DESIGN AND STABILITY ANALYSIS OF GRAVITY DAM USING STAAD PRO

A

PROJECT REPORT

Submitted in partial fulfillment of the requirements for the award of the degree

Of

BACHEOR OF TECHNOLOGY

IN

CIVIL ENGINEERING

Under the supervision

Of

Mr. Akash Bhardwaj

(Assistant Professor)

By

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To

JAYPEE UNIVERSITY OF INFORMATION AND TECHNOLOGY

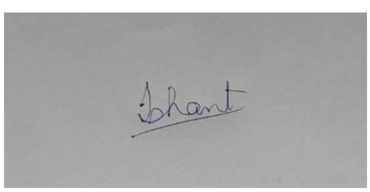
WAKHNAGHAT, SOLAN-173234

HIMACHAL PRADESH, INDIA

MAY-2021

STUDENT'S DECLARATION

I hereby declare that the work presented in the Project report entitled **"DESIGN & STABILITY ANALYSIS OF GRAVITY DAM USING STAAD PRO SOFTWARE"** submitted for partial fulfillment of the requirements for the degree of Bachelor of Technology in Civil Engineering at **Jaypee University of Information Technology, Waknaghat** is an authentic record of my work carried out under the supervision of **Mr. Akash Bhardwaj**. This work has not been submitted elsewhere for the reward of any other degree/diploma. We are fully responsible for the contents of our project report.



Signature of Students Name & Roll no:

Ishant shekhri

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Department of Civil Engineering

Jaypee University Of Information Technology, Wakhnaghat, India

CERTIFICATE

This is to certify that the work which is being presented in the project report titled **DESIGN AND STABILITY ANALYSIS OF GRAVITY DAM USING STAAD PRO SOFTWARE** in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Civil Engineering submitted to the Department of Civil Engineering**, Jaypee University of Information Technology, Waknaghat** is an authentic record of work carried out by ISHANT SHEKHRI[171601]during a period from August, 2020 to May,2021 under the supervision of Mr. Akash Bhardwaj. Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat.

The above statement made is correct to the best of our knowledge
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ACKNOWLEDGEMENT

I'd like to express my heartfelt thanks to all who assisted us in completing this mission. We encountered many hurdles during the project due to our lack of skills and experience, but these individuals assisted us in overcoming these obstacles and in the final transformation of our concept into a formed sculpture. I would like to thank **Mr. Akash Bhardwaj sir** for his guidance monitoring and continuous help during the project work. In the last I would like to thank staff of department of civil engineering JUIT for providing us such an opportunity to learn from these experience I am also thankful to our whole class and most of all to my parents who have inspired me to face all the challenges and win all the hurdles in life

Thank you all

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Abstract

A gravity dam is a strong structure,made of concrete and or workmanship, built across a waterway to make a supply on its upstream. The segment of the gravity dam is roughly three-sided fit as a fiddle, with its summit at its top and greatest width at base. The part is proportioned to the point that it opposes the different powers following up on it by its own weight. In this paper examination of dam is done utilizing Staad.Pro programming. Staad.pro is generally utilized for multi-celebrated structures with shaft andcolumns.

Anyway Staad.Pro can investigate any kind of component, for example, plate, shell or strong notwithstanding shaft individuals. In this way, in the product with reasonable information, dam is demonstrated with strong components. Consequence of stresses and stress shapes are depicted toward the finish of paper. The target of paper is to have a bearing of investigation of dam considering strong components utilizing STAAD.Pro.

CHAPTER 1
INTRODUCTION

1.1 Introduction to GravityDam

Dams created outof workmanship concrete andwhich rely completely upon its self burden for sufficiency fells under the characterization of gravity dams. Masonary dams had been being utilized in past routinely yet after opportunity, last critical block work dam structure that was built was Nagarjunsagar. Dam on stream Krishna which was worked between 1958-69. Consistently, streamed rubble stone work was used which was supported together by lime concrete or solid concrete. In any case block work dam is finished being arranged in our country likely in light of essence of substitute viably open dam improvement material and need advancement development.

Truly, gravity dams are as of now being worked of mass strong, whose arrangement and improvement points would be discussed in this part. There are various dams worked out of strong like the Curve/Different Curve or Brace type. These have in any case not been arranged or inherent India, except for the sole one being the bend dam at Idukki on stream Periyar. In India the example for strong dam is simply of the gravity type and appropriately the arrangement various kinds of strong dams have not been discussed in this course. Interested perusers may knowmoreaboutsuchdamsfromstandardbooksonthesubjectlikeEngineeringofLarg eDamsby Henry H. Thomas, Volumes I and II disseminated by John Wiley and Children (1976). Designing of Dams, Volumes I, II, and III by W P Smith is a generally outdated distribution. Creager, J D Justin, and J Hinds passed on by John Wiley and Children (1917) has in addition been for quite a while considered a laudable in dam arranging, at any rate different new advances have don't discover mentionhere. It is essential to see that, it isn't just adequate to plan a solid dam structure, at any rate it is relatively fundamental to check the establishment too for key uprightness. For solid dams, the squeezing factor made at the intersection point of the base winds up being uncommonly high, which the establishment hastoresist.Usuallyconcretegravitydamsareconstructedacrossariverbyexcavatinga way the free overburden till firm stone is able which is considered as the certifiable establishment. Everything considered not all stones are of a similar quality; they fluctuate with various land materials and the cycle by which they have been laid out all through the long stretch. For instance, the inclinations of the Himalayan degree of the mountains are viewed as topographically youthful, comparably as more fragile than the massif of the Deccan level. The possibility of establishment not just effects the game plan, it in addition controls the kind of dam that would be fit at a course of action site. Subsequently, conversations on the ground establishment points of view have been presented in this movement aswell.

1.2 Introduction to Software

STAAD or (STAAD.Pro) is an essential examination and plan PC program at first made by Exploration Specialists Global in Yorba Linda, CA. In late 2005, Exploration Designer Global was bought by Bentley Frameworks. A more settled variation called Staad-IIIfor windows is used by Iowa State College for educational purposes for normal and hidden modelers. The business version STAAD.Pro is maybe the most by and large used hidden assessment and plan programming. It maintains a couple of steel, concrete and timber plan codes.It can use various kinds of examination from the standard first solicitation static assessment, second solicitation p-delta assessment, numerical nondirectinvestigationorabucklinganalysis.Itcanalsomakeuseofvariousformsofdy namicanalysisfrommodalextraction to time history and response spectrumanalysis.

STAAD.Proistodaythemostwidelyusedsoftwaretoolinthecivilengineeringfield.Thi ssoftwareis particularly extraordinary and include rich than AutoCAD, which is another well known programming in the development field. AutoCAD permits a client to deal with 2 measurements just in little detail. Then again, STAAD.Pro permits the client to deal with 3D or three-dimensional models in generous detail. Staad Pro significantly lessens your manual computation and time aswell.

1.4 Objective

- To analyze the specifications of a gravity dam.
- To design gravity dam using STADD. Pro

CHAPTER 2
PROBLEM IDEFINITION

2.1 General

General analyse and design Gravity Dam using Staad pro software intended for storing of water and then use it for various purposes like electricity generation

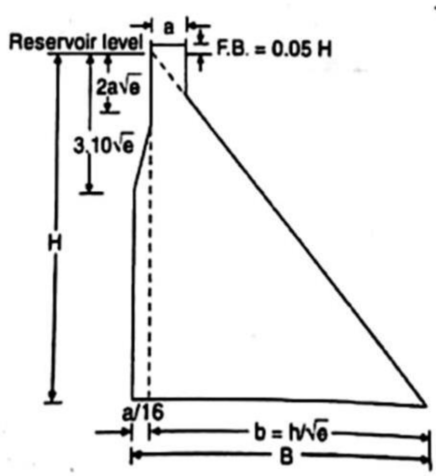


Fig. 18.14. Practical profile of gravity dam.

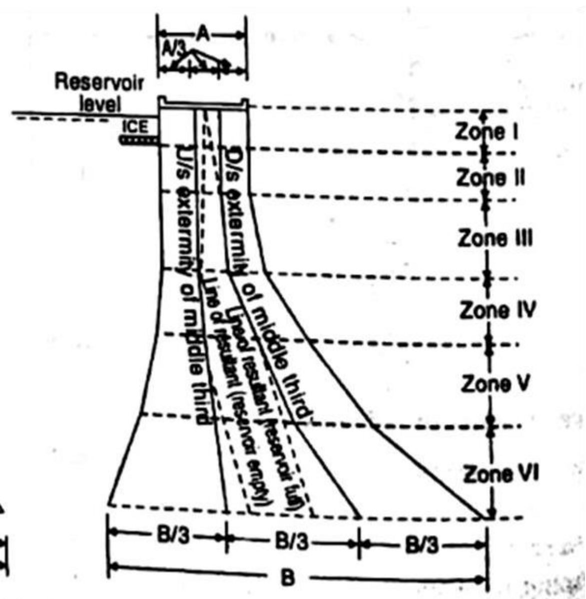


Fig. 18.15. Zoning of dam.

2.2 Scope

The fundamental extent of this venture is to apply homeroom information in reality by planning a gravity dam This plan presents investigation and plan direction for solid gravity dams. Audit by the staff of examinations performed by licensees, or their experts, should focus on the suppositions utilized in the investigation. The reason for basic suppositions like passable burdens, shear qualities, channel viability, and stacking conditions ought to be painstakingly analyzed. The specialist's reports, displays, and supplemental data should give defense to these suspicions like establishment investigation and testing, solid testing, instrumentation information, and records kept up during the real development of the task. Additionally, the staff architect's autonomous information on the dam acquired through site investigations or survey of activities examination report just as experience with past reports and examinations, ought to be utilized to check that the displays introduced are illustrative of real conditions. Techniques for investigation ought to adjust to the regular strategies utilized in the designing calling.

2.4 Background

The research that went into establishing this Major Qualifying Project is detailed in this portion of the history.The knowledge gathered about the different elements of the Dam, as well as the structural design and research processes for those elements, is presented in the sections below

CHAPTER 3

DESIGN ON STAAD PRO

3.1 General

STAAD or (STAAD.Pro) is a basic assessment and plan PC program at first made by Exploration Architects Global in Yorba Linda. In late 2005, Exploration Architect Worldwide was bought by Bentley Frameworks. A more prepared interpretation called Staad-III for windows is used by Iowa State College for enlightening purposes for normal and hidden planners. The business transformation STAAD.Pro is maybe the most by and large used hidden assessment and plan programming. It can moreover use various kinds of dynamic examination from measured extraction to time history and response range assessment. The dam body is shown in STAADpro utilizing the SOLIDisoparametric limited components with eight hubs. Every hub has three translational levels of opportunity.

The Dam is examined for a couple of fundamental loads and weight blends possiblymetwithduringitsservice.Concretedamsareusedmoreoftenthanfilldamsto producehydroelectricpower because of the way that doorways (similarly called conduits) or various kinds of outlet plans can be fused into the strong to believe water to be conveyed from the stock in a controlled manner. Right when water for power, drinking water, or water framework is required downstream, the doorways can be opened to convey the whole needed all through a predefined time. Water can be kept spilling in the stream downstream so fish and other normal life can persevere. Both concrete and fill dams are expected to have emergency spillways so that rising waters can be safely conveyed downstream before the water streams over the top or pinnacle of thedamandperhapsdeterioratesit.Spillwayschannelthewaterdownstreamandwellb elow thebaseortoeofthedamsothe dam and its foundation are noteroded.

3.2 Load considered

3.2.1 Dead Load

The Dead Load involves the heaviness of the solid design of the dam body notwithstanding dock doors and extensions, if any ludicrous. Cement's thickness is assessed to be 2400 kg/m3.

3.2.2 Primary load

a. Water Load: - The dam's u/s and d/s faces are subjected to water pressure. The most destabilising (or overturning) force acting on a gravity dam is the pressure of the water on the u/s face. Stability is aided by the tailwater pressure. The tail water pressure is modest in comparison to the water pressure on the u/s forehead.

To the surface, the water pressure is still natural. It is easier to compute the components of factors at work in the horizontal and vertical directions rather than the overall force on the inclined surface explicitly when calculating the forces due to water pressure on an inclined surface. Water pressure forces are discussed separately for non-overflow and portion and overflow sections below.

3.2.3 Secondary Load

Wave Pressure (hydrodynamic wave load): Swirling winds produce waves on the reservoir's top, causing pressure to shift to the d/s side. The highest point of the waves determines the wave pressure.

3.2.4 Sepageloads

The uplift is supposed to act on the whole width of the foundation

3.2.5 Windload

When the dam is full,wind acts only on thedownstream side thus contribute to stability

3.2.5 ExceptionalLoads

Under reservoir full conditions, the most adverse seismic loading will then occur when a ground shock is associated with: – Horizontal foundationaccelerationoperatingupstream,an–Verticalfoundation acceleration operatingdownwards.

Load combination

Load source	Qualification[1]	Load combination		
		Normal (NLC)	Unusual (ULC)	Extreme (ELC)
Primary				
Water	At DFL		√	
	At NML	√		√
Tailwater	At TWL	√		√
	Minimum		√	
Self-weight	-	√	√	√
Uplift	Drains functioning	√	√	
	Drains inoperative		-[2]	√
Secondary, if applicable				
Silt	-	√	√	√
Ice	Discretionary	√	√	√
Concrete	Minimum normal	√		√
temperature	Minimum at the time of event		√	
Exceptional				
Seismic	CME			√

3.3 General

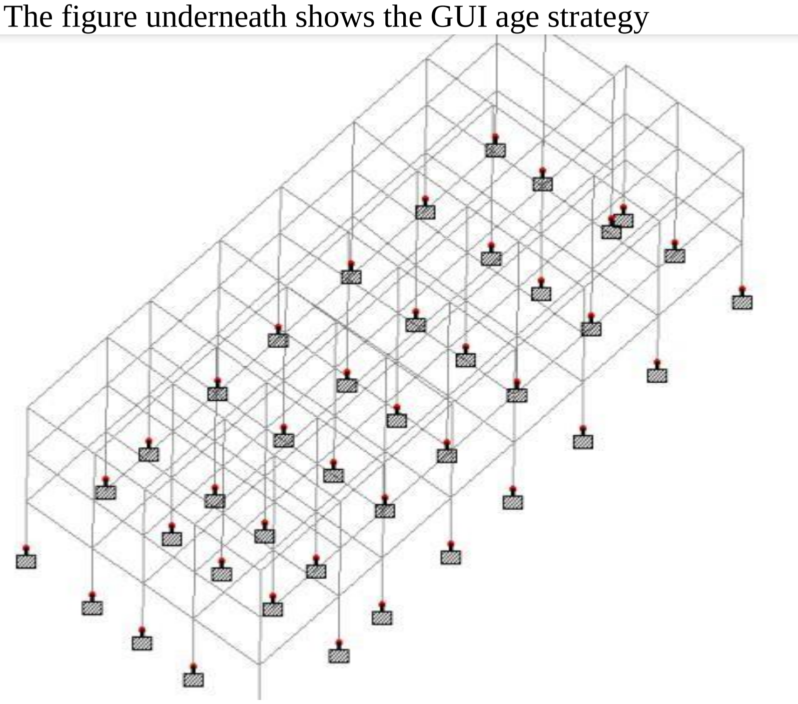
The STD input document is the manner by which the GUI (or Graphical User Interface) interfaces with the STAAD.pro research motor. The info document is a book record that contains a bunch of orders that are run all together. The orders either give guidelines or information about examination and additionally design. A content tool or the GUI Modeling office might be utilized to produce the STAAD input design. Any content manager can be utilized to alter/make the STD input record by and large. The info record is produced by the GUI Modeling office utilizing a vivid menu-driven designs arranged.

3.4 Types of structure

A plan can be portrayed as a variety of segments. STAAD.Pro is prepared for exploring and arranging structures containing packaging, plate/shell and solid parts. Essentially any kind of configuration can be destitute somewhere near STAAD.Pro programming. A space structure, which is a three dimensional laid out plan with loads applied in any plane, is the most get onto a plane development is restricted by an overall X-Y work with system with loads in a comparable plane. A Bracket structure contains oftruss people which can have recently crucial part controls and no curving in the people. A story structure is a couple of dimensional development having no even (overall X or Z) improvement of the plan [FX, FZ &MY are controlled at each joint]. The floor laying out (in overall X-Z plane) of a design is an ideal representation of a story structure. Portions can similarly be exhibited with the floor in a story structure as long as the development has no level stacking. On the off chance that there is any sort of even weight, it ought to be decayed as a space structure.

3.5 Generation of thestructure

The design might be produced from the info document or referencing the co-ordinates in the GUI. The figure underneath shows the GUI age strategy



3.6 Supports

Supports are demonstrated as Stuck, FIXED, or FIXED with different conveyances (known as FIXED However). A stuck assistance has limitations against all translational turn of events and none against rotational turn of events. With everything taken into account, a stuck assist will with having reactions for all forces anyway will go against no minutes. A fixed assistance has limitations against all headings of advancement. Translational and rotational springs can moreover be shown. The springs are tended to the extent their spring constants. A translational spring steady is described as the ability to remove an assistance joint one length unit the foreordained overall way. Also, a rotational spring steady is portrayed as the ability to turn the assistance joint one degree around the foreordained overall course.

3.7 Loads

A structure's joint loads, member loads, temperature loads, with a permanently attached terminal member loads can all be specified.STAAD is an acronym for "Standardized Transportation Authority In addition, Pro will calculate the structure's self-weight and use it in analysis as uniformly distributed member loads. Any fraction of this self-weight can be directed in any direction

3.7.1 Jointloads

Every free joint of a system may be subjected to joint loads, including all forces and moments. These loads operate on the structure's global coordinate scheme.The positive coordinate directions are affected by positive powers. A single joint will have any amount of loads attached to it, and the loads would be additive on that joint.

3.7.2 Member load

Three sorts of part loads may be applied directly to a person from a development. These piles are reliably appropriated loads, concentrated weights, and straightly moving weights (checking trapezoidal). Uniform weights circle back without limit or inadequate length of a section. Assembled troubles act at any moderate, decided point. Straightforwardly changing weights act preposterous length of a section. Trapezoidal straightly changing weights act over the full or midway length of a section. Trapezoidal weights are changed over into a uniform weight and a couple of concentrated weights. Many weights may be shown to circleback to a section in any free stacking condition.

Part loads can be shown in the part put together structure or the overall work with system. Reliably coursed part stacks gave in the around the world sort out structure may be demonstrated to act along the full or projected part length.

3.7.3 Area/Floarload

A uniformly distributed load is also applied to a floor (bounded by the X-Z plane). Calculating the member load for each floor's individual members might take a long time. Using the AREA or FLOOR LOAD commands, the user may define the area loads (unit load per unit square area) for members.For these participants, the software will measure the tributary region and calculate the appropriate individual loads. One-way distributions are handled by the Area Load, and two-way distributions are handled by the Floor Load.

3.8 Section types of concretedam

Concrete members may be constructed for there are several different kinds of cross sections.

Prismatic Beams for (Rectangular) Prismatic Columns (Rectangular)

3.9 Designparameters

A range of parameters are included in the software that are needed for IS 13920 architecture. It accepts all of the parameters required for IS: 456 architecture. It also has some additional criteria that are only available when the design is completed according to IS: 13920. The default parameter values were chosen to be numbers that are often found in traditional architecture specifications. This manual includes a comprehensive list of the available parameters as well as their default values, which can be modified to accommodate the specific design being done. Before beginning the concrete plan, the length and force units must be declared in millimetres and Newtons.

3.9.1 Beam

Arrangement Pillars are planned for flexure, shear and curve. At whatever point required the effect of the center force may be considered. For all of these forces, all unique bar loadings are pre sifted to recognize the essential weight cases at different spaces of the shafts. For design to be continued by IS: 13920 the width of the part won't be under 200mm. Similarly the part will in a perfect world have a width-to significance extent of more than 0.3.

3.9.2 Design forflexure

Plan strategy is same as that for IS 456. Regardless while arranging following measures are satisfied by IS-13920: 1. The base assessment of concrete will in a perfect world be M20. 2. Steel fortresses of assessment Fe415 or less will be used. 3. The base pressing factor steel extent on any face, at any part, is given by: 4. Pmin = 0.24 √ fckfy 5. The best steel extent on any face, at any section, is given by Pmax = 0.025 6.

The positive steel extent at a joint face ought to be in any occasion comparable to an enormous part of the negative steel at that face. 7. The steel gave at all of the top and base face, at any fragment, will at any rate be identical to one-fourth of the best regrettable second steel gave at the substance of either joint.

3.9.3 Design forShear

The IS 13920:1993 revision specifies the shear force that vertical hoops must resist. When measuring shear power, elastic sagging and hogging moments of resistanceofthebeamsectionatendsare taken into account. Plastic drooping and hoarding snapshots of opposition can likewise be utilized for shear plan if the PLASTIC boundary is characterized in the information document. Shear support is utilized to oppose torsional and shear powers.

3.9.4 ColumnDesign

Sections are proposed for significant forces and biaxial minutes per IS a456:2000. Portions are similarly proposed for shear powers. All critical models for picking longitudinal and get over help as determined by IS: 456 have been managed in the section plan of STAAD.Pro Anyway following stipulations have been satisfied to unite courses of action of IS 13920: 1. The base assessment of concrete will preferably be M20 2. Steel fortresses of assessment Fe415 or less will be used. 3. The base component of area part won't be under 200 mm. For segments having unsupported length outperforming 4m, the most concise component of fragment won't be under 300 mm. 4. The extent of the briefest cross-sectional estimation to the contrary estimation will in a perfect world be in any event 0. 5. The partitioning of circles won't outperform a huge bit of the most un-sidelong segment of the portion, except for where uncommon restricting help is given. 6. Unprecedented limiting help will be given over a length lo from each joint face, towards mid reach, and on either side of any part, where flexural yielding may occur. The length lo won't be not by and large a) greater sidelong component of the part at the portion where yielding occurs, b) 1/6 of clear scope of the part, and c) 450 mm. 7. The scattering of circles used as remarkable keeping backing won't outperform ¼ of least part estimation anyway need not be not by and large 75 mm nor more than 100 mm.

3.10 Design operation

STAAD.Pro contains a broad course of action of workplaces for arranging basic people as individual sections of a took apart plan. The part plan workplaces outfit the customer with the ability to pass on outa number of different arrangement exercises. These workplaces may design issue. The exercises to play out an arrangement are: 1. Decide the people and the stack cases to be considered in the arrangement. 2. Demonstrate whether to perform code checking or part assurance. 3. Decide plan limit regards, if not equivalent to the default regards. 4. Show whether to perform part decision by headway. These exercises may be repeated by the customer many occasions depending on the arrangement essentials. Seismic quake development oftentimes instigates power sufficiently huge to cause inelastic misshapenings in the plan. In case the development is frail, sudden frustration could occur. However, in case the development is made to carry on malleable, it will really need to help the seismic quake impacts liked with some redirection greater over the yield evasion by maintenance of energy. As such pliability is furthermore required as a key segment for prosperity from sudden breakdown during outrageous dazes. STAAD.Pro has the capacities of performing strong arrangement as per IS 13920. While arranging it satisfies all plans of IS 456 – 2000 and IS 13920 for columns and sections

3.11 Allowablestress

STAAD's participant design and code testing. Pro are based on the IS: 800 allowable tension design process (1984). It's a technique for proportioning structural members under duty conditions by using construction loads and pressures, permissible stresses, and design limits for the required material. In this textbook, it will be impossible to cover any part of IS: 800. However, the main features of the permissible stresses defined by IS: 800 and applied in STAAD will be discussed in this section. Advantageous During the consideration
of different forms of permissible pressures, appropriate parts of IS: 800 will be cited

3.12 MultipleAnalysis

Multiple studies in a single run can be needed for structural analysis/design. To enable numerous analyses in the same run, STAAD.Pro allows the user to modify input such as member properties, support requirements, and so on in an input file. For design purposes, the results of various analyses may be integrated. It may be possible to render those members disabled for one load case and then allow them for another in systems with bracing. For this form of study, STAAD has an INACTIVE choice.

3.13 Post processingfacilities

The STAAD could use all of the output from the run for additional processing. The user interface is excellent.

3.13 StabilityRequirements

The two individuals' thinness proportions are estimated and contrasted with the most noteworthy qualities. The generally speaking slendernessratios for different classifications of individuals are summed up in the IS: 800. An appropriate maximal thinness proportion for every part can be given in the STAAD execution of IS: 800. Pressure individuals will be checked against a most extreme worth of 180, while strain individuals will be checked against a greatest worth of 400 if no greatest thinness proportion is determined.

3.13.1 DeflectionCheck

This office allows the customer to consider aversion as models in the code checkand part assurance measures. The evasion check may be controlled using three limits. Redirection is used despite other strength and robustness related principles. The close by aversion assessment relies upon the latest assessment results

3.13.2CodeChecking

The purpose of code testing is to determine if a certain section will fulfil the requirements of the relevant specification code. The code verification is founded on IS: 800 requirements (1984).The code checking equations use forces and moments at specific parts of the participants. The BEAM parameter or the SECTION command may be used to specify sections. When no parts are mentioned, the code is checked using powers.

CHAPTER 4
DESIGN FOR CONCRETE DAM

Design of concrete gravity Dam sections

From an overall perspective a gravity dam should satisfy the going with measures:

1. It will be ensured against overturning at any even circumstance inside the dam at the contact with the foundation or inside thefoundation.

2. It should be secured against sliding at any level plane inside the dam, at the contact with the foundation or along any topographical segment inside thefoundation.

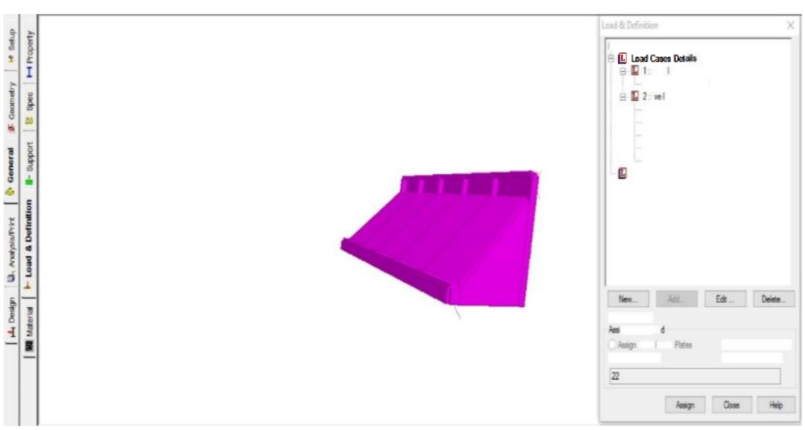
3. The part should be comparing so much that the reasonable weights in boththe concrete and the foundation should notexceed.

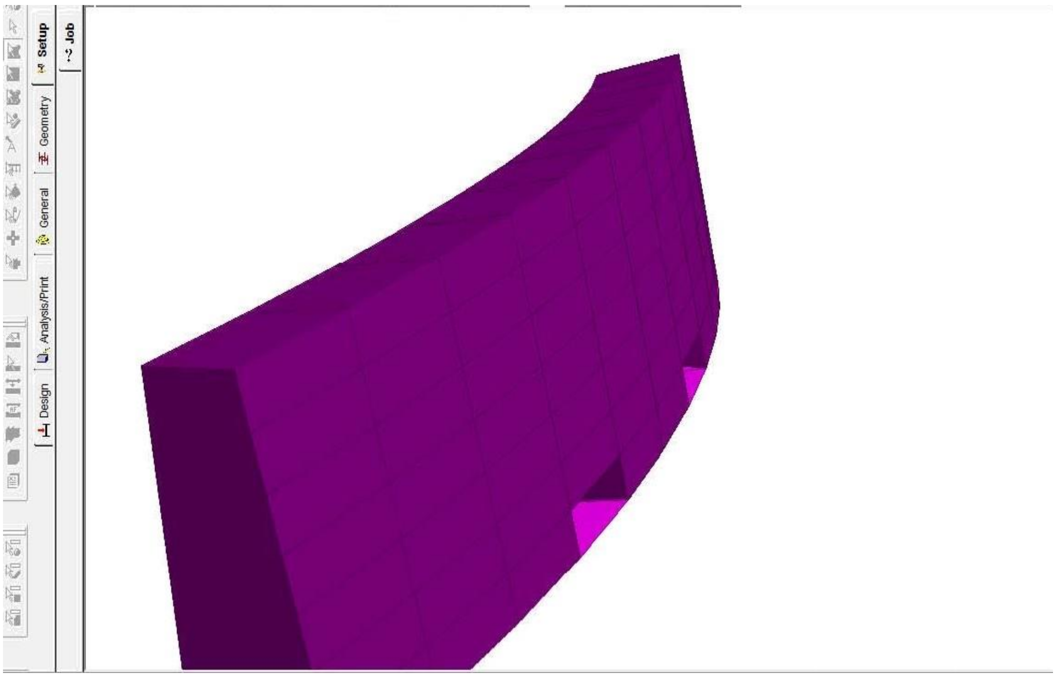
Security of the dam structure is to be checked against likely loadings, which may be designated fundamental, discretionary or excellent.The gathering is made similar to the fittingness and also for the general meaning of the store.

1. Essential weights are perceived as all around material and of

prime significance of the heap.

2. Discretionary weights are all around discretionary and of lesser degree likes ediment trouble or warm tensions in view of mass establishing.





Astounding weights are arranged dependent on limited general fittingness or having low probability of occasion like inertial weights related with seismic activity.

Indeed a strong gravity dam gets its solidarity from the force of gravity of the materials in the portion and hereafter the name. The gravity dam has sufficient load to withstand the forces and the disturbing second achieved by the water seized in the stock behind it. It moves the stores to the foundations by cantilever action and along these lines incredible foundations are pre basic for the gravity dam.

The powers that offer strength to the dam include:

1. Weight of the dam
2. Thrust of the tailwater

The powers that attempt to destabilize the dam include:

1. Reservoir waterpressure
2. Uplift

3. Forces because of waves in thereservoir
4. Icepressure
5. Temperaturestresses
6. Siltpressure
7. Seismicforces
8. Windpressure

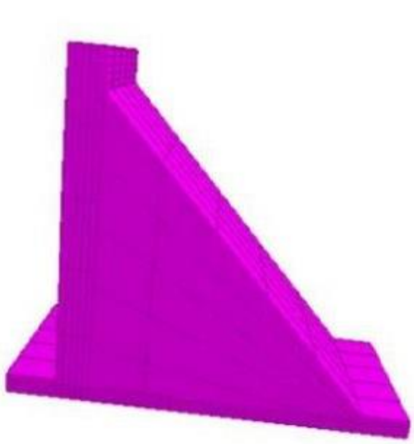
The powers to be opposed by a gravity dam fall into two classes as given underneath:

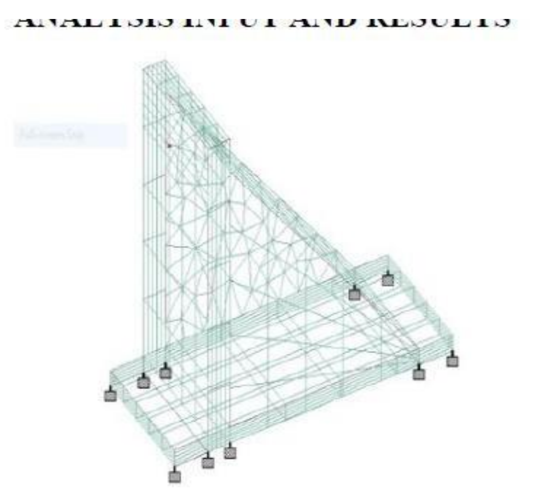
.Forces,suchasweightofthedamandwaterpressurewhicharedirectlycalculatedfro mtheunit load of materials and properties of liquid pressureand

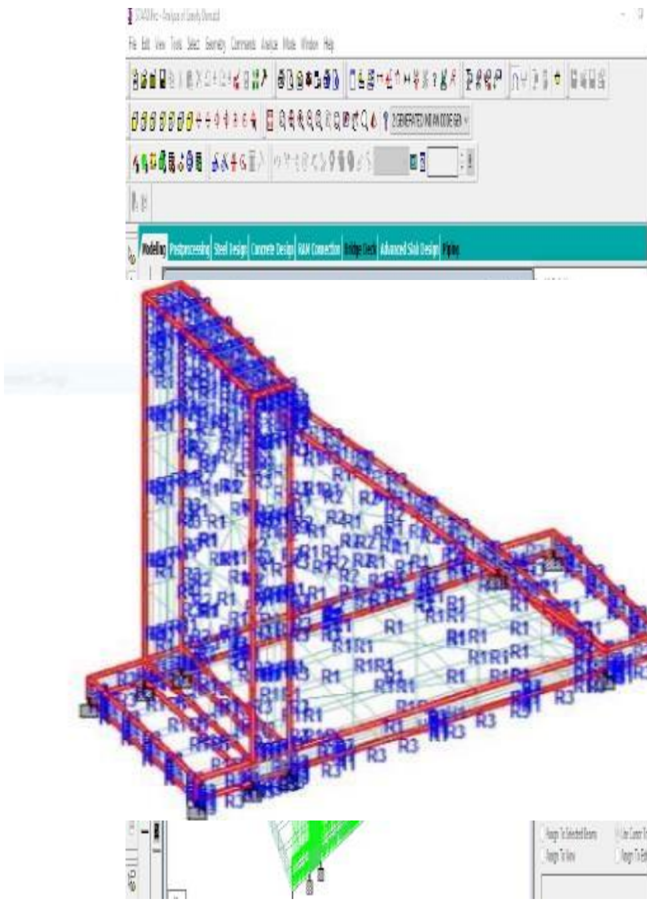
.

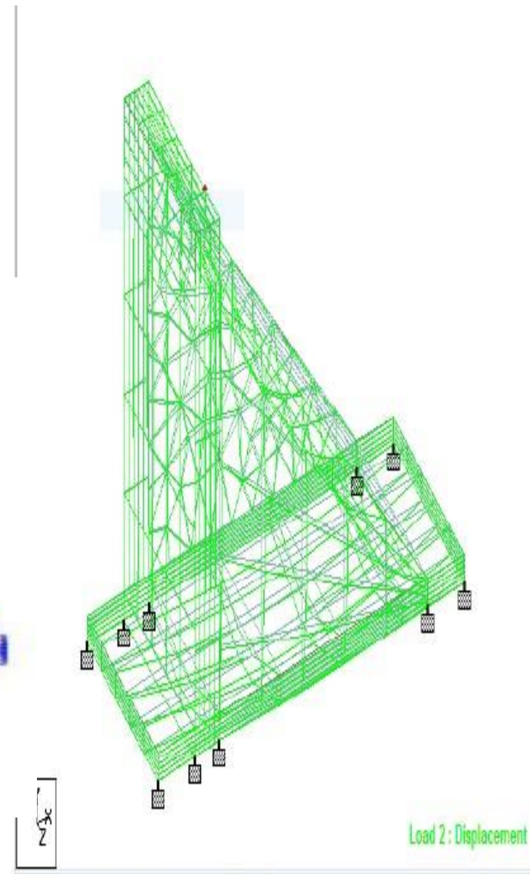
Forcessuchasuplift,earthquakeloads,siltpressureandicepressurewhichareassum edonlyonthe premise of suppositions of fluctuating level of dependability. Indeed to assess this class of powers, unique consideration must be taken and dependence put on accessible information, experience andjudgement.

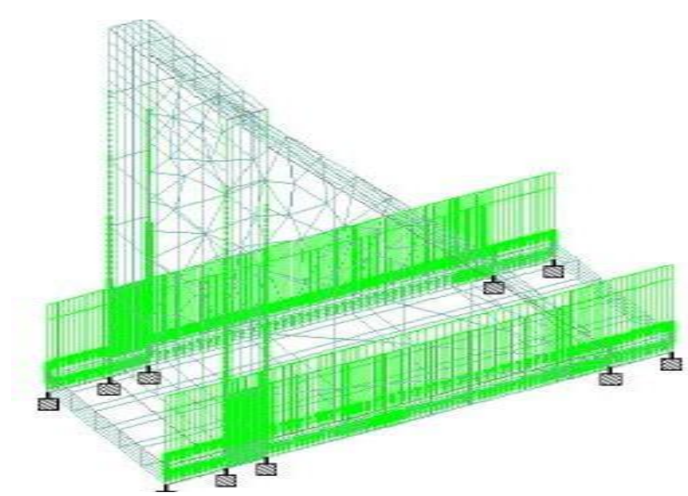
Design in Staad



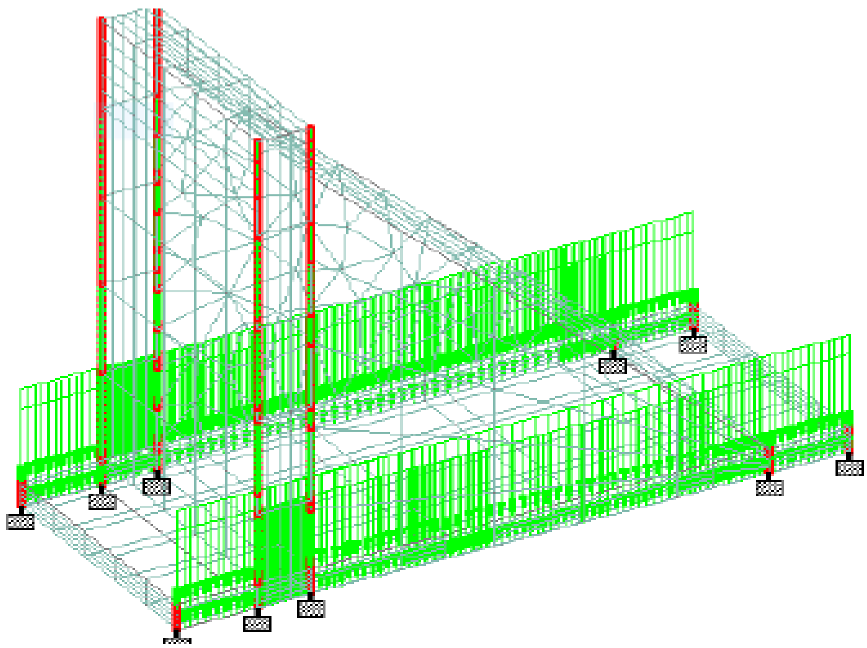





Load 2 : Displacement



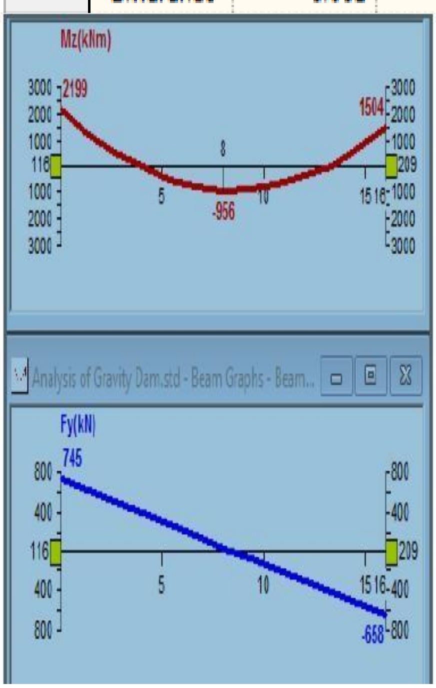
Bending



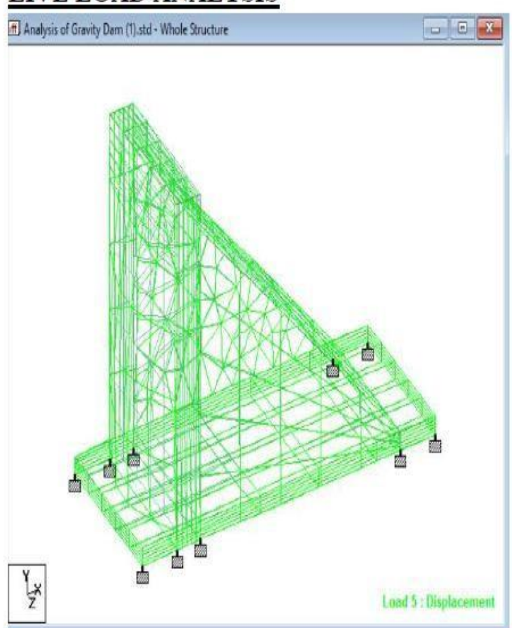
		Horizontal	Vertical	Horizontal	Moment		
Node	L/C	Fx kN	Fy kN	Fz kN	Mx kNm	My kNm	Mz kNm
17	1 DL	-27.407	31252.461	730.085	40.964	130.094	-539.914
	2 GENERATE	-41.111	46878.691	1095.128	61.447	195.142	-809.872
	3 GENERATE	-32.889	37502.957	876.102	49.157	156.113	-647.897
	4 GENERATE	-24.667	28127.213	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

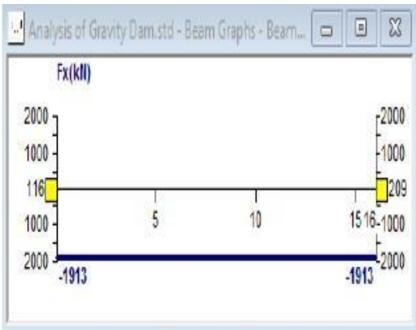
Analysis of Gravity Dam.std - Statics Check Results

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

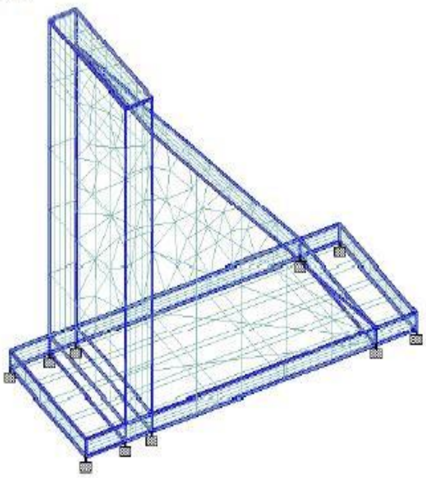


LIVE LOAD ANALYSIS





Graph shows the beam displacement along axis



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

All / Summary

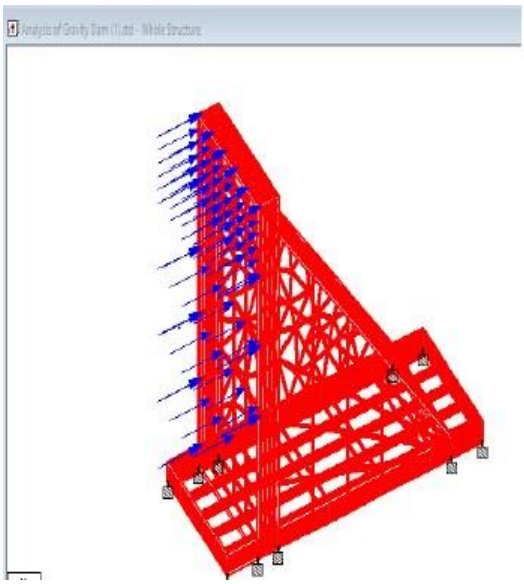
		Horizontal	Vertical	Horizontal	Resultant	Rotational		
Node	L/C	X mm	Y mm	Z mm	mm	rX rad	rY rad	rZ rad
1	1 DEAD LOA	1.306	-19.291	-32.795	38.070	0.000	-0.004	-0.00
	2 WL+X	0.002	0.014	0.074	0.076	-0.000	0.000	-0.00
	3 WL-X	-0.002	-0.014	-0.031	0.034	0.000	-0.000	0.00
	4 WL+Z	-0.031	-0.089	11.120	11.120	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

Wind Deflection



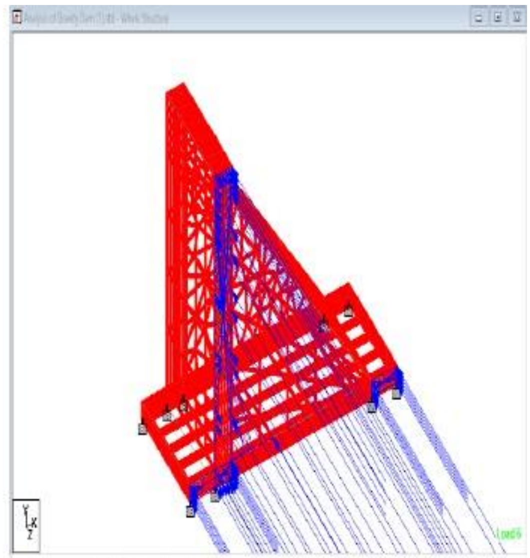


Figure5.20 wind direction -z with 15KN

Design steps in STAAD.pro

Step - 1: Development of nodal centers. Considering the arranging of plan we entered the center concentrations into the STAAD record.

Step - 2: Portrayal of plates. By utilizing, add plate order we had drawn the plates between the relating hub focuses.

Step - 3: 3D viewpoint on structure. Here we have used the Momentary intermittent request in Y bearing get the 3D point of view on structure.

Step - 4: Supports and property relegating. After the formation of construction, the backings at the foundation of design are determined as fixed. Furthermore, the Materials were indicated and cross segment of plate individuals was alloted.

Step - 5: 3D conveying view. Ensuing to designating the property the 3d conveying point of view on the development can be showed up.

Step - 6: Doling out of wind loads. Wind loads are portrayed by IS 875 Section 3 ward on power decided and transparency factor. By then loads are incorporated weight case nuances in +X,- X, +Z,- Z course.

Step - 7: Appointing of dead loads.

Step-8:- Relegating of weight blends DL+LL, DL+LL+UPL,DL+LL+UPL+WL Worldwide Diary of Unadulterated and Applied Science Extraordinary Issue 300 various factor of 1,1.5& breeze load having different headings of X+ ,X-,Z+ ,Z
Step-9:- For the analysis part, use STAAD.pro software and assign all required parameters as well. IS 456: 2000 and SP 16:2000 are the code books.

Step-10:- save and run the file for analysis print. Check how many errors for dam from this process, if not getting any results so can we modified & find out where did we mistaken. Finally post processing & print out of analysis can be taken out.

Step-11:- Following the study, only a portion of the entire gravity dam is applicable to begin STAAD. Foundation v8i is used to plan the whole house independently. We may build styles of foundations and footing depths depending on our needs.

Calculation

Case 1 :-when the reservoir is empty Self-weightW= l x b x h x γcon W1= 4.6mx47mx100mx24x9.81 =509021.28kN W2=1/2x30.4x40x2.4x9.81x100 =1431475.2kN

Case 2:- when the reservoir is maximum level Self-weightW1=509021.28kN W2=1431475.2Kn Water pressure:- PW=ρgh =1000x9.81x40mts

PW=392400N/m =392.4KN/m2 Water pressure=1/2x40x392.4 =7848kN Uplift pressure: 40/30=13.34mts from base- At heel P'=γh =1000x9.81x40 =392400N/m =392.4kN/m At toe P''=γh' =1000x9.8x10 =98100N/m =98.1kN/m Snapshots of upsetting:- Moments of toppling:- Moments of toppling:- Moments of upsetting:- Moments of toppling:- Moments of upsetting:- Moments of toppling:- Moments of upsetting:- Moments of topple - At this time 509021.28x32.7 =16644995. M1=w1x32.7 =509021.28x32.7 =16644995. M1=w1x32.7 =509021.28x32.7 =16644995. 86kNm M1=w1x32.7 =509021.28x32.7 =16644995. 86kNm is a unit of power. M1=w1x3M1=w1x3M1=w1x3 29001687 =1431475.2x20.26mts M2=w2x20.26mts M2=w2x20. M2=w2x20.26mts M2=M1+m2=45646683.41kNm Opposing moments:- Mw1=784800x13.34 =10469232 KN.m Mup1=490506x20.26m =9937530kNm Mw1 +mup1 =10469232 + 9937530 KN.m Factor of safety=45646683/20406762 =2.24 >2 safe Sliding:- Friction ff=μ.N =0.7(509021.28 + 1431475.2

1358347.536 Wp=784800 F.o.s =1358347.536/784800 =1.73 >1.5 Safe

Case 3:- When the reservoir is half fill W1=509021.28kN W2=1431475.2kN Water

pressure:- W1=ρgh =1000x9.81x20m =196200N/m =196.2kN/m2

Wp1=1/2x20x196.2 =1962kN Acts on20/3=6.67mts

Uplift pressure:- At heel up1=γwxh =1000x9.81x20 =196.2kN/m

At toe Up2=γwxh =1000x9.81x10 =98100N/m =98.1kN/m Over turning moment Stabilizing moment Mw1=16644995.86kNm

Mw2=29001687.55kNm Mw1+Mw2=45646683.41

Opposing moment Mw1'=196200x6.67=108654kNm

Mup'=257512.5x2026 =521720.25 Mw1'+

Mup'=6525857.25 Factor of safety=4564668.41/6525857.25 =6.9972

Safe Sliding force:- Friction Ff=μn =0.7(509021.28+1431475.2 =1358347.536 kN

Wp =196200kN Factor of safety=1358347.536/196200 =6.9 > 1.5 Safe

Tables and results

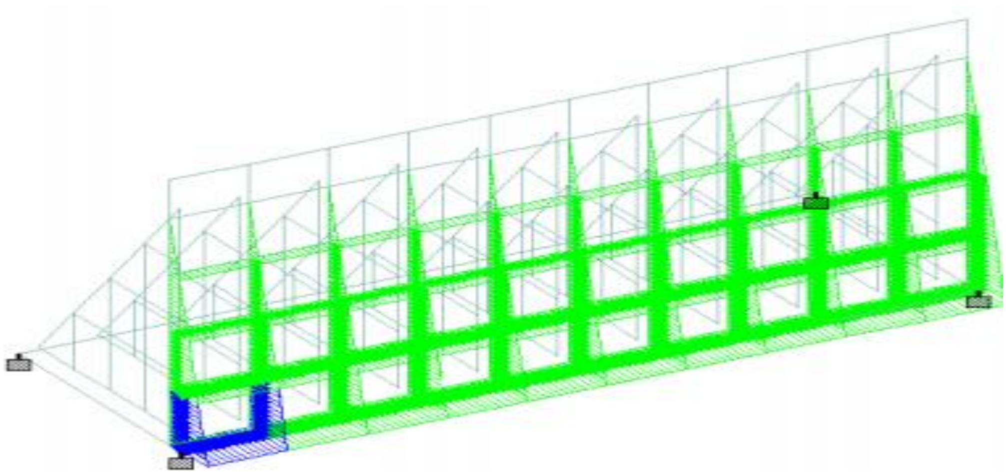
Sl.no	force	Horizontal force	Vertical force
1	Self-weight M1		509021.28
	M2		1431475.2
2	Water pressure W	748400	
3	Uplift pressure, at heel		-396.2
	At toe		-98.1
4	Silt pressure	-180	

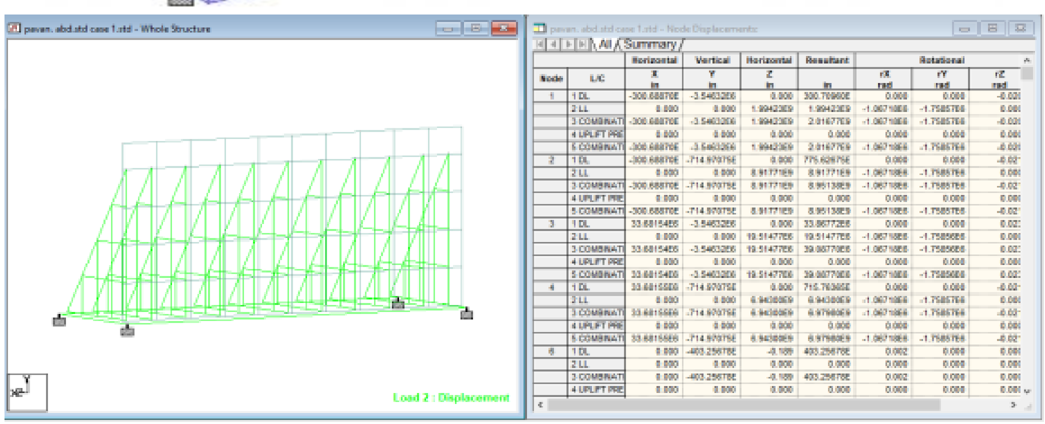
Table 1

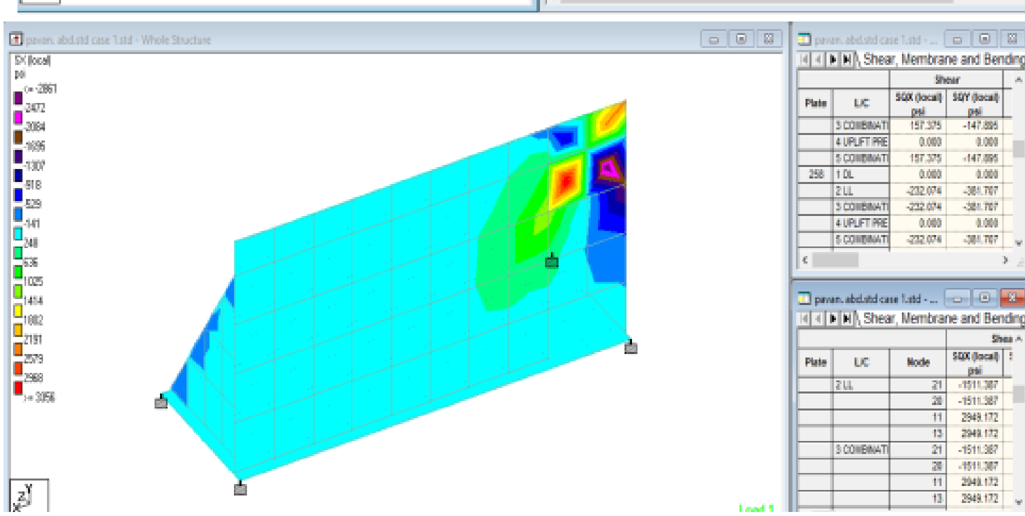
Sl.no	force	Horizontal force	Vertical force
1	Self-weight M1		509021.28
	M2		1431475.2
2	Water pressure W	196200	
3	Uplift pressure, at heel		-196.2
	At toe		-98.1
4	Silt pressure	-180	

Table 2

Results-:




Load 2 : Displacement
All
Summary


Shear, Membrane and Bending
Shear, Membrane and Bending

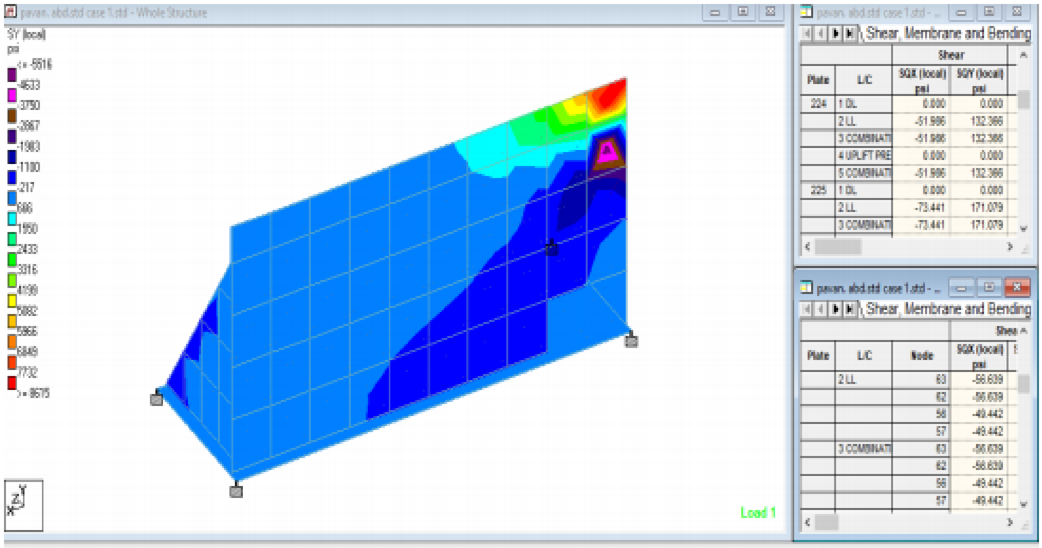
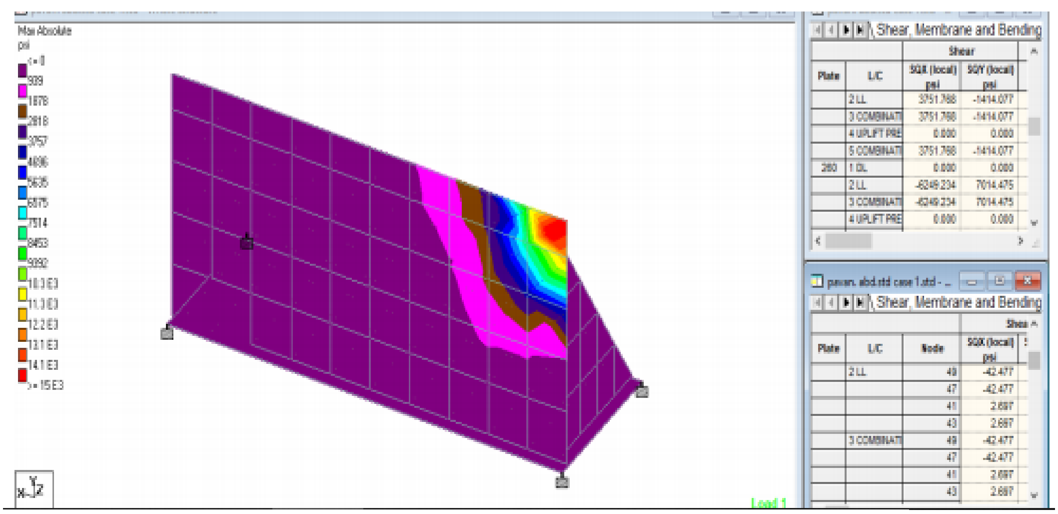
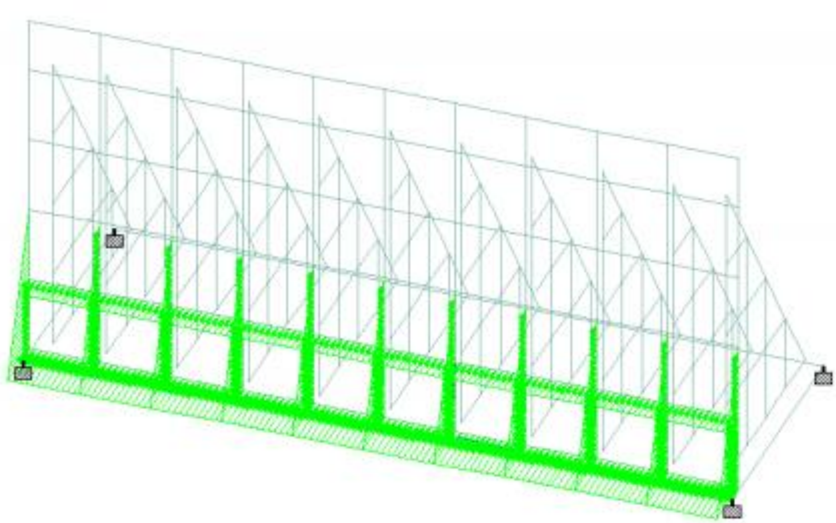
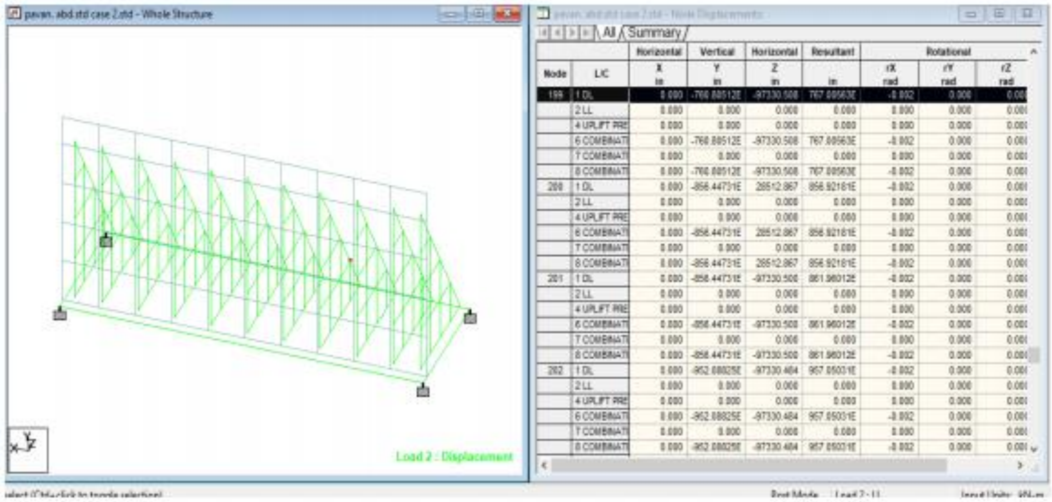
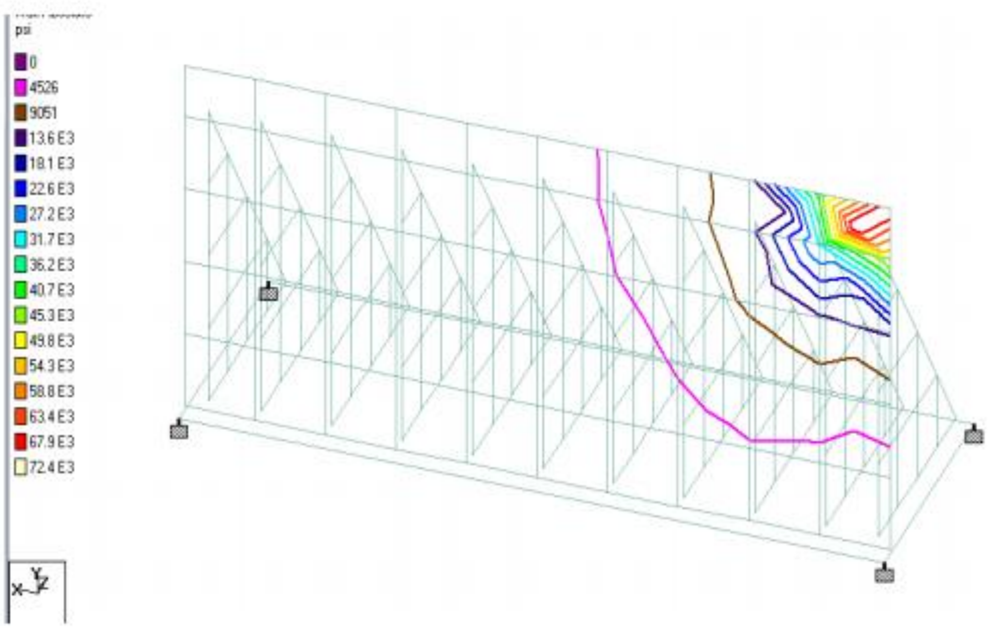


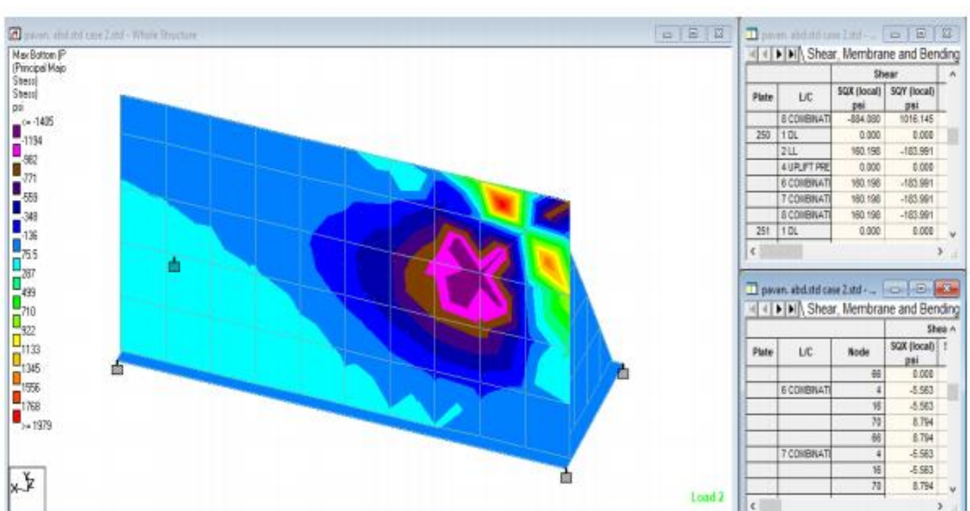
Fig 4 SY local for case-2






pavan. abd.std case 2.std - Whole Structure
Load 2 : Displacement
All
Summary
Node
L/C
Horizontal
Vertical
Resultant
Rotational


psi
0
4526
9051
13.6 E3
18.1 E3
22.6 E3
27.2 E3
31.7 E3
36.2 E3
40.7 E3
45.3 E3
49.8 E3
54.3 E3
58.8 E3
63.4 E3
67.9 E3
72.4 E3


Shear, Membrane and Bending
Plate
L/C
Shear
Node
psi
Load 2

Chapter 5 Conclusion

STAAD.Pro and STAAD.foundation can learn the help needed for any strong fragment. The program contains different limits which are arranged by IS: 456(200The dam has been investigated with CODE-IS-6512-1984, the variable diversion found extremely less roughly 0.002mts which can be considered as immaterial.

In the wake of playing out the examination the blunders discovered to be zero that implies the plan of the construction is impressive and the standard burdens are taken for investigation of live and wind loads.

Staad – ace given outcomes must be improved practicallyto execute structure conclusion in future. So far quake powers static stacking is given according to the STAAD.Pro definitions and order and not physically, anyway unique investigation isn't considered in this paper.

There are a few vulnerabilities actually winning with respect to dependability at help

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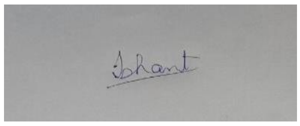

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