A Structural Engineering Firm

Business Plan

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1.0 EXECUTIVE SUMMARY

1.1 CONSULTING SERVICE

This new venture will be positioned as a structural engineering firm whose core competency is the design and analysis of advanced composite materials for structural rehabilitation of existing structures. The firm will offer single source support to the customer from project specification through construction and be a vital resource for selecting the type of retrofit and qualified contractors to effectively upgrade or restore the structure's integrity.

1.2 MARKET OPPORTUNITY

The demand for infrastructure rehabilitation in the United States is a huge, emerging market brought about by the aging of the nation's highway and bridges. Because of the prohibitive cost of replacing large numbers of decaying structures, efforts have focused on methods of strengthening existing structures. New technology has provided advanced composite materials that can be used to repair or retrofit existing structures at a fraction of the cost.

1.3 MARKETING STRATEGY

This structural engineering firm's strategy will be to provide engineering consulting services for advanced composite retrofit solutions to the emerging infrastructure renewal industry. Advanced composites are light weight, high-strength, relatively easy to apply, but very difficult to analyze. As the benefits of using advanced composites in structural applications become better known and the U.S. infrastructure continues to deteriorate, the market demand for retrofitting with advanced composites will be very strong over the next few decades.

1.4 OPERATIONS

The engineering firm will be founded upon a partnership composed of myself and two other structural engineers. All three of us will have a Masters Degree in Structural Engineering and be registered professional engineers in the State of California. Two of us will also have a Masters in Business Administration and the third will have a Masters in Contract Law. The three of us will be equal partners in the business and each invest a certain amount of personal savings to get the firm off the ground. In addition to the necessary engineering expertise to perform the core competency of the business we will each have specific responsibilities in running the firm. I will be responsible for the marketing and advertisement of the firm to build awareness of the services offered. One of the partners will be responsible for running the day to day operations of individual projects and managing support staff, and the third partner will be responsible for setting up strategic alliances with key companies. A strategic alliance will be formed with a manufacturer of composite material and a qualified contractor for installation of these materials in order to offer sole source support to the customer from specification through installation.

1.5 FINANCING

	Projected Sales	Net Profit
Year 1	$335,000	($306,418)
Year 2	$579,000	($116,618)
Year 3	$811,750	$ 50,495

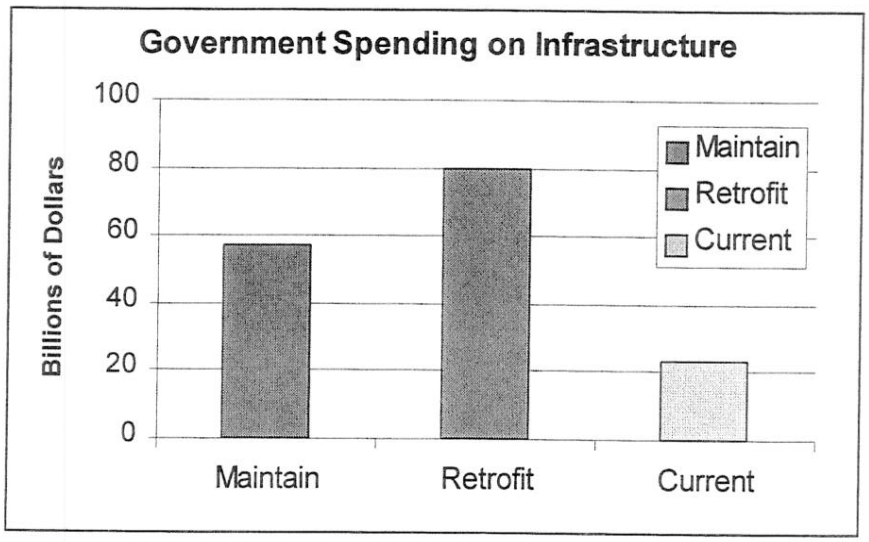
Total Start-up Costs:	$500,000
Personal contribution from (3) Managers:	$350,000
Short term Debt from family:	$150,000

Legal Form/ Ownership: Limited Liability Company

2.0 Market Analysis

2.1 Market Overview

The demand for infrastructure rehabilitation in the United States is a huge, emerging market brought about by the aging of the nation's highways and bridges. The Federal Highway Administration recently estimated that it would cost the federal government $57 billion annually just to maintain the nation's highway and bridge infrastructure at current conditions [Braestrup, 1998]. The same report noted that the government would have to spend $80 billion annually to improve and upgrade these structures. The United States is currently spending only $23 billion a year. Thus, historical under-investment in these areas has led to massive decay and obsolescence in our transportation infrastructure.



Recent civil engineering articles have iterated the problems of a decaying infrastructure, with nearly one quarter million bridges in the United States being structurally deficient [Dunker and Rabbat, 1995]. Because of the prohibitive cost of replacing large numbers of decaying structures, efforts have focused on methods of strengthening existing structures. New technology has provided advanced composite materials such as carbon fiber and kevlar which can be combined with durable resins to repair or retrofit existing structures. These materials are light weight, high-strength, and relatively easy to apply. As the benefits of using advanced composites in structural applications become better known and the U.S. infrastructure continues to deteriorate, the market demand for retrofitting with advanced composites will be very strong over the next few decades. *The structural engineering firm's strategy will be to provide engineering consulting services for composite retrofit solutions to the emerging infrastructure renewal industry.*

2.2 MARKET OPPORTUNITY

The U.S. Congress recently enacted the largest transportation bill (TEA-21) in the history of the nation - an estimated $217 billion over the next 6 years for roads, bridges, rail and transit projects - making transportation spending a national priority. The transportation infrastructure is critical to a nation's economy, because no highways and bridges means no movement of people and goods which means no commerce. There is a definite need for innovative technologies to repair, retrofit and upgrade this transportation infrastructure. Until recently, steel jacketing was the only retrofitting method approved by the California Department of Transportation. Steel jacketing has been proven effective in strengthening weak columns and preventing collapse due to earthquake loads. Installation of steel jackets, however, is labor intensive and requires heavy equipment to handle the massive steel. A typical 4 ft. diameter by 22 ft. high circular concrete column requires five 8-hour shifts excluding site excavation and painting. The steel jacket is often over designed because it's geometry is determined by installation requirements rather than confinement requirements. For example, each jacket must be much heavier than otherwise required in order to prevent it from buckling under its own weight during lifting, placing and grouting. In most retrofit projects this method is both expensive and inefficient [Gergely, et al., 1997]. An alternative to steel jackets is wrapping the concrete columns with advanced composite material. Carbon-composite retrofit wrapping is significantly more durable than steel jackets and does not corrode over time. Despite the high strength and corrosion resistant characteristics of this material, the fibers and laminates which compose this advanced composite material are very difficult to analyze for stress loads and potential failure. The necessary tools for analyzing these materials have been developed; however very few engineers are familiar these tools in the structural engineering industry. As the benefits of retrofitting using composite materials becomes more accepted in the structural industry, the market demand for engineering design and analysis of advanced composites will be very strong over the next few decades.

2.3 MARKET NICHE

I have been able to find a number of manufacturing and construction companies who provide advanced composite materials and/or innovative machinery to initiate the structural retrofit using advanced composite materials. However, none of these companies provide the structural analysis of the structure which must be done in order to determine the extent of structural rehabilitation that is necessary or determine the critical components of the structure that need the retrofit. It would be necessary for a structural engineering firm to be involved in this work and perform a consulting service; however, very few professional engineers have the

knowledge or engineering tools to analyze these advanced composites. *This is where the engineering consulting firm would find its niche in the market.* The firm would be able to perform the necessary analysis of the structure in the following applications:

- Finite element analysis of the concrete and composite interaction
- Structural dynamic analysis of the filament wound carbon fiber hoops
- Vibration analysis of the composite laminates
- Fatigue analysis of the composite material over the remaining life of the structure.

In this particular business approach, none of the composite material used in the retrofit of the structure would be considered "proprietary" because material properties have to be revealed to professional engineers by the manufacturing company in order to determine whether or not they satisfy structural design code.

The goal in this new market will be to find key decision makers, educate and communicate with them regarding the advantages of retrofitting existing structures with advanced composites, and then help convince them to deploy these new technologies in the rehabilitation of our aging infrastructure. Once a decision is made, the consulting firm will be able to provide the structural engineering analysis services required in order to determine the following; (1) type of composite material to be used given the structure and loading conditions, (2) the orientation and required number of laminates that will compose the material, and (3) the critical locations of the structure that require the structural retrofit.

The key to marketing our company will be to position this new venture as an engineering firm on the cutting edge of technology. This will be done by sending out monthly newsletters to prospective customers about our recent success solving industry problems and projects that we are currently working on. These business letters will also be posted on our internet website along with information about our company.

2.4 TARGET MARKET PROFILE

After analyzing the market opportunity in the context of this new venture, I have taken a close look at who the key decision makers are that will be interested in applying these advanced composite materials as a structural retrofit for existing structures. The potential customers for the firm's engineering consulting services can be found in the government, commercial, & private sectors. The main characteristic of these market segments is that they all have a need for structural engineering services to analyze existing structures for potential rehabilitation. These structures may be composed of reinforced concrete, unreinforced masonry, timber, or steel piles.

2.5 Market Segments

- **Government** - State Department of Transportation agencies who plan to upgrade existing structures to meet current design codes in order to avoid the cost prohibitive steps of rebuilding bridges, overpasses, and other aging structures (i.e., water towers and tanks).
- **Commercial** - Technological retrofit companies who are bidding on construction contracts by state or federal agencies but need engineering services to determine the extent of the retrofit required in order to meet current design and building codes.
- **Private** - Community leaders who have identified buildings (i.e. classrooms, churches, or day care centers) that need to be protected against natural disasters. Individuals who own property where transportation structures are in need of structural reinforcement (i.e., bridge piers, wharves, docks, and bridges). Individuals who want to retrofit their homes to increase wind load or earthquake resistance.

3.0 Feasibility Study

3.1 Service Advantages

Some of the advantages found in this new venture creation are inherent in engineering consulting firms. Very little overhead, office space, or equipment is required to immediately begin performing consulting services. Also, relatively little capital is required to purchase this equipment (i.e., computers, analysis software, and communications). Another advantage for this new venture is it's flexibility in determining the final location of the main office. The needs of the customer will require that the structural engineers of this firm make site visits to inspect the structures under investigation. The important factor is not the location of the firm but the ability to transmit information from the site back to the office for study and engineering. Also, management of the firm will be flexible enough to travel to wherever the customer may be located to offer consulting services. One of the greatest advantages of the new venture will be it's core competency in the design and analysis of advanced composites for structural rehabilitation. Almost all other structural engineering firms are familiar with the material properties of steel, concrete and timber, but very few know enough about advanced composites to design or analyze structures with them. This "difference that makes a difference" will be a major focus of the firm's advertising in an effort to capture a large portion of this specialized but growing market.

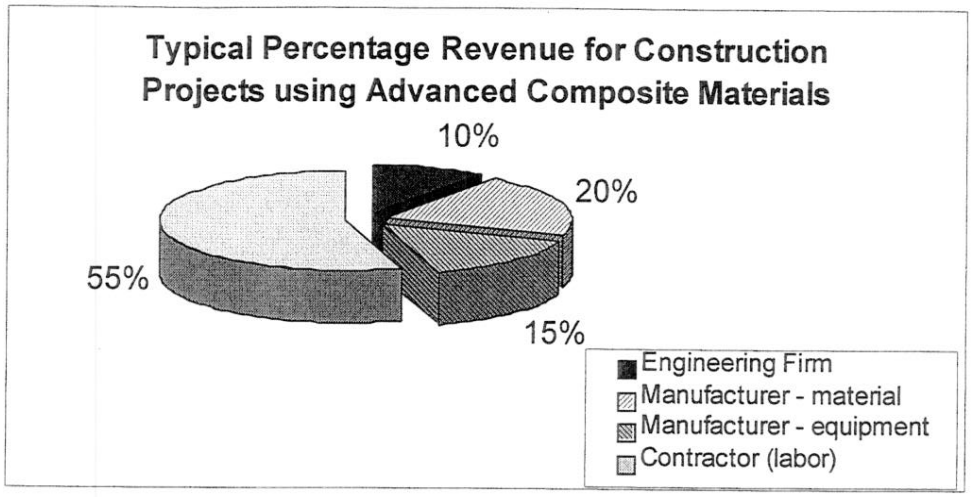
3.2 Industry Competitors

The infrastructure renewal industry is a large emerging market with relatively few competitors. The technology for this rehabilitation of existing concrete structures is in the early phases of commercialization and it appears to have a lot of potential that has not yet been

recognized by the market. In researching the competition, I found several structural retrofit companies that have built and patented machines that allow for a relatively quick and simple process of retrofitting existing concrete columns with advanced composites. One of these companies in particular, Xxsys Technologies, Inc., has developed a cost effective solution to retrofit older reinforced concrete bridge columns which do not meet current seismic design code. Their system, known as the Robo-Wrapper™ (see Figure 5.1 and 5.2), applies carbon fiber and epoxy resin to columns in order to strengthen them in axial compression and prevent collapse in the event of an earthquake (see Figure 5.3 and 5.4). Xxsys Technologies, Inc. business approach is to sell construction firms private-labeled composite material systems for the structural retrofit jobs, lease specialty equipment such as the Robo-Wrapper™, and provide technical support services for the equipment being leased. Another company, New Necessities, has recently manufactured a hybrid of site reformable Kevlar which can be used as a structural composite to reinforce the foundation and side walls of structures. This material, Kevlar Millbar®, can be used to strengthen concrete beams and slabs to increase shear and flexural resistance to environmental loading conditions (see Figure 5.5 and 5.6). Another product, MBrace™, produced by Master Builders, Inc. is similar to Kevlar Millbar®; however, it is manufactured out of carbon or e-glass fiber reinforcement. When applied to a structure in the correct location, the MBrace™ system increases the capacity of a structure to resist load through increased strength, increased stiffness, and increased durability by resisting shear and flexural forces from induced loading (see Figure 5.7 and 5.8). This product can also be used to structurally repair or retrofit concrete columns and slabs as well as pipes, tunnels, silos, tanks, and chimneys (see Figure 5.9). Master Builders, Inc. appears to have the largest selection of advanced composite materials when it comes to specific performance properties. This company has a strategic alliance with Structural Preservation Systems, Inc. as a leading contractor in structural repair and protection. Structural Preservation Systems operates as Master Builder's main contractor for the installation of MBrace™ composite strengthening systems on existing structures.

3.3 INDUSTRY DEMOGRAPHICS

In studying the industry competitors, we see that there are four main contributors in this type of structural retrofit using advanced composites; the manufacturer of composite material, the manufacturer of equipment for installation, the contractor, and the engineering firm. The following graph shows the percentage breakdown of revenue for each party when working together on a typical construction project involving the use of advanced composites (see graph).



When looking at the overall industry of infrastructure rehabilitation, we quickly learn that the manufacturing of the advanced composite materials is a mature but growing market [Dutta, et. Al., 1998]. The carbon fiber, structural fiberglass, and kevlar manufactures have been supplying material to the aerospace firms for several decades and in the last 5-10 years, tailored some new products for civil engineering applications. Also, the manufacturing of machinery and equipment to install these composite materials is beginning to grow rapidly (Xxsys technologies has a 3 year lead on its competitors in this area). The third major component of this industry is the contractors who actually use the material and equipment to perform the structural retrofit. Here we see more and more building contractors becoming specialized in the use of advanced composites and forming strategic alliances with these manufactures of material and equipment. The new venture will be established in this final component of the industry, where the actual engineering of existing structures using advanced composites is performed. Very few engineering firms specialize in this market, and consequently there is a small but quickly growing market as more federal and state agencies, high-technology retrofit companies, and individuals realize the need to analyze existing structures for potential repair or upgrade solutions.

3.4 Positioning vs. the Competition

To effectively compete against other engineering firms that offer consulting services in this field, the firm will be set apart through positioning and cost effective solutions. Most engineering firms that do provide engineering support for advanced composites, treat this work as a "satellite activity" while maintaining traditional civil applications as their core competency. *I will position the new venture as a structural engineering whose core competency is the design and analysis of advanced composite materials for structural rehabilitation of existing structures.* The firm will offer single source support to the customer from specification through completion

of the project and be a vital resource for selecting the type of retrofit and recommended contractor to accomplish the project objectives. Because the market is so small at this time, I will have first mover advantage in establishing the engineering firm as a respected and competent entity that can provide innovative design solutions to meet these structural challenges.

For those entities that currently provide consulting services solely in the area of advanced composites, I have found that these "firms" are typically not engineering firms at all. Rather they are engineering professors who specialize in the study of advanced composites for civil engineering applications and perform consulting on the side where it is aligned with current research and development. These individuals can offer excellent services; however, these consulting services are often accompanied by very expensive consulting fees. Also, University professors typically have little background in the construction industry and no professional license to approve structural designs according to current building codes. *The new venture will be able to provide these consulting services as a low cost provider and also have the required professional engineering background to stamp drawings and recommend contractor support.*

3.5 Significant Trends in Government & Technology

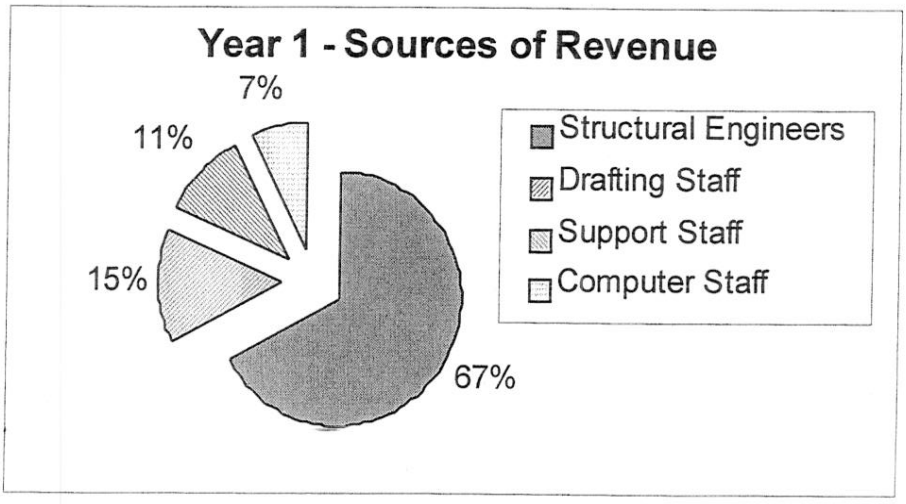
As mentioned in the market opportunity section of this report, the U.S. Congress recently enacted the largest transportation bill (TEA-21) in the history of the Nation - representing a 32% increase over the last bill and raising transportation spending as a national priority. Despite the increased highway spending, the $27.5 billion a year budget is not enough to take care of the huge challenges of the aging highways and bridges. With limited available funds, it is even more important to deploy innovative technologies to renew aging bridges. Several government partnerships have been developed to promote the accelerated use of innovation, particularly advanced materials and processes in new construction, repair, retrofit and maintenance of the transportation infrastructure. With this new energy and funding behind advanced materials, the market demand for retrofitting with advanced composites will be very strong over the next few decades. *This scenario is a classic case of a large emerging industry with vacuums that create unfilled market niches. Such an opportunity means it will be possible for the new venture to achieve significant sales by initially capturing only a small segment of the market.* For example, if we assume that the percentage of revenue for engineering work on a retrofit project is 10% and this new venture is able to capture as little as 1% of the market, the sales level would equal [.10*.01*$27.5B] $27.5 million dollars! Once the firm gains a reputation as a quality engineering consulting firm, I will then be able to grow the company with the market and capture more of the market share over time.

4.0 Top Line Forecast

4.1 Assumptions

One of the advantages of being a first mover in such a large emerging market will be the firm's ability to build a foundation of work experience and trust with customers in the first few years while posing no real threat to current competitors in the manufacturing and construction industry. The key question will be whether or not this new venture can quickly fill the market demand before the other players in the industry actually become experts in the design and analysis of advanced composites for rehabilitation of existing structures. One of my base assumptions is that I will have two to three years to build this experience and prepare for direct competition with other structural engineering firms who are just entering the market.

The engineering firm will be founded upon a limited liability company composed of myself and two other structural engineers. All three of us will have a Masters Degree in Structural Engineering and be fully licensed professional engineers in the State of California. Two of us will have an additional Masters degree in Business and the third will have a Law Degree as well. The three of us will be equal partners in the business and we will each invest a certain amount of our personal savings to initially get the firm off the ground. In order to eliminate overhead and increase cash flow in the first few years, the only other employees in addition to the (3) principal engineers will be; (2) draftsman to put together drawings for design solutions, (2) office support staff, and (1) computer support staff to assist with computer software analysis and communications. Because all principals and support staff will be billed out on a time and materials basis, all employees of the firm are sources of revenue. The more hours that the firm is able to bill to the customer, the more money the company will make. The percentage breakdown for this revenue is shown in the following graph and is based on the number of hours worked and amount billed per hour.



Another base assumption is that future revenue would be based on percent billable hours. The first year will require a lot of contacts to be made in order to establish the business; consequently, only 20-30% hours are expected to be billable in engineering. Computer analysis hours are expected to be low as a consequence of limited work load (see table below).

Year 1 Base Assumptions *Percent Billable Hours*	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Engineering Hours	20%	20%	30%	30%
Drafting Hours	30%	30%	40%	40%
Support Staff Hours	40%	40%	50%	50%
Computer analysis hours	20%	20%	30%	30%

Billable hours will be based on these percentages with a potential of 500 hours per Quarter. The following table shows the number of these projected hours for each employee.

Billable Hours based on 500 hours/ quarter	No. of Employees	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Structural Engineers	3	300	300	450	450
Drafting Staff	2	300	300	400	400
Support Staff	2	400	400	500	500
Computer Staff	1	100	100	150	150

This final table for the first year shows the actual revenue based on what the customer will be billed per hour for each employee. The billable rate of $150/hour is considered a conservative estimate for a registered professional structural engineer. In fact, we could possibly justify a rate of $200 to $250/hr because of the specialized knowledge required for analyzing composite materials. However, the principal engineers time is the greatest source of revenue and I wanted to keep these assumptions as realistic and plausible as possible for projecting total revenue.

Year 1 Service Revenue	Hourly rate ($/hr)	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Structural Engineers	150	45000	45000	67500	67500
Drafting Staff	35	10500	10500	14000	14000
Support Staff	20	8000	8000	10000	10000
Computer Staff	50	5000	5000	7500	7500
	Total Revenue	$ 68,500	$ 68,500	$ 99,000	$ 99,000

Over the first three years, I have projected a steady growth of 40 to 70% billable hours for the principal engineers. As the principal's hours go up, more drafting will be required as well as structural analysis that requires computer run time. Naturally, support and computer staff time is projected to go up as well during this time (see tables below).

Year 2 Base Assumptions	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Percent Billable Hours				
Engineering Hours	40%	40%	50%	50%
Drafting Hours	50%	50%	60%	60%
Support Staff Hours	60%	60%	70%	70%
Computer analysis hours	40%	40%	50%	50%

Here we see how billable hours are projected to get up to 40 - 50% during the second year the firm is in business. Computer analysis hours are shown to correlate directly with engineering hours while drafting and support staff will be expected to have more projects to coordinate and be able to better optimize the number of staff with the current work load.

Billable Hours based on 500 hours/ quarter	No. of Employees	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Structural Engineers	3	600	600	750	750
Drafting Staff	2	500	500	600	600
Support Staff	2	600	600	700	700
Computer Staff	1	200	200	250	250

As principal engineering hours have gone up from 20% in the beginning of the first year to 50% billable hours at the end of the second year, we can see the significant increase in total revenue (see table below). At this point in the firm's growth it may be wise to hire an additional engineer to increase production capacity; however, this would require some cost to benefit analysis. The projections with the number of staff have been kept constant to allow for a simple comparison between years so that other factors could be changed to study their effect.

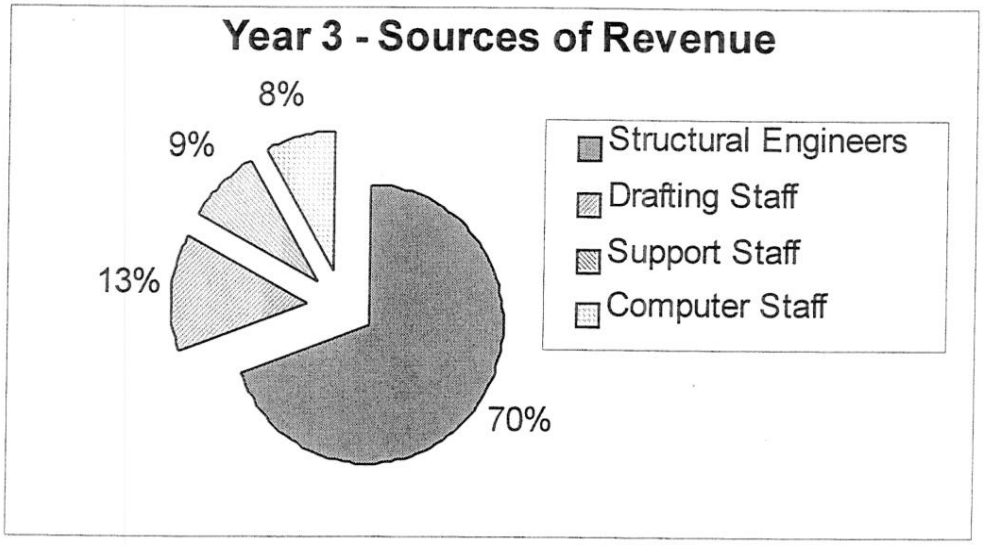
Year 2 Service Revenue	Hourly rate ($/hr)	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Structural Engineers	150	90000	90000	112500	112500
Drafting Staff	35	17500	17500	21000	21000
Support Staff	20	12000	12000	14000	14000
Computer Staff	50	10000	10000	12500	12500
	Total Revenue	$ 129,500	$ 129,500	$ 160,000	$ 160,000

Listed below are the tables shown for each quarter in the third year of the firm's operation including the final percentage breakdown of revenue for the different employees of the firm (this graph was identical for the second year).

Year 3 Base Assumptions *Percent Billable Hours*	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Engineering Hours	60%	60%	65%	70%
Drafting Hours	70%	70%	80%	80%
Support Staff Hours	80%	80%	90%	90%
Computer analysis hours	60%	60%	70%	70%

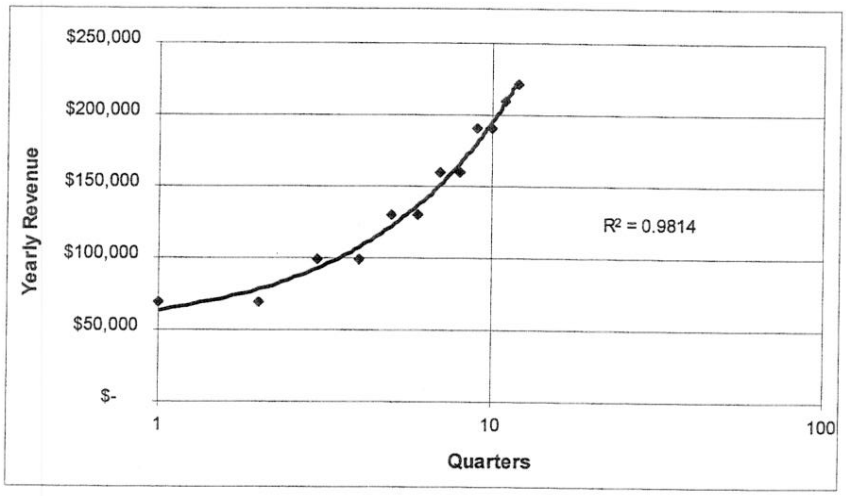
Billable Hours based on 500 hours/ Quarter	No. of Employees	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Structural Engineers	3	900	900	975	1050
Drafting Staff	2	700	700	800	800
Support Staff	2	800	800	900	900
Computer Staff	1	300	300	350	350

Year 3 Service Revenue	Hourly rate ($/hr)	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Structural Engineers	150	135000	135000	146250	157500
Drafting Staff	35	24500	24500	28000	28000
Support Staff	20	16000	16000	18000	18000
Computer Staff	50	15000	15000	17500	17500
	Total Revenue	$ 190,500	$ 190,500	$ 209,750	$ 221,000



4.2 ENTRY - PRICING STRATEGY

As discussed earlier, the firm's revenue for most jobs will based on a time & material basis with possibly only one or two lump sum projects per year. By estimating revenue on billable hours, the principal engineers should be billing around 70% of their time to current engineering projects by the end of the third year which is coincidentally the same percentage of direct revenue that principals pull in compared to other staff. This projected increase in billable hours which relates directly to revenue was plotted over the three year period in the graph below.



Although this graph is based only on projections, we can see a strong positive correlation between the number of quarters that the firm has been in business and the yearly revenue. Of course, the total revenue is limited by the total number of billable hours (500 per quarter in this case). However, new engineers can always be hired later on, as well as additional support staff to increase engineering and analysis capacity as the firm needs to grow to meet demand and secure a larger piece of the market share. The pricing strategy will not be critical to this new venture, because competition with other structural firms will be based on competence, cost effective solutions, and quick design turn around vs. billable rates for principal engineers.

4.3 PROJECTED MARKET SHARE

The market for structural engineering in the use of advanced composites is currently estimated to be $27.5 million dollars per year. The new venture will be positioned to capture a conservative 3.0% of the market within the first three years of establishment. This will result in approximately $825,000 per year in revenue. As shown in the income statement, the annual run rate by the 12th quarter is $812,000 which comes close to the projected market share of 3.0%. Once the firm gains a reputation as a quality engineering consulting firm, I will then be able to grow the company with the market and capture more of the market share over time.

5.0 Operational Plan

5.1 Legal Form/ Ownership

The engineering firm will be founded upon a limited liability composed of myself and two other structural engineers. All three of us will have a Masters Degree in Structural Engineering and be registered professional engineers in the State of California. Two of us will also have a Masters in Business Administration and the third will have a Masters in Contract Law. The three of us will be equal partners in the business and each invest a certain amount of personal savings to get the firm off the ground. This contributed capital will come from personal savings, and family loans. In addition to the necessary engineering expertise to perform the core competency of the business, we will each have specific responsibilities in managing the firm. I will be responsible for the *marketing and advertisement of the firm* to build awareness of the services offered. Another partner will be responsible for running the day to day *operations of individual projects and managing support staff*, and the third partner will be responsible for setting up *strategic alliances with key companies*. A strategic alliance will be formed with a manufacturer of composite material and a qualified contractor for installation of these materials in order to offer sole source support to the customer from specification through installation.

5.2 Location and Facilities

As mentioned under service advantages, the location of the firm is not an important factor as long as the principal engineers are able to transmit information from the potential construction site back to the office for study and detailed analysis. This service advantage will fulfill the one of the characteristics of a life style venture by allowing us to live in the Northwest of the United States. The principal engineers of the firm will be flexible enough to travel to wherever the customer or structures may be located to offer consulting services. Northern California will be an excellent location because of the need for seismic retrofits of structures in the west coast. Registration as a professional structural engineer in California is also a benefit, because all other state accept registration in this state as it is has the most stringent criteria in the United States. One of the inherent characteristics of engineering firms is that the required facilities to successfully run the business are quite small. Very little overhead, office space, or equipment is required to immediately begin performing consulting services. Also, relatively little capital is required to purchase this equipment (i.e., computers, analysis software, and communications).

5.3 Strategic Alliances

One of the service advantages found in this new venture that was mentioned earlier is the sole source support offered to the customer from specification through completion of the project. This firm will be a vital resource in helping the customer to select the type of retrofit and qualified contractor to accomplish these construction upgrades. In this endeavor, the firm's relationship of trust with the customer will be vital to the overall success of the firm. Business relationships with the manufacturers of these advanced materials will be just as critical as establishing a relationship of trust and respect with the government agencies requesting these services. A strategic alliance with a company such as Structural Preservation Systems or Master Builders Technologies will allow for a single source support system from specification through completion. Master Builders Technologies would supply the advanced composite material and high strength resins, the structural engineering firm would be involved in the structural analysis and design solution for the proposed retrofit, and Structural Preservation Systems would implement the installation of the advanced composites.

5.4 Barriers to Entry

One of the first barriers to entry that will be used upon entering the market is simply that of being the first structural engineering firm to specialize in the use of advanced composites. Because the market is so small at this time, we will have first mover advantage in establishing the engineering firm as a respected and competent entity that can provide innovative design solutions to meet these structural challenges. Another advantage of being a first mover in such a large emerging market will be the firm's ability to build a foundation of work experience with customers in the first few years while posing no real threat to current competitors in the manufacturing and contracting industry. Another barrier to entry will be to get the firm's experience and advanced composite material expertise in the bid specifications of the customers bid. For example, if a government agency bids out the work for engineering on a structural retrofit job, they can specify that the firm must have so many years of experience designing with advanced composites. If the firm does not have this experience or strong track record in the area of advanced composites, they will automatically be disqualified from the bid. The third and final barrier to entry will be to form strategic alliances with both manufacturers of material and equipment as well as contractors who perform composite retrofit installations. When competitors first enter the market and offer engineering support services to key manufacturers or contractors bidding on construction, they will find that this new structural engineering firm already has a continuing service contract in place with these key companies.

6.0 Financial Analysis

6.1 Assumptions

The same assumptions used in the Market Research report as far as number of employees and billable hours were used to forecast revenue during the first three years of business. The salary for each employee was kept constant during the three year period; however, the number of billable hours per employee was increased over time as firm gains a larger share of the market. Based on these assumptions, the total revenue for the new venture results in $335,000 the first year, $579,000 the second year and $811,750 the third year. According to these assumptions, an increase in the number of billable hours per quarter (through more work or more employees) or an increase in the rates per hour will lead to an even greater total revenue for each year.

The largest expense for the new venture will be salaries payable. Other foreseeable expenses in the first few years include rent, utilities, computer equipment, software analysis, drafting equipment, advertising, and travel. These expenses were estimated for each quarter and totaled for each year. Although the new venture's revenue is directly related to the number of billable hours worked by employees, the employees themselves are paid a base salary. This salary expense was assumed to be constant over the first three years because billable hours are expected to increase significantly over the first few years which contributes to firm's increase in revenue, but not necessarily the employees' salary. Other expenses that will increase over time are computer equipment and advertising. In order to maintain the new venture's core competency of structural analysis it will be necessary to keep up with the latest software and analysis tools for designing advanced composites. Also, advertising is expected to go up over time in order to notify the industry of the new venture's capabilities and capture more of the market share.

6.2 Income Statement

Based on revenue generated by office staff and general administrative and engineering expenses, the income statement can be derived. Gross sales are reduced by a discounted rate of 5% to account for continuing contract rates that may be established as part of a strategic alliance with other companies. Salariess payable shows up as the largest expense when compared to any of the other firm's expenses. This salaries payable expense could be reduced considerably if the principal engineers managing the company decided to go without any salary for the first few months. However, it seemed more conservative to show the principal engineers receiving some salary in return for their efforts. This understanding helps to balance out the large amount of cash ($500k) put up by the principal engineers which is necessary for starting operations. The income

statement in Appendix 7.1 shows depreciation expense constant over the three year period, while equipment expense, computer expense, and drafting expense are expected to go up over time as the company takes on more business. Travel and advertising expenses are also expected to go up considerably as significant marketing steps are taken to notify potential customers of the firm's consulting services. As shown in the income statement, the firm does not show a net profit until the beginning of the third year. By the end of the 12th quarter the firm shows a net profit of $29,783 and a running total of $50,495 for the third year.

6.3 Balance Sheet

The balance sheet shows total assets equal to $428,908 for the first quarter which then goes down considerably over the next four quarters. This is in part due to the large amount of cash which is expended in the first year to support operations. By the middle of the second year, total assets and total liabilities plus owner's equity are shown to slowly rise to a total of $274,950 by the end of the third year. This can be traced back to the gradual gain in Net Profit over time. The $500k pulled together by the principal engineers in order to get the firm off the ground is shown in contributed capital under owner's equity. Property and equipment totaling $80,000 is shown under Assets where it is depreciated over the three year period (Net Fixed Assets equal to $0 at the end of the 12th quarter). Accounts payable is assumed to be constant over the three year period at $20,000 per year; however, Short Term Debt is shown to accumulate beginning the second year. This Short Term Debt was used as a "plug" to balance statement once Assets were greater than Liabilities plus Owner's Equity. This Short Term Debt increases until the beginning of the third year; where it begins to go down as the firm becomes more profitable over time.

6.4 Ratio & Breakeven Analysis

The financial ratios in Appendix 7.1 show a very high Current Ratio (17.8) during the first year. This is due to the large amount of cash that is available under assets. As this cash is used up in business operations the current ratio goes down significantly until the middle of the second year. At this point the firm becomes more stable and the current ratio begins to go back up again ending around 1.86. The Times Interest Earned Ratio was not used in this ratio analysis because interest expense is not a factor due to the legal form of the company. The principal engineers' Return on Investment (ROI) starts out quite low due to the Net Loss over the first two years of operation; however, as the company becomes more profitable, the ROI reaches 1.17 by the end of the 12th quarter. Break even point of the company is best shown using this ROI ratio where it reaches 1.0 in the beginning of the third year. The Debt to Assets Ratio begins

extremely low in the first year because of the contributed capital pulled together by the principal engineers/ owners of the company. This Debt to Assets Ratio increases to 0.69 due to the accumulation of short term debt and then begins falling as Retained Earnings go up and Short Term Debt goes down.

6.5 CASH FLOW

The change in cash is shown to be negative during the first four quarters until the change in cash between the 4th and 5th quarter. Here the asset Cash is kept at a minimum of $20,000 and expected to increase approximately $5,000 every year for the next six quarters. The major Operating Activities shown in the Cash Flow are Depreciation, Change in Accounts Payable, and Change in Accounts Receivable. No Investing Activities are considered in this financial analysis. Under Financing Activities, the only effect on cash flow is change in Short Term Debt. Once the engineering firm has successfully completed several projects and met the projected revenue within the expense constraints, the new venture is expected to become much more stable and cash flow will remain constant after the middle of the second year.

6.6 FEASIBILITY

The financial analysis shows this new venture to be quite feasible. The most difficult part of getting this firm off the ground will be the contributed capital of $500,000 pulled together by the three principal engineers. This cash will come from such sources as personal savings, borrowing against a 401K, a second mortgage on a house, and family loans. The positive information gathered from the the financial analysis is that the end of the third year forecast shows a simultaneous increase in Net Profit, Return on Investment, and a stable Cash Flow. The market opportunity is very real in this industry and I believe that a competent, flexible and focused structural engineering firm could readily exploit this opportunity and make as significant amount of profit over time. Besides cash flow, the most critical component of the new venture will be to establish the firm with a strong track record and significant experience using advanced composites which will help the firm to gain the confidence of government agencies for future work. Once the firm is recognized by the industry with the core competency of design and analysis of advanced composite materials for structural rehabilitation, repeat business will be fairly easy to maintain. On a personal note, I have found the development of this business plan to be very exciting and rewarding. I believe that the integration of engineering skills with a sound understanding of business and what it takes to build a successful venture will provide for an exciting and rewarding career. Thanks for opportunity - I hope to take on this venture some day!

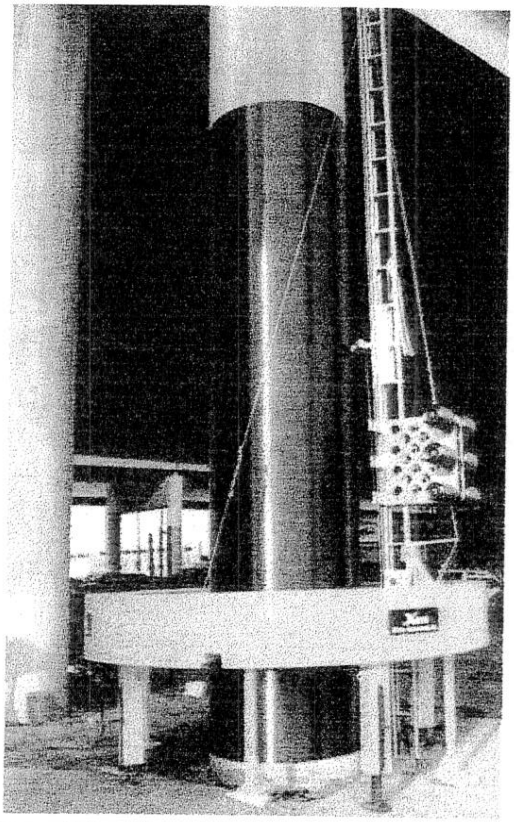


FIGURE 7.2A XXSYS TECHNOLOGIES ROBO-WRAPPER™

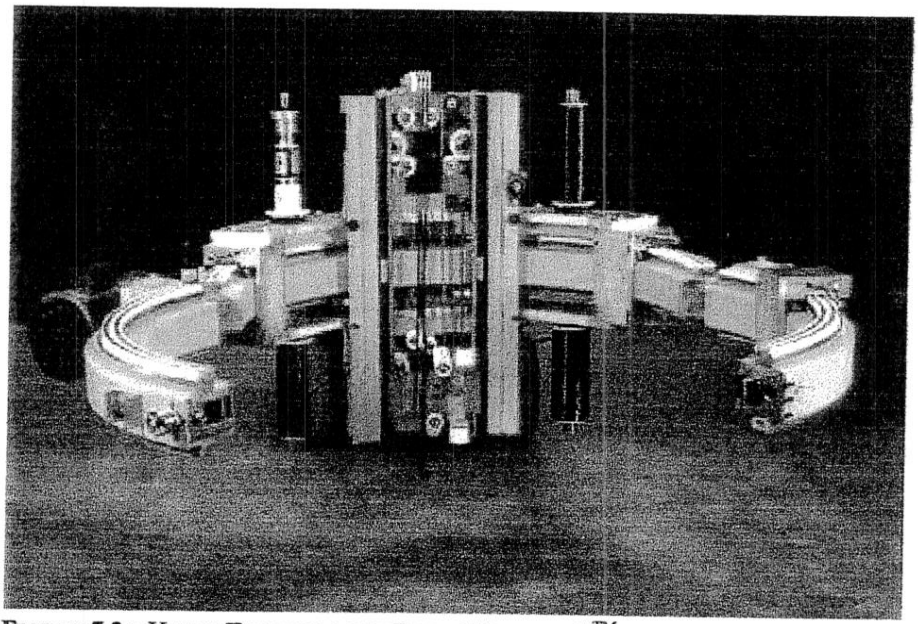


FIGURE 7.2B XXSYS TECHNOLOGIES ROBO-WRAPPER II™

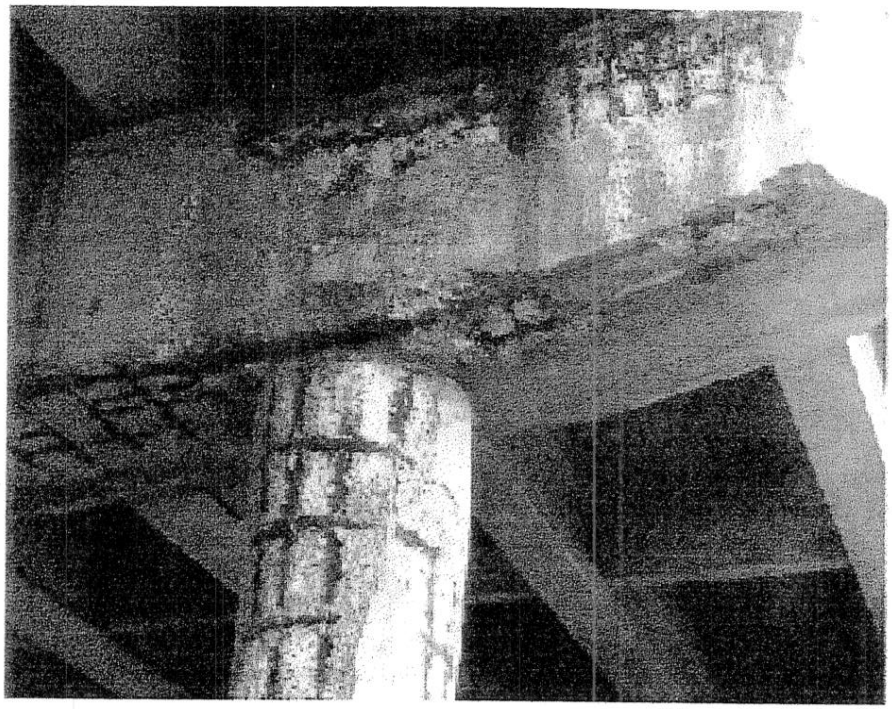


FIGURE 7.2C CORRODED COLUMN AND CAPPING BEAM UNDER A HIGHWAY OVERPASS

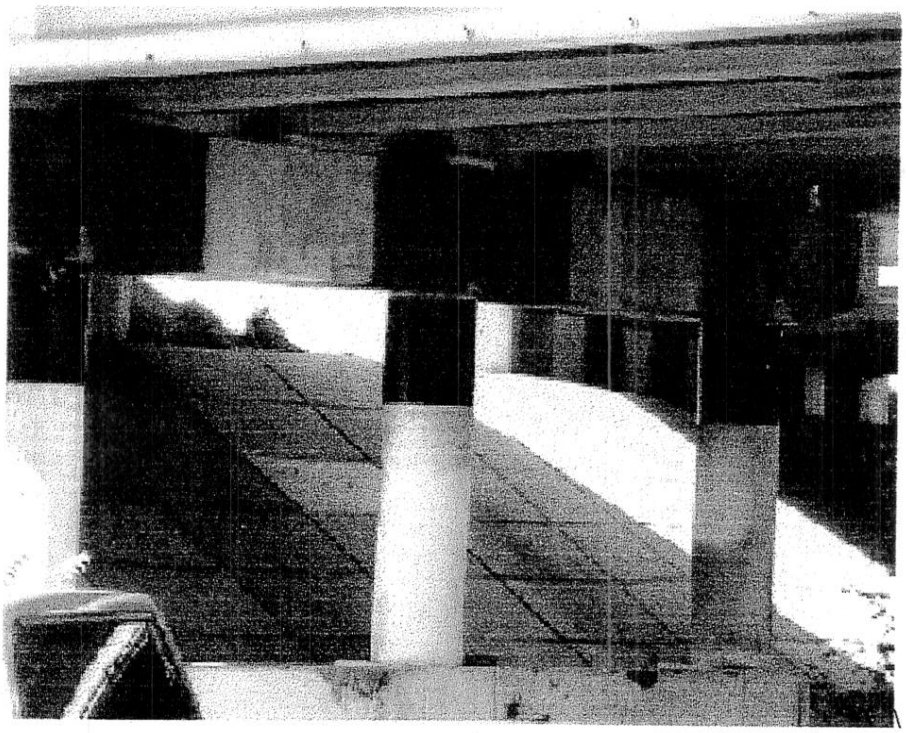


FIGURE 7.2D COLUMN AND CAPPING BEAM AFTER STRUCTURAL RETROFIT

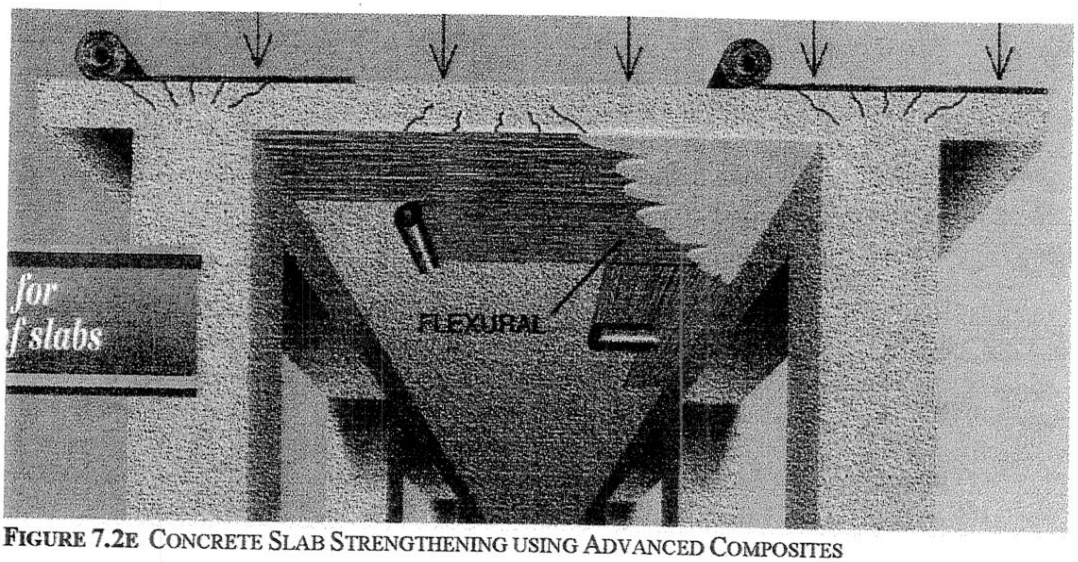


FIGURE 7.2E CONCRETE SLAB STRENGTHENING USING ADVANCED COMPOSITES

FIGURE 7.2F APPLYING COMPOSITE MATERIAL TO CONCRETE SLAB FOR RETROFIT

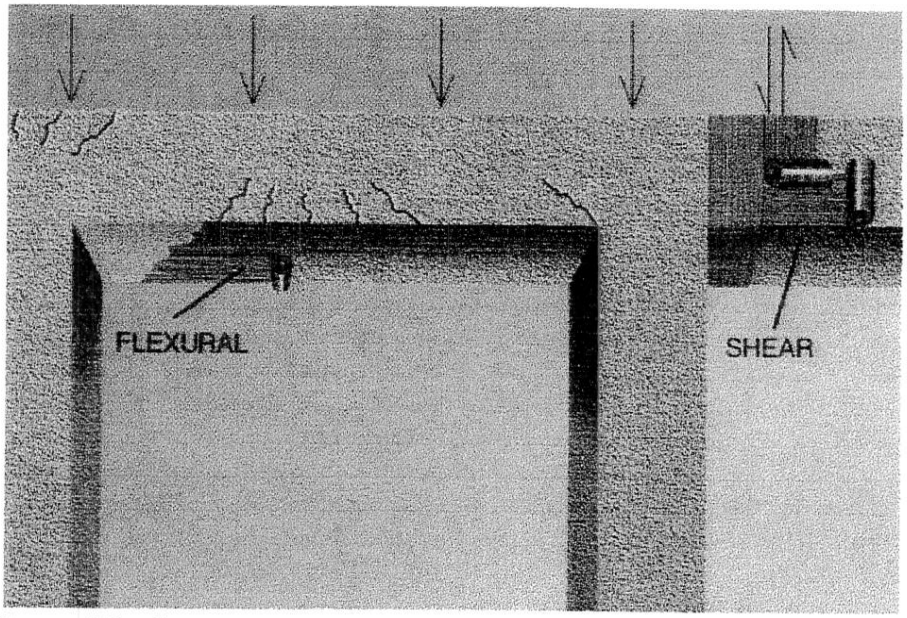


FIGURE 7.2G CONCRETE BEAM RETROFIT FOR FLEXURE AND SHEAR LOADING

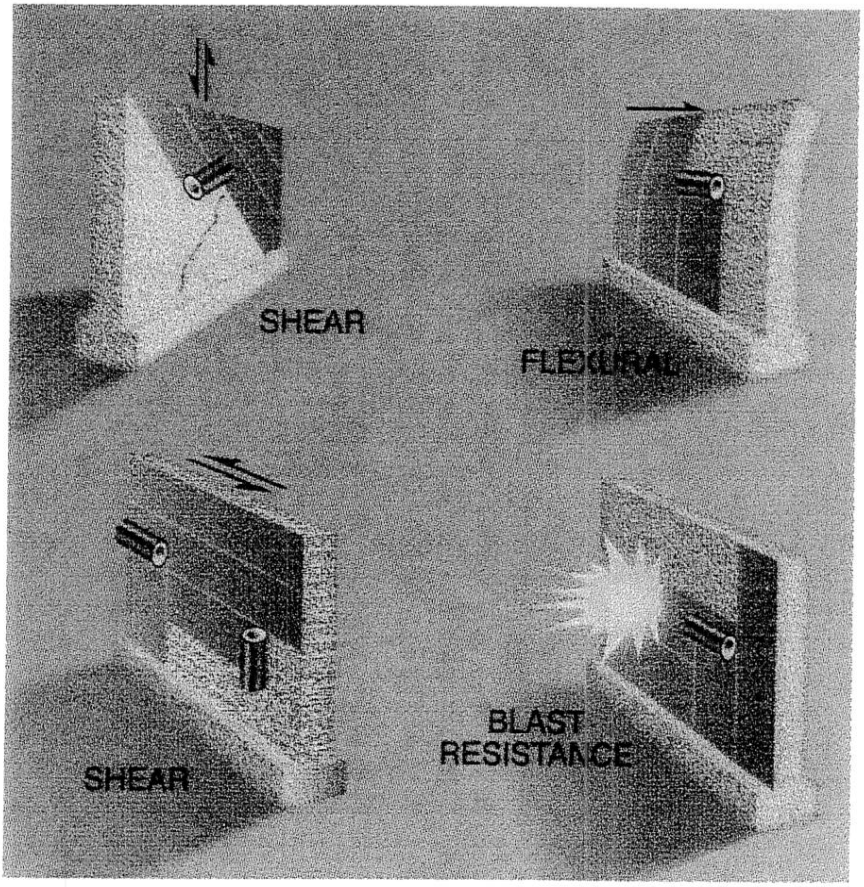


FIGURE 7.2H STRUCTURAL RETROFIT OF CONCRETE BEARING WALLS

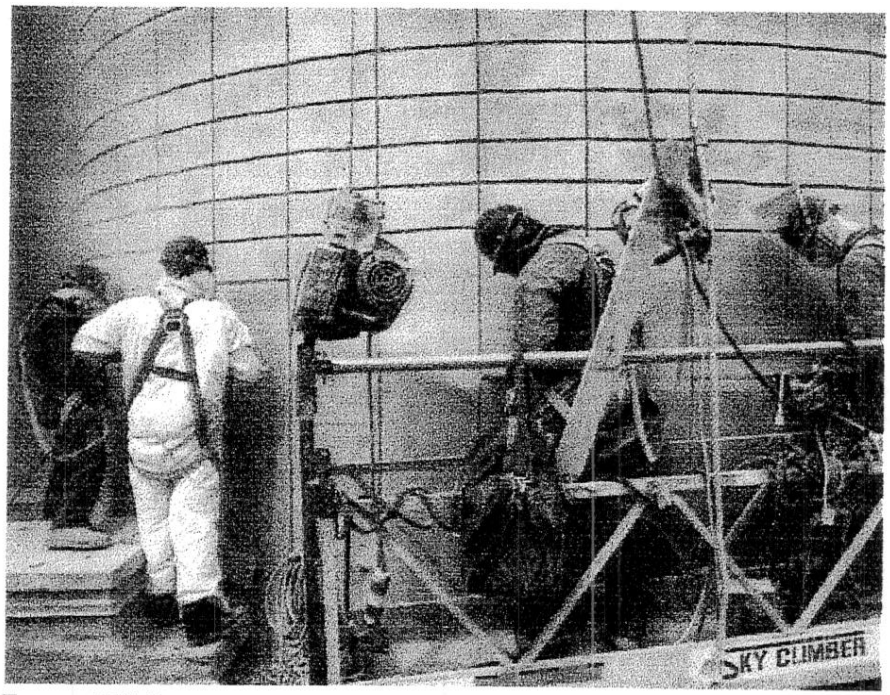


FIGURE 7.21 STRUCTURAL RETROFIT OF A CONCRETE TANK USING COMPOSITE RE-BAR

APPENDIX 7.3 REFERENCES

[1]Braestrup, M. (1998), Composite Approach. *Bridge Design and Structural Engieering*, Nov. (9), pp. 23-24.

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[3]Dutta, P.K., et al. (1998), Composite Grid Reinforcement in Concrete Sturctures: Construction Productivity Advancement Program. *US Army Corps of Engineers* - USACERL Technical Report, pp. 74-82.

[4]Saddatmanesh, H., et al. (1996), Repair of Earthquake-Damaged Reinforced Concrete Columns with FRP Wraps. *ACI Sturctural Journal*, 94 (2) pp. 206-215.

[5]Gergely, I., et al. (1997), Strengthening of Cap Beam Joists of Concrete Bridge Piers with Carbon Fiber Composite Wraps. *2nd National Seismic Conference on Bridges and Highways*, Sacramento, CA July 8-11, pp. 599-608.

[6]Jesen, D.W. and Earl, J.S. (1998), Composite Grid Reinforced Concrete Columns. *Structural Engineers World Congress*, July 19-23, San Francisco, USA, pp. 930.

Appendix 7.1a Revenue Assumptions

Year 1 Service Revenue	Hourly rate ($/hr)	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total Revenue
Structural Engineers	150	45000	45000	67500	67500	225000
Drafting Staff	35	10500	10500	14000	14000	49000
Support Staff	20	8000	8000	10000	10000	36000
Computer Staff	50	5000	5000	7500	7500	25000
Total Revenue		$ 68,500	$ 68,500	$ 99,000	$ 99,000	$335,000

Year 2 Service Revenue	Hourly rate ($/hr)	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total Revenue
Structural Engineers	150	90000	90000	112500	112500	405000
Drafting Staff	35	17500	17500	21000	21000	77000
Support Staff	20	12000	12000	14000	14000	52000
Computer Staff	50	10000	10000	12500	12500	45000
Total Revenue		$129,500	$129,500	$160,000	$160,000	$579,000

Year 3 Service Revenue	Hourly rate ($/hr)	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total Revenue
Structural Engineers	150	135000	135000	146250	157500	573750
Drafting Staff	35	24500	24500	28000	28000	105000
Support Staff	20	16000	16000	18000	18000	68000
Computer Staff	50	15000	15000	17500	17500	65000
Total Revenue		$190,500	$190,500	$209,750	$221,000	$811,750

Appendix 7.1b Expense Assumptions

Year 1	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
Wages Payable	$122,500	$122,500	$122,500	$122,500	$490,000
Rent Expense	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 30,000
Equipment Expense	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 12,000
Computer Expense	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 8,000
Drafting Expense	$ 2,000	$ 2,000	$ 2,000	$ 2,000	$ 8,000
Advertising Expense	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 24,000
Travel Expense	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 16,000
Utilities/ Misc. Expense	$ 2,500	$ 2,500	$ 2,500	$ 2,500	$ 10,000
Total	$149,500	$149,500	$149,500	$149,500	$598,000

Year 2	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
Wages Payable	$122,500	$122,500	$122,500	$122,500	$490,000
Rent Expense	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 30,000
Equipment Expense	$ 4,500	$ 4,500	$ 4,500	$ 4,500	$ 18,000
Computer Expense	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 12,000
Drafting Expense	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 12,000
Advertising Expense	$ 9,000	$ 9,000	$ 9,000	$ 9,000	$ 36,000
Travel Expense	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 24,000
Utilities/ Misc. Expense	$ 4,500	$ 4,500	$ 4,500	$ 4,500	$ 18,000
Total	$160,000	$160,000	$160,000	$160,000	$640,000

Year 3	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
Wages Payable	$122,500	$122,500	$122,500	$122,500	$490,000
Rent Expense	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 30,000
Equipment Expense	$ 4,500	$ 4,500	$ 4,500	$ 4,500	$ 18,000
Computer Expense	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 20,000
Drafting Expense	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 16,000
Advertising Expense	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 60,000
Travel Expense	$ 9,000	$ 9,000	$ 9,000	$ 9,000	$ 36,000
Utilities/ Misc. Expense	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 24,000
Total	$173,500	$173,500	$173,500	$173,500	$694,000

Appendix 7.1c Income Statement

	Year 1					
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Yearly Total	% of Net Sales
Gross Sales	$ 68,500	$ 68,500	$ 99,000	$ 99,000	$ 335,000	105.3%
Less Discounts (CR - 5%)	3,425	3,425	4,950	4,950	16,750	5.3%
Net Sales	$ 65,075	$ 65,075	$ 94,050	$ 94,050	$ 318,250	100.0%
General Administrative & Engineering Expenses						
Wages Payable	122,500	122,500	122,500	122,500	490,000	154.0%
Depreciation Expense	6,667	6,667	6,667	6,667	26,667	8.4%
Rent Expense	7,500	7,500	7,500	7,500	30,000	9.4%
Equipment Expense	3,000	3,000	3,000	3,000	12,000	3.8%
Computer Expense	2,000	2,000	2,000	2,000	8,000	2.5%
Drafting Expense	2,000	2,000	2,000	2,000	8,000	2.5%
Advertising Expense	6,000	6,000	6,000	6,000	24,000	7.5%
Travel Expense	4,000	4,000	4,000	4,000	16,000	5.0%
Utilities/ Misc. Expense	2,500	2,500	2,500	2,500	10,000	3.1%
Total Expenses	$ 156,167	$ 156,167	$ 156,167	$156,167	$ 624,667	196.3%
Net Profit/ Loss	$ (91,092)	$ (91,092)	$ (62,117)	$ (62,117)	$(306,417)	-96.3%

	Year 2					
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Yearly Total	% of Net Sales
Gross Sales	$ 129,500	$ 129,500	$ 160,000	$160,000	$ 579,000	105.3%
Less Discounts (CR - 5%)	6,475	6,475	8,000	8,000	28,950	5.3%
Net Sales	$ 123,025	$ 123,025	$ 152,000	$152,000	$ 550,050	100.0%
General Administrative & Engineering Expenses						
Wages Payable	122,500	122,500	122,500	122,500	490,000	89.1%
Depreciation Expense	6,667	6,667	6,667	6,667	26,667	4.8%
Rent Expense	7,500	7,500	7,500	7,500	30,000	5.5%
Equipment Expense	4,500	4,500	4,500	4,500	18,000	3.3%
Computer Expense	3,000	3,000	3,000	3,000	12,000	2.2%
Drafting Expense	3,000	3,000	3,000	3,000	12,000	2.2%
Advertising Expense	9,000	9,000	9,000	9,000	36,000	6.5%
Travel Expense	6,000	6,000	6,000	6,000	24,000	4.4%
Utilities/ Misc. Expense	4,500	4,500	4,500	4,500	18,000	3.3%
Total Expenses	$ 166,667	$ 166,667	$ 166,667	$166,667	$ 666,667	121.2%
Net Profit/ Loss	$ (43,642)	$ (43,642)	$ (14,667)	$ (14,667)	$(116,617)	-21.2%

	Year 3					
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Yearly Total	% of Net Sales
Gross Sales	$ 190,500	$ 190,500	$ 209,750	$221,000	$ 811,750	105.3%
Less Discounts (CR - 5%)	9,525	9,525	10,488	11,050	40,588	5.3%
Net Sales	$ 180,975	$ 180,975	$ 199,263	$209,950	$ 771,163	100.0%
General Administrative & Engineering Expenses						
Wages Payable	122,500	122,500	122,500	122,500	490,000	63.5%
Depreciation Expense	6,667	6,667	6,667	6,667	26,667	3.5%
Rent Expense	7,500	7,500	7,500	7,500	30,000	3.9%
Equipment Expense	4,500	4,500	4,500	4,500	18,000	2.3%
Computer Expense	5,000	5,000	5,000	5,000	20,000	2.6%
Drafting Expense	4,000	4,000	4,000	4,000	16,000	2.1%
Advertising Expense	15,000	15,000	15,000	15,000	60,000	7.8%
Travel Expense	9,000	9,000	9,000	9,000	36,000	4.7%
Utilities/ Misc. Expense	6,000	6,000	6,000	6,000	24,000	3.1%
Total Expenses	$ 180,167	$ 180,167	$ 180,167	$180,167	$ 720,667	93.5%
Net Profit/ Loss	$ 808	$ 808	$ 19,096	$ 29,783	$ 50,496	6.5%

Appendix 7.1d Balance Sheet

	Year 1			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Assets				
Cash	280,500	196,075	111,650	56,200
Office Supplies	10,000	10,000	10,000	10,000
Accounts Receivable	65,075	65,075	94,050	94,050
Total Current Assets	$ 355,575	$ 271,150	$215,700	$ 160,250
Property & Equipment	50,000	50,000	50,000	50,000
Computer Equipment & Software	30,000	30,000	30,000	30,000
Less Depreciation	6,667	13,333	20,000	26,667
Net Fixed Assets	$ 73,333	$ 66,667	$ 60,000	$ 53,333
Total Assets	$ 428,908	$ 337,817	$275,700	$ 213,583
Liabilities				
Accounts Payable	20,000	20,000	20,000	20,000
Short Term Debt	0	0	0	0
Total Current Liabilities	$ 20,000	$ 20,000	$ 20,000	$ 20,000
Owner's Equity				
Contributed Capital	500,000	500,000	500,000	500,000
Retained Earnings	-91,092	-182,183	-244,300	-306,417
Total Equity	$ 408,908	$ 317,817	$255,700	$ 193,583
Liabilites + Owner's Equity	$ 428,908	$ 337,817	$275,700	$ 213,583

	Year 2			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Assets				
Cash	20,000	25,000	30,000	35,000
Office Supplies	10,000	10,000	10,000	10,000
Accounts Receivable	123,025	123,025	152,000	152,000
Total Current Assets	$ 153,025	$ 158,025	$192,000	$ 197,000
Property & Equipment	50,000	50,000	50,000	50,000
Computer Equipment & Software	30,000	30,000	30,000	30,000
Less Depreciation	33,333	40,000	46,667	53,333
Net Fixed Assets	$ 46,667	$ 40,000	$ 33,333	$ 26,667
Total Assets	$ 199,692	$ 198,025	$225,333	$ 223,667
Liabilities				
Accounts Payable	20,000	20,000	20,000	20,000
Short Term Debt	29,750	71,725	113,700	126,700
Total Current Liabilities	$ 49,750	$ 91,725	$133,700	$ 146,700
Owner's Equity				
Contributed Capital	500,000	500,000	500,000	500,000
Retained Earnings	-350,058	-393,700	-408,367	-423,033
Total Equity	$ 149,942	$ 106,300	$ 91,633	$ 76,967
Liabilites + Owner's Equity	$ 199,692	$ 198,025	$225,333	$ 223,667

	Year 3			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Assets				
Cash	40,000	45,000	50,000	55,000
Office Supplies	10,000	10,000	10,000	10,000
Accounts Receivable	180,975	180,975	199,263	209,950
Total Current Assets	$ 230,975	$ 235,975	$259,263	$ 274,950
Property & Equipment	50,000	50,000	50,000	50,000
Computer Equipment & Software	30,000	30,000	30,000	30,000
Less Depreciation	60,000	66,667	73,333	80,000
Net Fixed Assets	$ 20,000	$ 13,333	$ 6,667	$ (0)
Total Assets	$ 250,975	$ 249,308	$265,929	$ 274,950
Liabilities				
Accounts Payable	20,000	20,000	20,000	20,000
Short Term Debt	153,200	150,725	148,250	127,488
Total Current Liabilities	$ 173,200	$ 170,725	$168,250	$ 147,488
Owner's Equity				
Contributed Capital	500,000	500,000	500,000	500,000
Retained Earnings	-422,225	-421,417	-402,321	-372,538
Total Equity	$ 77,775	$ 78,583	$ 97,679	$ 127,462
Liabilites + Owner's Equity	$ 250,975	$ 249,308	$265,929	$ 274,950

Appendix 7.1e Cash Flow

	Year 1			Year 2				Year 3			
Operating Activities	1Q - 2Q	2Q - 3Q	3Q - 4Q	4Q - 5Q	4Q - 5Q	6Q - 7Q	7Q - 8Q	8Q - 9Q	9Q - 10Q	10Q - 11Q	11Q - 12Q
Net Profit/(Loss)	-91,092	-62,117	-62,117	-43,642	-43,642	-14,667	-14,667	808	808	19,096	29,783
Depreciation	6,667	6,667	6,667	6,667	6,667	6,667	6,667	6,667	6,667	6,667	6,667
Change in A/R	0	-28,975	0	-28,975	0	-28,975	0	-28,975	0	-18,288	-10,688
Change in A/P	0	0	0	0	0	0	0	0	0	0	0
Net cash provided/(used)	$ (84,425)	$ (84,425)	$(55,450)	$ (65,950)	$ (36,975)	$(36,975)	$ (8,000)	$ (21,500)	$ 7,475	$ 7,475	$ 25,763
Investing Activities											
Capital Expenditures	0	0	0	0	0	0	0	0	0	0	0
Sales of Assets	0	0	0	0	0	0	0	0	0	0	0
Less Depreciation	0	0	0	0	0	0	0	0	0	0	0
Net cash provided/(used)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Financing Activities											
Change in short-term debt	0	0	0	29,750	41,975	41,975	13,000	26,500	-2,475	-2,475	-20,762
Issuance of stock	0	0	0	0	0	0	0	0	0	0	0
Net cash provided/(used)	0	0	0	29,750	41,975	41,975	13,000	26,500	-2,475	-2,475	-20,762
Total Cash Provided by all activities	$ (84,425)	$ (84,425)	$(55,450)	$ (36,200)	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,001
Change in Cash											
Change in cash balance	$ (84,425)	$ (84,425)	$(55,450)	$ (36,200)	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000

Appendix 7.1f Financial Ratios

	Year 1				Year 2				Year 3			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Current Ratio = Current Assets/ Current Liabilities	17.78	13.56	10.79	8.01	3.08	1.72	1.44	1.34	1.33	1.38	1.54	1.86
Times Interest Earned = EBIT/I	Not applicable - no interest expense											
Investment (ROI) = Net Sales/ Total Expenses	0.42	0.42	0.60	0.60	0.74	0.74	0.91	0.91	1.00	1.00	1.11	1.17
Debt to Assets = Total Liabilities/ Total Assets	0.05	0.06	0.07	0.09	0.25	0.46	0.59	0.66	0.69	0.68	0.63	0.54