



DEVELOPMENT OF SOFTWARE FOR DESIGN OF TANK SLUICE WITH TOWER HEAD

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Abstract: Nowadays, the usage and application of software in civil engineering for different jobs and purposes such as designing, drafting, drawing, estimation, and other jobs related. There are many designing software on the internet such as STAAD.Pro, SAP, ETABS, and RISA-3D. Drawing and drafting software also available such as Auto CAD, 3D Home, Architectural Desktop, and some other construction management software is quite popular in the civil engineering industry. Apart from the above-mentioned software, there is other special software for the design of treatment plants, pipeline design, etc. Some of the Civil Engineering-related jobs such as analysis and design. Finite element analysis and computational fluid dynamics are computer applications that are helping in the civil engineering study area. Although there is no significant attempt was made in the design and drawing of irrigation structures such as tank sluices with tower heads, syphon aqueducts, canal drops, etc. The study and work upon which the paper is based are to give a complete design solution for tank sluice with tower head. The structural and hydraulic components are considered in the design. This software is developed with the help of programming languages like HTML, CSS, JavaScript, PHP, and MySQL database for the development of user interface in the software and storing the data inputs. These programming languages need a code editor to correct the errors and debug the bugs while the programs are running. For the ease of our work, Visual studio code editor is used. MySQL database is created in the XAMPP server. All the software and other tools used for the development are available as open source.

Keywords— VS Code Editor, HTML, CSS, JavaScript, PHP, MySQL, Tank sluice with tower head, XAMPP server.

1. INTRODUCTION

Irrigation projects mean some engineering structures which collect, convey, and deliver water to agricultural lands to grow crops. Irrigation projects always vary from small to major. The major irrigation projects always depend on the Culturable Command Area which means CCA. Culturable Command Area means the area on which a crop is grown in a particular season or time. When the CCA is greater than 10,000 ha the project is called a major irrigation project. When the project will be major it will consist of huge water reservoirs, flow diversion structures, and large networks of canals for the entire region with some sun canals. For convenience and identification purposes, irrigation projects are categorized into three categories.

1. Major and Multipurpose Projects
2. Medium irrigation projects
3. Minor irrigation projects

These projects are significantly based on financial considerations. However multipurpose projects are used for irrigation, navigation, flood control, etc. Whereas medium projects serve for the development of irrigation and also for the drinking water supply purpose.

Minor irrigation projects consist of the following structures

- a. Tanks
- b. Lift irrigation
- c. Diversion Schemes

Irrigation Tanks

Irrigation tanks are mostly constructed across a stream in a valley for the small storage of water. A few times the irrigation tanks have their individual catchment areas and draw the supply through runoff. These types of irrigation tanks mostly depend on rainfall. Also, some of the tanks will draw the supplies from the nearest streams through the channel connections.

The irrigation tanks should consist of the following

- a) An earthen bund across the stream
- b) A surplus weir to dispose of flood discharge
- c) Sluice to feed the channels
- d) Channels from the sluice to feed the ayacut

The current paper is on the design of a Tank sluice with a tower head.

Tank Sluice with Tower Head

It is a structure in the irrigation tanks which is used to draw the water from the irrigation tank when required. The tank sluice is constructed with concrete. Tank sluice and tower head combined together for completion in construction of tank sluice with tower head. Let's define the two terms separately in detail.

Tank Sluice

It is an opening provided at the bottom of the tank to draw water for irrigation when required and delivers water to the channels. The number of sluices in a tank will depend on the size of the tank, these two are directly related to each other. Another factor also considered for the size of the tank is the fields or land to be irrigated.

Tower Head

It is a well-structured opening provided upstream of the tank for the installation of gates to regulate the water flow entering the sluice.

Need for development of software for irrigation structures

Medium and minor irrigation structures such as tank sluice with tower head, and surplus weir is common in every state. The state governments are looking for the development of irrigation structures. For manual calculations that is time taking process and chances of occurring errors will be more. For accuracy and speeding up the calculation software should be used. No software and desktop applications are developed for the design of irrigation structures. The current software is developing application software for the design of tank sluice with tower head using open-source platform i.e., Visual Studio Code Editor that supports programming languages like HTML, CSS, JavaScript, PHP and databases like phpMyAdmin.

Introduction to development tools

The current software is developing application software for the design of tank sluice with tower head using open-source platform i.e., Visual Studio Code Editor that supports programming languages like HTML, CSS, JavaScript, PHP and phpMyAdmin.

HTML

HTML, short for Hyper Text Markup Language, is a markup language used to create and structure content on the web.

CSS

Cascading Style Sheets (CSS) is a style sheet language used to describe the presentation of HTML and XML documents on the web

JavaScript

JavaScript is a programming language used to create dynamic and interactive web pages. It is a high-level, dynamic, and interpreted language that is supported by all major web browsers. PHP

PHP is a server-side scripting language that is widely used for web development. It is open-source and free to use, making it an accessible language for developers. PHP is used to create dynamic and interactive web pages that can interact with users, databases, and other web services.

phpMyAdmin

phpMyAdmin is a free, open-source web-based tool that is used to manage MySQL databases. It provides an easy-to-use graphical user interface (GUI) for managing databases, tables, and columns, as well as executing SQL queries.

XAMPP Server

XAMPP is a free and open-source cross-platform web server solution that includes Apache HTTP server, MySQL database, and PHP scripting language.

Software Capabilities

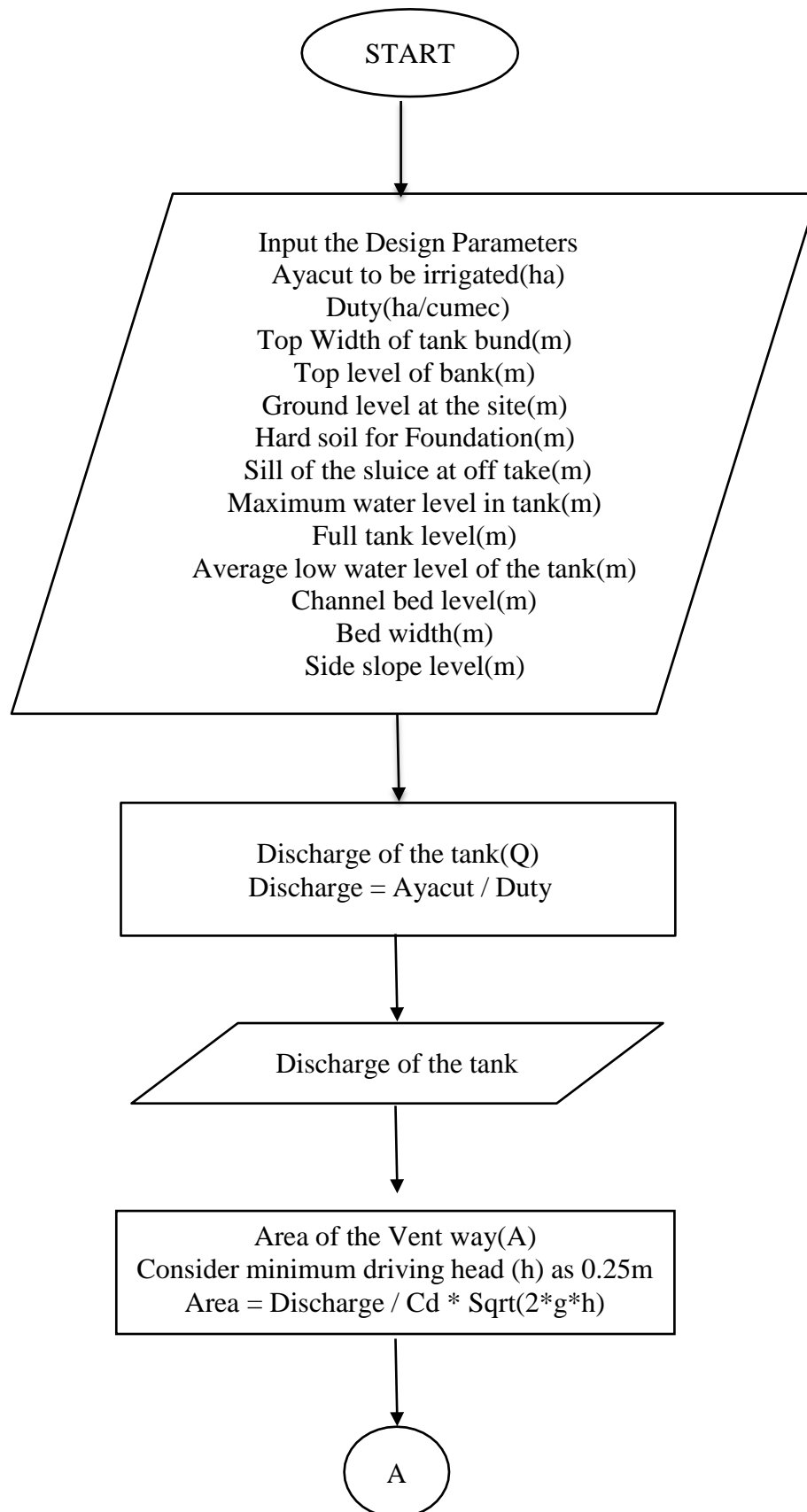
The all-software tools used in the development are essentially open sources. The software gives both hydraulic and structural design of a tank sluice with tower head.

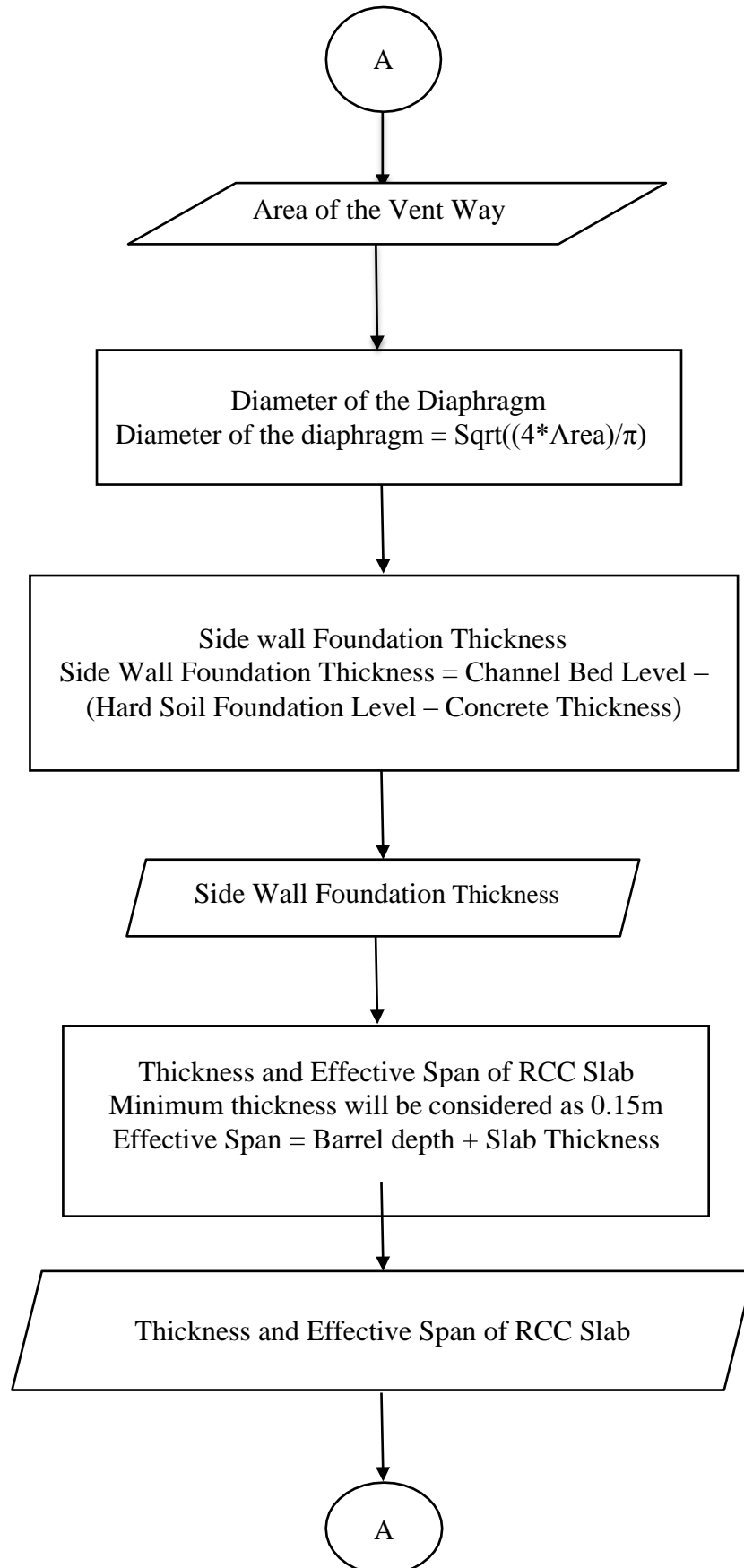
Essentials of Software Design

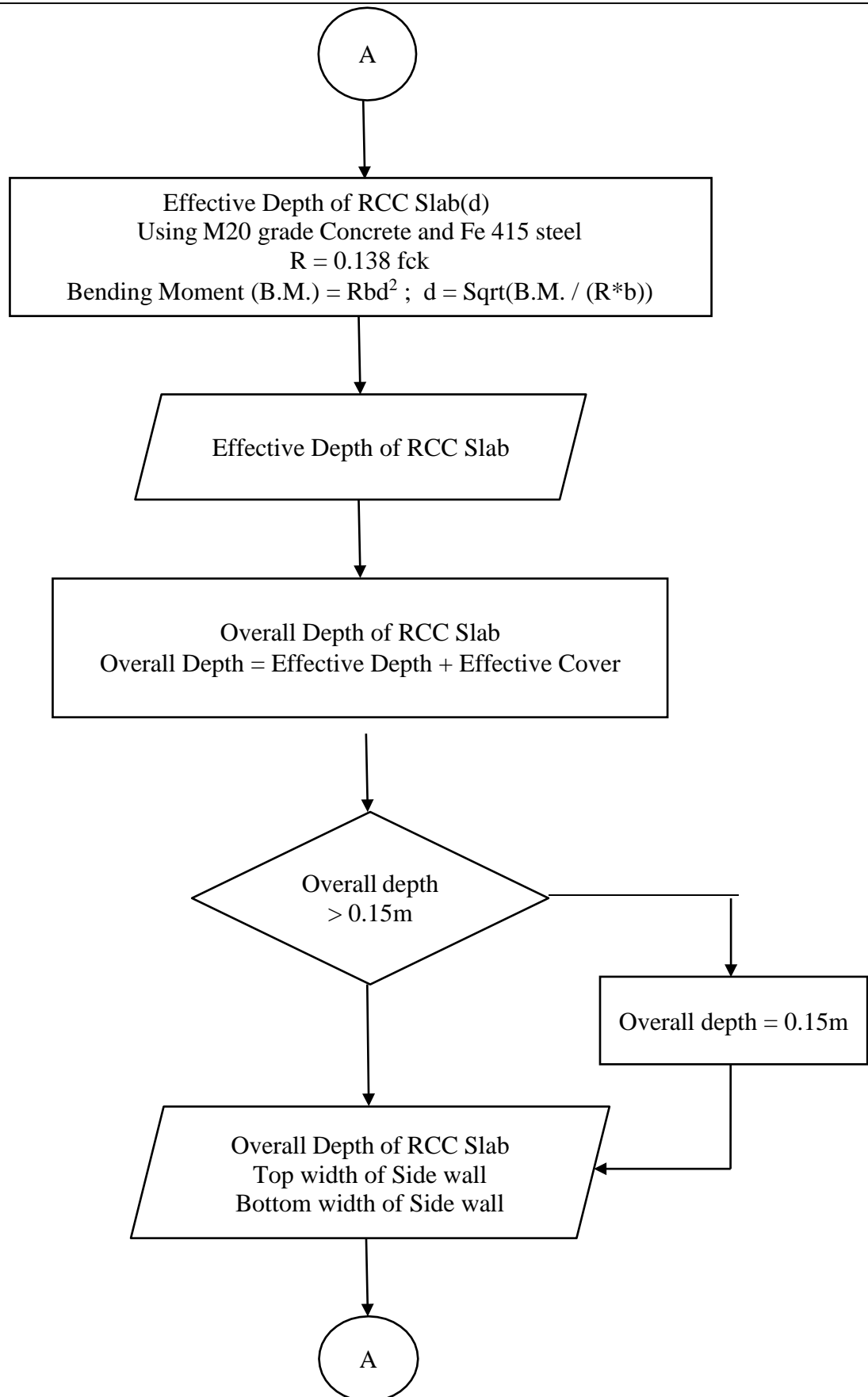
The data required for the design of the tank sluice with tower head are Ayacut, Duty, Top width of the tank bund, Top level of bank, Ground level at the site, Hard soil foundation level, Sill level of the sluice at off take, Maximum water level in the tank, Full tank level, Average low water level of the tank, Channel bed level, Full supply level, Bed width, Side slope level. Complete design steps for the design of tank sluice with tower tank is entered in the form of a flow chart.

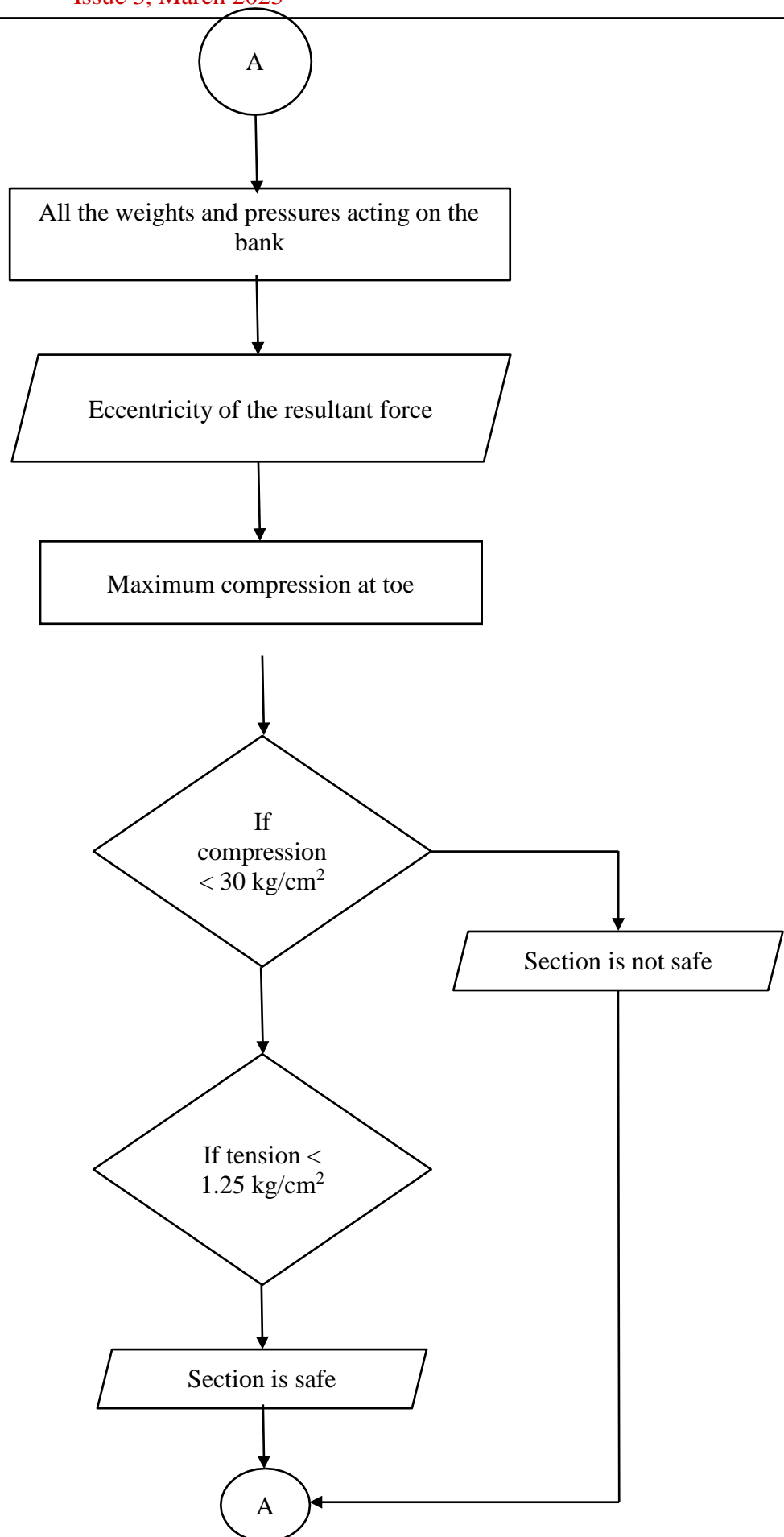
Software Functional Flow

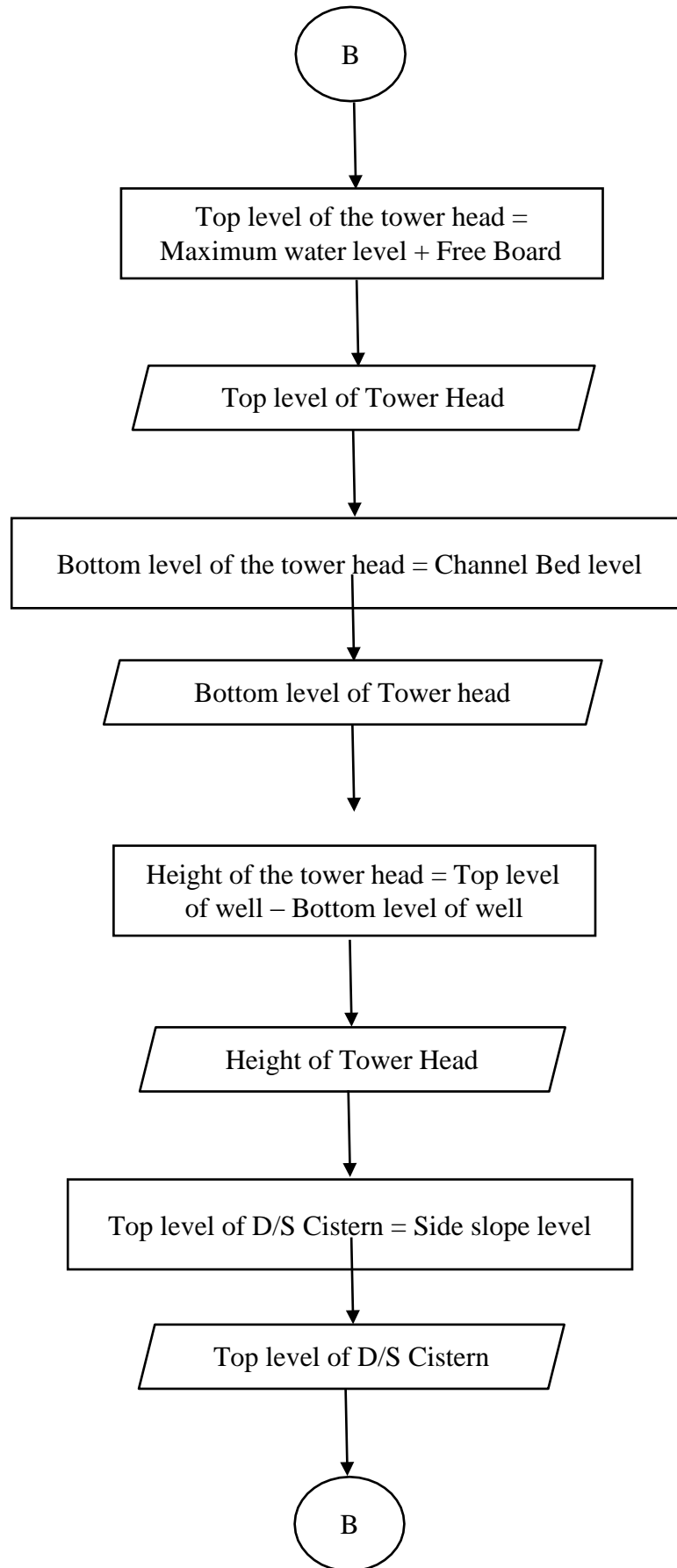
After bringing the executable file by clicking on the file, a web page will be displayed as shown in figure. For the accessing of the design page, the user has to be registered in the respective webpage using their email id and password and other credentials. After registering, the user has to login again using the registered credentials. Then after the design page will be displayed for entering the data. The user can enter the data required for the design of tank sluice with tower head in the field box and click the "Submit" button at the bottom of the form. By clicking the "Submit" button, it will redirect to the output page. Figure shows the valid data that has been entered by the user in the form. The data will be validated and entered into the database. The data is used for designing tank sluice with tower head and the output screen will be displayed with the result values required for the user. A "Download" button will be displayed at the bottom of the output page. By clicking the "Download" button the page will be redirected to print page to take the print of the output page and can also be saved as Portable Document Format (PDF) with an extension ".pdf" for saving the data into the device.

Flow chart









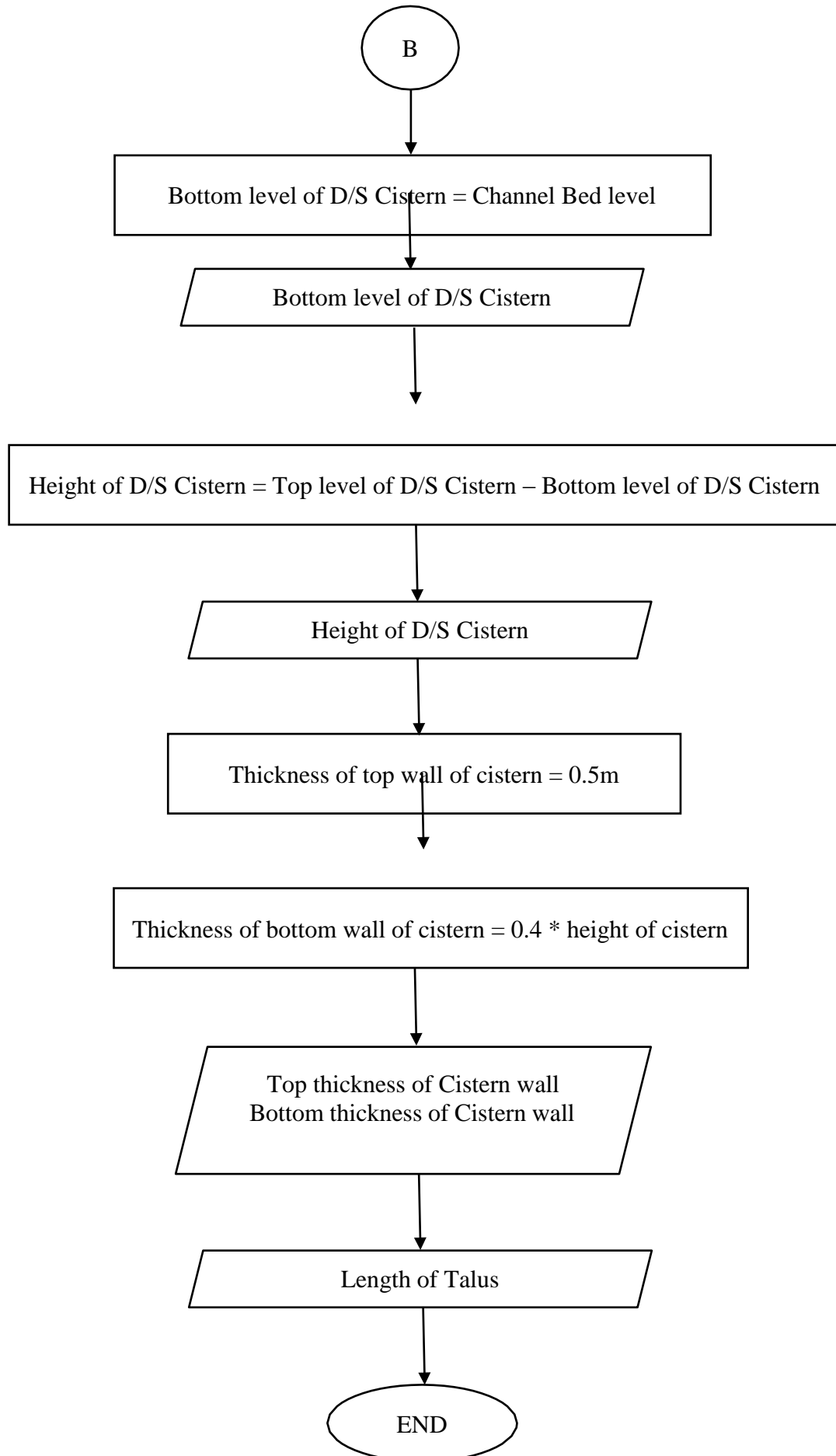




Fig.1

Signup

First Name Last Name

First Name Last Name

Email

Enter Your Email

Phone

Phone Number

Password Confirm Password

Password Confirm Password

Signup Now

Already signed up? [Login now](#)

Fig.2



The image shows a login form titled "Login Form" on a light blue background. It features two input fields: "Email" with a placeholder "Enter Your Email" and "Password" with a placeholder "Password". Below these fields is a dark blue button labeled "Login Now". At the bottom, there is a link that says "Not signed up? [Signup now](#)".

Fig.3

The image shows a data input form titled "TANK SLUICE WITH A TOWER HEAD - DATA INPUT". It contains 14 input fields, each with a label and a placeholder "Enter". The labels are: "Please enter the Ayacut to be irrigated(ha)", "Please enter the Duty(ha/cumec)", "Please enter the Top Width of tank bund(m)", "Please enter the Top level of bank(m)", "Please enter the Ground level at the site(m)", "Please enter the Hard soil for Foundation(m)", "Please enter the Sill of the sluice at off take(m)", "Please enter the Maximum water level in tank(m)", "Please enter the Full tank level(m)", "Please enter the Average low water level of the tank(m)", "Please enter the Channel bed level(m)", "Please enter the Full supply level(m)", "Please enter the Bed width(m)", and "Please enter the Side slope level(m)". A "Submit" button is located at the bottom right of the form.

Fig.4



TANK SLUICE WITH A TOWER HEAD - DATA INPUT

Please enter the Ayacut to be irrigated(ha)	<input type="text" value="200"/>
Please enter the Duty(ha/cumec)	<input type="text" value="1000"/>
Please enter the Top Width of tank bund(m)	<input type="text" value="2"/>
Please enter the Top level of bank(m)	<input type="text" value="40.00"/>
Please enter the Ground level at the site(m)	<input type="text" value="34.50"/>
Please enter the Hard soil for Foundation(m)	<input type="text" value="33.50"/>
Please enter the Sill of the sluice at off take(m)	<input type="text" value="34.00"/>
Please enter the Maximum water level in tank(m)	<input type="text" value="38.00"/>
Please enter the Full tank level(m)	<input type="text" value="37"/>
Please enter the Average low water level of the tank(m)	<input type="text" value="35"/>
Please enter the Channel bed level(m)	<input type="text" value="34"/>
Please enter the Full supply level(m)	<input type="text" value="34.50"/>
Please enter the Bed width(m)	<input type="text" value="1.25"/>
Please enter the Side slope level(m)	<input type="text" value="35.5"/>

Submit

Fig.5



OUTPUT REPORT

1. Discharge :

Discharge : 0.20 cumec

2. Vent Way :

Area of the Vent Way : 0.151 sq.m

Diameter of the diaphragm : 0.45 m

Width of the barrel : 0.6 m

Depth of the barrel : 0.75 m

3. Sluice Barrel :

Side wall foundation : 0.6 m

4. R.C.C. Slab :

Slab Thickness : 0.15 m

Effective Span : 0.75 m

Height of the bank over the slab : 5.1 m

Effective Depth : 0.055 m

Overall Depth : 0.15 m

5. Side Walls :

Top width of the side wall : 0.45 m

Bottom width of the side wall : 1 m

The assumed section is Safe and can be adopted.

6. Tower Head :

The top level of the well : + 38.3

The bottom level of the well : + 34

The height of the well : 4.3 m

7. Downstream Cistern :

The top level of the cistern : + 35.5

The bottom level of the cistern : + 34

Height of the wall : 1.5 m

Top thickness of the wall : 0.5 m

Bottom_thickness of the wall : 0.6 m

8. Talus :

Length of the talus is considered as 3m to 5m.

Download

Fig.6

CONCLUSION

The current software is developed by multiple programming languages used for web development like HTML, CSS, JavaScript, PHP, phpMyAdmin, Xampp Server. This software is graphical user interface and user friendly. By using this software, the user can get a complete hydraulic and structural design of tank sluice with tower head. It is well established from the practical data that the current software is quite accurate is providing the design of the tank sluice with tower head. In A.P. number of projects are spread in our 26 districts. There are around 40000 minor irrigation works are spread over the 26 districts. Similarly various states in our country constructs tank sluice with tower head. As our country is an agricultural based country the irrigation tanks have large demand. Therefore this software will be helpful for such projects.

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