Economic Analysis Project

New Warehouse Alternatives

CE 332, Group 7

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Project Executive Summary

A six-hundred-thousand square-foot Warehouse Facility is to be constructed by a private building owner in State College, Pennsylvania. The owner has a twenty-five acre parcel for the project. Ten of the twenty-five acres is dedicated for truck circulation and parking. Two project scenarios have been given. For these two scenarios, the Equivalent Uniform Annual Cost (EUAC) must be calculated to determine which of the two is more economical. The more economical and logical scenario shall be chosen for the project.

Both scenarios have several expenses including site work, construction, civil engineering and A/E fees, landscape and building maintenance, snow removal, pavement rehabilitation, and utilities. There is also rental and loan income. These values can be found under the income and expenses page.

For Scenario 1, the entire warehouse is to be designed and built in one phase. Half of the warehouse is to be used immediately after construction and the other half is to be leased five years beginning one year after construction. Scenario 1 includes expenses such as building retrofit, repair after the tenant moves out, office construction for the leased side, and advertising for the leasable space. The EUAC for Scenario 1 turned out to equal $1,935,425.99.

For Scenario 2, all six-hundred-thousand acres of the warehouse are designed at once, but half is built immediately. The other half is to be built five years after the completion of the first half. Because of these two phases, all expenses must be split between the end of Phase 1 and the beginning of Phase 2. Unlike Scenario 1, Scenario 2 includes an A/E five year building code evaluation which is performed while the second phase is underway. The EUAC for Scenario 2 turned out to equal $2,264,210.92.

As shown, the EUAC for Scenario 1 is less than the EUAC of Scenario 2. For this reason, Scenario 1 shall be the chosen option for the project.

Project Description

The objective of the project is to analyze two different scenarios and choose the best alternative for the construction of a 600,000 SF Warehouse facility. The owner of the project already has 25 acres to start the project.

The first scenario has a one-phase construction process that lasts 1 year. The civil engineering design will start right away taking a year to complete. The civil engineer is going to be paid 80% of the total fee when land development approvals are accepted. The other 20% is going to be paid when the site work is completed. The Architectural Engineer will design the building at the same time the site work is being constructed. He will be paid 80% of the total fee when the design is completed and the other 20% when the construction is completed.

A 2500 SF Office is going to be constructed for leasing, and once the overall construction is done, 300,000 SF of the Warehouse facility is going to be leased for 5 years. After the 5-year leasing period is over, the owner is going to take possession of the entire Warehouse and do retrofit.
The second scenario has two construction phases. The civil engineering design will start right away taking a year to complete. The civil engineering fee will be paid 80% of the total fee when land approvals are accepted, 10% after the first site work is completed, and 10% after the second site work is completed. The Architectural Engineer will be paid 80% when the design is completed, 10% when the first construction is done, and the other 10% after the second construction.

The phase one site work will start after land development approvals are accepted. It will last one year, followed by the one-year construction phase. The second site work will start the 5th year of building occupancy, and the construction the year after that.

Assumptions/Decision Points-Income and Expenses

Assumptions

Making a few general assumptions helped to make the calculations and decisions easier and consistent.

1. There will not be trouble finding a tenant as soon as leasing is offered. This eliminates the possibility of not filling the warehouse due to lack of rental interest.

2. All necessary tools and furniture for the space was previously purchased and therefore not included in our calculations.

3. Construction costs all fall under the initial construction cost of $48 million dollars. This assumption is important because it eliminates the consideration of extra cost during construction.

4. When considering financing, the interest rate was based on an educated assumption. After researching interest rates on related loans, the assumption was made for a 2.5% annual rate. This assumption had to be made as it would be difficult to get a real quote from an insurance agent for this project.

5. The assumption was made that there will be 60 employees working in the facility. This assumption was required for the costs of sewer and water that must be considered

Assumptions/Decision Points-Income and Expenses

Income/Expenses

Scenario 1:

Expenses:

The Civil Engineer gets a $85,000 fee. He gets 68000 (80%) on year 1, and 17000 (20%) on year 2.
The Site work costs $850,000, to be paid on year 2.
The Architectural Engineer gets a $2,880,000 fee for the design. He gets $2,304,000 (80%) on year 2, and $576,000 (20%) on year 3.
The additional 2500 SF Office construction costs $150,000, to be paid on year 3.
The building construction costs $48,000,000 to be paid on year 3.
The retrofit for the building costs $500,000 to be paid on year 9.
The pavement rehabilitation costs $150,000 to be paid on years 9,14, and 19.
The advertisement for leasing costs $1,200 annually on years 2, 3, and 4.
The landscape maintenance costs $3500 annually between the years 3 and 20.
The snow removal costs a $1,500 annually between the years 3 and 20.
The insurance costs $10,000 annually between the years 3 and 20.
The general building maintenance costs $1,200,000 annually between the years 3 and 20.
The electricity costs $480,000 annually between the years 3 and 20.
The sewer costs $3,000 annually every year between the years 3 and 20.
The water costs $1,000 annually between the years 3 and 20.
The fire suppression costs $500 annually between the years 3 and 20.
The loan payment is $2,277,223 annually between the years 1 and 20.

Income:

The Loan Income is a total of $35,500,000 on year 1.
The lease income is $3,000,000 annually between the years 4 and 9.
The rental income on the other side during the lease is $2,340,000 annually between the years 4 and 9.
The rental income is $4,680,000 annually between the years 10 and 20.

Assumptions/Decision Points-Income and Expenses

Scenario 2

Expenses:

The Civil Engineer gets a $91,000 fee. He gets $72,560 (80%) on year 1, $8,525 (9.4%) on year 2, and 9614 (10.6%) on year 10.

The Architectural Engineer gets a $3,360,000 fee for the design. He gets $2,688,000 (80%) on year 2, $312,480 (9.3%) on year 3, and %359,520 (10.7%) on year 11.

The Site work for phase one costs $425,000, to be paid on year 2.

The Site work for phase two costs $482,000, to be paid on year 10.

The building construction for phase one costs $26,000,000 to be paid on year 3.

The building construction for phase two costs $30,000,000 to be paid on year 11.

The Architectural Engineer 5 year building code evaluation costs $10,000 to be paid on year 10.

The pavement rehabilitation costs $150,000 to be paid on years 9,14, and 19.

The advertisement for leasing costs $1,200 to be paid on years 2, 3, and 4.

The landscape maintenance costs a $3,500 annually between the years 3 and 20.

The snow removal costs a $1500 annually between the years 3 and 20.

The insurance for construction one costs $5000 annually between the years 3 and 9.

The insurance for construction two costs $100,00 annually between the years 10 and 20.

The general building maintenance costs $600,000 annually between the years 3 and 9, and $1,200,000 between the years 10 and 20.

The electricity costs $240,000 annually between the years 3 and 9, and $480,000 between the years 10 and 20.

The sewer costs $1500 annually between the years 3 and 9, and $3000 between 10 and 20.

The water costs $500 annually between the years 3 and 9, and $1000 between 10 and 20.

The fire suppression costs $250 annually between the years 3 and 9, and $500 between the years 10 and 20.

The loan payment is $2,285,175 annually between the years 0 and 10, and $1,485,363 between the years 10 and 20.

Income:

The loan income for the first phase of the project is $20,000,000 on year 1.

The loan income for the second phase of the project is $13,000,000 on year 10.

The rental income for the first part is 2,340,000 annually between the years 4 and 20.

The rental income for the second part is $2,340,000 annually between the years 12 and 20.

Assumptions/Decision Points-Income and Expenses

Decision Points

The decision of scenarios was based on multiple aspects that were calculated throughout the analysis. First and foremost was the calculation of the EUAC. The EUAC is the annual amount that is equivalent to all cash flow and is a very important aspect of identifying which scenario is more cost effective. Since, the EUAC is an indicator of the overall costs of each scenario it can be taken as the most important aspect for making a decision on which is more cost effective. The financing aspect is also extremely important in making the decision. The best scenario is not always the one that requires the least initial financing, but that is an important consideration.

Risks

Building and leasing a warehouse evolves a large amount of decision making and risk analysis. Many parts of the project must be considered and dealt with in this project. It would be extremely difficult to identify every risk during the building and leasing process, but many of the major and most relevant risks may be identified.

- Unforeseen Worker Conditions- Often things happen with workers that were not predicted previously. Thus can include issues such as worker strikes, lack of personnel, or mistakes in construction. These issues can affect the cost and time of production.

- Technical/Specialized Work- Work that requires high skill level could hinder the project completion. If there is a lack of personnel to complete the work or a lack of knowledge by the acquired personnel, the quality and punctuality of the job would be at risk.

- Weather Conditions- Often, especially in Pennsylvania, weather cannot be counted on as a constant. During the winter months, snow, wind, and cold would cause construction delays in the building process. In the spring and summer large amounts of rain, causing flooding will hurt the building process.

- Construction Cost Increases- Cost increases that occur during construction would be a serious issue. Since the loan amount is majorly based on the expected price, additional costs could potentially be a major issue.

- Damage Over Time- After construction is complete there will obviously still be risks during leasing and operation. Damage caused to the building over time, whether due to tenants or due to unforeseen problems, could result in extra funding being required.

- Inability to Find Tenant- If the market in the area is not supportive of such a large warehouse at any point during the 20 year process, there may be issues in finding a tenant willing to lease it out. This could lead to multiple issues such as inability to make loan payments or causing lack of profit.

- Tenant Payment- When a tenant for the warehouse is found their ability to consistently pay for the space comes into question. In some cases the business or operation leasing the warehouse could become unable to pay the leasing costs. This could cost the owner money and time until the tenant is able to vacate and another tenant is found.

Discussion of Financing

For this project, how to finance all the expenses was a large portion of the initial planning. The owner of the project stated that they would be able to front 20% of the up-front costs. These costs included the site work costs, the civil engineering expenses, the architectural design work, and construction. It was assumed that all other expenses would be covered through the income that will be gained from the storage business, after the warehouse is set up. For both of the scenarios, a loan, or multiple loans will be taken out of the bank to help finance the other 80% of those initial costs.

Scenario 1:

In this scenario the up-front costs end up equaling $43.8M. The owner's contribution of these expenses is 20% of the cost. This comes out to approximately $8.8M out of pocket. The remaining 80% will need to be taken out as a loan. To be able to cover the rest of these costs, a loan of $35,038,100.00 will need to be taken out during the initial site work. It will be paid back from year one, with a 2.5% interest rate. This comes out to an annuity of $2,277,223.00 every single year.

Scenario 2:

In the second scenario, not one, but two separate loans will be taken out to cover the costs of the 80%. The total up-front costs for this scenario totals $41.2M and the owner will be able to cover $8.2M. This leaves a discrepancy of $32,969,750.00. It was decided that instead of taking out one loan and having it sit unused while still accruing interest, the project board will take out two separate loans, both of which will have a 2.5% interest rate, that will equal the $33M when added together. For the first ten years, a loan of $20M will be taken out immediately and will be paid back starting year one with an annuity of $2,285,175.00 per year. To decrease the complexity and confusion of having multiple loans, the board decided to pay off this first loan by year ten. Then the second loan would have to be taken out to fund the final portion of the costs. The second loan totals $13M and will be taken out at year ten. For this loan amount an annuity of $1,485,363.00 per year.

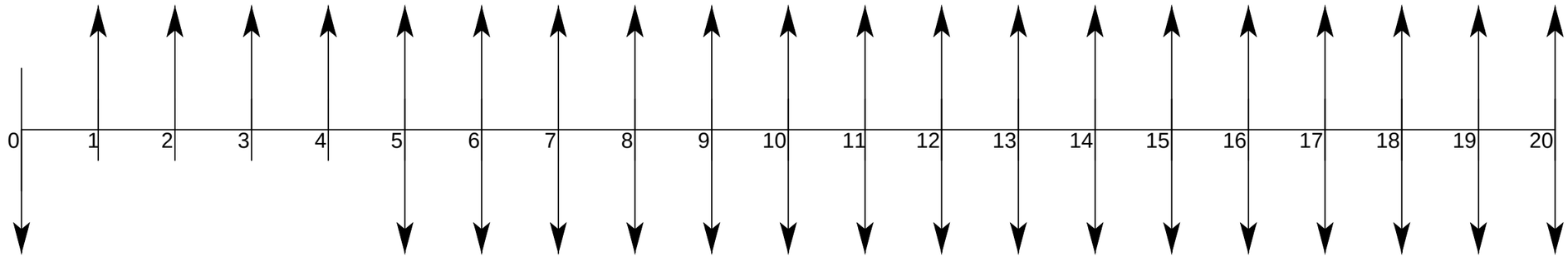
The decision to use scenario 1, although it would be a larger loan amount, was based more on the fact that half of the warehouse will be leased out to an outside buyer. This extra income helped incentivize the decision to choose the first scenario because the EUAC was a significant difference from the second scenario.

Cash Flow Diagram

Scenario 1

The Cash Flow Diagram for the first scenario of this project can be found on the following 11”x17” insert. For each expense or income found on the diagram, a cell sitting directly above or below each year’s corresponding arrow, will be filled when that monetary value is in effect.

Civil Engineering Fee (80%)	$68,000																					
Sitework	$850,000																					
A/E Design Fee (80%)	$2,304,000																					
Civil Engineering Fee (20%)	$17,000																					
Office Construction	$150,000																					
Building Construction	$48,000,000																					
A/E Design Fee (20%)	$576,000																					
Loan Payment	$2,277,000																					
Building Retrofit	$500,000																					
Pavement Rehabilitation	$150,000																					
Advertising	$1,000																					
Landscape Maintenance	$4,000																					
Snow Removal	$2,000																					
Insurance	$10,000																					
Building Maintenance	$1,200,000																					
Electricity	$480,000																					
Sewer	$3,000																					
Water	$1,000																					
Fire Suppression	$1000																					
EXPENSES	TOTAL	$0	$2.345M	$5.448M	$51.004M	$3.979M	$3.978M	$3.978M	$3.978M	$3.978M	$4.628M	$3.978M	$3.978M	$3.978M	$3.978M	$4.128M	$3.978M	$3.978M	$3.978M	$3.978M	$4.128M	$3.978M



INCOMES	TOTAL	$35.500M	$0	$0	$0	$0	$5.340M	$5.340M	$5.340M	$5.340M	$5.340M	$4.680M	$4.680M	$4.680M	$4.680M	$4.680M	$4.680M	$4.680M	$4.680M	$4.680M	$4.680M	$4.680M
Lease	$3,000,000																					
Rental Income From Half	$2,340,000																					
Rental Income From Whole	$4,680,000																					
Loan Income	$35,500,000																					

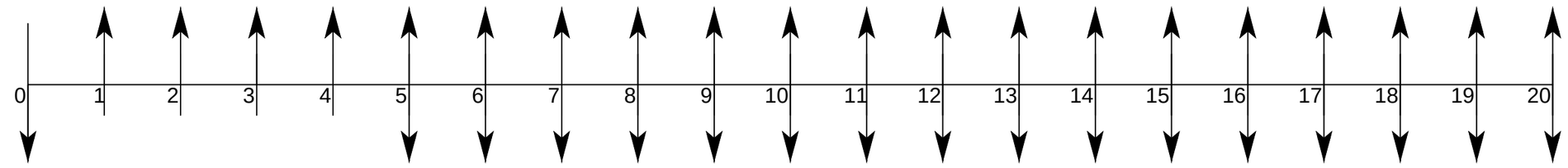
	CE 332 ECONOMIC ANALYSIS PROJECT		
ALL VALUES ROUNDED TO NEAREST $1000	DRAWING TITLE: SCENARIO 1		
	NAME: TEAM 7		DATE:3/28/15
COURSE: CE 332	SECTION: 1	DRAWING SIZE: B (11" X 17") SCALE: NA	GRADE:

Cash Flow Diagram

Scenario 2

The Cash Flow Diagram for the second scenario of this project can be found on the following 11”x17” insert. For each expense or income found on the diagram, a cell sitting directly above or below each year’s corresponding arrow, will be filled when that monetary value is in effect.

Civil Engineering Fee (80%)	$73,000																					
Site Work Phase 1	$425,000																					
A/E Design Fee (80%)	$2,668,000																					
Civil Engineering Fee (9.4%)	$9,000																					
Construction Phase 1	$26,000,000																					
A/E Design Fee (9.3%)	$312,000																					
Site Work Phase 2	$482,000																					
A/E Code Evaluation	$10,000																					
Civil Engineering Fee (10.6%)	$10,000																					
Construction Phase 2	$30,000,000																					
A/E Design Fee (10.7%)	$360,000																					
Loan 1 Payment	$2,285,000																					
Loan 2 Payment	$1,485,000																					
Pavement Rehabilitation	$150,000																					
Landscape Maintenance	$4,000																					
Snow Removal	$2,000																					
Insurance (Half)	$5,000																					
Insurance (Whole)	$10,000																					
Building Maintenance (Half)	$600,000																					
Building Maintenance (Whole)	$1,200,000																					
Electricity (Half)	$240,000																					
Electricity (Whole)	$480,000																					
Sewer (Half)	$2,000																					
Sewer (Whole)	$3,000																					
Water (Half)	$1,000																					
Water (Whole)	$1,000																					
Fire Suppression (Half)	$0																					
Fire Suppression (Whole)	$1000																					
EXPENSES	TOTAL	$0	$2.358M	$5.387M	$28.597M	$3.139M	$3.139M	$3.139M	$3.139M	$3.139M	$3.289M	$4.488M	$33.546M	$3.186M	$3.186M	$3.336M	$3.186M	$3.186M	$3.186M	$3.186M	$3.336M	$3.186M



INCOMES	TOTAL	$20.000M	$0	$0	$0	$0	$2.340M	$2.340M	$2.340M	$2.340M	$2.340M	$15.340M	$2.340M	$2.340M	$4.680M	$4.680M	$4.680M	$4.680M	$4.680M	$4.680M	$4.680M	$4.680M
Rental Income From 1st Half	$2,340,000																					
Rental Income From 2nd Half	$2,340,000																					
Loan 1 Income	$20,000,000																					
Loan 2 Income	$13,000,000																					

CE 332 ECONOMIC ANALYSIS PROJECT

ALL VALUES ROUNDED TO NEAREST $1000

DRAWING TITLE: SCENARIO 2

NAME: TEAM 7

DATE:3/28/15

COURSE: CE 332

SECTION: 1

DRAWING SIZE: B (11" X 17")

SCALE: NA

GRADE:

Computations

Scenario 1:

$$P_0 = 68000(1+0.06)^{-1} + 850000(1+0.06)^{-2} + 2304000(1+0.06)^{-2}$$
$$+ 17000(1+0.06)^{-2} + 150000(1+0.06)^{-3} + 48000000(1+0.06)^{-3}$$
$$+ 576000(1+0.06)^{-3} - \left(3000000\left[\frac{(1+0.06)^5-1}{0.06(1+0.06)^5}\right]\right)(1+0.06)^{-4}$$
$$-\left(2340000\left[\frac{(1+0.06)^5-1}{0.06(1+0.06)^5}\right]\right)(1+0.06)^{-4} - \left(4680000\left[\frac{(1+0.06)^{10}-1}{0.06(1+0.06)^{10}}\right]\right)(1+0.06)^{-10}$$
$$- 355000000 + 2277223.07\left[\frac{(1+0.025)^{20}-1}{0.025(1+0.025)^{20}}\right] + 500000(1+0.06)^{-9}$$
$$+ 150000(1+0.06)^{-9} + 150000(1+0.06)^{-14} + 150000(1+0.06)^{-19}$$
$$+\left(1200\left[\frac{(1+0.06)^2-1}{0.06(1+0.06)^2}\right]\right)(1+0.06)^{-2} + \left(3500\left[\frac{(1+0.06)^{17}-1}{0.06(1+0.06)^{17}}\right]\right)(1+0.06)^{-3}$$
$$+\left(1500\left[\frac{(1+0.06)^{17}-1}{0.06(1+0.06)^{17}}\right]\right)(1+0.06)^{-3} + \left(10000\left[\frac{(1+0.06)^{17}-1}{0.06(1+0.06)^{17}}\right]\right)(1+0.06)^{-3}$$
$$+\left(1200000\left[\frac{(1+0.06)^{17}-1}{0.06(1+0.06)^{17}}\right]\right)(1+0.06)^{-3} + \left(480000\left[\frac{(1+0.06)^{17}-1}{0.06(1+0.06)^{17}}\right]\right)(1+0.06)^{-3}$$
$$+\left(3000\left[\frac{(1+0.06)^{17}-1}{0.06(1+0.06)^{17}}\right]\right)(1+0.06)^{-3} + \left(1000\left[\frac{(1+0.06)^{17}-1}{0.06(1+0.06)^{17}}\right]\right)(1+0.06)^{-3}$$
$$+\left(500\left[\frac{(1+0.06)^{17}-1}{0.06(1+0.06)^{17}}\right]\right)(1+0.06)^{-3}$$

$$\Rightarrow P_0 = \$22199183.62$$

$$\Rightarrow EUAC = 22199183.62\left[\frac{0.06(1+0.06)^{20}}{(1+0.06)^{20}-1}\right]$$

$$\Rightarrow EUAC = \$1935425.99$$

Computations

Scenario 2:

$$P_0 = 72560(1+0.06)^{-1} + 425000(1+0.06)^{-2} + 2688000(1+0.06)^{-2}$$
$$+ 8525.80(1+0.06)^{-2} + 2600000(1+0.06)^{-3} + 312480(1+0.06)^{-3}$$
$$+ 482000(1+0.06)^{-10} + 10000(1+0.06)^{-10} + 9614.20(1+0.06)^{-10}$$
$$+ 30000000(1+0.06)^{-11} + 359520(1+0.06)^{-11}$$
$$- \left(2340000\left[\frac{(1+0.06)^{16}-1}{0.06(1+0.06)^{16}}\right]\right)(1+0.06)^{-4} - \left(2340000\left[\frac{(1+0.06)^{12}-1}{0.06(1+0.06)^{12}}\right]\right)(1+0.06)^{-12}$$
$$- 200000000 + 2285175.26\left[\frac{(1+0.025)^{10}-1}{0.025(1+0.025)^{10}}\right]$$
$$- 130000000(1+0.06)^{-10} + \left(1485363.92\left[\frac{(1+0.025)^{10}-1}{0.025(1+0.025)^{10}}\right]\right)(1+0.06)^{-10}$$
$$+ 150000(1+0.06)^{-9} + 150000(1+0.06)^{-14} + 150000(1+0.06)^{-19}$$
$$+ \left(3500\left[\frac{(1+0.06)^{17}-1}{0.06(1+0.06)^{17}}\right]\right)(1+0.06)^{-3} + \left(1500\left[\frac{(1+0.06)^{17}-1}{0.06(1+0.06)^{17}}\right]\right)(1+0.06)^{-3}$$
$$+ \left(5000\left[\frac{(1+0.06)^{6}-1}{0.06(1+0.06)^{6}}\right]\right)(1+0.06)^{-3} + \left(10000\left[\frac{(1+0.06)^{10}-1}{0.06(1+0.06)^{10}}\right]\right)(1+0.06)^{-10}$$
$$+ \left(1.00000\left[\frac{(1+0.06)^{6}-1}{\quad}\right]\right)(1+0.06)^{-3} + \left(\quad\left[\frac{(1+0.06)^{10}-1}{\quad}\right]\right)(\quad)^{-10}$$
$$+ \left(500\left[\frac{(1+0.06)^{6}-1}{0.06(1+0.06)^{6}}\right]\right)(1+0.06)^{-3} + \left(1000\left[\frac{(1+0.06)^{10}-1}{0.06(1+0.06)^{10}}\right]\right)(1+0.06)^{-10}$$
$$+ \left(250\left[\frac{(1+0.06)^{6}-1}{0.06(1+0.06)^{6}}\right]\right)(1+0.06)^{-3} + \left(500\left[\frac{(1+0.06)^{10}-1}{0.06(1+0.06)^{10}}\right]\right)(1+0.06)^{-10}$$

$$\Rightarrow P_0 = \$25970320.90$$

$$\Rightarrow EUAC = 25970320.90\left[\frac{0.06(1+0.06)^{20}}{(1+0.06)^{20}-1}\right]$$

$$\Rightarrow EUAC = \$2264210.92$$

Summary of Project

The objective of this project was to economically analyze two scenarios for the construction of a Warehouse Facility. Scenario 1 was more of a straightforward process by building the warehouse in one phase. After completion of construction, half the warehouse would be used and the other half would be leased. Scenario 2's process was more intricate by splitting the construction into two phases, thus making the EUAC calculation more complicated. Upon further economic analysis and calculation, the EUAC of Scenario 1 was $1,935,425.99 and the EUAC of Scenario 2 was $2,264,210.92, thus making Scenario 1 the better economic option.

Several steps were taken to obtain this final decision. The project description was read multiple times in order to fully understand every detail. If any small piece of information was skipped, the final calculations could be skewed. An executive summary was developed in order to essentially summarize this project description in a manner that made it easier for readers to understand the project without reading the entire description. Assumptions were then considered. These assumptions included the expenses and incomes that would be calculated in the EUAC equations for both scenarios. Risks were also taken into account, but were not mathematically calculated into the final EUAC equations. If they were, the final calculations could be subject to change. Then, financing options were evaluated. Because Scenario 1 has a single phase, only one loan would need to be taken out. Scenario 2, on the other hand, was determined to have two loans be taken out. A larger loan would need to be taken out for Scenario 1, but because of the income from the leased half, a smaller EUAC was rendered. These computations were shown to exhibit how the final yearly annuities were exactly calculated. In order to show all incomes and expenses in a logistical manner, a cash flow diagram was made for each scenario. This shows precisely when each payment was made, how long it would be payed for, and how much there was to be paid.

These very elaborate steps generated the educated decision of choosing Scenario 1 as the plan of attack to move forward with this project.

Project Meeting Minutes and Attendance

To maximize productivity and effort; and to allow the project to move along to a further stage, multiple meetings were held. On the following inserts, accounts of each of the meetings, including agenda, time spent, and executive decisions that were made, are all included.