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3D VIRTUAL CONSTRUCTION OF SRISAILAM DAM USING REVIT SOFTWARE FOR PERFORMING COMPUTATIONAL FLUID DYNAMICS SIMULATION FUNCTIONS

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ABSTRACT: 3D modeling is significant modern day tool to design a working concept and to analyze all parameters such as discharge, depth, area, volume, etc. for fluid dynamics. It is used to deduce the horizontal, vertical and diagonal lines of the 2D sketches into 3D model. It can create a structure model using 3D elements such as dam body, spillway gates, drainage gallery, sluice gates, upstream and downstream faces of the dam and such other components. It generates models with minimal efforts and maximum portability. The dam design is explained in detail using Revit software and comparisons of classical design techniques with modern ones and modern construction techniques. It is designed to scale effectively through large number of analysis by transparent use for automated results. It can create realistic and accurate view.It gives better understanding of product performance and allows to develop cost-effective, innovative, and more reliable designs in less time. The flow inside the model can be seen clearly and where it was moving. It enables engineers to explore more ideas and make better decisions. It is used to analyze parameters of fluid dynamics of the SRISAILAM dam. It is used for modeling of structural components, analyze and simulate systems and structures.To further perform computational fluid dynamics and simulation fumctions to analyze structure condtions during floods and other situations.

KEYWORDS: 3D modeling, revit software, computational fluid dynamics.

I. INTRODUCTION

3D modeling is significant modern day tool to design a working concept and to analyze all parameters such as discharge, depth, area, volume, etc. for fluid dynamics. It is used to deduce the horizontal, vertical and diagonal lines of the 2D sketches into 3D model. The design becomes more clear and can take a virtual view of their construction project. It can also quickly check whether a new plan is applicable or check small changes to the design would look like. The project approval rate in construction business is quicker when a 3D model is used. It is easy to make minor or major changes in the overall design without must cost. It is easier for the construction engineers to complete the project at low cost and as per the plan. Using 3D modeling we can do simulations in the fluid dynamics. Simulation is the imitation of the situation or the process. Simulation gives the accurate analysis. Using revit aspects develope the quantity of the materials which can be used in the construction can be estimated. And this paper also estimates the cost of the materials when we know the quantity. So we can estimate the cost of the construction.
With 3D modeling we can do computational fluid dynamics (CFD) in the Revit software. (CFD) provides a qualitative (sometimes quantitative) prediction of fluid flow by means of mathematical modeling (partial differential equations), numerical methods, and software tools. It performs numerical experiments in a virtual flow laboratory. (CFD) will enables to architects to design comfortable and safe living environments, designers of vehicles to improve the aerodynamic characteristics, safety experts to reduce health risks from radiations and other hazards.

Autodesk Revit is software for architects, structural engineers, MEP engineers, designers and contractors developed by Autodesk in 2000. It allows users to design a building, bridges, dams and structures and its components in 3D, annotate the model with 2D drafting elements. Revit is capable with tools to plan and track various stages in the structures lifecycle, from concept to construction and later demolition.
Revit provides the infrastructure and calculation tools, generates models with minimum effort and maximum portability. Modern dams is a very fascinating topic and a vast subject. The several different types of dams

along with the types of suspension cables which are very important to the dams built now-a-days.. The dam design is explained in detail using Revit software and comparisons of classical design techniques with modern ones and modern construction techniques. It can create a structure model using 3D elements such as dam body, spillway gates, drainage gallery, sluice gates, upstream and downstream faces of the dam and such other components.

This paper visualizes the dam or interior designing project with respect to its scale, volume and proportions. This enables us to study design alternatives and develop superior quality design solutions.

Building Information Modeling

The concept of BIM has existed since the 1970s. Building Information Modeling "BIM" is becoming a better known established Collaboration process in the construction industry. Owners are increasingly requiring BIM services from construction managers, architects and engineering firms. Many construction firms are now investing in "BIM" technologies during bidding, preconstruction, construction and post construction.

Computational Fluid Dynamics (CFD) covers a wide range of methods by which computers numerically simulate fluid flow. In CFD projects, the environment to be studied is virtualized and simplified into a digital model. The model includes numeric representations of the material elements (existing and proposed structures and topography) as well as methods of solving physical equations that simulate themotion of the flow. These models, and the results they produce, are visually displayed on the computer and allow the model to be reviewed without any physical analogue.

It provides a qualitative (sometimes quantitative) prediction of fluid. It is a branch of fluid mechanics that uses numerical analysis and data structures to solve and analyze problems that are involved in the fluid flows.

Computational fluid dynamics is the use of applied mathematics, physics and computational software to visualize how a gas or liquid flows. It is based on the Nervier-stokes equation. This equation describes how the velocity, pressure, temperature and density of a moving fluid. It has been started around 20th century. It is a tool for analyzing.

Animation is Artists work and Simulation is Scientists/Engineers work, Creation of illusion is known as Animation and image of real life things is known as Simulation.

Study Area:

This dam, built on the river Krishna in Andhra Pradesh, is primarily meant for hydro power generation. Apart from a total generating capacity of 770 MW, the dam also caters to the storage of water for irrigation to about 1.6•105 hectares. Though the narrowness of the gorge at the dam suggests the adoption of an arch dam, this idea was ruled out as the abutment rocks were not considered competent enough to take the arch thrusts. The dam was finalized to be of concrete- gravity type. A general layout of the project and upstream view of the dam along with typical sections are shown in figure.

- This paper deals with dam virtual 3d modelling through revit software analysing the existing SRISAILAM DAM. The features of the Srisailam dam are

Location: Kurnool district, Andhra Pradesh State, And, Mahabubnagar District, Telangana state.
Construction began: 1960, Opening date: 1981

Type of dam: Earth-fill &Gravity River: Krishna

Height: 145.10 m (476 ft), Length: 512 m (1,680 ft), Spillway capacity: 38369 Cumecs. Creates: Srisailam Reservoir, Total capacity: 216 Tmc ft.
Catchment area: 206,040 km2 (79,550 sq mi) Surface area: 616 km2 (238 sq m), Turbines: 6 × 150 MW (200,000 hp) reversible Francis-type (left bank) 7 × 110 MW (150,000 hp) Francis type (right bank),Installed capacity: 1,670 MW (2,240,000 hp), Length of spillway: 270.6m
No. of spillway gates: 12, Crest level of spillway: 253m
Size of spillway gates: 18.288m*16.746m ,Type of spillway gates: Radial

A project of this magnitude is complicated, given the number of engineering disciplines and design elements, including power production, living quarters, processing plants, and auxiliary facilities linked by a network of infrastructure and roads. The project includes complicated retaining structures, underground factories, and diversionary structures, as well as very large and complex equipment and a multitude of supporting utilities. With an integrated, model, engineers are able to speed the understanding of the hydrology, to calculate the volume of material that needs to be removed along with grading plans, to calculate the amount of cement needed, the location of structures, and the interconnecting infrastructure between the facilities.

Srisailam right main canal (SRMC) is constructed with 44,000 cusecs capacity at full supply level of 267.92 metres (879 ft) MSL to feed Veligodu reservoir, Brahmamsagar Reservoir, Alaganoor reservoir, Gorakallu reservoir, Owk reservoir, Gandikota Reservoir, Mylavaram reservoir, Somasila resrvoir and Kandeleru reservoir. This canal also supplies water to Telugu Ganga project which supplies Krishna river water to Chennai city for its drinking purpose. This main canal by feeding water to K.

C. Canal, Srisailam right bank canal, Telugu Ganga canal and Galeru Nagari canal irrigates vast area in Kurnool, Kadapa, Chittor and Nellore districts. Handri-Neeva lift canal by drawing water from the Srisailam reservoir, supplies drinking water in all the districts of Rayalaseema Veligonda reservoir receives water by gravity through tunnels to irrigate lands in Nellore, Kadapa and Prakasam districts. Kalwakurthy lift irrigation scheme by drawing water from the Srisailam reservoir, supplies irrigation water in Mahbubnagar and Nalgonda districts Srisailam left bank canal receives water by gravity through tunnels to irrigate lands in Nalgonda district.

The contour map of Srisailam dam site is shown in below figure. The highest elevation point in this site is 600m, the lowest elevation is river bed level 200m.

Fig:1: Srisailam Dam

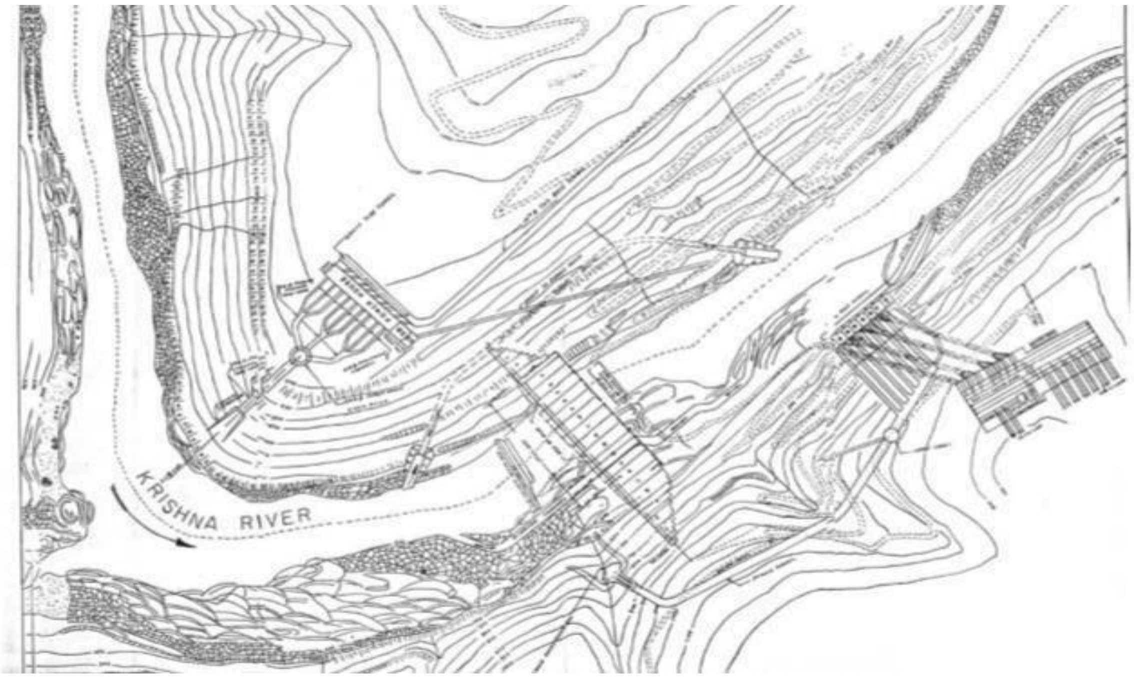

Fig:2:contour map

Fig-3: An Aerial View Of Srisailam Dam Site

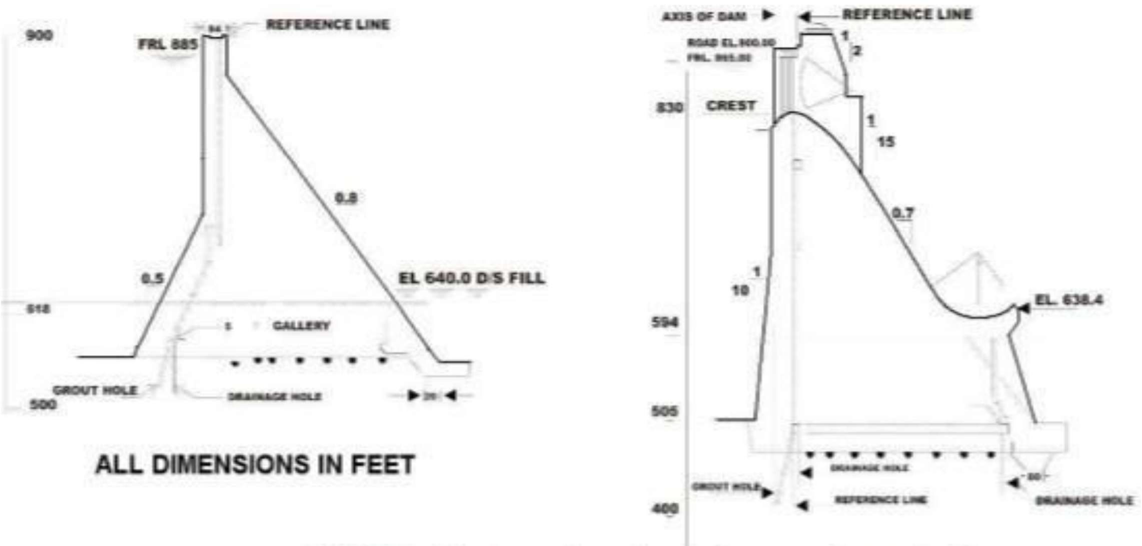

Fig :4: upstream view and typical non-overflow and spillway sections of sris

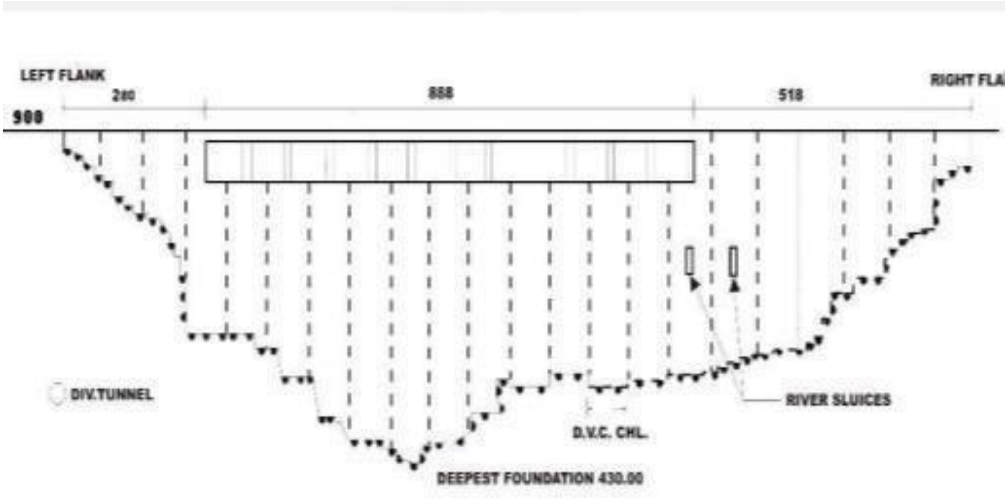

Fig :5: longitudinal section of the srisailam dam along reference line

Problem Statement:
To analyze parameters of fluid dynamics of the Srisailam dam. And for modeling of structural components, analyze and simulate systems and structures. The dam or interior designing project with respect to its scale, so that volume and proportions can be visualized.. This results in better coordination, which helps to reduce clashes and rework.
To create realistic and accurate view. To develops intelligent 3D models for a range of activities and purposes.
CFD analysis for predictive modeling, and capacity planning. Viable design and maintenance tool for data centers to provide the ability to validate fluid flow performance indicators accurately and easily. To give better understanding of product performance and allows to developcost-effective, innovative, and more reliable designs in less time. To see the flow inside the model where it was moving. to enables engineers to explore more ideas and make better decisions.

II. METHODOLOGY

The methodology of the study involves the virtual construction of Srisailam dam and contour map at dam area. For that real time data of Srisaialm gravity dam is collected from JALASOUDHA, Hyderabad. And contour map is made by using sketchup and photoshop softwares.
The methodology is applied is to prepare a dam model and contour map in 3D.

Traditional way of dam drafting
Before the development of softwares drafting were used for designing of civil engineering structures or projects. Drafting was the slow process manually done by the engineers and it take more time to design. Cannot be make any changes in the manual drafting. Drafting is represented in 2 dimensional view only.
Designer cannot estimate any volumes of the project, area of submergence, depth of water, quantity of materials and cost of construction.
After the development of softwares like Autocad, Revit, Staddpro by autodesk. The design and modelling of the project became easy for drawing.
The softwares are easy to operate and requires less time to design. In the short period of time, using softwares, more number of models and designs can be done and the changes can be made in the design at any time of execution.

Modern day tool -using Revit
Using the Revit software one can estimate the volume and area of required place and materials, quantity of materials and cost of the materials so that it is to estimate the cost of the construction.
In conventional design, specialists across disciplines communicate and coordinate by issuing a design change notification form, a paper-based process where it's difficult to quickly convey design changes or catch conflicts, resulting in a serious waste of resources. base this and future projects on a Building Information Modeling (BIM) process, using solutions from Autodesk in order to improve business productivity and gain competitive

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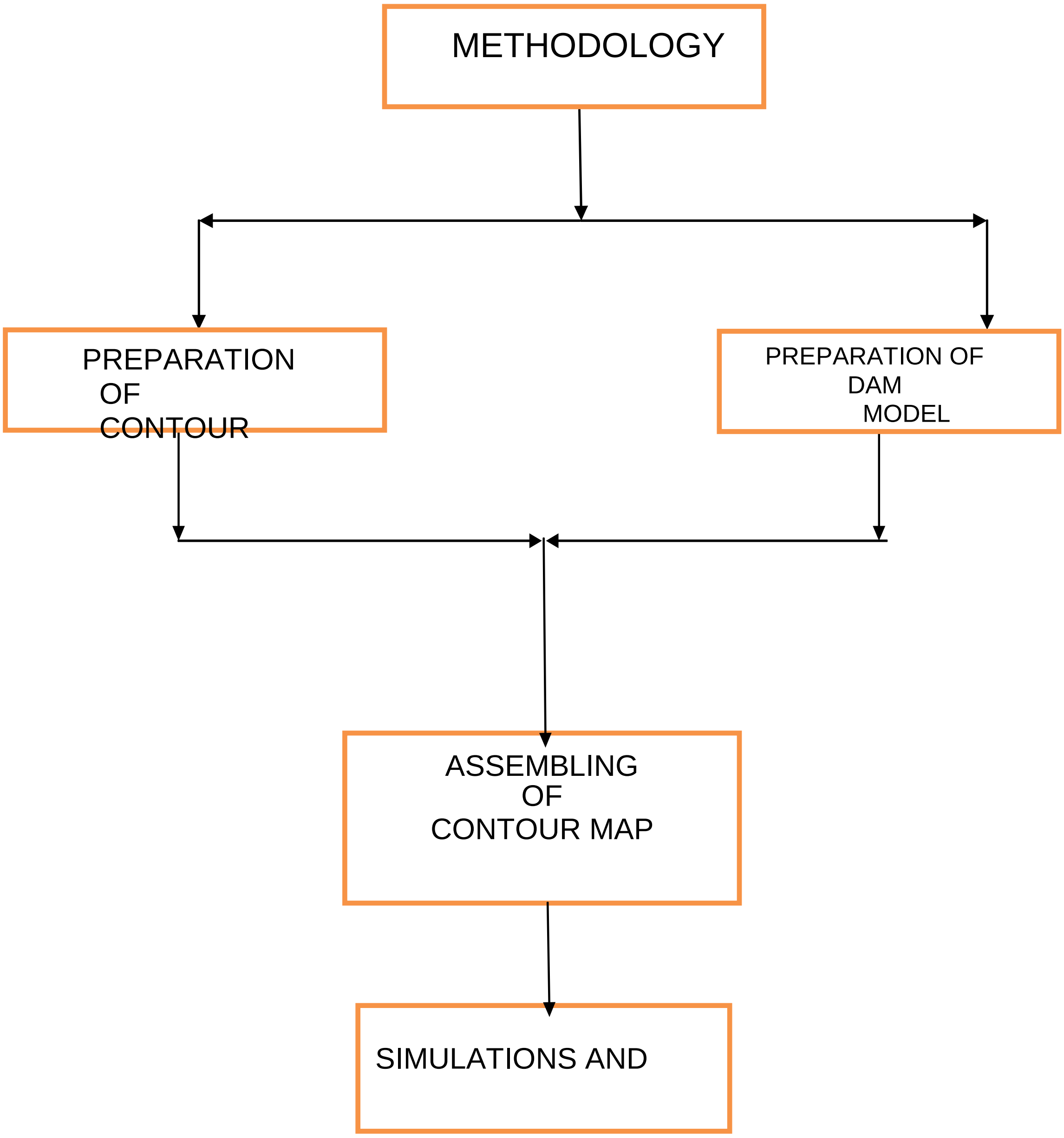
advantage.

FLOW CHART: 1 Overview of methodology of Srisailam dam virtual modelling



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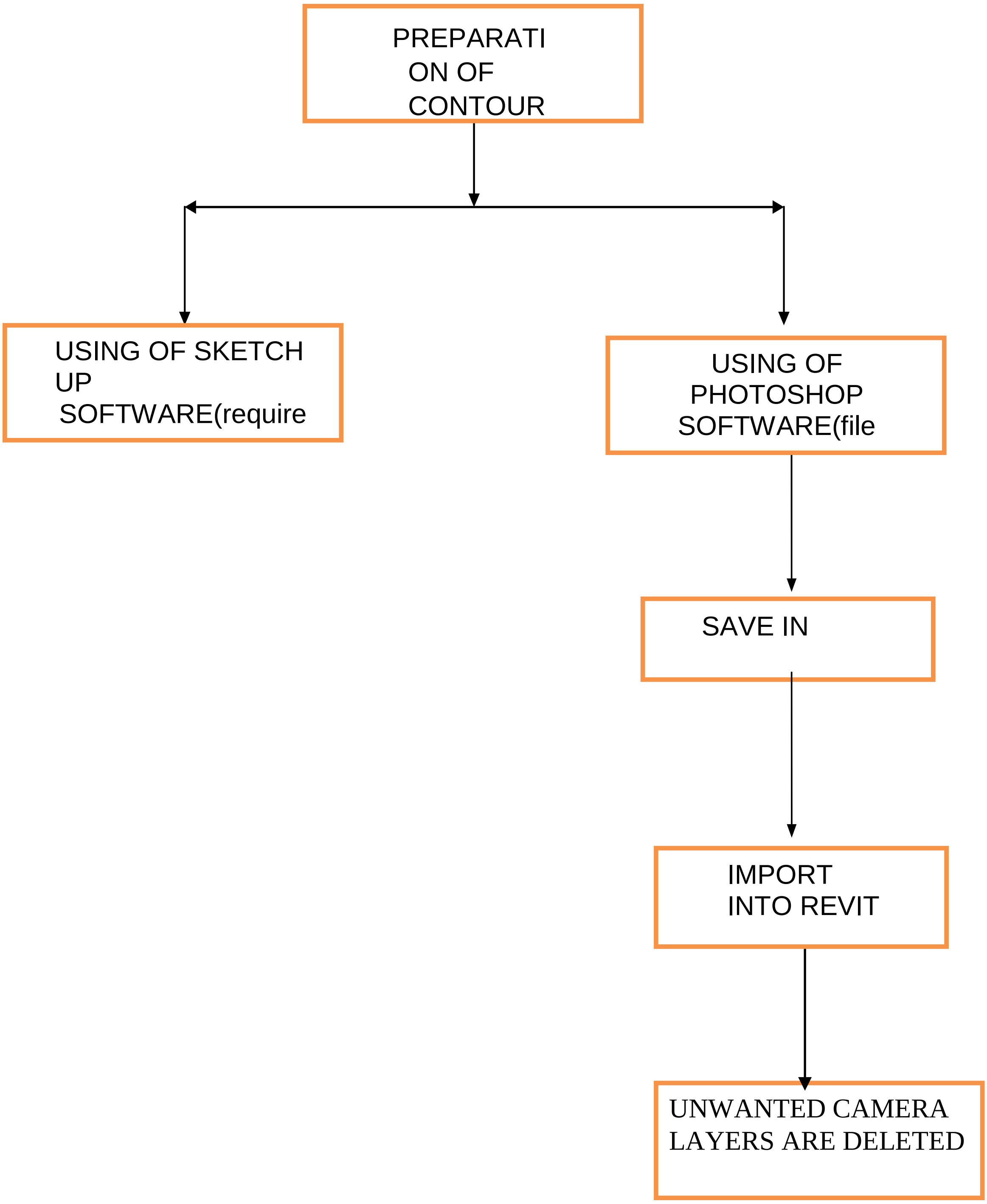
FLOW CHART: 2 Development of contour map.



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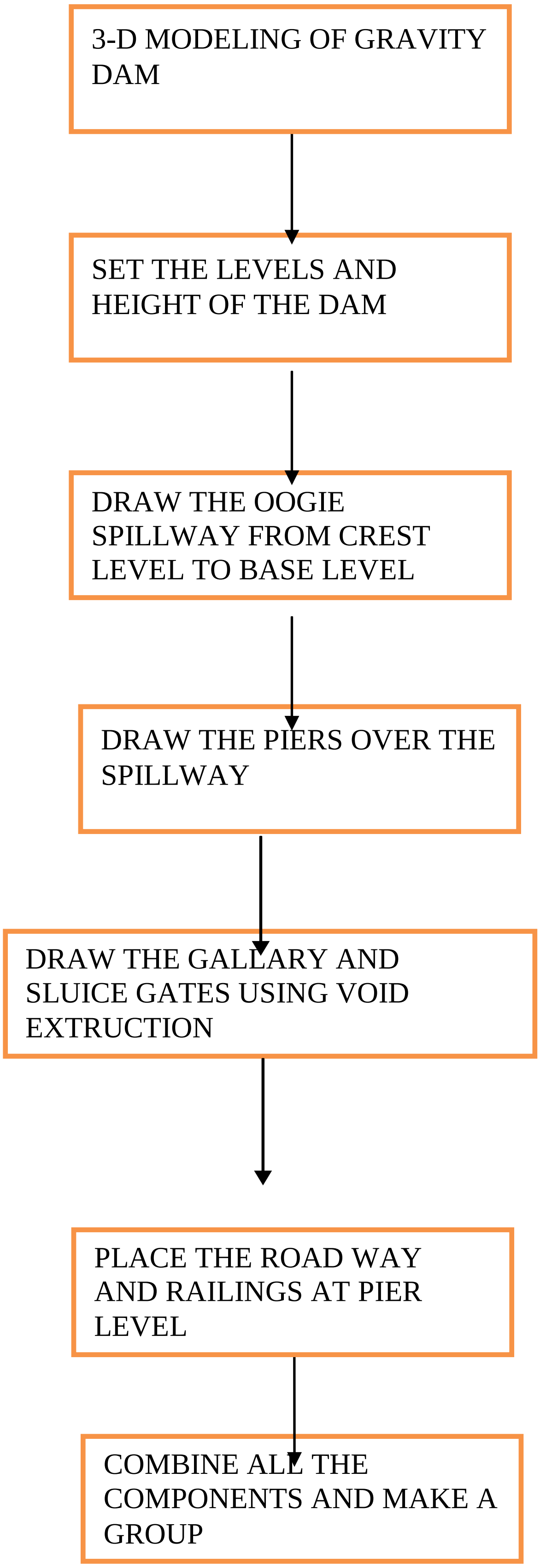
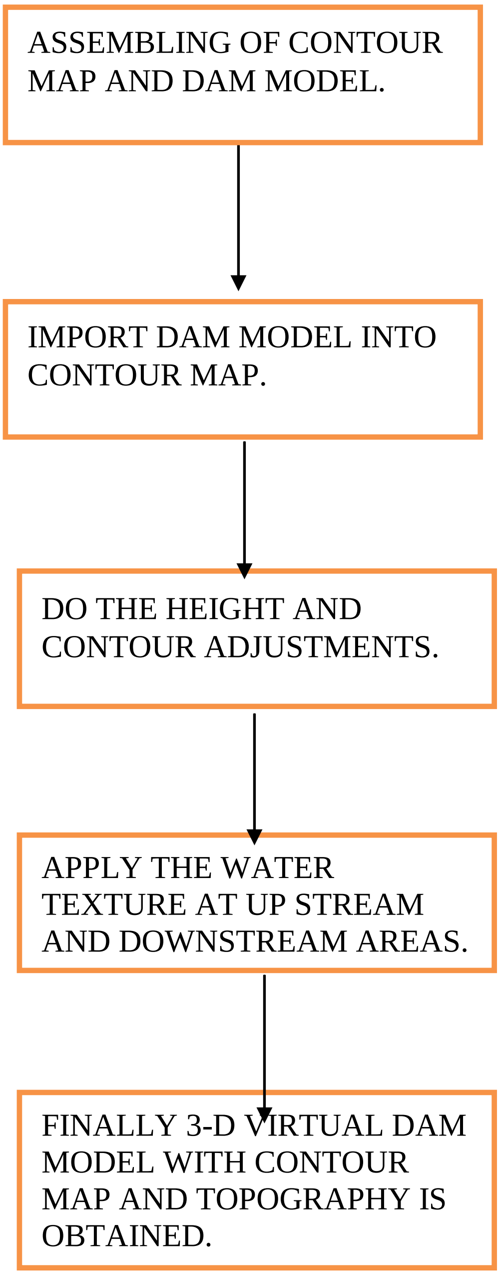
FLOWCHART: 3 3-D VIRTUAL MODELING OF SRISAILAM DAM



FLOWCHART 4: ASSEMBLING OF CONTOUR MAP AND DAM MODEL



III. RESULTS

Topography of dam site and contour map are obtained:
The real time topography of dam site and contour map is obtained by using sketchup, photoshop and edited using Revit software.

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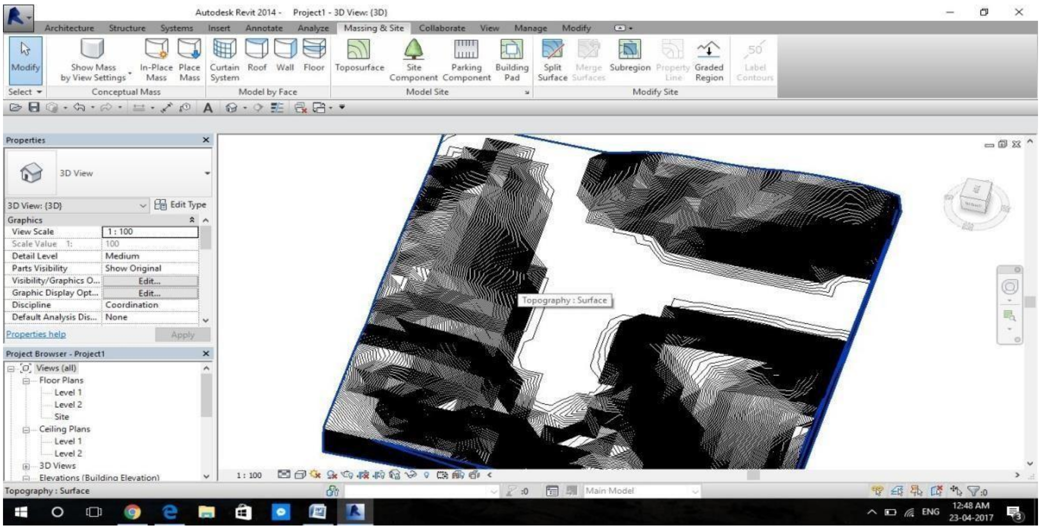

Fig:6:autodesk revit view

Individually major dam components were obtained: Spillway

The spillway is obtained by drawing the oogie shape from crest level to base level of the dam with respect to reference line.

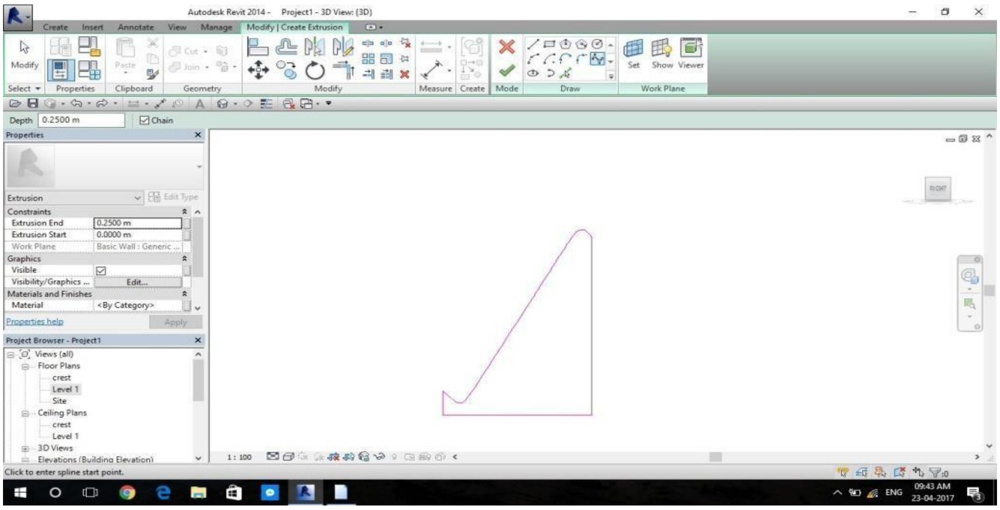

Fig:7:3d view in autodesk revit

Piers

The piers are drawn over the oogie spillway with the help of draw line in a close figure. No. Of piers present in Srisailam dam are 13.

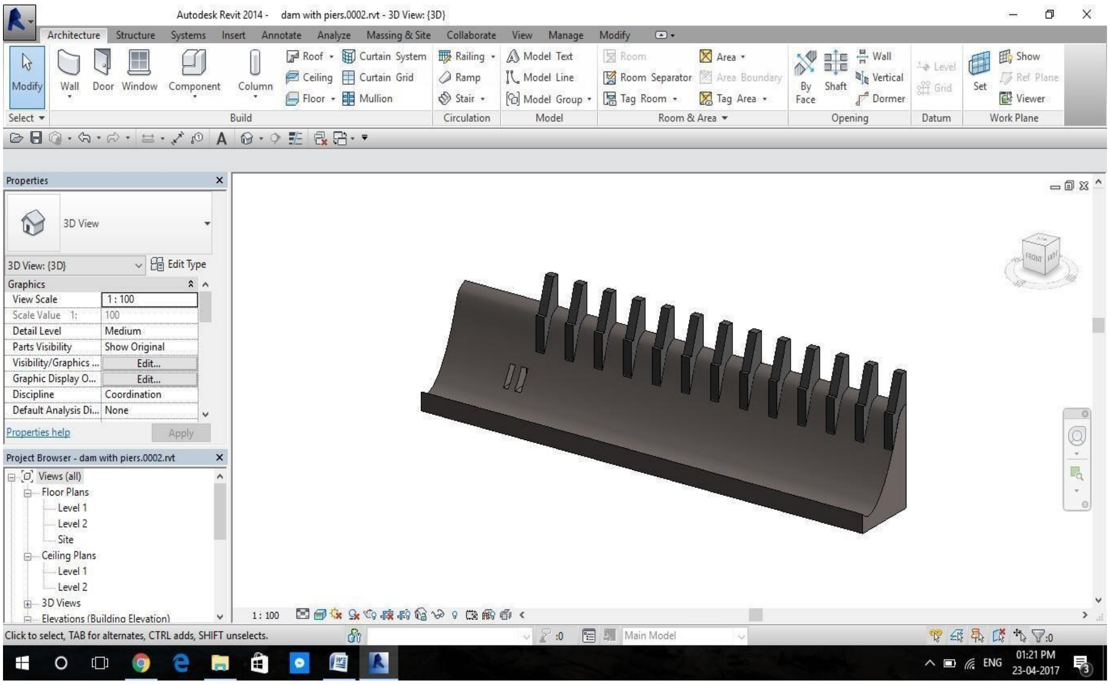

Fig:8: dam with piers

Radial gates:

The radial gates are drawn with respect to piers and above crest level.

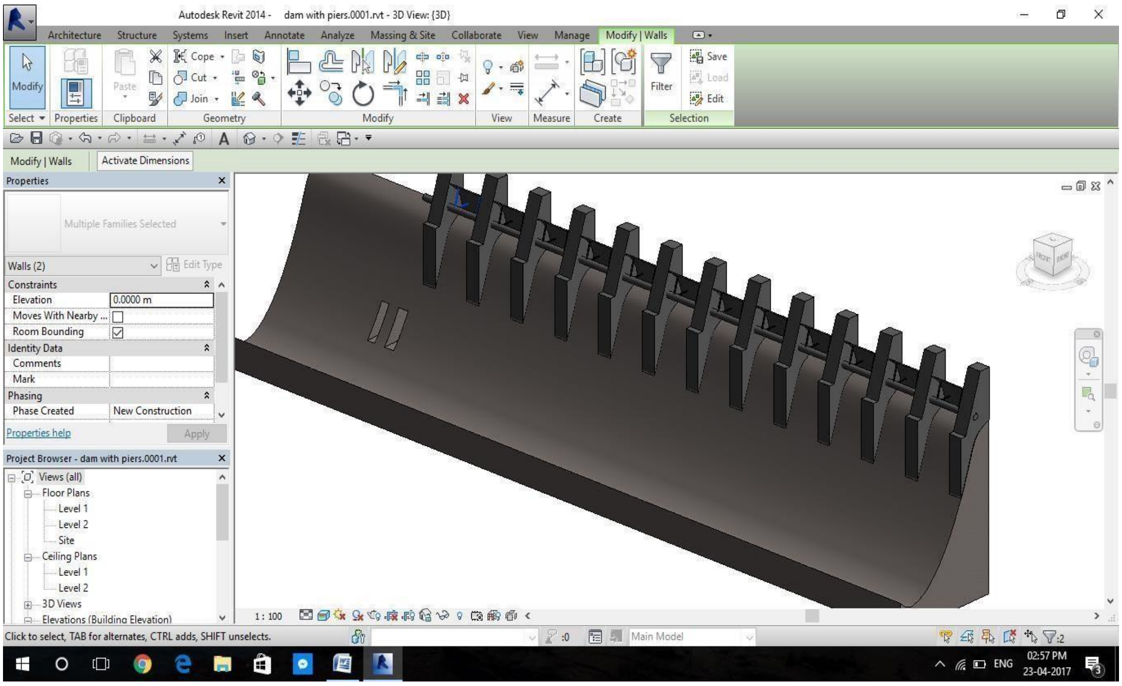

Fig:9: dam with piers-3d view

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Inspection gallery and sluice gates:

The inspection gallery and sluice gates are done by void extrusion in dam body.

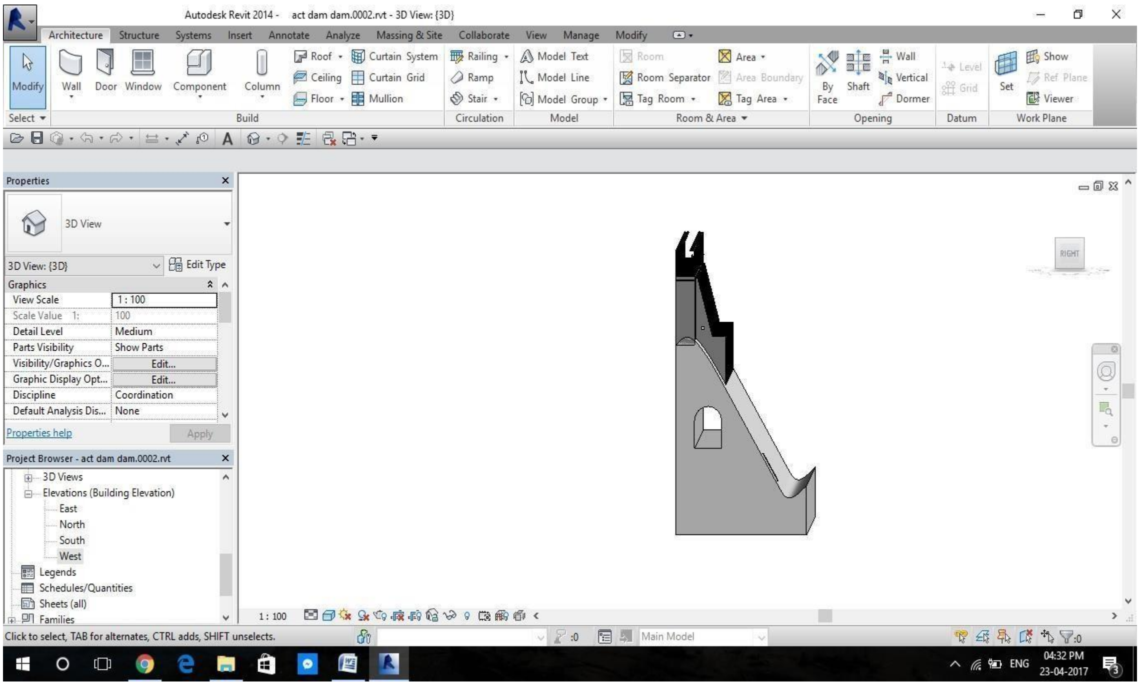

Fig:10: dam -3d view

Roadway and railings:

The roadway and railings are done over the piers with the decal type.

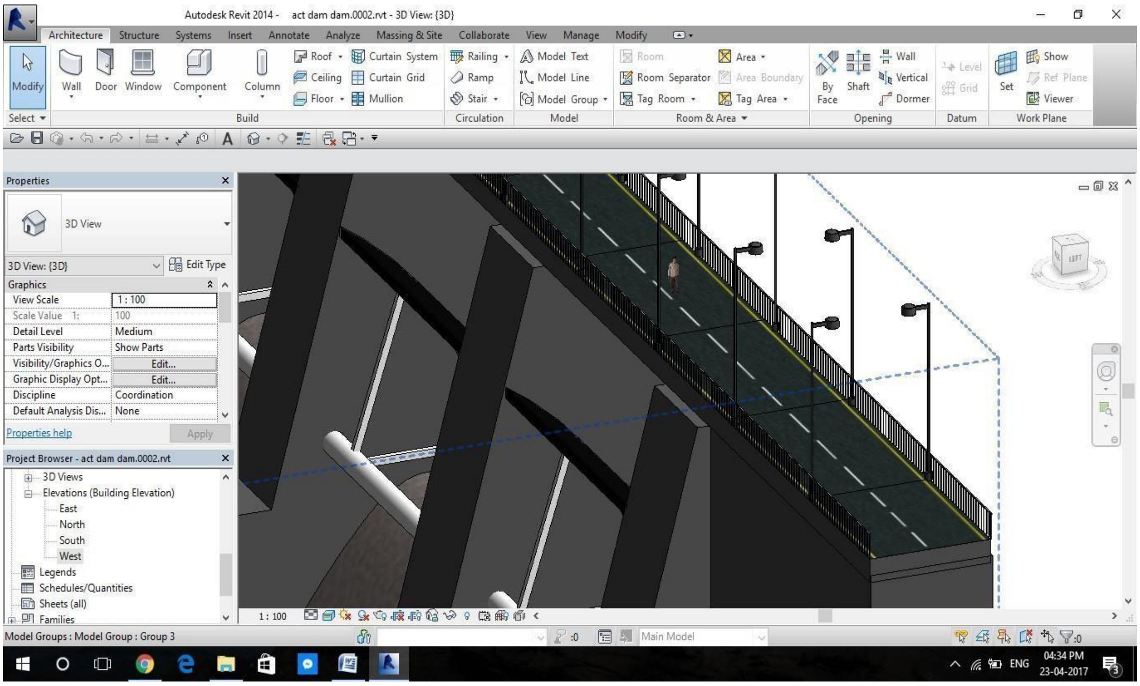

Fig:11: dam -3d view

Combined view of contour map and virtual dam model:
Finally, topography of dam site, contour map, and virtual model of dam were obtained by import dam model into the contour map.

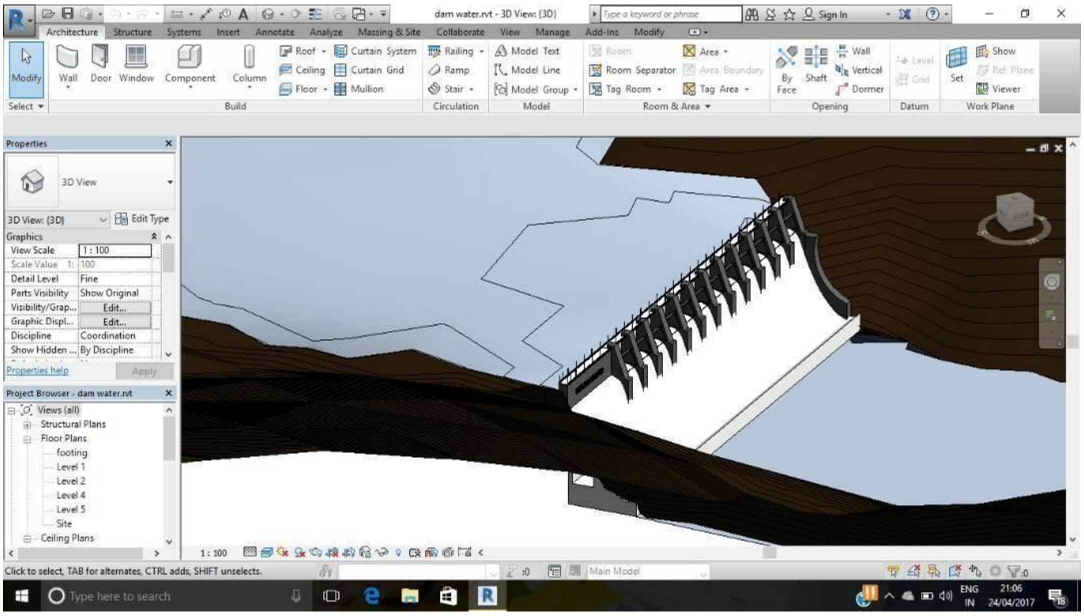

Fig:12: dam -3d view

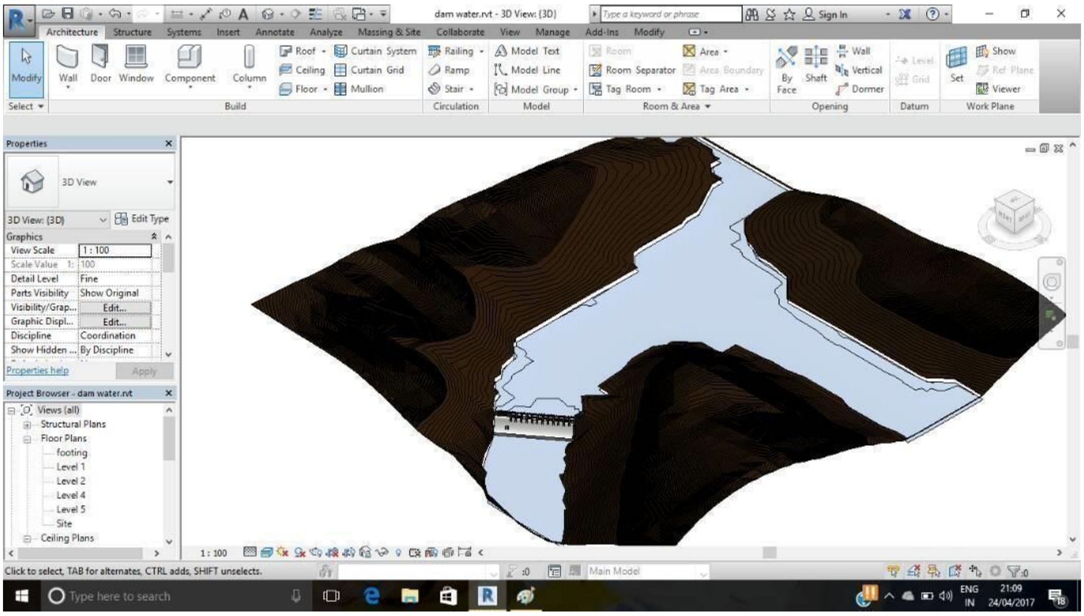

Fig:13: dam -3d view

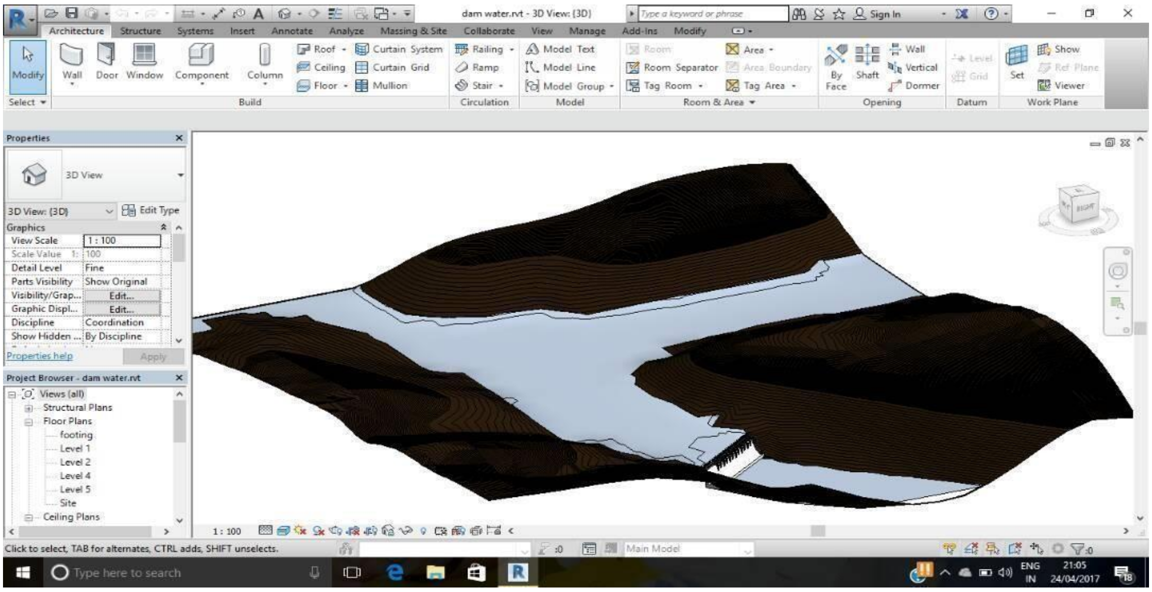

Fig:14: dam ,water-3d view

Computational Fluid Dynamics(CFD) and Simulations:
Computational fluid dynamics and its simulations for Srisailam dam are obtained.

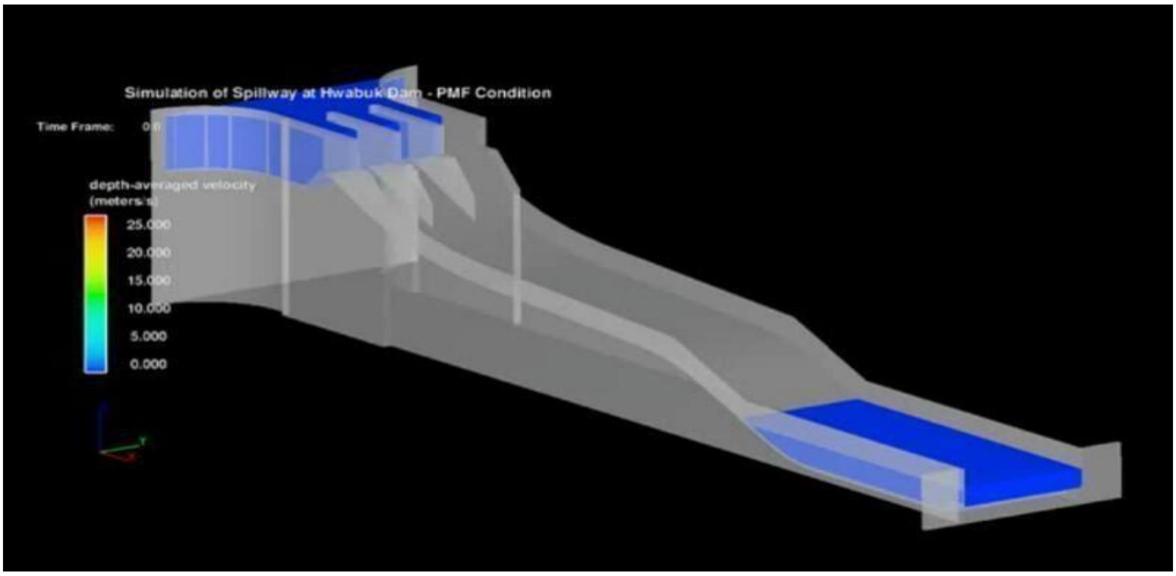

Fig:15: Computational Fluid Dynamics

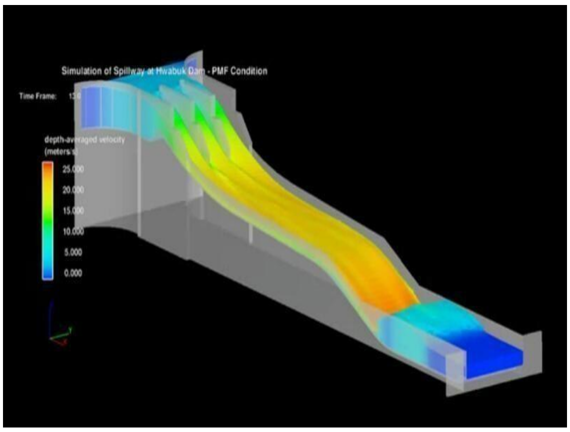

Fig:16: Computational Fluid Dynamics

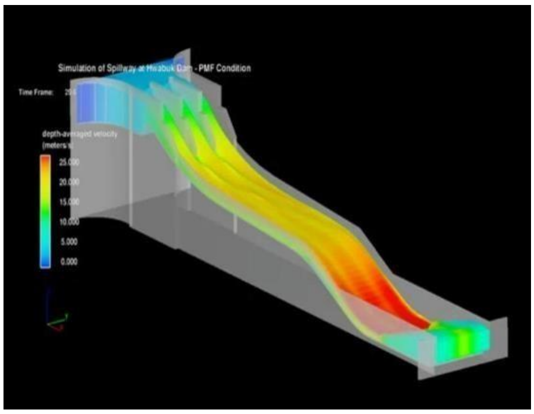

Fig:17: Computational Fluid Dynamics

IV. CONCLUSIONS

In this study,3D modeling is used to analyze parameters of fluid dynamics of the Srisailam dam. It is used for modeling of structural components, analyze and simulate systems and structures. The dam or interior designing project with respect to its scale, volume and proportions can be visualized. This features supports the design for fabrication detailing and construction. This results in better coordination, which helps to reduce clashes and rework. It can create realistic and accurate view. It develops intelligent 3D models for a range of activities and purposes. It has improved the efficiency of drawing production, with higher quality construction documentation. Each component of the design model can be updated individually, with just the affected design documents modified and communicated. It provides the overall construction site layout and communicates design intent so that each discipline is aware of the work of others, and how their own work integrates with the overall project plan.CFD analysis is used for predictive modeling, and capacity planning. Viable design and maintenance tool for data centers is also being proved nowadays. It provides the ability to validate fluid flow performance indicators accurately and easily.It gives better understanding of product performance and allows to develop cost-effective, innovative, and more reliable designs in less time. The flow inside the model can be seen clearly and where it was moving. It enables engineers to explore more ideas and make better decisions.

V. REFERENCES

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