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TECHNICAL AND ECONOMICAL COMPARISON OF AERIAL CONCRETE AND AERIAL STEEL WATER STORAGE TANKS IN PLAIN AREAS OF MAZANDARAN PROVINCE (DISTRICTS OF GOHARBARANAND MOALLEMKOLA IN THE CITY OF SARI)

HAMED TAGHIPOOR TRAHER[1], SEYED ROUHOLLAH ALIMOHAMMADI JELOUDAR[2], MOHSEN BARAHUEI[3], HADI HEYDARPOUR MATIKOLAOY[4]

1- M.Sc. Student of construction management and engineering, Islamic Azad University, Science and Research Branch, Tehran, Iran.(Hamed.taghipoortaher@yahoo.com)

2- M.Sc. Student of construction management and engineering, Islamic Azad University, Science and Research Branch, Tehran, Iran.(Rooh_35@yahoo.com)

3-Lecture Free University Qaymshhr- Pardisan Caspian Frydvnknar- khazar Mahmud Abad (m_barahuei@yahoo.com)

4- M.Sc.Student of Civil Water, Islamic Azad University, Tehran center, Iran. (hheydarpour@yahoo.com)

ABSTRACT

The literature review showed that there are significant deficiencies in the field of tanks, especially the drinking water storage tanks. Since the construction of these tanks is associated with certain difficulties in some areas, there is a particular need for construction management as well as proper economic assessment. As mentioned in the problem statement section, in this study, we consider some important factors that in this section, it has been taken from the research technical factors.

In the present study, we examine the selection of appropriate tank for drinking water storage in order to supply drinking water to the rural areas of Goharbaran and Moallemkola in the city of Sari. In this study, using three quantities of corrosion, earthquake, geometric volume and

implementation timing (msp) and economic assessment (comfar3) software, we select the appropriate tank for construction in the project.

Keywords: Drinking water storage tanks, technical and economic comparison

INTRODUCTION

Today water, this vital source, as one of three environmental forming and keeping elements (water, air and soil) is under much more attention than any time before. Undoubtedly today the protection and keeping water sources and optimized, economical and justly implementation of water is a global issue. Therefore in 21th century water assumed as a wide challenge for human. The global society emphasis is on this importance that government and nations consider water as a key of development. The water sources although are not dissoluble, their volume is fixed and the human order for it is increasing daily. To the point in last 100 years the global inquiry for water increase 6times, while the population increase 3 times, therefore the annual consumption of water for world people is decreased and hence there should be attempts to keep and maintain it.

Because today regardless of great need to drinking water, we see some paucities in some of provinces, it is meritorious to talk about this issue vulnerability and saving tanks which due to working condition should be designed and built with different safety according to the kind of application , they should have different structures. In the country water industry we see the wide application of concrete and metal stores that in this research we evaluate the technical and economical analysis of metal and concrete air tanks according to which we evaluate some important factors like erosion, geometric volume and earthquake… therefore in this research we tried to analyze each of these factors in proper construction method in technical and economical explanations to choose between concrete and metal stores. Hence this main question exists that between the metal and concrete stores which on is much more proper technically and economically?

By evaluation of observed literature in the field of stores specially drinking water stores we find considerable paucities .because making these tanks in some of regions has special difficulties, building this structure also need specific requirements to building management and proper economical assessment, as mentioned in the issue presentation we try in this research to evaluate some main factors that in this part we used the technical factors of research. The

erosion environment in industrial processes leads to increase of economical damages due to erosion in future years, MEYSAMI, 1384. According to water organization experts, every year due to erosion phenomenon in different cities discharging system in the country at least 30% of water is wasted that is equal to damages made by changing and repairing eroded pipes at homes which is a considerable amount, health investigation magazine, 1391.

The philosophy behind resistant structure toward earthquake in the form of structural regulations is based on the security coefficient adequate toward the structure destruction and also avoidance of heavy economical damaged at the time of possible earthquake. The theory of considering hydro dynamic pressure on the structure at the time of earthquake shaped from the beginning of 1930 and during designing some of high dams in the lands with frequent earthquakes, VAFAIE, ESTEKANCHI, 1387.

Statistical society

MAZANDARAN province rural sewage and water experts and mangers

Datas analysis and evaluation

In this research to gather datas, we used the field method and laboratory. On a way that according to sources and different research reports about different systems and modern software in economical and management systems, first attempt made to gather information by laboratory method in relation with the research first step performance and categorization of different kind of discussions. Then to complete information in second step the field method and by the use of observation tool and review of underperformance projects the necessary information are gathered and prepared for analyze them. In this research to obtain field datas for:

1- The metal and concrete stores structures behavioral analysis.

2- The possibility assessment by using EXEL, MPS, COMFAR3, by two methods of observation and technical theories.

The economical evaluation main concepts

The process of economical evaluation in an investment to decision making is as below:

1-recognition of projects number on the way of owner targets to investment

2- Economical analysis for programming horizon determination.

3- Determination of each financial flow prospect for each project.

4- Investor attracting outcome minimum rate determination.

5- The investment assessment criterions and reasoning determination to accept or reject options.

6- The results sensitivity analysis compared to possible changes in unsecure hypothesis.

7- Accepting or rejecting options and prioritize them.

Stores:

Stores are structures to store different liquids like water, oil products and chemicals. Destruction of water stores, the drinking water and assistance and fire extinguishing will face with problem. Damages to oil stores and chemical materials will lead to wide fire and toxic liquid emersion and environmental pollution. About the stability condition the water tanks are divided in to three kinds:

1- The airy water stores: depended to the condition and requirements are made by proper materials and higher than the earth surface.

2- The ground water stores: according to condition and requirements like pools are constructed on the land surface with intended materials.

3-undergroud water stores: these stores are built under the ground with intended materials for special applications.

The store covering

According to the water erosion effect on concrete and metal, the internal and external sides of metal stores and internal side of concrete stores should be covered by below colors which don't have improper effect on the water quality

1-rezine epoxy

2-vinille

3-metal coating

4- Coal tar

At present time the public idea is that the use of airy stores is much more better in water discharging system due to control of pressure frequencies and water consumption frequencies and reduction of watering events like pipes breaks, and annually we see the construction and implementation of airy store s all around Iran and world. But by technical evaluation of both watering system, we observed that by use of ground stores equipped with pumps and variable electro pumps is more proper and cheaper to airy stores. Of course it does not mean to reject airy stores in all locations; rather it is to provide more information and better selection.

Stores generally are designed based on the required volumes which are mainly cylindrical which connected to a cone at the bottom or like a cylinder with two lentiform at the top and bottom of the store body.

The store design is based on two parameters:

1- The store geometric shape

2- The erosion rate calculated for the time duration in the implemented store

The factors effective in the store holding pillars:

1- The loading based on the loaded weight by wind

2- Loading based on the earthquake

3-the water ground stores which are build buried or semi buried are used for storing and proving water at the time of consumption peek in civil watering system. These structures have important role at the time of earthquake to the point their important coefficient in the 2800regulation considered as 1.4.

4-on the other hand none linear behavior of structure at the time of earthquake leads to lots of considerable input energy in the form of damping energy and waste and hence structures could be designed for earthquakes force lower that linear condition, but due to high costs of none linear analysis, frequently it is attempted to be replaced with linear analysis.

Underground structures as special structures in very country has important role in construction, military and economical applications. In our country according to the oil existence and necessity to store oil in oil terminals in high volumes and other applications from buries stores, many of them are built. In security issue also underground stores have priority while on the ground stores are vulnerable. The history of building buried concrete stores referred to 1914 which built for the first time in Tokyo. Then during the World War II for saving ships fuel these kinds of stores were built. During 1940 to 1946 almost 210 concrete stores were built for oil product storing, the emersion problem in concrete stores according to the new method of construction removed. YAKUBSEN was of the first researcher who made researches about the dynamic features of water stores and then HAVEZNER in 1957 presented an approximate method for calculation of pressure distribution and the stature of liquid surface waves in cylindrical and rectangular stores under the effect of horizontal fluctuation effect. HAROUN performed similar studies for flexible stores

The loads on the stores are as below:

Dead load: it contains the simple load which calculated by having the material specific weight and sixth discussion construction national regulations and different parts dimensions easily.

2- Live load: it means that the snow load that loaded to the store roof whose amount obtained according to the store location by sixth discussion construction national

regulation but documented to the magazine number 123 of programming and management organization research office and technical criterions, the snow weight should not be fewer than 150 kg/ m2.

3-liquids static pressure: the liquid vertical pressure that forced to the storage base and the lateral pressure which forced to the walls.

4-the soil static pressure: the soil lateral pressure calculation formula is the RANKIN equation. In no condition the lateral pressure should in calculation be fewer than liquid similar lateral pressure with specific weight of 6kN/m. While the moving vehicle wheels could be close up to horizontal distance equal to half of wall stature, so the their horizontal pressure effect should be considered.

5- The reaction pressure or lifting pressure: in stores design whose base is lower than the penetrating water and underground water we should consider the reaction or lifting force of underground water as well.

6- The forces due to thermal variation: the store structure should be designed based on the forces made by thermal variation, the amount of temperature variation for buried stores should be 20 degree of centigrade and for semi buried stores it should be 40 degree of centigrade.

7-dynamic forces: dynamic forces, earthquake force, inertia forces due to structure vibration, the liquid inside it and the soil around it.

In the earthquake horizontal movements usually the fluctuation pressure due to having high period doesn't have significant role in making hydrodynamic pressure. In most of structures due to high axial stiffness in direction of earthquake vertical movement is not considered determinative in their designing. While in stores containing liquid the earthquake vertical movements leads to hydrodynamic pressure and as the result it will make considerable loading to the store wall. The hydrodynamic pressure due to vertical movements includes two pressure criterions as coordinate pulsing pressure to the earth vertical gravity and the pressure with short period due to store wall vibration. In earthquake periodical movement all the made hydrodynamic pressure, includes two pressure criterions as pulse and frequency. The liquid surface agitation leads to pulses to the storage roof from the fluid considerably.

As we know the earthquake forces different loads to the structure and relatively different tensions made in the structure. Generally every structure which is supported to the ground, during the earthquake will be affected by the ground movement criterions which include two lateral criterions, one as the vertical movement and 3 twisting

criterions around the structure axis. Evaluation of structures performance during the time of earthquake has special intricacy and this intricacy from on hand and the necessity to realize the store reaction and water at the time of loading and under the dynamic movement of water turbulence in the store, will make the airy stores structure analysis more difficult. Based on the studies performed it seemed that the regulations written in bylaw 2800 is for airy stores calculation with water lower than assurance and this issue has been confirmed by experts.

The stores to store the liquids especially airy stores are considered as the most important elements in the watering systems which after earthquake could be applied as expected before. OMIDNASAB and SHAKIB analyzed an airy concrete store with 900 meter square in capacity by 7 effects of earthquake records dynamically and the store responses as the pillar cut of, overturn luffing, the store replacement and turbulence replacement under the effect of seven gravity obtained were compared. They showed that store critical response will not occur in the time of full condition and it might happen in the time of filling or fewer percentages and even the empty store has the possibility of such problems.

The airy stores in intensive earthquake have significant importance as should not lose their application after the earthquake and be capable to provide water for drinking and fire extinguishing. Water leakage and breakdown will cause the possibility of dangers like city health due to water paucity or lack of capability to withstand toward firing in critical conditions. Up to now researches performed about the behavior and stores earthquake design and analysis especially for ground stores. In past decades airy stores also we considered by many researchers. In past earthquake airy stores were vulnerable structures and their earthquake behavior was not proper and they faced with minor and great damages. So their security capability toward earthquake loads breaking forces has vital importance. Past earthquakes showed that due to important structure beaks as airy stores with inadequate resistance, encountering with fire and other attempted will faced with delay. Many studies performed about the dynamic behavior of fluid stores while most of these studies concentrated on the cylindrical stores on the ground. HAROUN and coworkers presented a model includes the airy fixed stores number under the movement and twist.

This study evaluated the turbulence moods and assessed the store walls flexibility effect

for the airy stores responses. TERMAZ and coworkers evaluated the airy stores models with cross bracings and based on the separated foundation to evaluate the dynamic interaction effects of store and the foundation- soil support. But they avoid from the effect of turbulence effects. MARASHI and SHAKIB performed environmental vibration test to evaluate the airy stores dynamic features, DOTA and coworkers also analyzed the twist inelastic behavior differences of store random centrifugal system by increase of supporting frame numbers. Consequently DOTA and coworkers showed that the soil- structure interaction might cause the pillar break possibility enhancement about airy stores with lower structure periods. Also this study concludes that the avoidance of soil-structure interaction effect might lead to potential great extension forces due to earthquake load on some of pillars. DOTA and coworkers presented a simple analysis process to analyze the soil systems at airy fluid stores foundation used this approximation in selected stores. LIYUGLOU performed approximate study on airy stores earthquake moods by evaluation of fluid structure interaction.

Figure 1: on the right there was a store with 265 cube meter capacity in 20 kilometers distance from the earthquake center that at the time of event has been approximately full, the left figure is the store of 2270 cube meter capacity with 29.5 height in which we can observe the deflection crack at half of pillar circumference at the performing slit in the 103 meter stature higher than ground surface. The crack has made due to earthquake event in 1997 at JABAL POURHEND.

In piping systems to transfer liquids and gases we should try to avoid designing which leads to rapid deformation as much a possible, as we don't have to use elbows with intensive angles which leads to emergence of eroding fraction especially metals like copper, lead and their alloys. On the other hand equipment's should be designed on a way that parts which are under the intensive erosion effect and cause destruction, could be easily replaced.

According to the store material and quality and capacity, the form and stature of construction, the costs are different. But as usual the airy stores construction cost is more than 2 or 3 times than ground stores. Also to

make airy stores safety toward earthquake other costs are necessary as well. On the other hand issues and problems related to airy stores is more than ground stores to the point their beneficial life due to short repairing periods will increased up to 30 years, 4.

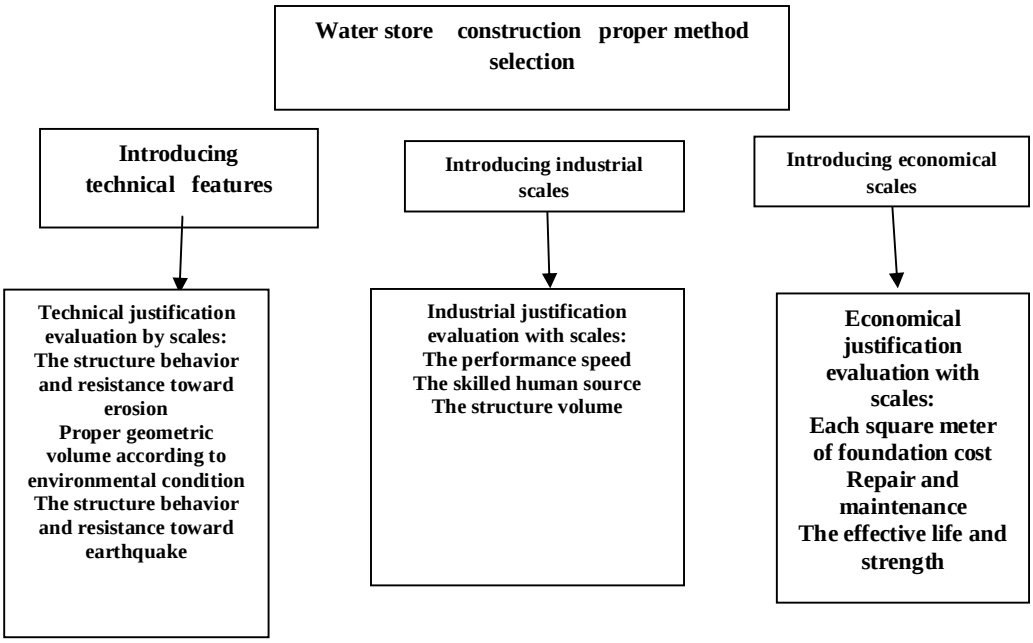
The applied researching method:

In present research purpose is practical because we can use the research results in water storage airy metal and concrete economical and technical comparison. The method of research performance is as below:

The research scope:

The research domain is the water storage in airy metal and concrete stores, the location scope is the MAZANDARAN province regions (GOHARBARAN, MOALEM KOLAY SARY) and the time domain is 1392

The research structural model



100 cube meter concrete store metering total summery

The obtained results from statistical calculations about economical costs of water storing concrete stores in MAZANDARAN province flat regions (GOHARBARAN, MOALEM KOLA SARY) is as below:

Total metering summery

Total cost	rate	Unit price	unite	Performance description	row
			Soil operation with machineries	Third chapter	
5814000	**340**	**17100**	**Cube meter**	**Foundation, channel, digging with mechanical instruments in hard lands up to 2 meter depth and carrying the digging soil to determined places**	**30502**
2709800	**340**	**7970**	**Cube meter**	**Loading materials after soil digging operation and carrying them with truck or any mechanical machineries to discharge it to 100 distance from the location**	**30701**
8,523,800.00			**Third chapter sum**		

			The construction operation with stone	Fourth chapter	
8650000	**50**	**173000**	**Cube meter**	**Providing and discharge natural around and at the store base**	**40504**
8,650,000.00	**Fourth chapter sum**				

			Metal molding	Sixth chapter	
26040000	**210**	**124000**	**Cube meter**	**Providing molding equipment by the use of metal molds in foundations**	**60101**
18431550	**110.7**	**166500**	**Cube meter**	**Providing materials and molding materials for the height of 10 meter**	**60201**
65800000	**400**	**164500**	**Cube meter**	**Providing equipment and molding instruments for pillars up to 10 meter height**	**60301**
88250000	**500**	**176500**	**Cube meter**	**Providing equipments and molding devices by the use of metal molds in slabs up to maximum10 meter height**	**60401**
358380	**72.4**	**4950**	**Cube meter**	**Extra cost for the use of special supporting spacers with sealing plat instead of bolt**	**60802**
198,879,930	**Sixth chapter sum**				

			Metal operation with rods	Seventh chapter	

91140000	4200	21700	Kilograms	Providing, cutting, bending, locating the ribbed rods up to 10 millimeter for the reinforced concrete with all kinds of required wiring	70201
46305000	2450	18900	Kilograms	Providing, cutting, bending, locating the ribbed rods from 12 up to 18 millimeter for the reinforced concrete with all kinds of required wiring	70202
1.11E+09	58000	19130	Kilograms	Providing, cutting, bending, and locating the ribbed rods from 20 up to more than 20 millimeter for the .reinforced concrete with all kinds of required wiring	70203
1,246,985,000		Seventh chapter sum			

			On time concrete	Eighth chapter	
10081488	21.03	479500	Cube meter	Preparation and performance with natural washed sand or broken type by 150 mega Pascal cutie	80102
224875000	350	642500	Cube meter	Concrete Preparation and performance by pressure resistance of 20 mega Pascal- except the roof	80105
35275000	50	705500	Cube meter	Concrete Preparation and performance by pressure resistance of 25 mega Pascal- the roof	80106
1869000	30	62300	Cube meter	Extra cost for pillar concrete and walls which concreted in addition to roof	80301
2424192	226.6	10700	Cube meter	Smoothing the base and walls surface	80308
274524680		Eighth chapter sum			

			Humidity isolation	Thirteenth chapter	
8519920	112.4	75800	Cube meter	Humidity isolation with prefabricated isolators from tar and polyesters yarns with 3 millimeter thickness with covering layer for all surfaces	130302
8519920		Thirteenth chapter sum			

Steel light application	Sixteenth chapter	

15512000	560	27700	Kilograms	Preparation, construction and installation of iron gate	160201
175198000	6980	25100	kilograms	Preparation, construction and installation of fences and ladders with costs of lacings installation in addition to welding	160103
1575468	38.52	40900	kilograms	Preparation and installation of galvanized pipe as the concrete stores roof vent	160213
192285468	Sixteenth chapter sum				

			Plastic affairs	Twenty third chapter	
3454500	49	70500	Length in meter	Preparation and installation of water stop with 15 centimeter width	230901
244000	122	2000	Cube meter	The cost of water purchasing for discharging to the store and wash it for disinfection	*
244000	Chapter 23 star article price and sum of chapter 23				
3454500					

3698500	The structure total cost

			Total summery-metering		
Total price	volume	Unit price	unit	Operation description	row
				Chapter 4-8	
12048000	4	3012000	number	Gate valve with 100 millimeter diameter	40104
46000000	92	500000	Length meter	Galvanized pipe with nominal diameter of 100 mm (4 inches)	80104
58048000	Miscellaneous chapter sum				.

Rials	2,000,115,297.50	Total cost assessment

The summery of 100 cube meter airy metal store cost

Obtained result from statistical calculation about economical cost of metal stores in MAZANDARAN flat regions (GOHARBARAN, MOALEM KOLASARY) is as below:

Manual soil operation				
Total price	**Unite price**	**unite**	**volume**	**description**
76,000	**19,000**	**Cube meter**	**4**	**Digging operation, foundation operation and channel making in soft lands up to 2 meter depth and**
1,336,500	**49,500**	**Cube meter**	**27**	**Foundation, channel, digging with mechanical instruments in hard lands up to 2 meter depth and carrying the digging soil to determined places**
6,747,000	**519,000**	**Cube meter**	**13**	**Foundation, channel, digging with mechanical instruments in stony lands up to 2 meter depth and carrying the .digging soil to determined places**
1,900,800	**43,200**	**Cube meter**	**44**	**Loading materials from every soil operation, none sewage process and carrying to the 50 meter distance where there .is no possibility to carriage by machineries**
10,060,300	**The base items total sum**			
10,060,300	**The chapter total sum**			

Soil operation with machineries			
Unite price	**unite**	**volume**	**Description**
7970.00	**Cube meter**	**44**	**Loading materials after soil digging operation and carrying them with truck or any mechanical machinery to discharge it to .100 distances from the location**
685.00	**Cube meter**	**176**	**Carrying materials from soil operation when the distance is more than 100 meter up to 500 meter and for every 100 meter extra to first 100 meter, the 100 meter ratio is calculated**
3320.00	**Cube meter kilometer**	**334**	**Carrying the soil operation materials when the distance is more than 500 meter to 10 kilometer for each extra kilometer in addition to fist 500 meter, for none built roads like detours and connecting roads (kilometer to price ratio is calculated)**
	The base items total sum		
1,580,120	**Chapter total sum**		

Construction operation with stone				
Total cost	**Unite price**	**unite**	**volume**	**description**
5,025,000	**167,500**	**Cube meter**	**30**	**Preparation and casting soft sand in channels, foundation, pipe and structures base, on the roof, roads and areas or any where necessary in addition to discharge in required thickness**
	The base items total sum			
5,025,000	**Total sum**			

Wooden molding				
Total cost	**Unite price**	**unite**	**volume**	**Description**
3,024,000	**112,000**	**Square meter**	**27**	**Preparation of molding equipments by the use of external dicer board in foundation and relative bases**
3,024,000	**The base total items sum**			
3,024,000	**Total sum**			

Steel affairs with rods				
Total cost	**Unite price**	**unite**	**volume**	**Description**
20,145,000	**23,700**	**kilograms**	**850**	**Providing, cutting, bending, locating the ribbed rods up to 10 millimeter for the reinforced concrete with all kinds of required wiring**
53,300,000	**20,500**	**kilograms**	**2600**	**Providing, cutting, bending, locating the ribbed rods from 12 up to 18 millimeter for the reinforced concrete with all kinds of required wiring**
9,118,800	**29,800**	**kilograms**	**306**	**Preparation, building and installation with bolt rods with required nuts in necessary locations before concreting**
82,563,800	**The base total items sum**			
82,563,800	**Total sum**			

On time concrete				
Total cost	**Unite price**	**unite**	**volume**	**Description**
2,997,000	**499,500**	**Cube meter**	**6**	**Preparation and performance with natural washed sands with 150 kilograms of cements in each cube meter**
34,922,250	**705,500**	**Cube meter**	**49.5**	**Preparation and performance of concrete with natural washed sands with pressure resistance of 25 mega Pascal.**
493,020	**9,960**	**Cube meter**	**49.5**	**Extra costs for concreting rows in concrete used in reinforced concrete**
The base total items sum				
38412270	**Total sum**			

Heavy steel affairs				
Total cost	**Unite price**	**unite**	**volume**	**Description**
987,000,000	**32,900**	**kilograms**	**30000**	**Preparation, construction and installation of water metal stores with welding, cutting and polishing and necessary bolds and nuts**
12,243,400	**27,700**	**kilograms**	**442**	**Preparation and construction of iron parts and installation in concrete bases or in any location which built before, using plate, rods, pipes edges, three edges and required ramus, welding, cutting, drilling, polishing completely**
999,243,400	**The base total items sum**			
999,243,400	**Total sum**			

Bricks sorting and concrete pouring				
Total cost	**Unite price**	**unite**	**volume**	**Description**
6,195,000	**105,000**	**Square meter**	**59**	**The brick wall with pressurized brick and cements mortar of 1:6.**
	The base total items sum			
	Total sum			
Total cost	**Unite price**	**unite**	**volume**	**Description**
435,000	**4,350**	**Square meter**	**100**	**Preparation and installation of nylon the ply ethylene films about 150 grams in square meter for the concrete sides or similar works, that the nylon remains in the concrete**
	The base total items sum			
	Total sum			

painting				
Total cost	**Unite price**	**unite**	**volume**	**Description**
29,045,000	**1,570**	**kilograms**	**18500**	**Metal and rods structure rust removing by sand blast method**
10,034,000	**34,600**	**Square meter**	**290**	**Metal and rods structure rust removing except metal skeleton by sand blast method.)**
83,388,200	**88,900**	**Square meter**	**938**	**Material preparation and performing epoxy color by air less method on the metal structures in three layers each with 25 micron thickness.**
80,386,600	**85,700**	**Square meter**	**938**	**Material preparation and performing the zinc rich color by air less method on the metal structures in three layers each with 25 micron thickness**
	The base total items sum			
202853800	**Total sum**			

The base and under base				
Total cost	**Unite price**	**unite**	**volume**	**Description**
4,860,000	**108,000**	**Cube meter**	**45**	**Preparing the under base materials from river materials with sand grading of 0to 50 millimeter.**

6,007,500	133,500	Cube meter	45	Preparing the base materials from river materials with sand grading of 0 to 25 millimeter, when at least 50 percent of remained materials are broken in the sieve by grade 4
	The base total items sum			
10,867,500	Total sum			

Transportation

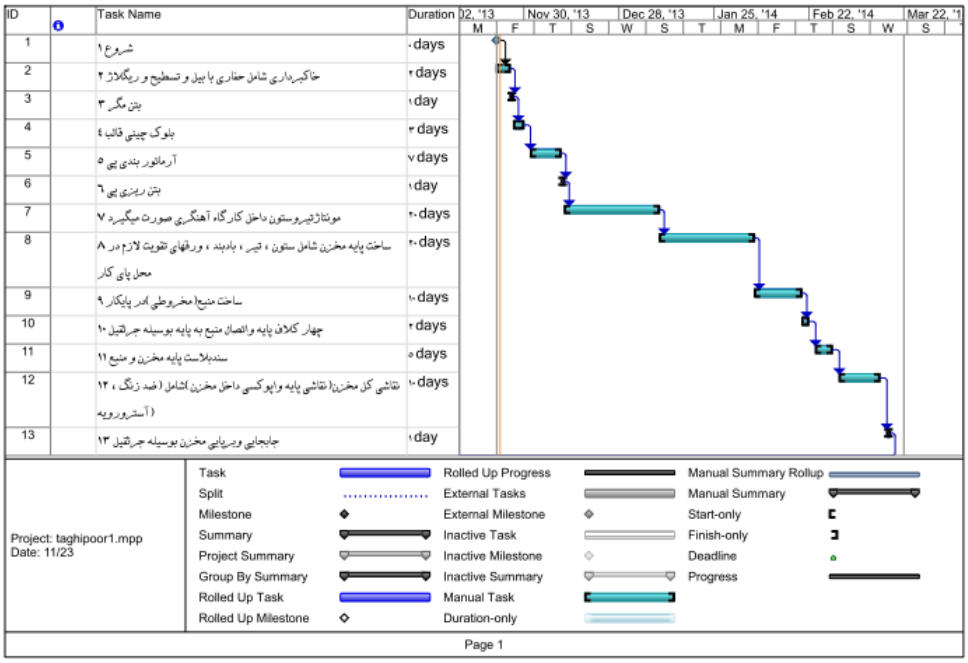
Total cost	Unite price	unite	volume	Description
919,800	365	Ton-kilometer	2520	Carrying irons and cements packages from excess 30 kilometer to 75 kilometers
1,029,000	245	Ton-kilometer	4200	Carrying irons and cements packages from excess 75 kilometer .to 150 kilometers
837,000	155	Ton-kilometer	5400	Carrying irons and cements packages from excess 150 kilometer to 300 kilometers
675,000	125	Ton-kilometer	5400	Carrying irons and cements packages from excess 300 kilometer to 450 kilometers
5,634,000	400	Ton-kilometer	14085	Carrying bricks and heavy materials from excess 30 kilometer to 75 kilometers
9,094,800	The base total items sum			
9,094,800	Total sum			

1,369,354,990	The base items costs sum
54,770,000	The factory equipping and removing
1,424,124,990	Total cost

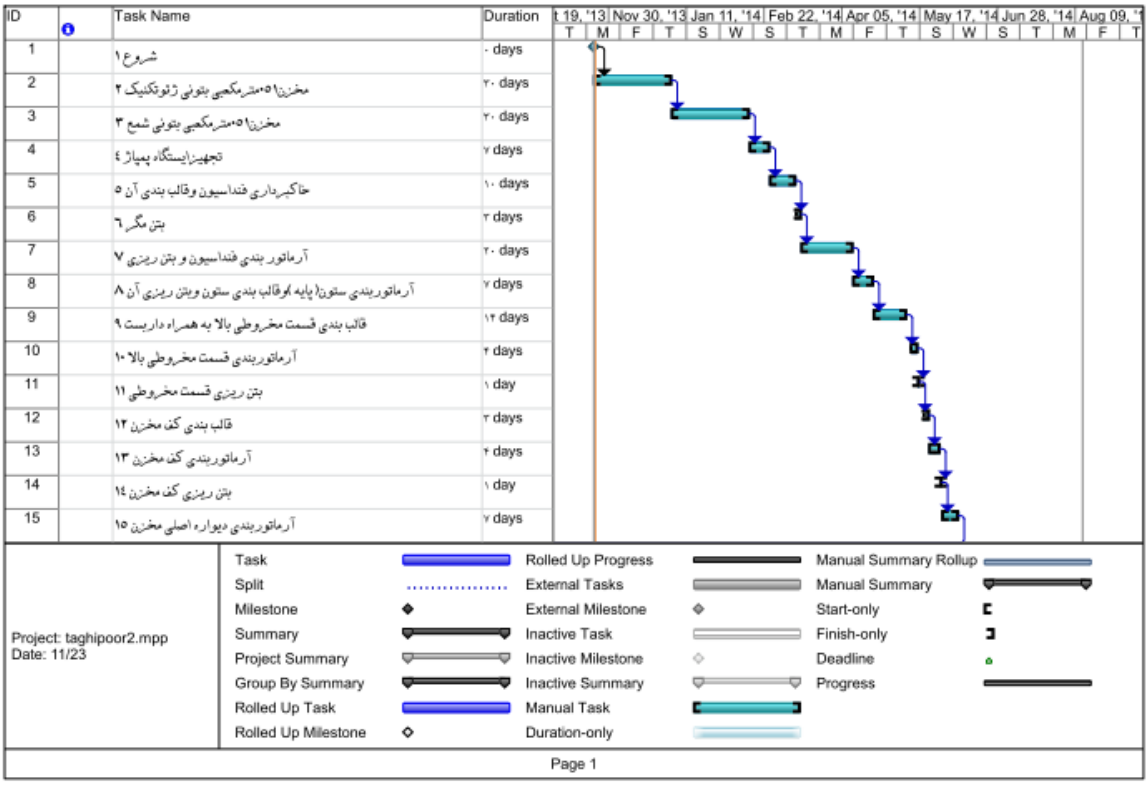
Metal store	Concrete store	costs
1424124990 Rials	2,000,115,297.50Rials	Construction fixed costs
12 million in each 10 years	-	Implementation period variable costs
90days	155days	Construction period
At most 30 years	at least 50 years	Implementation period
100 cube meter	100 cube meter	Capacity

MSP project performing timing schedule

Metal store



Concrete store


ID
Task Name
Duration
t 19, '13 Nov 30, '13 Jan 11, '14 Feb 22, '14 Apr 05, '14 May 17, '14 Jun 28, '14 Aug 09, '1
1 شروع ۱ · days
2 مخزن۱ ۵۰۰متر مکعبی بتونی ژئوتکنیک ۲ ۲۰ days
3 مخزن۱ ۵۰۰متر مکعبی بتونی شمع ۳ ۲۰ days
4 تجهیزایستگاه پمپاژ ٤ ۷ days
5 خاکبرداری فنداسیون وقالب بندی آن ۵ ۱۰ days
6 بتن مگر ٦ ۳ days
7 آرماتور بندی فنداسیون و بتن ریزی ۷ ۲۰ days
8 آرماتوربندی ستون(پایه)وقالب بندی ستون وبتن ریزی آن ۸ ۷ days
9 قالب بندی قسمت مخروطی بالا به همراه داربست ۹ ۱۲ days
10 آرماتوربندی قسمت مخروطی بالا ۱۰ ۴ days
11 بتن ریزی قسمت مخروطی ۱۱ ۱ day
12 قالب بندی کف مخزن ۱۲ ۳ days
13 آرماتوربندی کف مخزن ۱۳ ۴ days
14 بتن ریزی کف مخزن ۱٤ ۱ day
15 آرماتوربندی دیواره اصلی مخزن ۱۵ ۷ days
Project: taghipoor2.mpp
Date: 11/23
Task
Split
Milestone
Summary
Project Summary
Group By Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
External Tasks
External Milestone
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
Deadline
Progress
Page 1


ID
Task Name
Duration
t 19, '13 Nov 30, '13 Jan 11, '14 Feb 22, '14 Apr 05, '14 May 17, '14 Jun 28, '14 Aug 09, '1
16 قالب بندی دیواره اصلی مخزن ۱٦ ۸ days
17 بتن ریزی دیواره اصلی مخزن ۱۷ ۲ days
18 قالب بندی دیواره اصلی مخزن ۱۸ ۲ days
19 آرماتوربندی استوانه داخل مخزن جهت بازده ازسقف ۱۹ ۲ days
20 بتن ریزی استوانه داخل مخزن جهت بازده ازسقف ۲۰ ۲ days
21 قالب بندی سقف مخزن ۲۱ ۳ days
22 آرماتوربندی سقف مخزن ۲۲ ۲ days
23 بتن ریزی سقف مخزن ۲۳ ۱ day
24 آرماتوربندی دیواره جان پناه ۲٤ ۱ day
25 قالب بندی دیواره جان پناه ۲۵ ۲ days
26 بتن ریزی دیواره جان پناه ۲٦ ۱ day
27 اجرای راه پله داخل ستون بتنی ۲۷ ۷ days
28 نصب تاسیسات لوله ها ۲۸ ۷ days
29 ایزوگام داخل مخزن ۲۹ ۳ days
30 خاکریزی اطراف مخزن ۳۰ ۷ days
Project: taghipoor2.mpp
Date: 11/23
Task
Split
Milestone
Summary
Project Summary
Group By Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
External Tasks
External Milestone
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
Deadline
Progress
Page 2

Each store analysis by COMFAR 3 soft ware

SARY city MOELEM KELAY township and GOHARBARAB village watering project

Project description

To water HOGARBARAN and MOALEM KELAY villages in SARY city, the water store construction was evaluated. Two kinds of concrete and metal stores were compared to perform the best option. By the use of COMFAR software the economical issue about construction of each store was evaluated. The results showed that regardless of both store construction economy, the metal store despite lower life has specific value and higher investment return rate and more suitable compared to concrete store. General information presented below. Also more complete information about each stores in addition to the software outlet has been presented separately

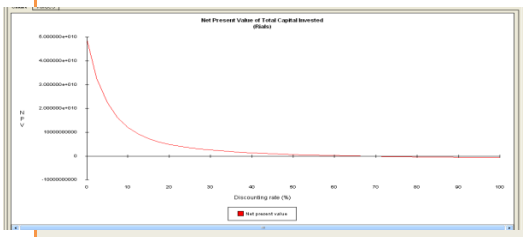
Metal store construction

The project time horizon:

Implementation phase: 30 years Equipment preparation phase: 3months

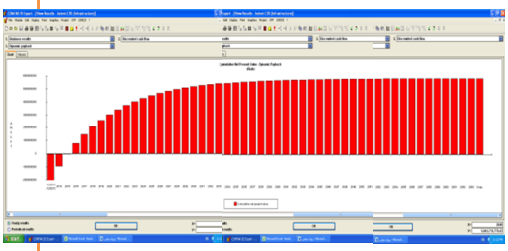
:Internal rate of return:*(IRR)*

this rate represents the obtained benefit through the project performance under the considered condition



$IRR = 89.81\%$

: *(Payback Period)*



Pp is the representation of time taken to arrive to peak

$2\text{years} PP =$

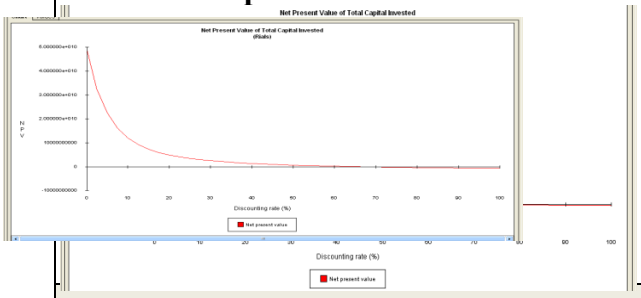
.

NVP net value obtained from the project performance

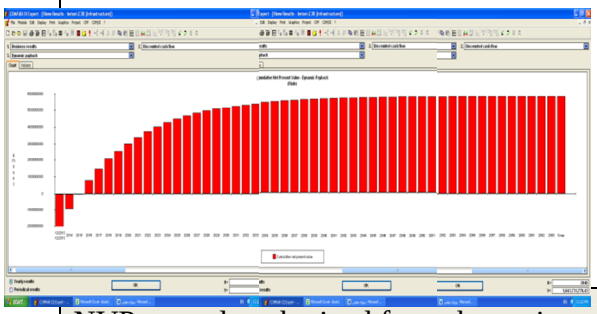
ریال*NPV*=6268194935

Description: the present net value is actually the transference of all financial flows at present time and future. The positive obtained number for 0<NVP shows that the project benefit according to the lot rate considered for the project. The negative obtained number also NVP<0 declares lack of economical justification in the project fulfillment.

Concrete store construction
The project time horizon:
Equipment preparation phase: 5months Implementation phase: 50 years
:Internal rate of return:*(IRR)*
this rate represents the obtained benefit through the project performance under the considered condition
: (*Payback Period*)
Pp is the representation of time taken to arrive to peak
NVP net value obtained from the project performance:



IRR= 64.89 %



3years*PP* =

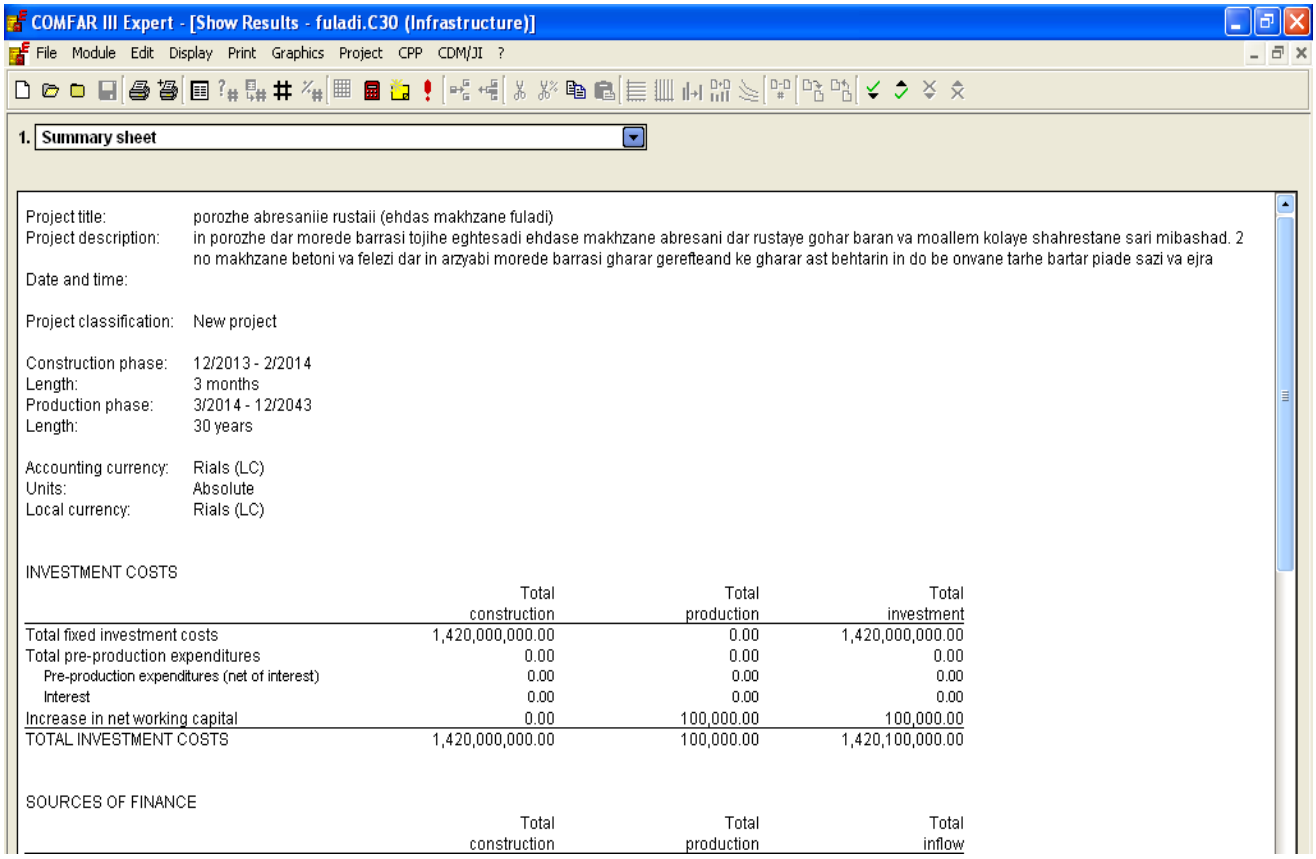
NPV=5756153979 Rials

Description: the present net value is actually the transference of all financial flows at present time and future. The positive obtained number for 0<NVP shows that the project benefit according to the lot rate considered for the project. The negative obtained number also NVP<0 declares lack of economical justification in the project fulfillment**.**

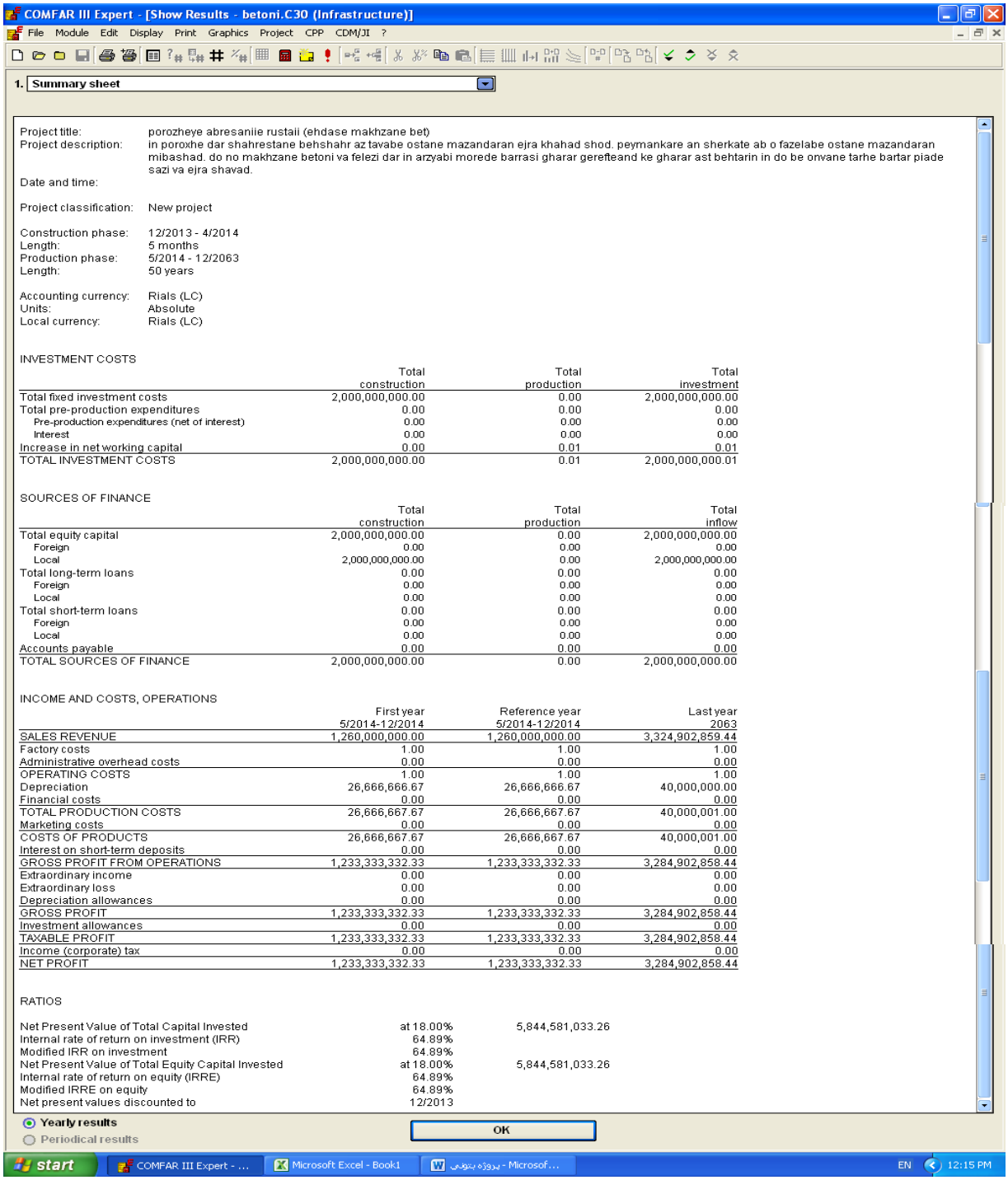
Summery sheet

Actually the first sheet from the software outlet is adequate ant the obtained results for projects are written in it, according to this outlet we can have a thorough view to the project evaluated condition. The project features, the construction phase and implementation phase and monetary unite applied for the project justification, first year and last year cost and outcomes, investment rate return and also the project net present value NVP are the most important information presented for metal and concrete store construction project below:

Summery sheet for metal store



Summery sheet for concrete store:



COMFAR III Expert - [Show Results - betoni.C30 (Infrastructure)]

File Module Edit Display Print Graphics Project CPP CDM/JI ?

1. Summary sheet

Project title: porozheye abresaniie rustaii (ehdase makhzane bet)
Project description: in poroxhe dar shahrestane behshahr az tavabe ostane mazandaran ejra khahad shod. peymankare an sherkate ab o fazelabe ostane mazandaran mibashad. do no makhzane betoni va felezi dar in arzyabi morede barrasi gharar gerefteand ke gharar ast behtarin in do be onvane tarhe bartar piade sazi va ejra shavad.
Date and time:

Project classification: New project

Construction phase: 12/2013 - 4/2014
Length: 5 months
Production phase: 5/2014 - 12/2063
Length: 50 years

Accounting currency: Rials (LC)
Units: Absolute
Local currency: Rials (LC)

INVESTMENT COSTS

	Total construction	Total production	Total investment
Total fixed investment costs	2,000,000,000.00	0.00	2,000,000,000.00
Total pre-production expenditures	0.00	0.00	0.00
Pre-production expenditures (net of interest)	0.00	0.00	0.00
Interest	0.00	0.00	0.00
Increase in net working capital	0.00	0.01	0.01
TOTAL INVESTMENT COSTS	2,000,000,000.00	0.01	2,000,000,000.01

SOURCES OF FINANCE

	Total construction	Total production	Total inflow
Total equity capital	2,000,000,000.00	0.00	2,000,000,000.00
Foreign	0.00	0.00	0.00
Local	2,000,000,000.00	0.00	2,000,000,000.00
Total long-term loans	0.00	0.00	0.00
Foreign	0.00	0.00	0.00
Local	0.00	0.00	0.00
Total short-term loans	0.00	0.00	0.00
Foreign	0.00	0.00	0.00
Local	0.00	0.00	0.00
Accounts payable	0.00	0.00	0.00
TOTAL SOURCES OF FINANCE	2,000,000,000.00	0.00	2,000,000,000.00

INCOME AND COSTS, OPERATIONS

	First year 5/2014-12/2014	Reference year 5/2014-12/2014	Last year 2063
SALES REVENUE	1,260,000,000.00	1,260,000,000.00	3,324,902,859.44
Factory costs	1.00	1.00	1.00
Administrative overhead costs	0.00	0.00	0.00
OPERATING COSTS	1.00	1.00	1.00
Depreciation	26,666,666.67	26,666,666.67	40,000,000.00
Financial costs	0.00	0.00	0.00
TOTAL PRODUCTION COSTS	26,666,667.67	26,666,667.67	40,000,001.00
Marketing costs	0.00	0.00	0.00
COSTS OF PRODUCTS	26,666,667.67	26,666,667.67	40,000,001.00
Interest on short-term deposits	0.00	0.00	0.00
GROSS PROFIT FROM OPERATIONS	1,233,333,332.33	1,233,333,332.33	3,284,902,858.44
Extraordinary income	0.00	0.00	0.00
Extraordinary loss	0.00	0.00	0.00
Depreciation allowances	0.00	0.00	0.00
GROSS PROFIT	1,233,333,332.33	1,233,333,332.33	3,284,902,858.44
Investment allowances	0.00	0.00	0.00
TAXABLE PROFIT	1,233,333,332.33	1,233,333,332.33	3,284,902,858.44
Income (corporate) tax	0.00	0.00	0.00
NET PROFIT	1,233,333,332.33	1,233,333,332.33	3,284,902,858.44

RATIOS

Net Present Value of Total Capital Invested	at 18.00%	5,844,581,033.26
Internal rate of return on investment (IRR)	64.89%	
Modified IRR on investment	64.89%	
Net Present Value of Total Equity Capital Invested	at 18.00%	5,844,581,033.26
Internal rate of return on equity (IRRE)	64.89%	
Modified IRRE on equity	64.89%	
Net present values discounted to	12/2013	

Yearly results
Periodical results
OK

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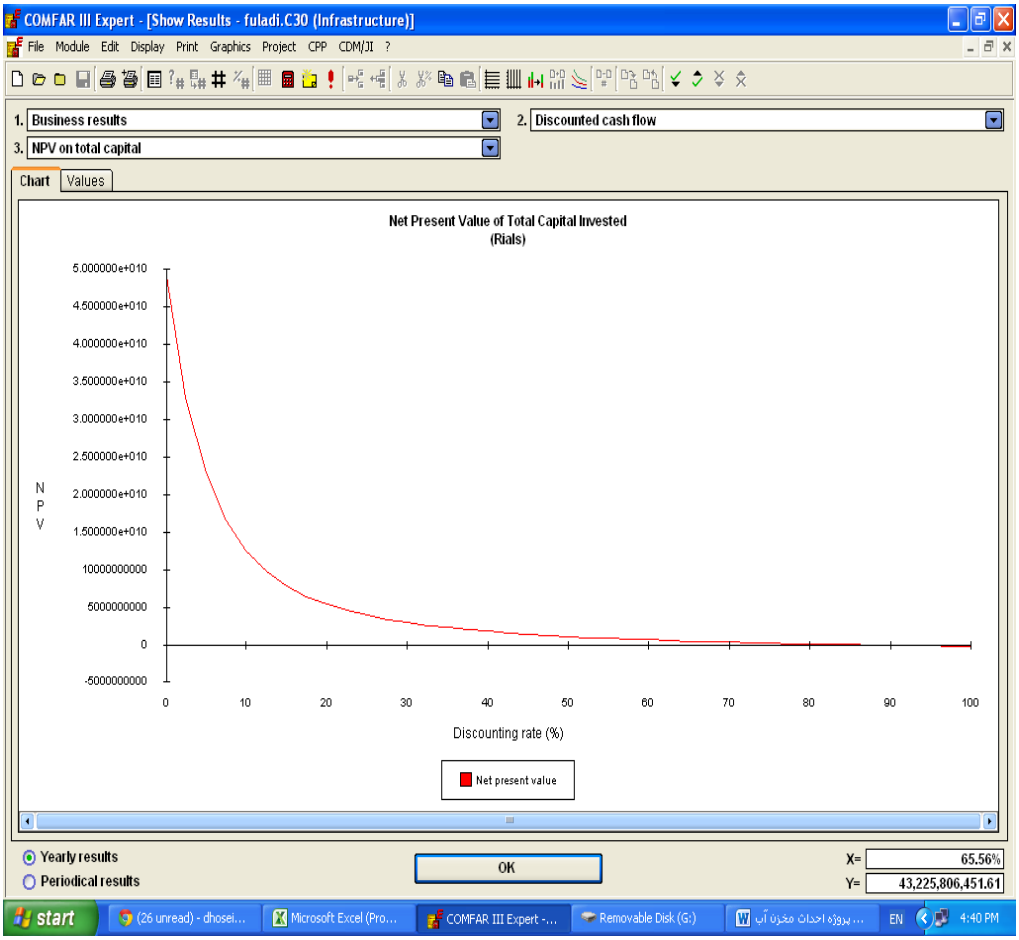
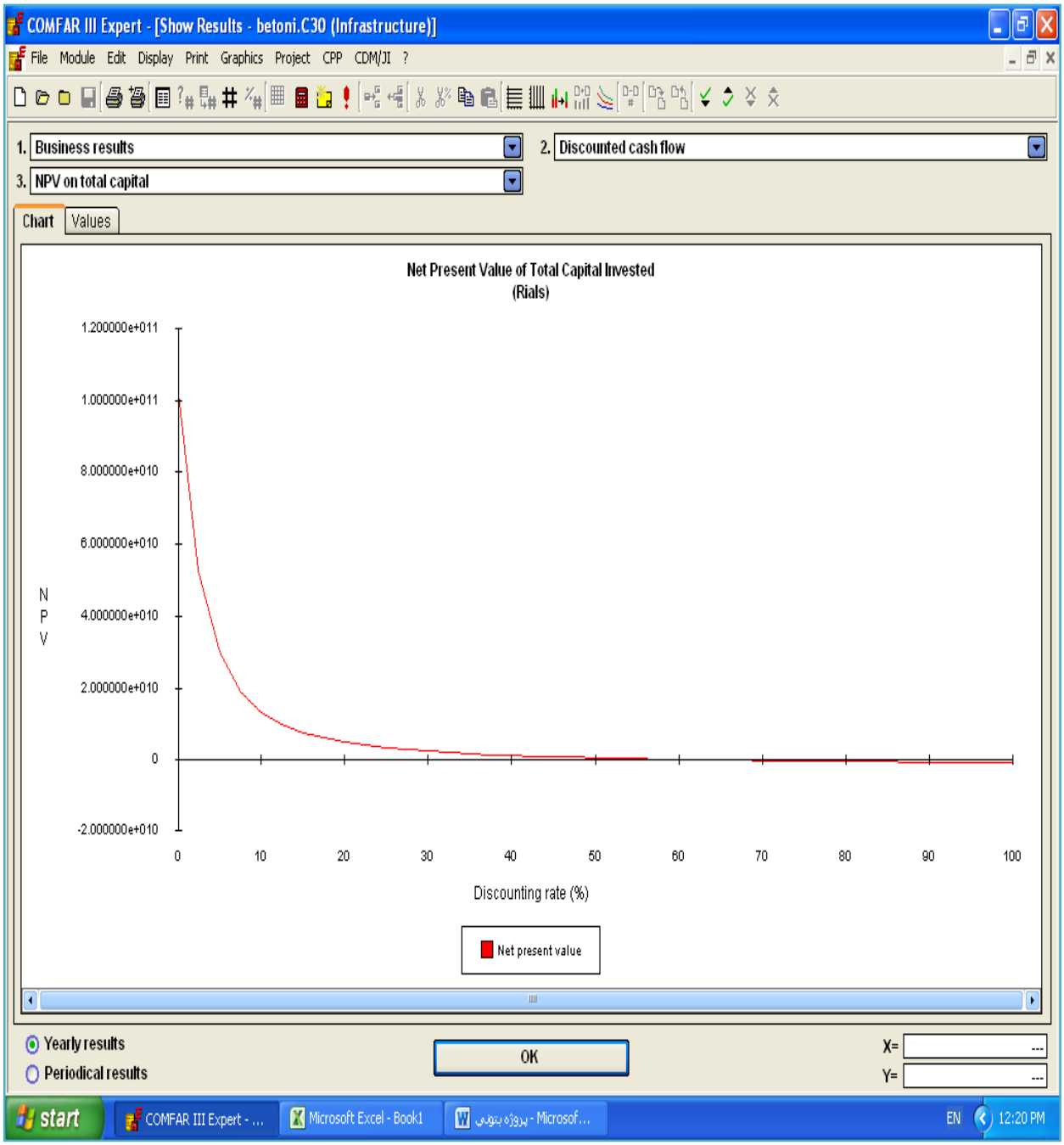
Internal rate of return:

The internal rate of return represents the project growth rate and the obtained benefit from the project performance. In other word it shows the investment proper level in project. As its numeral rate is more, the benefit rate is more as well and the project has more desirability. In two graphs of ZHAIEN the graph cross with horizontal axis shows the internal rate return for these projects as presented before. This benefit percentage is equal for 89.81 and 64.84% for both metal and concrete projects. The result is that the metal project has higher beneficiary rather than the concrete store.

Metal store:



Concrete store:



100 cube meter concrete store metering total summery

The obtained results from statistical calculations about the economical costs of water concrete stores construction in MAZANDARAN province

(MOHARBARAN, MOALEM SARY) is presented as below:

The maximum cost in concrete store construction in order related to metal works with rods and light steel affairs, on time concrete and miscellaneous affairs and metal molding and plastic works and humidity isolation are in the next steps. The construction operation with stone and soil operation with machineries has the lowest costs

The summery of metal 100 cube meter airy stores

According to performed calculation in order the maximum costs related to heavy steel works and coloring and metal affairs with rods, on time concrete and transportation costs

According to obtained results from statistical calculations, the construction cost of concrete store is 1.5 more than the metal store and it seems that due to economical and technical consideration, the metal store building is more affordable

CONCLUSION

According to both stores kinds in DASHTI region and the security coefficient for each, all considerations are regarded for both stores are the same

According to the weather humidity in MAZANDARAN province and its effect on metal, the variable cost of implementation period for each 10 years in metal stores is 12 million and in concrete store it is zero and implementation period in concrete is stores 3 times more than metal stores. But according to analysis made we conclude that the metal stores costs is lower than concrete stores, therefore metal structures are economically and technically more appropriate.

RESOURCES

1- Analysis paper of technology, economy and technology transferring and commercialization office, MEHR 1391.

2- Evaluation of concrete airy stores earthquake behavior, HAMID SOLTANI MOHAMADY, FAYAZ, RAHIM ZADEH, concrete second international congress, 1384.

3- AWW (American Water Works Association). 1997. AWWA Standard for Coating Steel Water Storage Fanks. AWWA D102-97. Denver, Colo.: AWWA

4-watering system economical and technical evaluation, using airy stores, using pumping stations , AQHBEYGI, the third national congress of water and sewage with the consumption model correction.

5- Water airy stores earthquake behavior evaluation and passive defense, SAEID SADEGHI NIYA, HOSEIN MEYSAMI, 1388.

6- LEYLA KOLANI SAROU KOLAYIE, BAHRAM NAVAI NIYA, 1389, the ground store covers evaluation and formation behaviors coefficient determination, civil engineering fifth congress.

7-AMIRY, QHALEH NO, MEHRAN, using concretes with low penetration in concrete oil store construction, the thesis of M.S AMIR KABIR industrial university.

8- Hamdan, F.H. "Assessment of Eurocode8-Part4: design of Liquid storage Tanks", European Seismic Design Practice, Elnashai, 1995

9- Haroun, M.A. "Dynamic analysis of liquid storage tanks", EERL 80 -4, 1980

10- The building and housing research center, the structural designing regulation toward earthquake, standard 28, 1384.

11- Livaoglo, R. and Dogangun, A. (2006) Dynamic behavior and seismic performance of elevated tanks due to Ground types defined in EC-8 and TEC-06. First European Conference on Earthquake Engineering and Seismology, Geneva, Switzerland

12-the concrete airy stores seismic performance evaluation with cylindrical pillars and deflection frame, MOHAMD TAQHI KAZEMI, ZEINAB TOURANG, civil engineering national fourth congress, 1387.

13- Reinforced concrete water airy stores seismic performance evaluation by the use of dynamic analysis, FERYDUN OMIDY NASAB, HAMZEH SHAKIB, the eighth civil engineering international congress.

14- Haroun, M.A., Ellaithy, M.H. (1985), "Seismically induced fluid forces on elevated tanks." J. Tech. Top

Civil Eng., Vol. 111, No. 1, PP. 1-15.

15- Haroun, M.A., Termaz, M.K. (1992), "Effects of soil-structure interaction effects on seismic response of elevated tanks", Soil Dynamics Earthquake Engineering, Vol. 11, No. 2, PP. 37-86

16- Marashi, E.S., Shakib. H. (1997), "Evaluations of dynamic characteristics of elevated water tanks by

ambient vibration tests", Proceedings of the 4th International Conference on Civil Engineering, Tehran,

Iran, I, PP. 367–73

17-Dutta, S.C., Jain, S.K., Murty, C.V.R. (2000b). "Assessing the seismic torsional vulnerability of elevated

Tanks with RC frame-type Staging", Soil Dynamics and Earthquake Engineering, Vol. 19, PP. 183–197

18- Dutta, S.C., Jain, S.K., Murty, C.V.R. (2001), "Inelastic seismic torsional behavior of elevated tanks."

Journal of Sound and Vibration, Vol. 242, No. 1, PP. 151–167

19- Dutta, S., Mandal, A., Dutta, S.C. (2004), "Soil–structure interaction in dynamic behavior of elevated

Tanks with alternate frame staging configurations."Journal of Sound and Vibration, Vol. 227, Issues 4-5,

PP. 825-853

20- Livaoglu, R., Dogangun, A. (2005), "Seismic evaluation of fluid-elevated tank-foundation/soil systems in Frequency domain." Structural Engineering and Mechanics, Vol. 21, PP. 101–119

21- Rai, D.C. and Singh, B. (2004) Seismic design of concrete pedestal supported tanks. 13th Word conference on earthquake engineering, Vancouver, B.C., Canada

22- MASOUDI, QHAFOURI, ASHTIAYNI and ESHQHI, the concrete airy stores seismic modelization analysis, earthquake engineering investigation magazine, 23, 2-26.

23- water and sewage stores erosion types and reasons, ALI MOMENIE, MAJID LOTFIE HAQHIQHAT, water resources development company, 1385.