STRATA SOLUTIONS

ORTHODONTIC CLINIC STRUCTURAL DESIGN

Project Plan

February 4, 2013

MORRISON HERSHFIELD

Prepared for:	**Morrison Hershfield**
and	**Dr. Steve Bruneau ENGI 8700 Memorial University of Newfoundland**

Group F:

- Colin Gibling
- Kathy Higgins
- Mark Reynolds
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February 4, 2013

CC: Dr. Steve Bruneau

Dear Mr. Noel, Ms. Antle and Ms. Pynn:

We are pleased to provide you with the following Project Plan for the Orthodontic Clinic Structural Design project that we will be completing under your request. This project plan describes the project's requirements, how we plan on completing the work; i.e. how we will manage tasks, troubleshoot solutions to problems, complete the cost estimation, etc. Provided within this plan is also a project schedule to assure that the project is progressing in a timely fashion.

If you have any questions regarding the content of the enclosed plan, please feel free to contact Strata Solutions via the contact information provided above.

Regards,

Kathy Higgins
On behalf of Strata Solutions

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1.0 Project Description

A proposed three-story orthodontic clinic is to be built on Hebron Way, located in the Stavanger Drive area of St. John's, NL. Office spaces in the city are becoming more desired, making commercial developments such as this necessary. By the request of Morrison Hershfield, Strata Solutions (Strata) will provide the structural design of the new clinic.

The team will be responsible for completing a design of the steel superstructure and concrete foundations using specified codes and standards. S-Frame structural design software will be used in the design process.

Figure 1 shows a 3D architectural rendering of the proposed orthodontic clinic. The curved feature on the third story of the building will be the main work area of the orthodontist clinic, with smaller offices and rooms in the area behind. Potential retail and office spaces will be on its two lower levels. The second floor also features north and south facing open terraces.

Figure 1: Architectural 3D Rendering of the Proposed Orthodontist Building

2.0 Statement of Project Requirements

Morrison Hershfield has appointed Strata to provide design services for most structural aspects of the three-story orthodontic clinic. This will require the team to complete all relevant design calculations including all environmental loading, such as wind and snow, and the loads due to the structure itself. The team will provide structural design for the roof, all beams, all columns, floors and foundation; all aspects of which will be modeled and analyzed using S-Frame software.

AutoCAD drawings will be provided, complete with elevation and section views of the building, the floor plans of each story and the foundation design. These drawings will be done on D size paper. Standard notes on concrete and steel will be provided on the drawing as well.

Strata will also produce a cost estimate for the structural components of the building including the concrete, steel and decking materials.

3.0 Methodology

3.1 Approach

Strata is taking on the role of “engineering consultant” to its “client”, Morrison Hershfield. This provides a scenario that represents a typical commercial undertaking. Strata’s approach to the project is oriented toward effectiveness in work and efficiency in completing tasks. Appropriate responsibilities will be assigned to each member, and collaboration between team members is encouraged where beneficial. Much like an actual engineering consultant, Strata will provide project updates, deliverables, and eventually a completed engineering package to its client.

3.2 Group Organization

3.2.1 Organizational Structure

The majority of the work to be completed will be done as a team. However, to assure that tasks are managed efficiently and communication throughout the group is effective, all major components of the project will be given a “Task Lead” to assure that the work is being done effectively and on schedule. Each of these major components will be further subdivided into specific tasks. In doing this, the work can be distributed more evenly and all team members can be given tasks that best suit their abilities and interests. Section 4.0 goes into further detail on organization and breakdown of tasks. Also see Appendix A for a detailed organizational breakdown chart.

The Project Manager or the Task Lead will allocate work and assure that data is kept organized and information is relayed to the needed individuals.

3.2.2 Internal Meetings

Strata will hold formal group meetings on a weekly basis. These meetings will provide the team with updates on all aspects of the project. Each Task Lead will discuss the work that was undertaken in the week previous, any challenges that they faced and how they overcame these obstacles. The team will discuss any potential difficulties at these meetings as well as create a list of items to discuss with Morrison Hershfield representatives at the next client meeting. Meeting minutes will be recorded and distributed to all team members.

3.2.3 Weekly Business Meetings

Strata will also attend weekly Business Meetings as a part of the ENGI 8700 Civil Engineering Project Class. These weekly meetings will take place on Monday afternoons, from 2:00-3:15pm. At these meetings, Strata will be required to give the class an update on the previous week's activities, any issues they came across and the tasks planned for the next week. Strata will provide Dr. S. Bruneau with a formally written Progress Report and an updated copy of the project schedule.

3.3 Client Role

Interaction with the client throughout the semester is critical to success of the structural design. Morrison Hershfield will help Strata clarify any issues of concern they may come across when completing all deliverables.

Weekly client meetings have been scheduled for Thursdays at 3:45pm. During these meetings, Strata will update Morrison Hershfield with their previous week's progress and report any

issues that may require assistance or guidance. Strata will create and distribute tentative meeting agendas prior to each week's meeting. Meetings can be cancelled or rescheduled if either party's schedules become conflicted (eg. during midterms, inclement weather conditions, etc.). Both Strata and Morrison Hershfield will contact each other via email or telephone should an issue arise.

3.4 Design Principles

3.4.1 Codes and Standards

To ensure that the Orthodontic Clinic building is being built to the acceptable principles of design, Strata will follow design codes and CSA standards. All calculations will be completed with reference to the following standards:

- National Building Code of Canada, 2005 [1]
- CISC Handbook of Steel Construction, 9th Edition [2]
- CAC Concrete Design Handbook, 4th Edition [3]

To ensure that all hand calculations are completed accurately, computer modeling and structural analysis software (S-Frame) will be used.

3.4.2 Environmental Best Practices

In determining the best design methods for this design, Strata will be sure to keep in mind the environmental impacts that the building will have on its surroundings. The team will try to utilize materials that can be recycled or re-used when the building comes to the end of its service life.

3.5 Cost Estimating Strategy

A cost estimate for the structural building materials will be calculated. This includes estimates for the concrete, steel and

metal sheeting required. Concrete estimates will be determined by a cost per cubic meter and steel and metal-sheeting estimates will be determined by a cost per tonne. The team will determine the total amount of concrete and steel used in the design. They will then consult with local suppliers to determine the average cost per unit for each material.

To keep track of the tonnage/volume of all materials and the total cost, spreadsheet software will be used.

3.6 Labour Breakdown

In addition to materials cost estimates, Strata will provide labour breakdowns and charge out rates for its members. Labour information will be maintained on a bi-weekly basis and updated in a spreadsheet, eventually providing total labour costs that will be reported to the client.

3.7 Desired Outcomes

Strata will provide Morrison Hershfield with all required deliverables. They hope to provide a well thought out design and clear, effective structural design drawings. They hope that communication between all parties, i.e. the client, the faculty and the group, is effective. If any troubles arise, they will turn to the troubleshooting method described in section 3.8. They hope that all deliverables will be completed as per schedule with a final completion before March 29, 2013.

3.8 Troubleshooting

Being the first full structural design project for Strata as a group, challenges are likely to present themselves. It is important for the team to prepare a solution strategy for these challenges in order to ensure they are solved in a timely manner. Table 1 shows a list of potential issues and corresponding solutions.

Table 1: Troubleshooting

Issue	Solution
Difficulty with any design aspects as they arise	- Contact Morrison Hershfield for guidance - Contact A. Hussein for guidance - Consult class notes - Consult classmates
Difficulty with AutoCAD	- Consult Morrison Hershfield - Consult friends with AutoCAD experience - Utilize AutoCAD help website - Utilize AutoCAD help function
Difficulty getting suitable pricing from local suppliers	- Consult Morrison Hershfield - Consult classmates with similar projects

4.0 Tasks

Table 2 shows the various tasks that will be undertaken for this project. It highlights the personnel assigned to each task, the estimated time that the task will take to complete, and the resources required. This task table was also beneficial in helping to create the project schedule.

Table 2: Strata Task Allocation

Task	Sub-Task	Allocation of Personnel				Estimated Duration of Task	Resource Requirements
		Jacob Tucker	Mark Reynolds	Kathy Higgins	Colin Gibling		
Research of Technical Requirements	N/A	X	X	X	X	10 days	Design codes, class notes, internet, client support, instructor support
Roof Design	N/A	X	X			4 days	Design codes, course notes, software, client support
Wall and Column Design	N/A	X			X	4 days	Design codes, course notes, software, client support
Floor Design	N/A	X	X			4 days	Design codes, course notes, software, client support
Foundation Design	N/A	X		X		4 days	Design codes, course notes, software, client support

Drafting	N/A			X	X	25 days	AutoCAD
Administrative Tasks	Document Control			X		Ongoing	Excel, Notebooks, Project Binder
Project Controls	Schedule Tracking		X			Ongoing	Microsoft Project
	Quantity Takeoffs		X		X	10 days	Excel, AutoCAD
	Cost Estimation		X			10 days	Excel, supplier support
	Financial Mgmt		X			Ongoing	Excel
Final Design Reports	Final Report			X	X	20 days	Microsoft Word
	Final Presentation			X	X	20 days	Microsoft PowerPoint

5.0 Schedule

It is critical that Strata complete a well thought out schedule prior to commencing the project. A comprehensive schedule will assure that progress is being made efficiently, the series of tasks are being undertaken in an optimal order and resources are being allocated effectively. Appendix B shows a Gantt chart representation of Strata's tentative schedule.

MAJOR TASKS:

Project Plan:

The team has scheduled a self-imposed due date of January 29, 2013 for the project plan; about a week earlier than the actual due date of February 4, 2013. With the project plan and the project schedule complete, the team can focus attention on starting the design process. The *Guide to Writing an Engineering Project Plan* [4] will be used as a reference when completing the project plan.

Technical Research:

All team members will familiarize themselves with the National Building code and additional resources (eg. Dr. Amgad Hussein's class notes), to better understand applicable design methodologies.

Design:

- Determination of loading patterns:
    - Strata will start design by first determining the necessary environmental loads applied to the building; including snow and wind loads. The team will use the provided architectural drawings to complete this task along with the National Building Code and class notes from Dr. Amgad Hussein's Structural Building System's class.

- Roof design:
    - The roof will be designed as a concrete slab on steel decking based on snow loads and wind uplift loading, as well as any dead load or equipment loads required. In addition,

consideration will be taken for snowdrift loading on any present equipment.

- Wall and column design:
    - Wall and column design will be based on appropriate transfer of loads from the roof and intermediate floors of the structure, as well as any applicable wind load in the case of exterior walls. Columns will be composed of steel members. The walls on each level will be composed of metal studs, with additional material varying per level. Level 1 contains an additional brick face, level 2 contains a great deal of glass, and level 3 contains composite paneling.

- Floor design:
    - The floor on level 1 of the building will be designed as a slab on grade. Floors on level 2 and 3 will be designed as concrete slabs on steel decking. All floors will be designed based on required dead and live loading for the building, with special dead load requirements for orthodontic equipment on level 3. In addition, snow loading will be present on terraces on level 2 and wind loading may provide uplift on the underside of level 3.

- Foundation Design:
    - The last element of the building to be designed will be the foundations. Foundations will be composed of concrete strip footings and foundation walls, and will be designed based on the load transfer of the building and geotechnical properties of the site. Geotechnical properties are assumed to be 200 kPa bearing pressure and that the foundations will be below the frost line.

Drafting:

Drafting can be started early in the project timeline, and continued as different structural elements are completed. Drafting throughout the project timeline will maximize efficiency and resources so all team members can complete the project simultaneously.

Quantity takeoffs/Cost estimation:

This aspect of the project will commence shortly after the design starts. As quantities are finalized, the team can determine the cost per unit of material.

Project Report:

The team will begin preliminary work on the final project report and presentation as design is being completed. The report will contain all relevant calculations, software outputs, drawings and other deliverables.

Each task leader will be responsible for determining how actual project progress compares to the suggested project schedule. The team will discuss the progress at the weekly team meetings and determine if changes to the schedule are to aid in the overall project schedule. The schedule will be updated weekly to reflect the current state of the project.

6.0 Costs to Strata

Direct costs to Strata throughout the duration of this project will be minimal. The majority of the costs will go towards the cost of printing and binding the colored documents required for submission to Dr. Bruneau and Morrison Hershfield. The project plan, final report, final presentation as well as a complete set of structural design drawings are required for submission. See Table 3 below for an estimated cost breakdown based on the Staples Business Depot Pricelist.

Table 3: Cost of Printing Services

	Cost/ Page (B&W)	Cost/Page (Color)	# of Pages (B&W)	# of Pages (Color)	Coil Binding	# of Copies	TOTAL COST incl. HST
Project Plan	$ 0.10	$ 0.39	13	16	$ 4.99	2	$ 28.32
Final Report	$ 0.10	$ 0.39	90	10	$ 5.99	2	$ 42.69
Final Presentation	$ 0.10	$ 0.39	n/a	30	$ 4.99	2	$ 37.72
Structural AutoCAD Drawings	$ 2.00	n/a	7	n/a	n/a	2	$ 31.64
						Subtotal	$ 140.37
						Contingency (10%)	$ 14.04
						TOTAL	**$ 154.41**

Funds will also have to be allotted for the transportation to and from Morrison Hershfield's office, once per week for client meetings. The most efficient route from the Engineering Building to The Client's office located at 205 East White Hills Road is approximately 10.5 kilometers and 10 minutes of travel. Strata plans on having one client meeting per week for a total driving time and distance of 21 kilometers and 20 minutes. Canada Revenue Agency [5] gives a mileage reimbursement rate of $0.52 per kilometer in the province of Newfoundland and Labrador. This gives an approximate total cost of $1.04 per meeting.

7.0 Deliverables

Several deliverables were discussed and determined to be appropriate. Table 4 below lists the deliverables, descriptions, due dates and delivery methods.

Table 4: Deliverables

Deliverable	Description	Date Due	Delivery Method	Delivery Mode
Statement of Qualifications	Outline of team qualifications, overview of project experience	Jan 14, 2013	Email (PDF) and hard copy	Email
Project Plan	Document containing project description and requirements, as well as breakdown of tasks and deliverables.	February 4, 2013	Hard copy	Hand Delivery to client and S. Bruneau
Meeting Agendas and Minutes	Weekly documents outlining upcoming meetings (agenda), and summarizing meeting outcomes (minutes).	Weekly	Email (PDF)	Hand delivery
Design Drawings	CAD drawings showing building designs and properties	April 1, 2013	Hard copy	Hand delivery
Detailed Calculations	Calculations used during design process	April 1, 2013	Hard copy	Hand delivery
Cost Estimate	Material cost estimates for the structure, as well as labour cost estimate	April 1, 2013	Hard copy	Hand delivery

Project Schedule	Timeline of project elements and deliverable dates. Will be included in final report.	February 4, 2013	Email (PDF) and hard copy	Hand delivery
Project Binder	Assortment of documents related to project. Not necessarily required for final submission.	N/A	Hard copy	Hand delivery
Final Report	Finished project report to be submitted to client and instructor	April 1, 2013	Email (PDF) and hard copy	Hand delivery/Email
Final Presentation	Presentation to be delivered to client, instructor and class on final project due date	April 1, 2013	Email (PDF) and hard copy	Hand delivery

8.0 Risks

All risks associated with this project are considered minimal. These risks are highlighted below in Table 5.

Table 5: Risks

Risk	Mitigation
Obtaining all necessary software	• Contact S.Bruneau/A.Husain to attain necessary software on engineering lab's computers • Download student trial versions of software
Difficulty for some members using software that they are unfamiliar with	• Use help functions • Allot software tasks to members that have more experience with specified software • Task other team members for help.
Team undertaking structural design challenges that they have yet to face in class or industry	• Professor will cover the necessary material in the month of January, before Strata commences design
Balancing time between Project and other courses	• Adhere to the schedule • Make Realistic goals and stick to project schedule • Create schedule such that task completion dates do not correspond with midterm exams.
Cancellation of client or group meetings due to weather	• Reschedule meeting • Coordinate necessary information between parties through email.

9.0 References

[1] National Research Council of Canada, (2010), User's Guide – NBC 2010 Structural Commentaries (Part 4 of Division B)

[2] Canadian Institute of Steel Construction, (2006), Handbook of Steel Construction, Ninth Edition

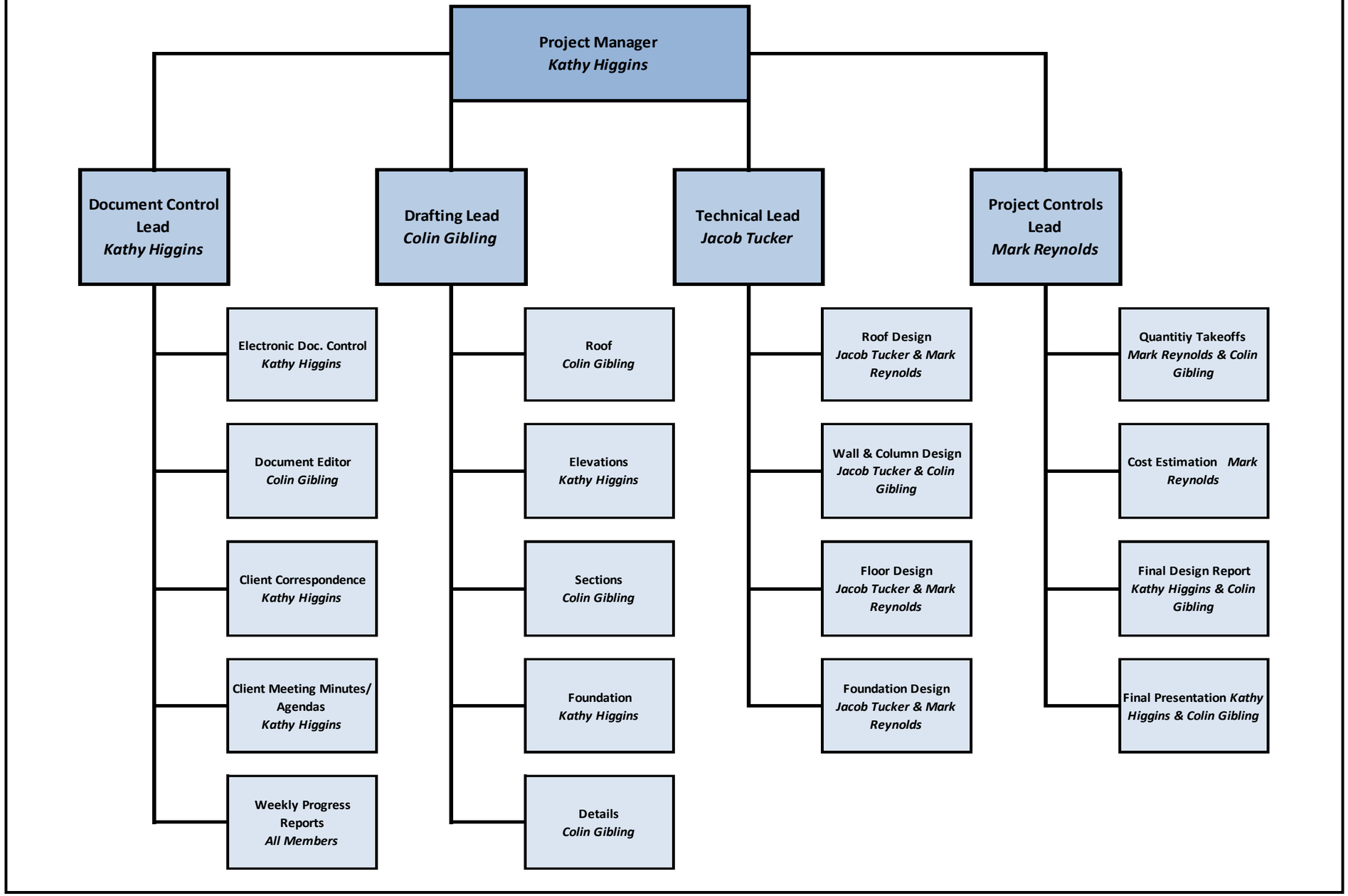
[3] Cement Association of Canada, (2005), Concrete Design Handbook, Third Edition

[4] Bruneau, S. (2010), Guide to Writing an Engineering Project Plan, http://www.engr.mun.ca/~sbruneau/teaching/8700project/classof2013/

[5] Canada Revenue Agency, (2012), *Meal and vehicle rates used to calculate travel expenses for 2012 and previous years*, http://www.cra-arc.gc.ca/travelcosts/

Appendix A

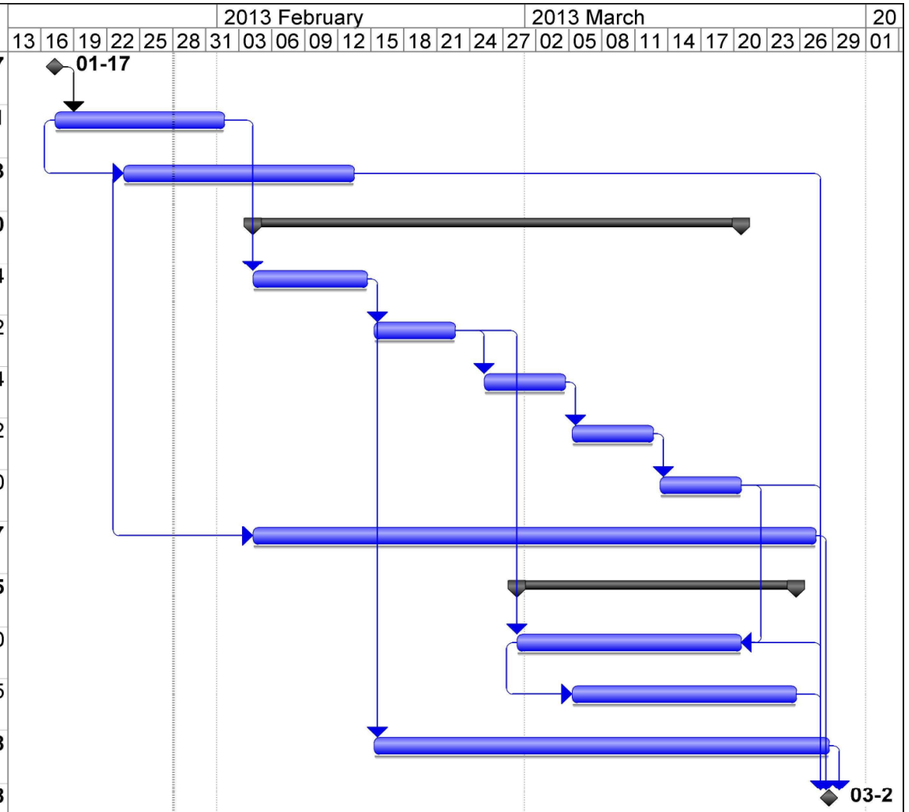
Organization Chart


Project Manager
Kathy Higgins
Document Control Lead
Kathy Higgins
Drafting Lead
Colin Gibling
Technical Lead
Jacob Tucker
Project Controls Lead
Mark Reynolds
Electronic Doc. Control
Kathy Higgins
Document Editor
Colin Gibling
Client Correspondence
Kathy Higgins
Client Meeting Minutes/ Agendas
Kathy Higgins
Weekly Progress Reports
All Members
Roof
Colin Gibling
Elevations
Kathy Higgins
Sections
Colin Gibling
Foundation
Kathy Higgins
Details
Colin Gibling
Roof Design
Jacob Tucker & Mark Reynolds
Wall & Column Design
Jacob Tucker & Colin Gibling
Floor Design
Jacob Tucker & Mark Reynolds
Foundation Design
Jacob Tucker & Mark Reynolds
Quantitiy Takeoffs
Mark Reynolds & Colin Gibling
Cost Estimation Mark Reynolds
Final Design Report
Kathy Higgins & Colin Gibling
Final Presentation Kathy Higgins & Colin Gibling

Appendix B

Orthodontist Clinic Project Schedule

ID	Task Name	Duration	Start	Finish
1	**Project Start**	**0 days**	**Jan 17**	**Jan 17**
2	**Create project plan**	**8 days**	**Jan 17**	**Feb 01**
3	**Research technical requirements**	**10 days**	**Jan 23**	**Feb 13**
4	**Structural design**	**22 days**	**Feb 04**	**Mar 20**
5	Determination of loading patterns	6 days	Feb 04	Feb 14
6	Roof design	4 days	Feb 15	Feb 22
7	Wall and column design	4 days	Feb 25	Mar 04
8	Floor design	4 days	Mar 05	Mar 12
9	Foundation design	4 days	Mar 13	Mar 20
10	**Drafting**	**25 days**	**Feb 04**	**Mar 27**
11	**Project control**	**12 days**	**Feb 28**	**Mar 25**
12	Quantity takeoffs	10 days	Feb 28	Mar 20
13	Cost estimate	10 days	Mar 05	Mar 25
14	**Project report**	**20 days**	**Feb 15**	**Mar 28**
15	**Project Completion**	**0 days**	**Mar 28**	**Mar 28**



Project: Project Plan
Date: Jan 28

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

Appendix C

Statement of Qualification

STRATA SOLUTIONS

STRATA
SOLUTIONS

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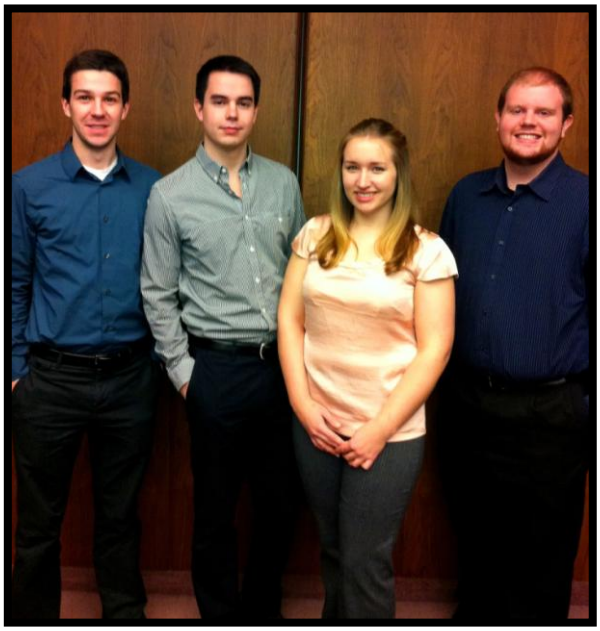
OUR VALUES

MISSION STATEMENT

To deliver the highest quality design solutions to clients in the areas of civil and structural engineering. We aim to meet client needs by delivering project-oriented solutions on time and within budget.



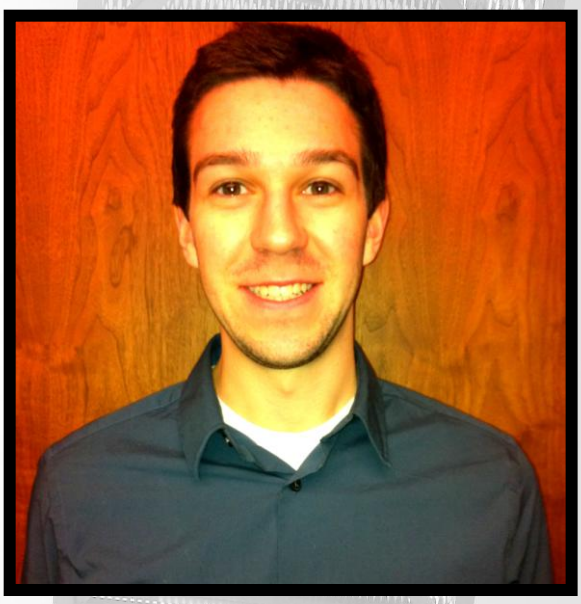
WHO WE ARE

Strata Solutions is a newly developed engineering consulting group poised to make a major impact in the structural design industry in the St. John's area. Comprised of four senior civil engineering students, Strata Solutions has the engineering experience, technical knowledge, and enthusiasm needed to provide quality services to clients looking for assistance with structural engineering projects.

PREVIOUS EMPLOYERS

- Allnorth Consultants Ltd.
- Bell Aliant
- Department of Municipal Affairs
- Fluor Canada Ltd.
- Hatch Ltd.
-
- H.J. O'Connell Construction Ltd.
- Newfoundland Design Associates Ltd.
- Propel Research Inc.
- Public Works and Government Services Canada
- Teck Coal Ltd.

STRATA SOLUTIONS



STRATA SOLUTIONS

OUR TEAM

COLIN GIBLING

Colin Gibling is a senior Civil Engineering student at Memorial University, expected to graduate in the spring of 2013. Colin's interests lie in infrastructure development and structural design. He has completed several co-op work terms related to these fields all across Canada, designing municipal infrastructure for residential and commercial developments, and performing heavy lift and transportation studies for project modules. Being exposed to work both in office and field environments, Colin has learned to apply his skills in a variety of scenarios. His exposure to design procedures and requirements has showcased both his technical and creative abilities, and well as his commitment to quality work.

JACOB TUCKER

Jacob Tucker is a civil engineering student currently in his final academic term at Memorial University of Newfoundland. Throughout the co-operative education program, Jacob has focused his efforts on structural based courses, and has had significant work experience in civil and structural engineering consulting as a complement to his studies. In his recent work terms, Jacob worked for Hatch Ltd. on projects involving structural design, dam stability analysis and safety review, and preliminary design and estimating for hydroelectric projects in Labrador. His work experience in engineering consulting has also provided an understanding of the importance of client relationships in the engineering industry.

OUR TEAM

KATHY HIGGINS

Kathy Higgins is an engineering student attending Memorial University of Newfoundland, currently completing her final term of the civil engineering program. Having completed five work terms and numerous civil related courses, she has gained experience in a wide range of engineering areas, including coastal and municipal design, as well as project management and control in the construction industry. Her construction experience in particular has shaped an enthusiastic and motivated individual who is always looking to provide clients with the best quality work through excellent communication, dedication and professionalism. Most recently, Kathy worked as a member of H.J. O'Connell Construction's Operations Team in Labrador West providing construction support to the mining industry.

MARK REYNOLDS

Mark Reynolds has spent the last five years at Memorial University developing his structural engineering skills. Thanks to Memorial's co-operative education program, he boasts a wide variety of professional experience in project management and structural engineering for the construction industry. Mark has represented both clients and contractors in the past, which has given him a firm grasp of the importance of meeting client needs. He has significant site and office experience throughout Newfoundland and Western Canada, and has recently transitioned his professional focus from project management to structural engineering to reflect his academic expertise. Most recently, Mark worked as a member of Fluor Canada's Civil/Structural/Architectural team in Calgary.

STRATA SOLUTIONS

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