3 uses, 100' long	1.00	Ea.	\$616.46	\$616.46
015113500560	A	Contingencies, for estimate at preliminary working drawings stage (Design Development)	1.00	Project	\$61.65	\$61.65
015113500560	A	Contingencies, at conceptual design stage	1.00	Project	\$123.29	\$123.29
015113800100		Temporary Heat, per week, 12 hours per day, incl. fuel and operation	700.00	CSF Flr	\$36.84	\$25,788.00
015113800100	A	Contingencies, for estimate at preliminary working drawings stage (Design Development)	1.00	Project	\$3.68	\$2,576.00
015113800100	A	Contingencies, at conceptual design stage	1.00	Project	\$7.37	\$5,159.00
015113800360		Temporary Power, lighting, incl. service lamps, wiring and outlets, max	700.00	CSF Flr	\$48.12	\$33,684.00
015113800360	A	Contingencies, for estimate at preliminary working drawings stage (Design Development)	1.00	Project	\$4.81	\$3,367.00
015113800360	A	Contingencies, at conceptual design stage	1.00	Project	\$9.62	\$6,734.00
015113800700		Temporary Utilities, temporary construction water bill per month, average	51.00	Month	\$70.24	\$3,582.24
015113800700	A	Contingencies, for estimate at preliminary working drawings stage (Design Development)	1.00	Project	\$7.02	\$358.02
015113800700	A	Contingencies, at conceptual design stage	1.00	Project	\$14.05	\$716.55
015213200020		Office Trailer, furnished, buy, 20' x 8', excl. hookups	2.00	Ea.	\$10,583.83	\$21,167.66

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LineNumber		Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
015213200020	A	Contingencies, for estimate at preliminary working drawings stage (Design Development)	1.00	Project	\$1,058.38	\$2,116.76
015213200020	A	Contingencies, at conceptual design stage	1.00	Project	\$2,116.77	\$4,233.54
015213201200		Storage Boxes, buy, 20' x 8'	5.00	Ea.	\$6,026.11	\$30,130.55
015213201200	A	Contingencies, for estimate at preliminary working drawings stage (Design Development)	1.00	Project	\$602.61	\$3,013.05
015213201200	A	Contingencies, at conceptual design stage	1.00	Project	\$1,205.22	\$6,026.10
015213400120		Field Office Expense, office supplies, average	23.00	Month	\$96.59	\$2,221.57
015213400120	A	Contingencies, for estimate at preliminary working drawings stage (Design Development)	1.00	Project	\$9.66	\$222.18
015213400120	A	Contingencies, at conceptual design stage	1.00	Project	\$19.32	\$444.36
015213400120	A	Contingencies, at conceptual design stage	1.00	Project	\$19.32	\$444.36
015626500100		Temporary Fencing, chain link, 6' high, 11 ga	1,500.00	L.F.	\$12.12	\$18,180.00
015626500100	A	Contingencies, for estimate at preliminary working drawings stage (Design Development)	1.00	Project	\$1.21	\$1,815.00
015626500100	A	Contingencies, at conceptual design stage	1.00	Project	\$2.42	\$3,630.00
015626500100	A	Contingencies, at conceptual design stage	1.00	Project	\$2.42	\$3,630.00
017413200050		Cleaning Up, cleanup of floor area, continuous, per day, during construction	70.00	M.S.F.	\$50.21	\$3,514.70
017413200050	A	Contingencies, for estimate at preliminary working drawings stage (Design Development)	1.00	Project	\$5.02	\$351.40
017413200050	A	Contingencies, at conceptual design stage	1.00	Project	\$10.04	\$702.80
017413200050	A	Contingencies, at conceptual design stage	1.00	Project	\$10.04	\$702.80
017413200055	U	Progress Cleanup	70.00	day	\$0.00	\$300,000.00
017413200100		Cleaning Up, cleanup of floor area, final by GC at end of job	70.00	M.S.F.	\$104.24	\$7,296.80
017413200100	A	Contingencies, for estimate at preliminary working drawings stage (Design Development)	1.00	Project	\$10.42	\$729.40
017413200100	A	Contingencies, at conceptual design stage	1.00	Project	\$20.85	\$1,459.50
017413200100	A	Contingencies, at conceptual design stage	1.00	Project	\$20.85	\$1,459.50
Division 01 Subtotal						\$1,403,773.11

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CRITICAL INDUSTRY ISSUES

18TH ANNUAL PACE ROUNDTABLE SUMMARY OF EVENTS

WELCOME ADDRESS AND BANQUET

The banquet, held at the Penn Stater, was a time for the students to get a chance to talk to industry workers on a more casual basis than normal. The evening started with a cocktail hour during which I was able to talk casually with a few members from the Barton Malow Company. During dinner conversation was kept very casual and had very little to do with construction. The evening ended with Dr. Riley and Dr. Anumba thanking everyone for coming and also giving a heads up on what the general schedule was for the following day of events.

INDUSTRY PANEL: STATE OF CONSTRUCTION

Day two of the PACE Roundtable started out by having a panel of members in the industry share their observations about the impact of the downturn of the construction industry due to the failing economy. They then stated the strategies that their individual firms planned on using to move forward.

A reoccurring theme in this opening part of the roundtable was that the market as a whole is not doing well but education and healthcare projects still provide big markets. Some examples of strategies that were mentioned to help in moving forward included incorporating BIM into renovation projects and not just new ones, work on building up smaller markets, going “back to basics” by looking within the company (employee development, internal company re-tooling), and being able to diversify so that any size job is capable of being carried out.

ENERGY AND THE CONSTRUCTION INDUSTRY: DR. DAVID RILEY

This is the breakout session that I decided to attend. The first thing we did upon getting into our room was to arrange ourselves in a circle and then go around the room introducing ourselves and saying why we decided on this session. The industry side of the group was made up of a mixture of people who were very knowledgeable about the topic and also a few who were new to it and were looking to learn. Most of the students were there to search for ideas for their thesis proposals.

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The first half of the session was spent listing key construction issues in today's society pertaining to energy design and construction. Some of the topics listed as issues included increased energy costs, deregulation, alternative forms of energy, stimulus package, incentives, life cycle costs, green washing, LEED performance, and the integration of building systems.

After a short break the second half of the breakout session began. This was the most interesting part to me. The second half of the session was spent analyzing the issues listed in the first half and searching for answers. The information that stood out most to me was that which was said about alternative forms of energy and new materials. The information that I was able to gather will ultimately help me to develop my thesis proposal. Some of the ideas that were thrown out in the group included...

1. Integrating PV systems with schools not only as an alternative source of energy, but also as an educational tool for students.
2. Switching out fluorescent light bulbs with LED lights where possible to lessen the HVAC loads.
3. Incorporating a geothermal system.
4. Using solar thermal technology, which is widely used in California (where the Santa Rosa Junior College is located), for solar cooling throughout the building. Southland Industries has had a lot of success with this already (solar chillers).

These are only a few of the ideas that were talked about in our session. Many other great ideas were mentioned but these are ones that I am the most interested in researching more for my thesis project.

BUSINESS AND NETWORKING: DR. JOHN MESSNER

I was not able to attend the business and networking session but through a review at the end of the breakout sessions I was able to hear briefly about some of the main topics of conversation.

1. Shifts in delivery methods from negotiated to hard bids.
2. Joint ventures take risk away from the owner and allow expansion to new markets, new geographic regions, etc.
3. Chase clients and not projects. By chasing individual clients and developing relationships you increase the chance of getting repeat business.
4. Identify trends so that you are able to stay ahead of the market rather than play catch up.
5. Get everyone involved from the start by incorporating integrated project delivery.

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BIM EXECUTIVE PLANNING: CRAIG DUBLER

Like the business and marketing session I was not able to attend the BIM breakout session either. A review was done briefly for this session as well and I was able to get an idea of what some of the main topics discussed were. Because of the short time of the review, the information I was able to gather was minimal. Topics discussed included...

1. BIM implementation
2. Benefits from working as a team
3. Value of BIM vs. Delivery method
4. Owners role in BIM
5. Ways to filter use of BIM down through sub contractors

STUDENT PANEL: COMMUNICATION PATTERNS OF THE “NOW” GENERATION

After the short review of the breakout sessions a panel of students was brought to the front of the room to talk about methods of communication and social networking used by the younger generation. The panel started conversation by individually stating their view of the “now” communication and how it is used in everyday life for them. Next the panel was opened up for questions from the rest of the room. Some of the topics that were discussed involved the use of informal email vs. phone calls, use of social networking sites such as facebook and twitter, and text messaging on the job site. Although everyone has their own idea of how communication should be perfected at a professional level a few ideas seemed to be agreed upon by the majority of those in attendance. One of the ideas that was stated was to find a way to identify the “norms” and make them known to everyone in the company. This would let employees know when an email, text message, or phone call would be sufficient for whatever purpose on a job. Another idea for a way to tackle the communication issue is to find out what form of communication works best for an individual and stick to that.

GROUP DISCUSSION: CONTINUOUS PERSONAL GROWTH

The last topic of discussion for the day was that of continuous personal growth. As the snow outside began to accumulate this session was cut short. Because of this only a few methods and personal opinions of training for personal growth were discussed.

1. Webinars: are very convenient but 2-way conversation opportunity is lost

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2. 5 day intensive training
3. Professional organizational development (ASHRAE for example)
4. Try to keep the time per day to only a few hours at a time otherwise interest is lost.
5. Start with face to face meetings and then move on to webinar later

KEY CONTACTS

Throughout the Roundtable discussion I met multiple useful contacts. Jeremy Silbert of Hensel Phelps is very knowledgeable about a new type of insulation called aero-gel. He has been involved with the incorporation of this new form of insulation into the Pentagon. Should I have any questions about the performance or cost of the insulation Jeremy will be able to help me. Another important contact that I may be able to use is Dr. David Riley of Penn State University. Dr. Riley is very knowledgeable about the emerging solar thermal technology and could answer valuable questions that I will have in the upcoming months pertaining to this since I plan on incorporating this technology into the SRJC. Other than these two I also met valuable contacts from Barton Malow who may be able to help to answer a variety of other questions that I may have throughout the continued development of my thesis project.

