# Developing Estimation Module for Existing Surplus Weir Design Software

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## Abstract

The previous version of Surplus Weir software which as developed as a desktop application on widows operating system which much appreciated as it is capable of providing an accurate design. This cannot be claimed as a complete software solution for Surplus Weir. The authors are very keen on enriching the application with rich capabilities such as adding the new modules for estimation and costing. Now the current version is fully functional in giving detailed quality estimate and cost estimate for Surplus Weir. The Estimation module is only an addition to the existing software.

**Keywords:** VB.Net, .Net Frame work and Surplus weir.

## 1. Introduction

In India irrigation has always been the largest user of water. Irrigation projects mainly consists of engineering structures which collect, convey, and deliver water to areas on which crops are grown. Irrigation projects are classified in different ways

**• Major project:**

This type of project consists of huge surface water, storage reservoirs and flow diversion structures. The area envisaged to be covered under irrigation is of the order over 10000 hectare.

**• Medium project:**

These are also surface water projects but with medium size storage and diversion structures with the area under irrigation between 10000 hectare and 2000 hectare.

**• Minor project:**

The area proposed under irrigation for these schemes is below 2000Ha and the source of water is either ground water or from wells or tube wells or surface water lifted by pumps or by gravity flow from tanks. It could also be irrigated from through water from tanks.

The major and medium irrigation projects are further classified as

• Direct irrigation method

• Storage irrigation method.

Each of the two classifications is explained in subsequent sections. But before that, it may be worthwhile to discuss here a few terms related to irrigation

projects which may also be called irrigation schemes.

Commanded area (CA): is defined as the area that can be irrigated by a canal system, the CA may further be classified as under:

Gross command area (GCA): This is defined as total area that can be irrigated by a canal system on the perception that unlimited quantity of water is available.

It is the total area that may theoretically be served by the irrigation system. But this may include inhibited areas, roads, ponds, uncultivable areas etc. which would not be irrigated.

Culturable command area (CCA): This is the actually irrigated area within the GCA. However, the entire CCA is never put under cultivation during any crop season due to the following reasons:

• The required quantity of water, fertilizer, etc. may not be available to cultivate the entire CCA at a particular point of time. Thus, this is a physical constraint.

• The land may be kept fallow that is without cultivation for one or more crop seasons to increase the fertility of the soil. This is a cultural decision.

• Due to high water table in some areas of the CCA irrigated water may not be applied as the crops get enough water from the saturation provide to the surface water table.

During any crop season, only a part of the CCA is put under cultivation and this area is termed as culturable cultivated area. The remaining area which is not cultivated during a crop season is conversely termed as culturable uncultivated area.

Intensity of irrigation is defined as the percentage of the irrigation proposed to be irrigated annually. Usually the areas irrigated during each crop season (Rabi, Kharif, etc) is expressed as a percentage of the CCA which represents the intensity of irrigation for the crop season. By adding the intensities of irrigation forall crop seasons the yearly intensity of irrigation to be obtained.

As such, the projects with a CCA of more than 2000 hectare are grouped as major and medium irrigation projects. The ultimate irrigation potential of our country from major and medium projects has been assessed as 58.46 M-hectare.

Minor irrigation consists of irrigation from

a). Tanks
b). Lift Irrigation
c). Diversion Schemes on small streams.

**Irrigation Tanks:**

Irrigation tank is generally a small storage reservoir form across a stream in a valley. Sometimes these tanks could be having independent catchments, drawing their supplies from the runoff from catchment areas. These tank fully depended rainfall in their catchments. In addition, some tanks may have a supply channel from a neighbouring stream, which has a dependable flow.

The irrigation tanks essentially consist of the following.
a) An earthen bund across the valley creating a storage
b) A surplus weir to dispose off flood discharge
c) Sluice to feed the channels
d) Channels from the sluice to feed the ayacut
The current work focus on design of surplus weir.

## 2. Surplus weir

The weir is solid obstruction put across to raise the water level water and divert the water in to a canal. And surplus weir is a pukka structure constructed to dispose of excess water from an irrigation tank. It is a safety device in the tank. The surplus work of a tank is usually either a weir or flus escape. The length of such a weir or an escape must be such that the quantity of water estimated as the maximum flood discharge likely to enter from the catchment into the tank, can be disposed of with a depth of water over the weir equal to the difference between the maximum water level and full tank level.
Generally it is better to limit the difference between the M.W.L. and F.T.L. to as small a height as possible. This difference is called the "Head over the Surplus Weir" With which the flood water can be disposed off or small tanks head limited to between 50 and 75 centimetres.

## 3. Overview of Software

The current version of the software is an advancement over its previous version. The first version of the software is capable of giving hydraulic and structural design. The updated version can provide detailed estimation and costing.

## 4. Software Development details

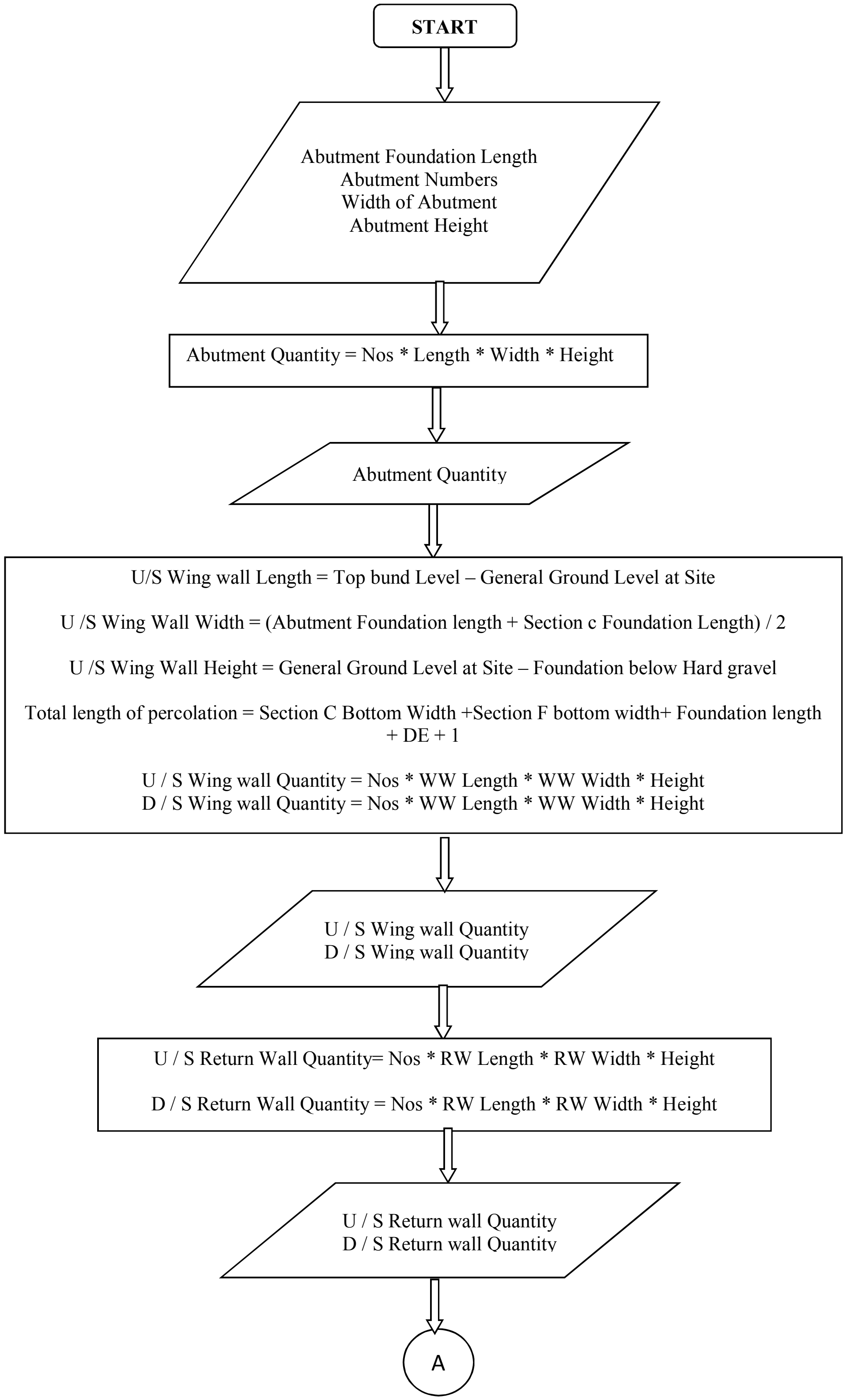
The developed application software for Surplus Weir is a desktop application which runs on windows platform and .Net frame work. The programming language is VB.Net and the application has user friendly GUI. This application is developed on .Net community edition and is essentially an open source.

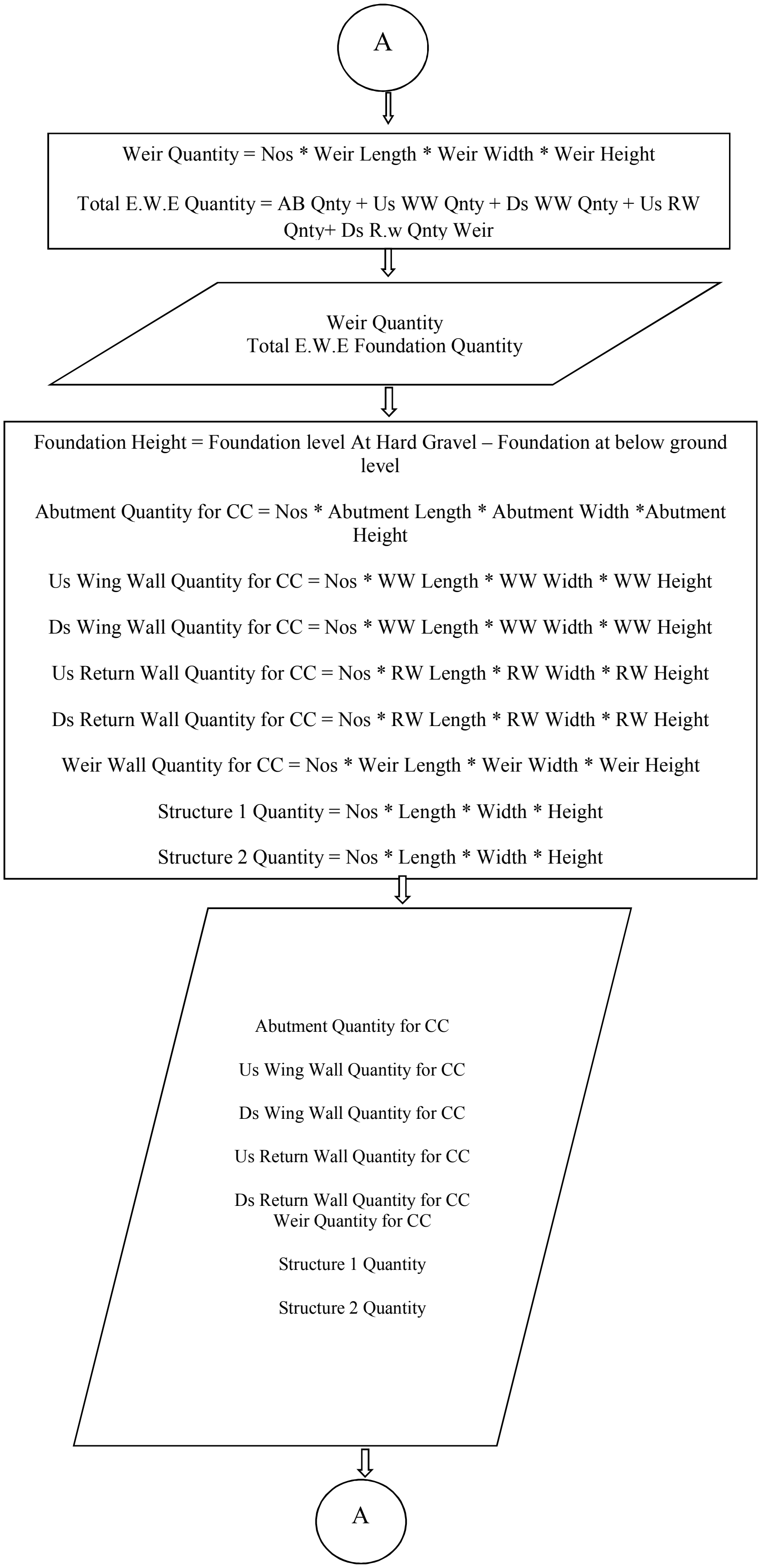
## 5. Software Capabilities

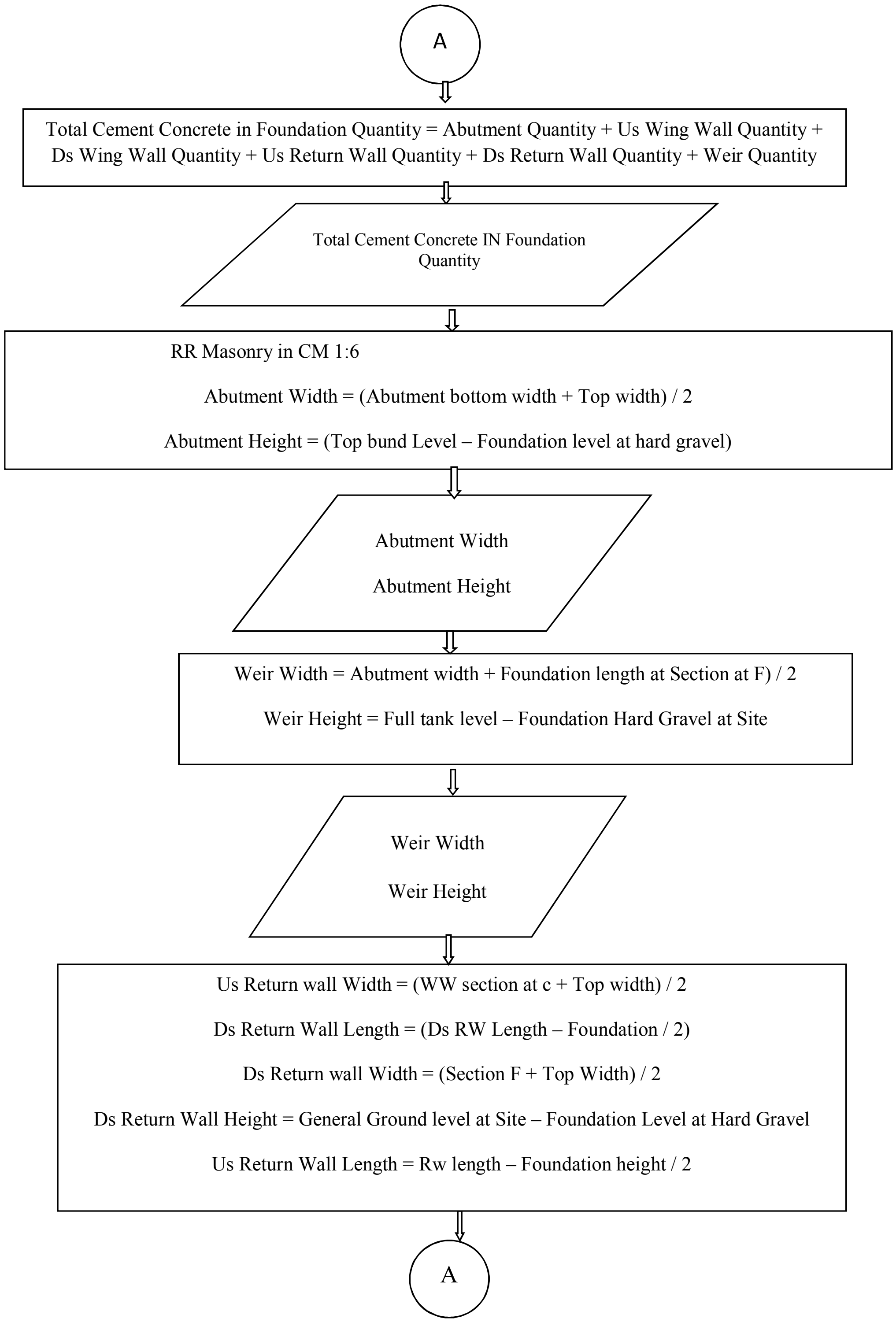
The previous version of this application software is quite capable of providing both hydraulic and structural design of a surplus weir. However the end user this itself is not adequate. Preparing a detailed estimate and arriving at the cost of construction is also a challenge for such special structures. The current version of the software caters this demand as it successfully gives the detailed quantity estimates and cost estimates as well.

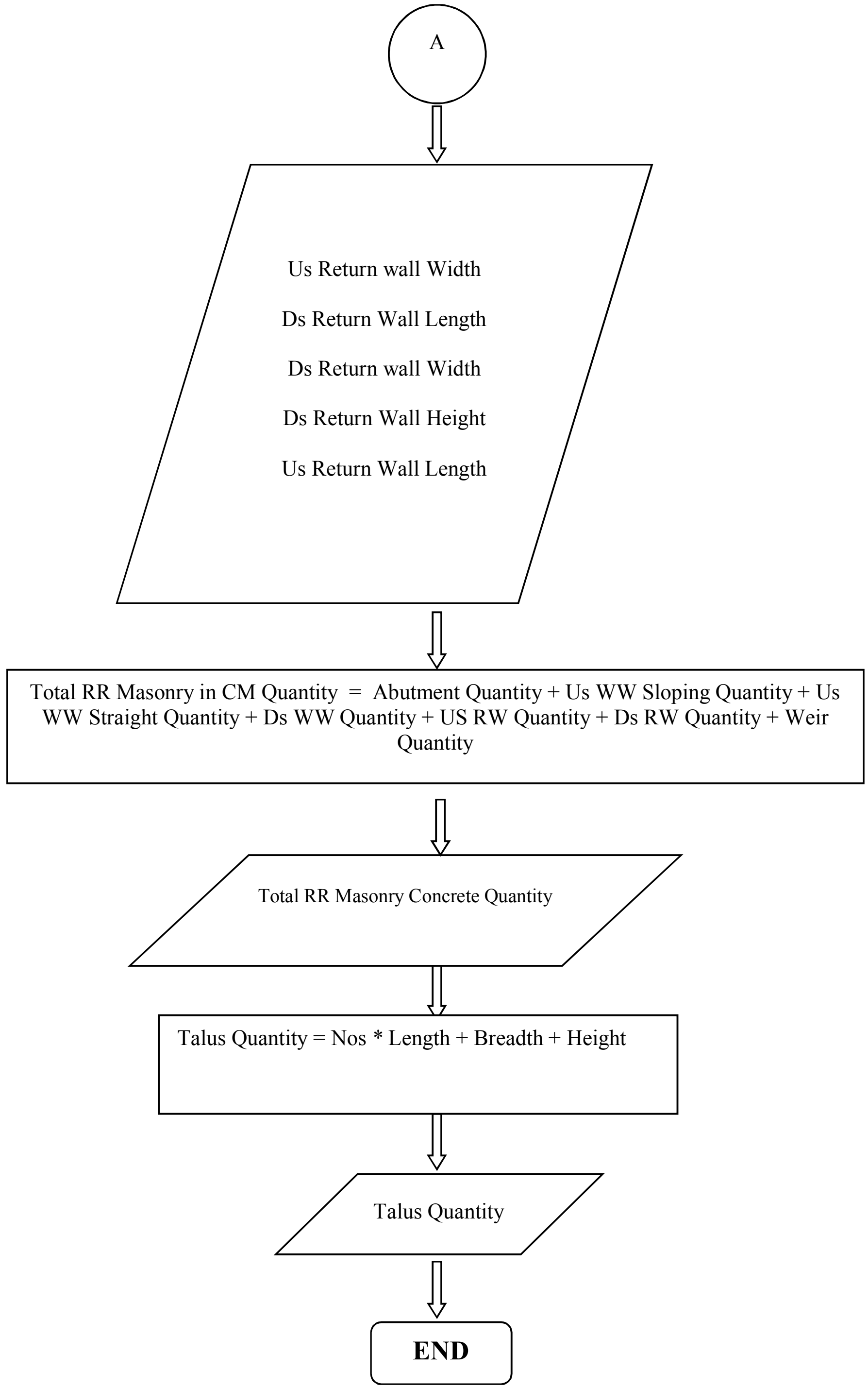
## 6. Flow chart of software estimation

Logical flow of quantity estimation and cost estimation is detailed in flow chart as shown in fig.


START
Abutment Foundation Length
Abutment Numbers
Width of Abutment
Abutment Height
Abutment Quantity = Nos * Length * Width * Height
Abutment Quantity
U/S Wing wall Length = Top bund Level – General Ground Level at Site
U /S Wing Wall Width = (Abutment Foundation length + Section c Foundation Length) / 2
U /S Wing Wall Height = General Ground Level at Site – Foundation below Hard gravel
Total length of percolation = Section C Bottom Width +Section F bottom width+ Foundation length + DE + 1
U / S Wing wall Quantity = Nos * WW Length * WW Width * Height
D / S Wing wall Quantity = Nos * WW Length * WW Width * Height
U / S Wing wall Quantity
D / S Wing wall Quantity
U / S Return Wall Quantity= Nos * RW Length * RW Width * Height
D / S Return Wall Quantity = Nos * RW Length * RW Width * Height
U / S Return wall Quantity
D / S Return wall Quantity
A


A
Weir Quantity = Nos * Weir Length * Weir Width * Weir Height
Total E.W.E Quantity = AB Qnty + Us WW Qnty + Ds WW Qnty + Us RW Qnty+ Ds R.w Qnty Weir
Weir Quantity
Total E.W.E Foundation Quantity
Foundation Height = Foundation level At Hard Gravel – Foundation at below ground level
Abutment Quantity for CC = Nos * Abutment Length * Abutment Width *Abutment Height
Us Wing Wall Quantity for CC = Nos * WW Length * WW Width * WW Height
Ds Wing Wall Quantity for CC = Nos * WW Length * WW Width * WW Height
Us Return Wall Quantity for CC = Nos * RW Length * RW Width * RW Height
Ds Return Wall Quantity for CC = Nos * RW Length * RW Width * RW Height
Weir Wall Quantity for CC = Nos * Weir Length * Weir Width * Weir Height
Structure 1 Quantity = Nos * Length * Width * Height
Structure 2 Quantity = Nos * Length * Width * Height
Abutment Quantity for CC
Us Wing Wall Quantity for CC
Ds Wing Wall Quantity for CC
Us Return Wall Quantity for CC
Ds Return Wall Quantity for CC
Weir Quantity for CC
Structure 1 Quantity
Structure 2 Quantity
A


A
Total Cement Concrete in Foundation Quantity = Abutment Quantity + Us Wing Wall Quantity + Ds Wing Wall Quantity + Us Return Wall Quantity + Ds Return Wall Quantity + Weir Quantity
Total Cement Concrete IN Foundation Quantity
RR Masonry in CM 1:6
Abutment Width = (Abutment bottom width + Top width) / 2
Abutment Height = (Top bund Level – Foundation level at hard gravel)
Abutment Width
Abutment Height
Weir Width = Abutment width + Foundation length at Section at F) / 2
Weir Height = Full tank level – Foundation Hard Gravel at Site
Weir Width
Weir Height
Us Return wall Width = (WW section at c + Top width) / 2
Ds Return Wall Length = (Ds RW Length – Foundation / 2)
Ds Return wall Width = (Section F + Top Width) / 2
Ds Return Wall Height = General Ground level at Site – Foundation Level at Hard Gravel
Us Return Wall Length = Rw length – Foundation height / 2
A


A
Us Return wall Width
Ds Return Wall Length
Ds Return wall Width
Ds Return Wall Height
Us Return Wall Length
Total RR Masonry in CM Quantity = Abutment Quantity + Us WW Sloping Quantity + Us WW Straight Quantity + Ds WW Quantity + US RW Quantity + Ds RW Quantity + Weir Quantity
Total RR Masonry Concrete Quantity
Talus Quantity = Nos * Length + Breadth + Height
Talus Quantity
END

## 7. Software functionality

Fig.2 shows the basic data entry screen for Design and Estimation of Surplus Weir. The user after giving valid input, can navigate to "Surplus Weir – Design" screen as shown in the fig.3 by clicking "Submit" button, where the detailed design is displayed. The current version is equipped with estimation and costing capabilities, the user can navigate to estimation part by clicking on "Submit" button place at the middle bottom of "Surplus Weir – Data Output". The user can export the detailed estimate and costing by clicking on "Export Data" button on "Quantity Estimation" screen.

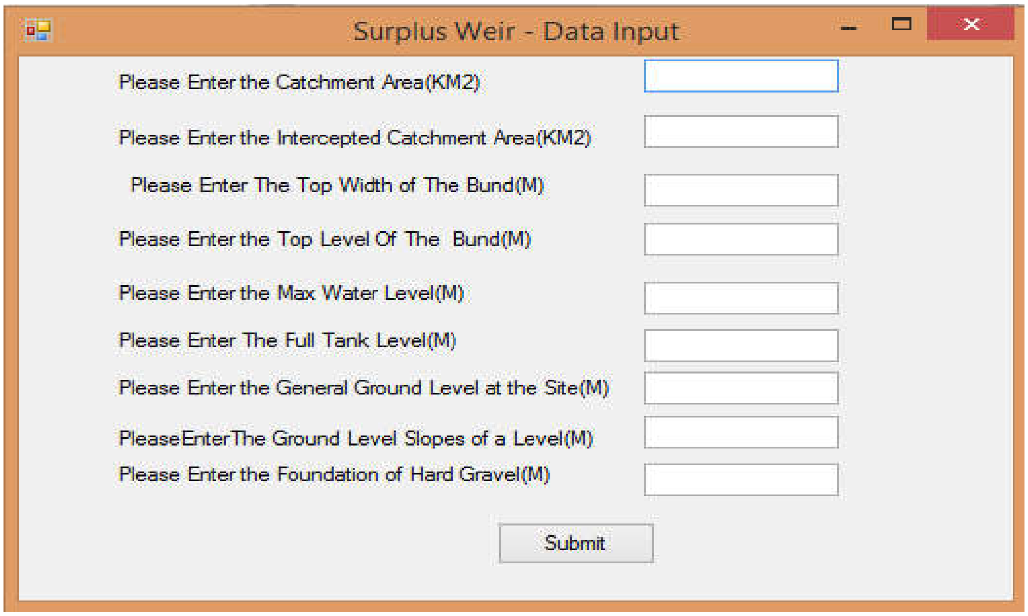



Fig.1

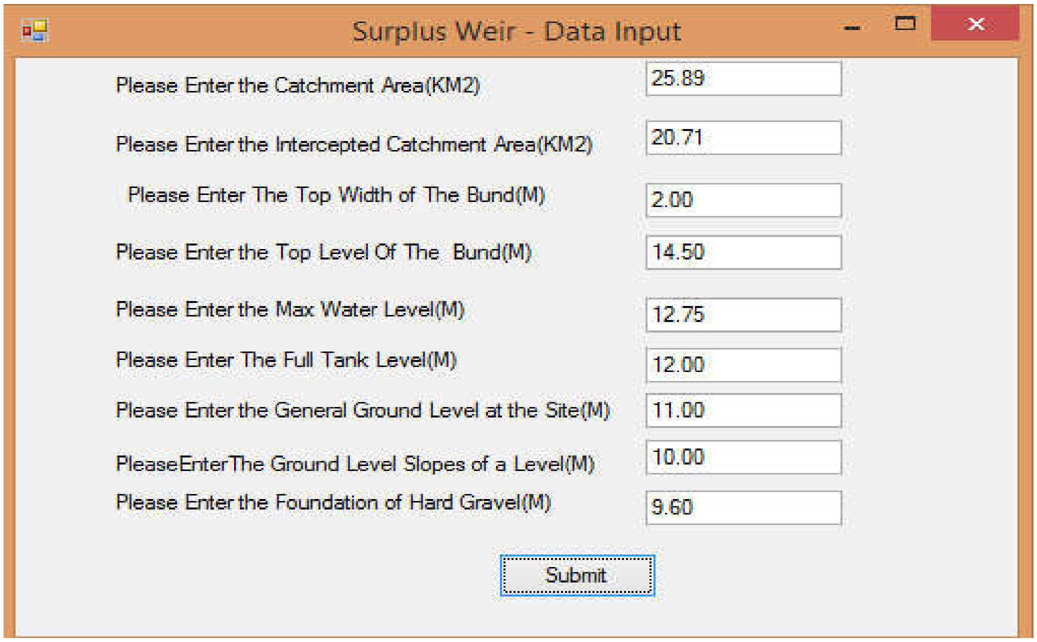



Fig.2

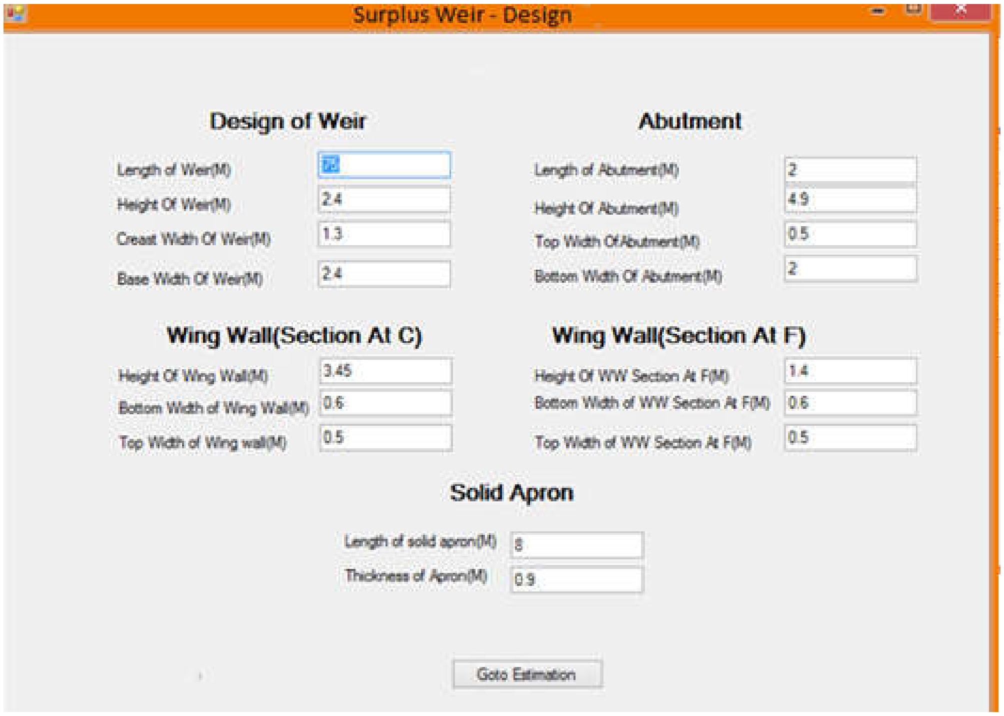



Fig.3

After go to Estimation to click on the Go to Estimation Button to navigate the Surplus weir Quantity as Shown in Fig.


Fig.4

## 8. Conclusion

The current version of the software is fully functionally is getting both Design and Estimation of Surplus Weir. The authors are already on the job to enrich Surplus Weir software by incorporating drawing/drafting of the designed software in the coming versions.

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