Section A-Research paper
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ANALYSIS AND DESIGN OF HYDRAULIC STRUCTURE (GRAVITY DAM)

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Abstract
A dam developed with gravity is a sizable, workmanship or cement constructed structure that traverses the waterway and is utilized to make a supply in front of the stream. The part of the gravity dam is by and large three-sided in shape, with its broadest piece at the base and the peak on the top. The segment's attributes permit it to oppose the different powers following up on it by weight. This exposition looks at a dam utilizing the Staad.Pro program. Staad.pro is much of the time used for multi- story structures with bar and segments. Staad.Pro can examine any kind of part, for example, a serving dish, shell, or strong, notwithstanding the shaft individuals. Thus, the product reenacts the dam utilizing strong pieces and the pertinent information. The paper's decisions depict the impacts of stressors and stress shapes. The reason for the review is to figure out how to examine a dam utilizing STAAD.Pro and strong components.

1. INTRODUCTION

The expression "gravity dams" alludes to workmanship or cement based dams that are totally self- supporting. Workmanship dams had been utilized somewhat as often as possible previously, yet after autonomy, the Nagarjunsagar Dam on the Krishna Stream, finished somewhere in the range of 1958 and 1969, was the last huge workmanship dam design to be developed. Commonly, lime cement or concrete cement was utilized to tie flowed rubble workmanship. Be that as it may, brick work dams are done being planned in

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our country, maybe because of the accessibility of option, promptly available materials for dam development and the prerequisite for development innovation.

Truth be told, mass substantial gravity dams are at present being developed; this section will cover their plan and development. Other substantial dams, like the Curve/Different Curve or Brace type, exist. With the exception of the curve dam at Idukki on the stream Periyar, none of these have, notwithstanding, been considered or implicit India. Since just gravity-type substantial dams are famous in India, this course won't cover the plan of some other kinds of substantial dams. Standard chips away at the subject, like Designing of Enormous Dams by Henry H. Thomas, Volumes I and II distributed by John Wiley and Children (1976), could illuminate perusers keen on getting familiar with these dams. Designing of Dams, Volumes I, II, and III by W. P. Creager, J. D. Justin, and J. Hinds, distributed by John Wiley and Children in 1917, has likewise lengthy been viewed as an exemplary in dam designing, in spite of the shortfall of numerous cutting edge advancements.

It is pivotal to remember that planning a solid dam development alone isn't satisfactory; surveying the underlying honesty of the foundation is likewise vital. For substantial dams, a lot of pressure creates at the base-to-base point, which the establishment should endure. Normally, a waterway crossing includes building substantial gravity dams by unearthing until hard rock is found, which is believed to be the genuine establishment, free overburden should be taken out. In any case, not all stones are of a similar quality; they contrast contingent upon unmistakable topographical parts and the strategy by which they were made over the long haul. For example, it is accepted that the slopes of the Himalayan mountain range are more fragile and more geographically late than the massif of the Deccan level. The sort of dam that would be reasonable at a plan site relies upon the nature of the establishment, which likewise impacts the plan. Accordingly, this meeting has additionally included discusses the ground primary elements.

2. DESIGN OF CONCRETE GRAVITY DAM SECTIONS

A gravity dam ought to essentially meet the accompanying prerequisites:

1. It should be secure against spilling at any level situation inside the dam, whether it's at the establishment's contact point or inside the establishment.

2. It should be secure against sliding at any even dam plane, at the establishment's contact point, or at any topographical element there.

3. The part should be adequately proportionate to guarantee that the establishment's and

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cement's reasonable burdens are not surpassed.

It is vital to evaluate the dam's underlying security considering any expected essential, optional, or remarkable loadings. The arrangement is done in light of the heap's appropriateness as well as relative pertinence.

1. Essential burdens are perceived just like the most significant and all around important sorts of burdens.
2. Auxiliary burdens, for example, silt loads or intensity stresses welcomed on by mass cementing, are regularly discretionary and of a more modest size.
3. Outstanding burdens, for example, the inertial burdens welcomed on by seismic action, are planned in view of their limited general pertinence or low likelihood of event.

A substantial gravity dam, as the name recommends, in fact draws its dependability from the gravitational draw of the materials in the part. The gravity dam is sufficiently weighty to oppose the powers and the hour of upsetting welcomed on by the water accumulated in the repository behind it. Since it cantilevers the heaps to the establishments, strong groundworks are a prerequisite for the gravity dam.

The accompanying variables add to the solidness of the dam:

1. The dam's mass
2. The water's tail push

The accompanying elements work to subvert the dam:

1. Water strain in a supply
2. Energize
3. Powers welcomed on by repository waves ice pressure 4.
5. Thermodynamic tensions
6. Residue force
7. Quake powers
8. Wind speed

Following are two kinds of powers that a gravity dam should stand up to:

2. Powers, for example, elevate, quake loads, residue tension, and ice pressure which are just accepted based on suspicions of shifting levels of unwavering quality. 1. Powers, for example, the heaviness of the dam and water pressure, which are straightforwardly determined from the unit weight of materials and properties of liquid strain. Truth be told, cautious thought and dependence on the data within reach, insight, and judgment are expected for surveying this gathering of powers.

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3. OBJECTIVES

1. Method to calculate fundamental period and design base shear.
2. Vertical distribution of base shear along the height of the dam.
3. To analys analyse the dam by using staad- pro.

4. LITERATURE REVIEW

IIT Kharagpur (2010) sorted dams commonly founded on their structure parts. The gathering is as per the following: 1) Dike dams: These are dams made of regular materials that were recovered or accumulated from the region around the dam site. The two essential sorts of bank dams are as per the following: 2) Earth-filled dams - The primary piece of this dam is worked from compacted soil. Most of the designed soils utilized in its development are reliably and seriously compacted in slight layers at a predefined dampness content. This dam might be zonal, where more than one sort of soil material is used, or it could be homogeneous, where just a single kind of soil is accessible and the dam level is low. They are the most practical sort of dam since they use materials that are commonly near hand and don't require broad handling. These dams, nonetheless, need consistent upkeep since they are inclined to disintegration. Furthermore, bringing in soil may be fundamental on the off chance that the neighborhood soils are not mud based soils. 3. Substantial dams - The utilization of mass cement in dam development started on the grounds that it was easy to fabricate and could oblige perplexing plans, for example, having a spillway inside the dam body. On the off chance that added substances like slag and fuel debris are not utilized, hardships brought about by temperature are decreased, undesirable breaking is stayed away from, and the venture's general expense is diminished.

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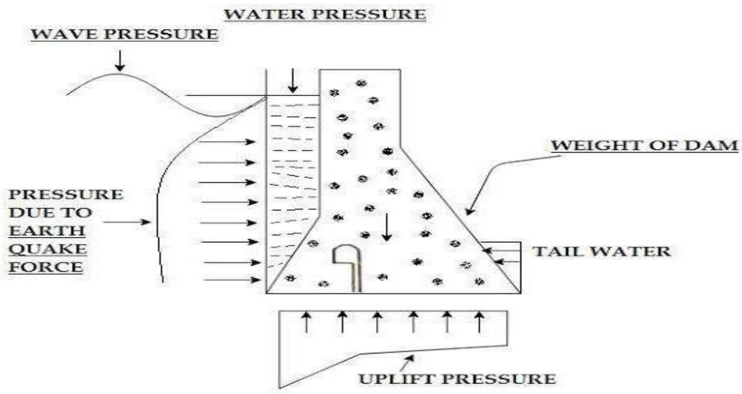

There are a few various types of substantial dams, including: I) Curve dams, which rely upon the projections curving to move water loads onto the stream valley walls. Such dams remember huge upstream ebb and flow for their arrangements. ii) Brace dams: such dams have a consistent upstream face that is upheld by support walls divided routinely separated and a downstream side. iii) Gravity dams - A gravity dam is one whose dependability is exclusively reliant upon its own weight. It very well may be worked out of cement or block. Extra classes of dams incorporate

In view of capability and put (I) Stockpiling dams (or protection) dams: These are dams worked to keep down floodwater during the stormy season when streams are streaming quickly to be utilized some other time when the waterway's stream is diminished and the interest is lower. Various purposes of the water kept in the repository made upstream incorporate water system, water supply, and power.

(ii) Redirection dam: A redirection dam is worked to raise the water level and direct stream water into a trench, course, or transport framework, where it very well may be utilized for water system, run-off stream hydroelectric plans, or water conveyance. water driven designing (I) Flood dams: A flood dam is a construction that fills in as a flood. The flood dam's peak, which fills in as a spillway, is available to the overabundance water that can't be held back in the supply. The flood dam is developed of a material that opposes disintegration from spilling over water, for example, concrete cement or stone work. The plan of a non-flood dam forestalls any stream over it. The body of the dam has a different spillway where additional rising water can be unloaded; overabundance water isn't allowed to pour over the dam.

As depicted beneath, the cycle is:

1. During the critical dry time, accumulate stream information at the repository site. Much of the time, the month to month inflow rates are fundamental. Be that as it may, the yearly

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inflow rates might be utilized for exceptionally enormous supplies. To fulfill water privileges, decide the release that will be delivered downstream.

2. Work out the volume of direct precipitation that fell on the supply during the month.
3. Compute the repository's potential vanishing misfortunes. The 4. Assessments of vanishing misfortunes during the month regularly utilize the skillet dissipation information. Decide the interest over a scope of months.

Decide the changed inflow during various months as follows: = +− − vii) Calculation of the stockpiling limit with respect to every month. = −

5. DESIGN SPECIFICATIONS AND METHODOLOGY

Design specifications

Height of the dam =

90mts Length =50mts

Base width=85

mts Concrete

grade=M40 Steel

grade-FE500

Road width

=10mts

Water flow distance= 10mts

6. METHODOLOGY

The underlying examination and plan PC program STAAD or (STAAD.Pro) was made by Exploration Designers Global in Yorba Linda, California. Bentley Frameworks procured Exploration Architect Global before the finish of 2005. Iowa State College involves Staad-III for Windows, a prior rendition, for its affable and primary designing projects. One of the most famous underlying investigation and plan programming programs is STAAD.Pro, which is accessible financially. It can likewise use various powerful scientific strategies, including modular extraction, time history investigation, and reaction range examination.

Eight hub SOLIDisoparametric limited components are utilized to mimic the dam body in STAADpro. There are three translational levels of opportunity for every hub. Eight Gauss-Legendre focuses are utilized in the mathematical joining cycle to decide the firmness grid of the strong component. The dam is analyzed for various basic loads and burden mixes that

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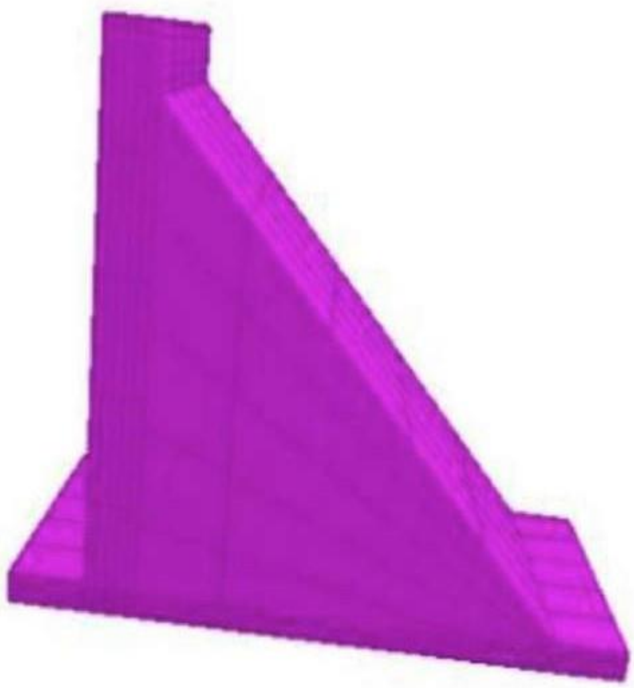
it could experience while in activity. Table 1 beneath records them all. All changes of the burdens caused are inspected, and the aspects are set up so that the recently shown variable of wellbeing is kept up with. The establishment rock for the dam is displayed around and underneath the establishment level, and the additional unearthing will be loaded up with cement of a similar strength. The foundation of the dam will lay on rock.

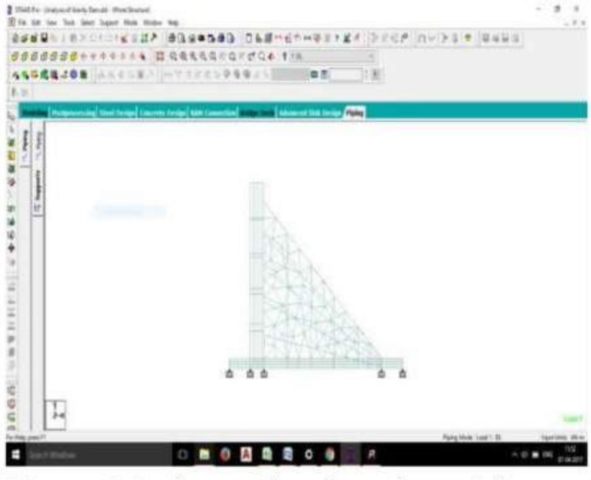
The time history approach of dynamic examination is the subject of the ongoing review. The design should be pivoted with occurrence point from 0 to 90 degrees, with an augmentation of 10 degrees, to apply powers at different points since time history is just available for the X course. For each situation,

segment powers have been inspected. The timespan degree is additionally utilized to get the exact point. Corner, side, and inside (focus) segments were isolated into three essential classes, and the outcomes are differentiated.

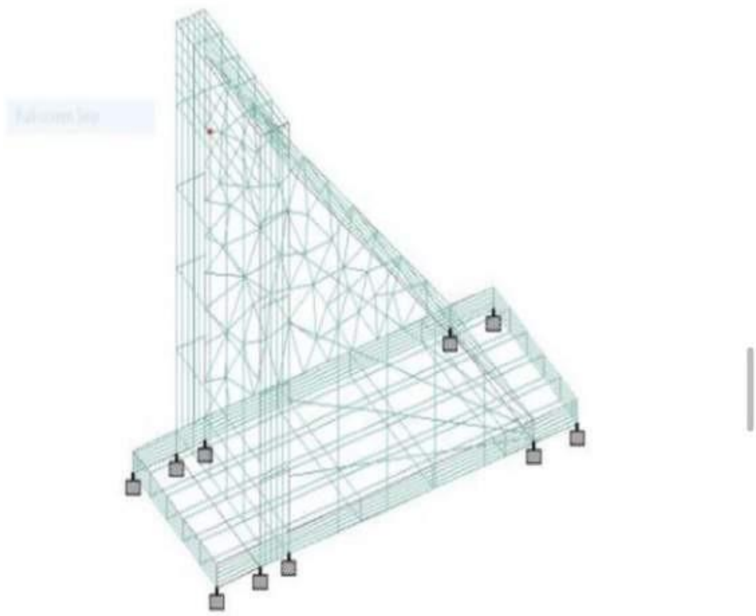
7. DESIGN IN STAAD



shows the 3d construction in staad



ANALYSIS INPUT AND RESULTS



shows the support areas in staad

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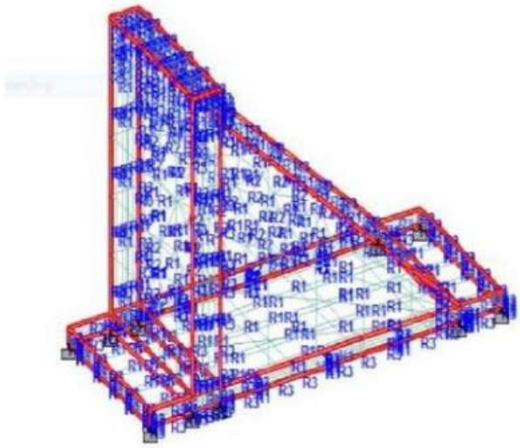
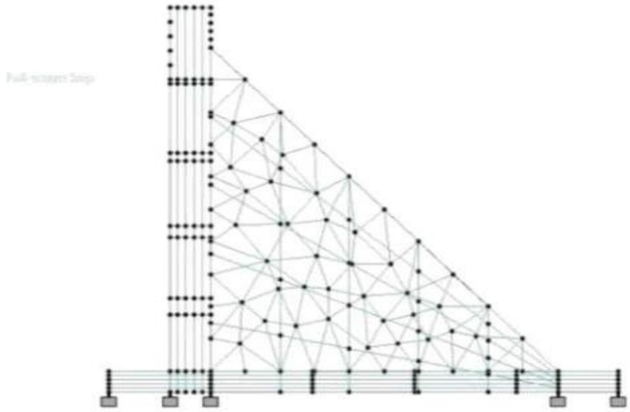
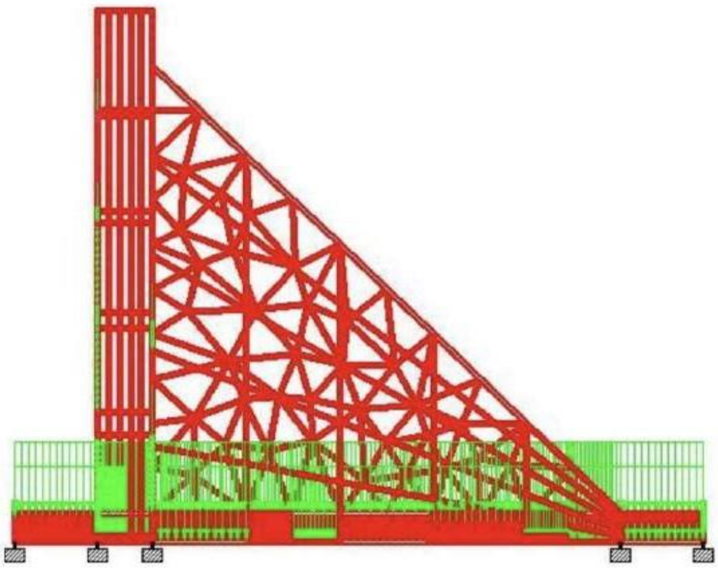


shows the geometry of the dam



shows the piping geometry



shows piping assignments and dead load conditions i.e self weight

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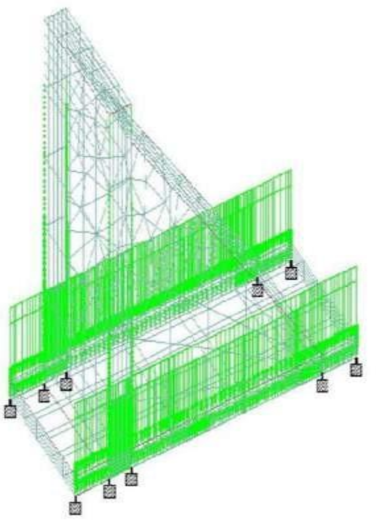

shows the load assignment IS codes

Job Information

Engineer Approved

Date: 07-Apr-17

Structure Type SPACE FRAME

Checked

Number of Nodes

441 Number of

Elements 665

441 Highest Node 257 Highest Beam 444

Highest Plate Number of Plates

701

Number of Basic Load Cases 1 Number of Combination Load Case 3

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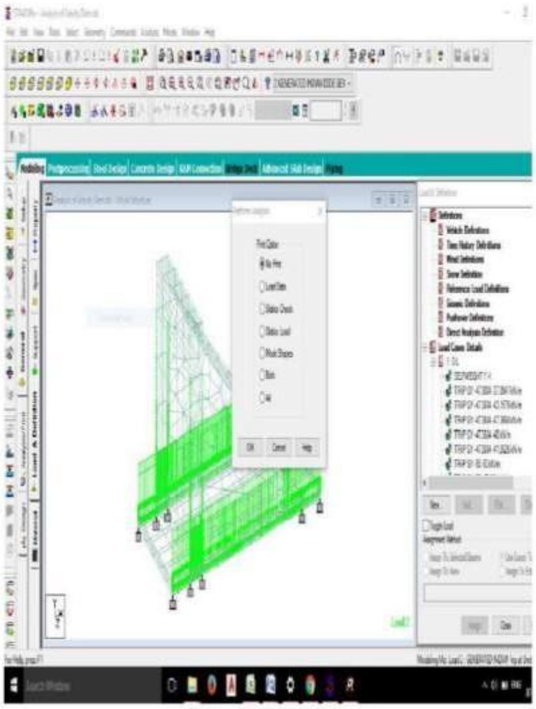

shows analysis input data assignments

Analysis of Gravity Dam.std ...

Node	X m	Y m	Z m
1	0.000	0.000	0.000
2	0.000	90.000	0.000
3	10.000	0.000	0.000
4	10.000	90.000	0.000
5	95.000	0.000	0.000
6	10.000	80.000	0.000
7	0.000	0.000	50.000
8	0.000	90.000	50.000
9	10.000	0.000	50.000
10	10.000	90.000	50.000
11	95.000	0.000	50.000

Analysis of Gravity Dam.std ...

Beam	Node A	Node B	Property Refn
1	1	34	3
2	3	434	3
3	6	404	3
4	1	318	3
5	2	298	3
6	1	36	3
7	2	29	3
8	3	151	3
9	4	350	3
10	5	90	3

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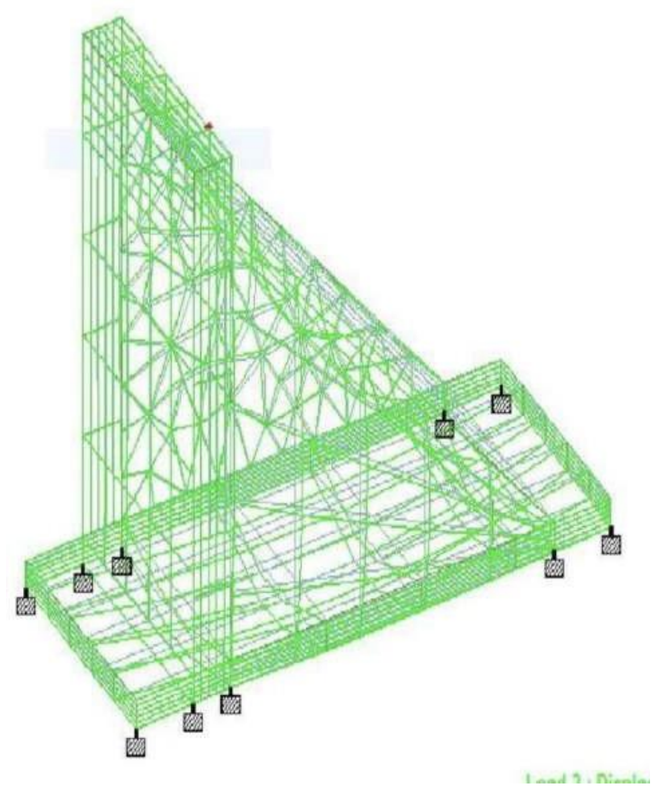
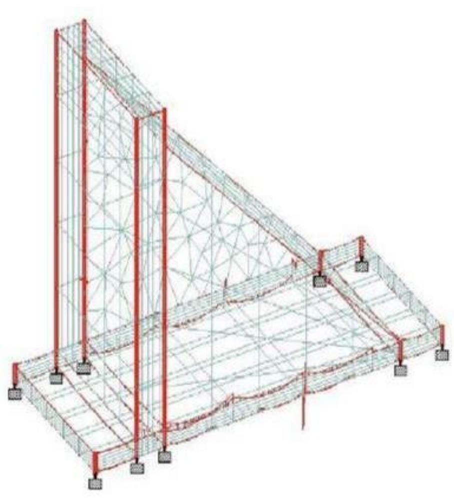


shows displacement



shows bending

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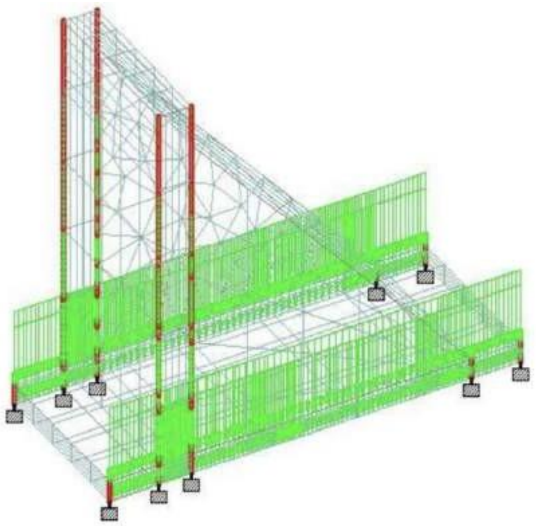
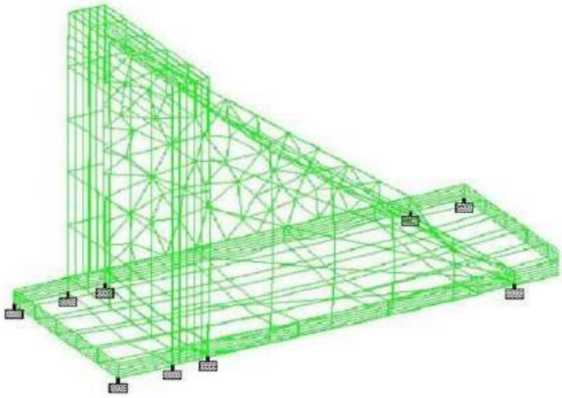


shows displacement along axis



shows displacement conditions for load assignment

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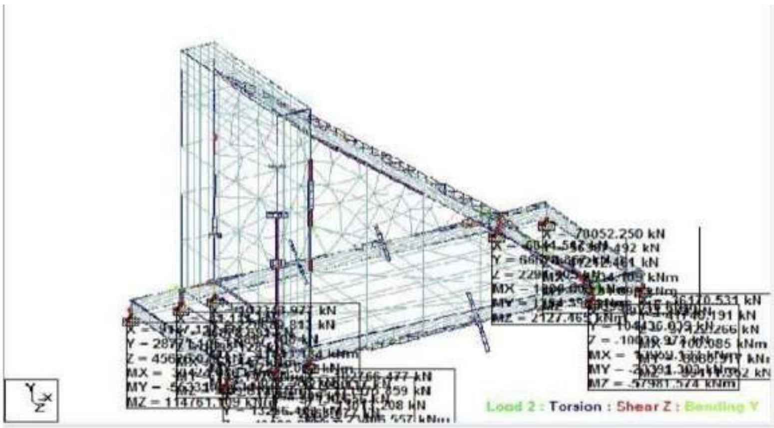

shows torsion, shear along Z bending along Y

		Horizontal	Vertical	Horizontal	Moment		
Node	L/C	Fx kN	Fy kN	Fz kN	Mx kNm	My kNm	Mz kNm
17	1 DL	-27.407	31252.461	730.085	40.964	130.094	-539.914
	2 GENERATE	-41.111	46878.691	1095.128	61.447	195.142	-809.872
	3 GENERATE	-32.889	37502.957	876.102	49.157	156.113	-647.897
	4 GENERATE	-24.667	28127.213	657.077	36.868	117.085	-485.923
18	1 DL	68229.320	147.12055E	5911.805	-27895.455	38188.719	-3385.726
	2 GENERATE	102.34398E	220.68081E	8867.708	-41843.184	57283.082	-5078.588
	3 GENERATE	81875.188	176.54467E	7094.167	-33474.547	45826.469	-4062.871
	4 GENERATE	61406.387	132.40848E	5320.624	-25105.908	34369.848	-3047.153
19	1 DL	-4563.011	44452.578	1527.603	666.669	836.264	1418.310

Analysis of Gravity Dam.std - Statics Check Results

L/C		Fx kN	Fy kN	Fz kN	Mx kNm	My kNm	Mz kNm
1	Loads	0.000	-565.29742E	0.000	14.30031E6	0.002	-20.48570E6
	Reactions	-0.008	565.29742E	0.005	-14.30031E6	-0.248	20.48570E6
	Difference	-0.008	-0.002	0.005	-0.098	-0.247	-0.096

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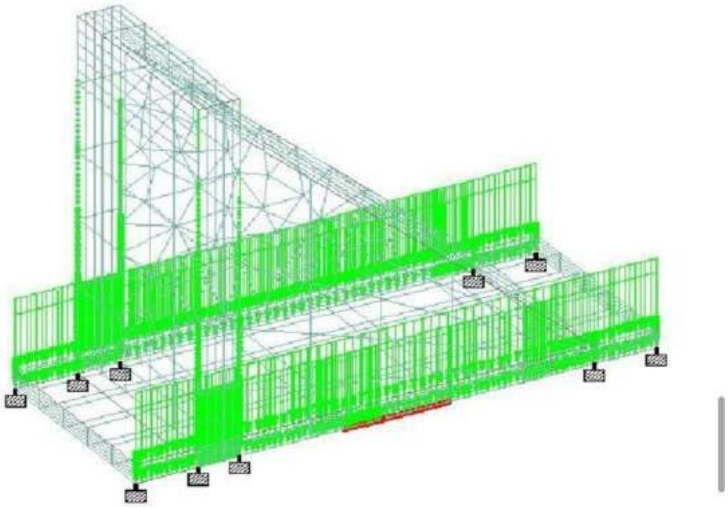
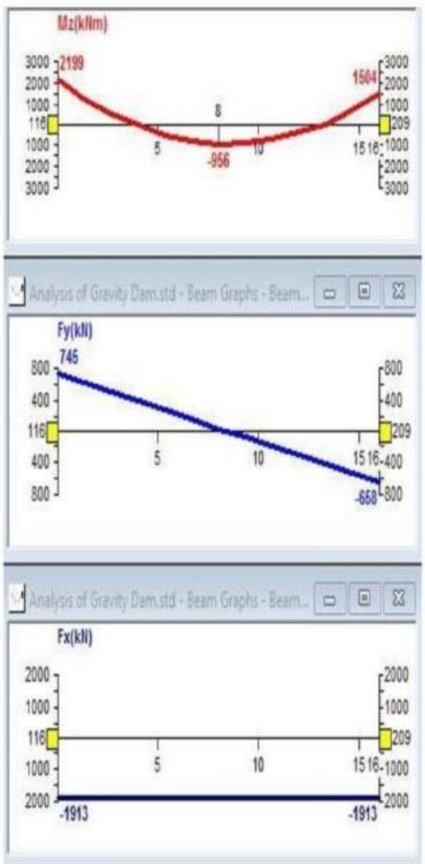
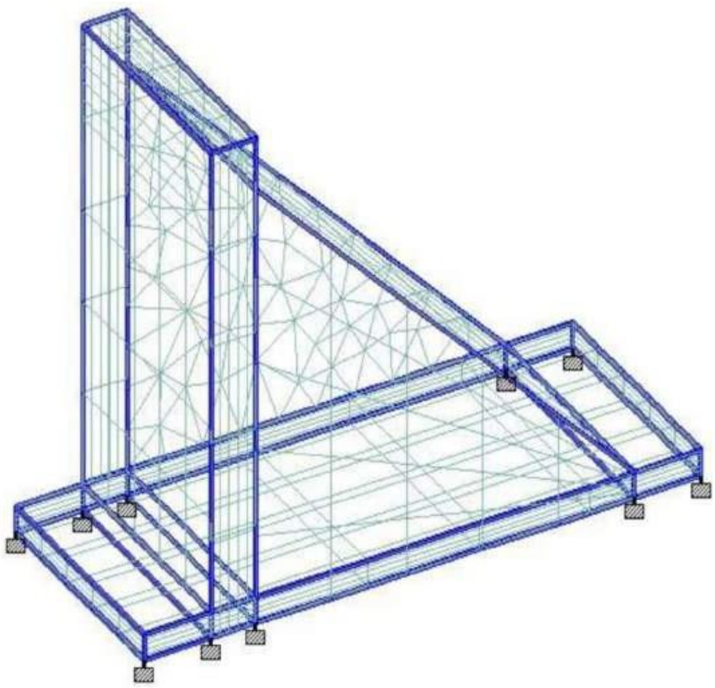


shows post processing

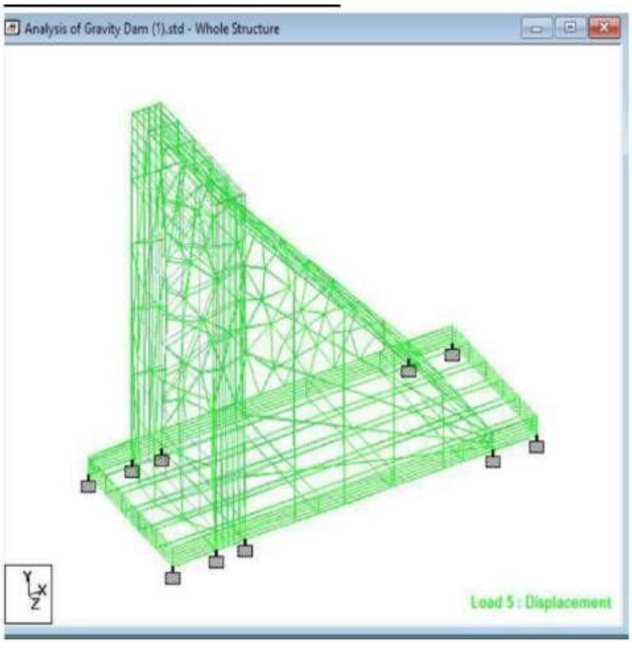


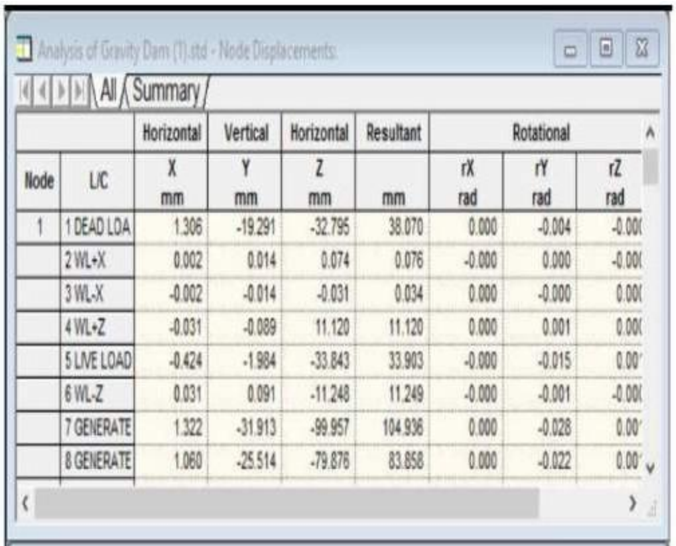
Graph shows the beam displacement along axis



shows the membrane and bending

LIVE LOAD ANALYSIS

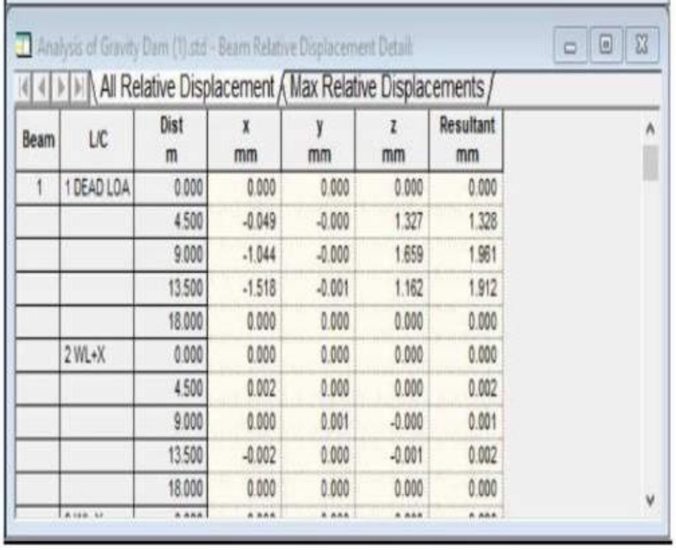




Analysis of Gravity Dam (1).std - Node Displacements:

All / Summary

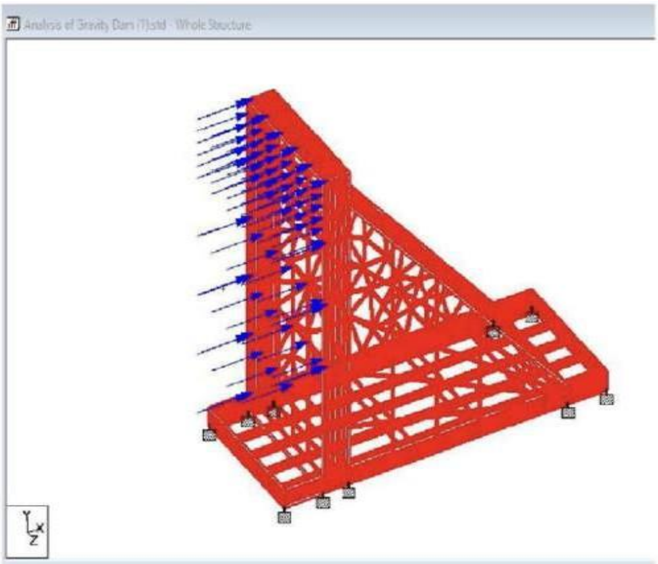
		Horizontal	Vertical	Horizontal	Resultant	Rotational		
Node	L/C	X mm	Y mm	Z mm	mm	rX rad	rY rad	rZ rad
1	1 DEAD LOA	1.306	-19.291	-32.795	38.070	0.000	-0.004	-0.00
	2 WL+X	0.002	0.014	0.074	0.076	-0.000	0.000	-0.00
	3 WL-X	-0.002	-0.014	-0.031	0.034	0.000	-0.000	0.00
	4 WL+Z	-0.031	-0.089	11.120	11.120	0.000	0.001	0.00
	5 LIVE LOAD	-0.424	-1.984	-33.843	33.903	-0.000	-0.015	0.00
	6 WL-Z	0.031	0.091	-11.248	11.249	-0.000	-0.001	-0.00
	7 GENERATE	1.322	-31.913	-99.957	104.936	0.000	-0.028	0.00
	8 GENERATE	1.060	-25.514	-79.876	83.858	0.000	-0.022	0.00



Analysis of Gravity Dam (1).std - Beam Relative Displacement Detail

All Relative Displacement / Max Relative Displacements

Beam	L/C	Dist m	x mm	y mm	z mm	Resultant mm
1	1 DEAD LOA	0.000	0.000	0.000	0.000	0.000
		4.500	-0.049	-0.000	1.327	1.328
		9.000	-1.044	-0.000	1.659	1.961
		13.500	-1.518	-0.001	1.162	1.912
		18.000	0.000	0.000	0.000	0.000
	2 WL+X	0.000	0.000	0.000	0.000	0.000
		4.500	0.002	0.000	0.000	0.002
		9.000	0.000	0.001	-0.000	0.001
		13.500	-0.002	0.000	-0.001	0.002
		18.000	0.000	0.000	0.000	0.000



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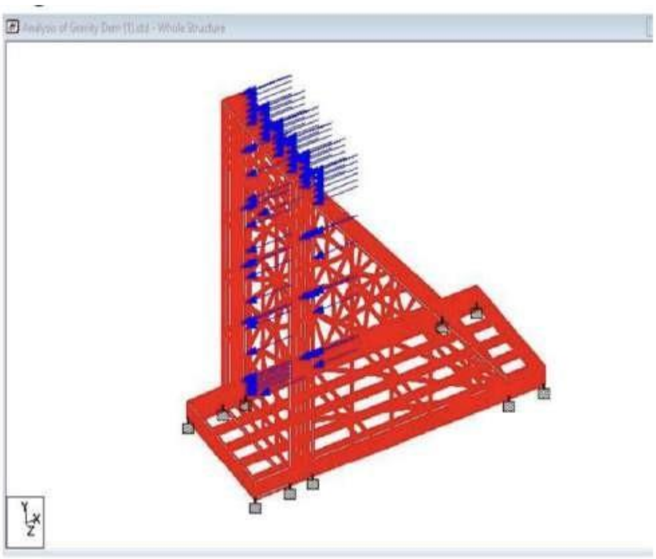
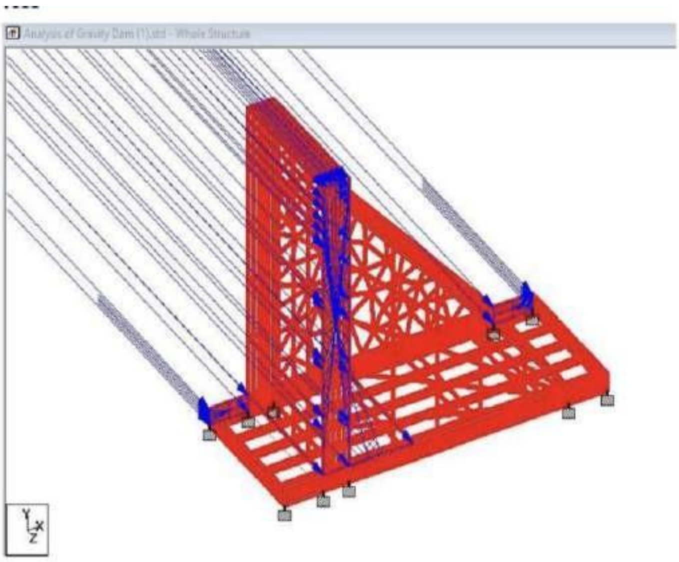
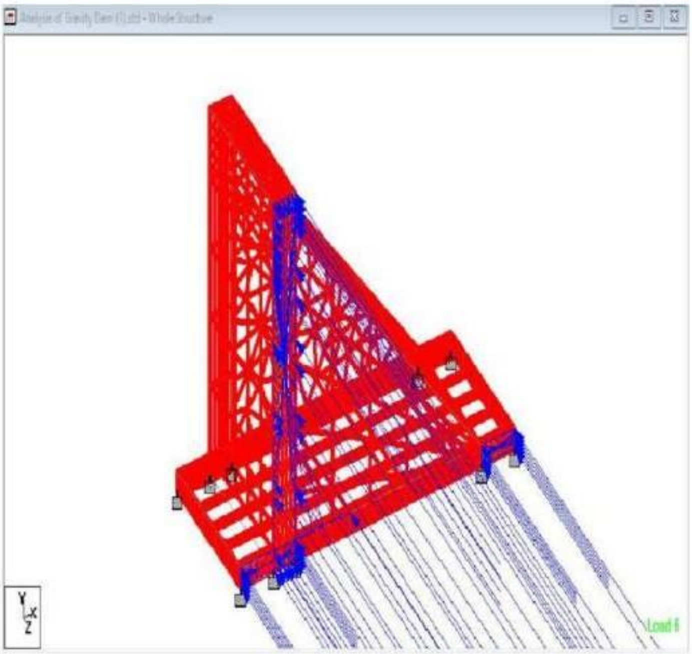


wind direction -x with 15KN- .m



wind direction z with 15KN-.m



wind direction -z with 15KN- .m

8. DISCUSSIONS

The load conditions and final deflection results are given below

ISOTROPIC CONCRETE

E 2.17185E+007

POISSON 0.17 DENSITY 23.5616 ALPHA 1E-005

DAMP

0.05 END

DEFINE

SELFWEIGHT Y -1 LIST 1 TO 701

9. CONCLUSIONS

The CODE-IS -6512-1984 analysis of the dam revealed a very little amount of variable deflection, or about 0.002 meters, which is inconsequential. After conducting the study, it was discovered that there were no errors, indicating that the structure's design was substantial. The live and wind loads were then analyzed using the standard loads. To execute structure finalization in the future, it is necessary to practically optimize the results from Staad-pro. The modeling and analysis's findings allow for the following conclusions:

1) The maximum stress in a dam with openings is 4193.257 KN/m2, whereas it is 3117.744 KN/m2 without openings.

2) The greatest stresses in the dam's vicinity of the u/s face range from 0.59 N/mm2 to 0.977 N/mm2, when there are no gaps.

3) Dam with apertures. The maximum stress is 4.13 N/mm2 around the openings.

4) Up to this point, static seismic loading has been provided using STAAD.Dynamic analysis is not taken into account in this research, despite pro definitions and command rather than manually.

5) There are still some questions about stability under support conditions.

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