

# Runway Re-declaration Tool - Team 9

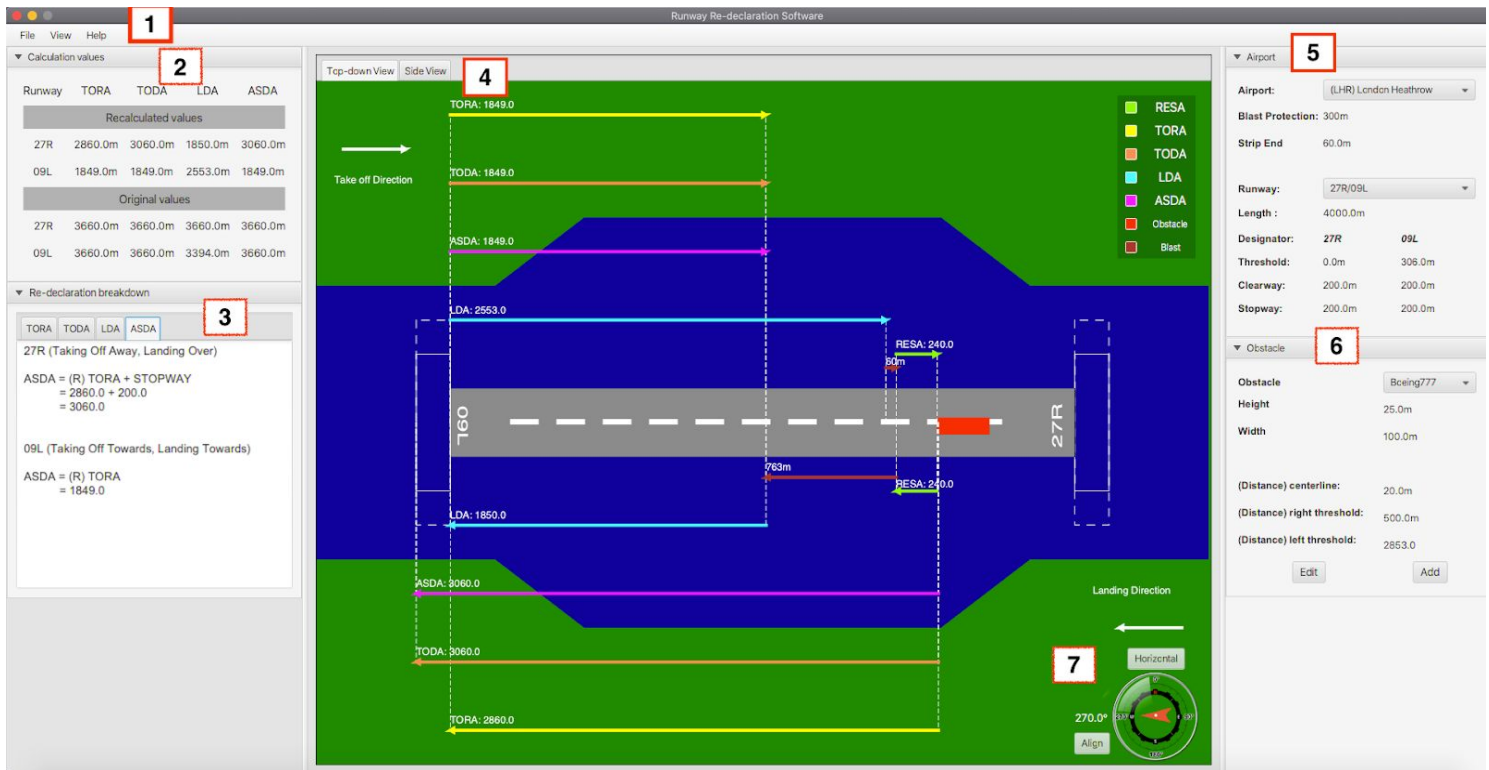
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The Runway re-declaration tool is usable by air traffic controllers at any UK airport to aid them in their re-declaration calculations. The tool provides them with a means for checking their calculated values as well as the calculations themselves. It should be noted the tool cannot fully replace the air traffic controllers as they are still required to carry out the calculations themselves in the interest of safety - it functions as a comparative to provide them with confidence in their mathematics and to help further ensure safety.

The tool is configurable to any UK airport and provides the functionality for multiple runways and obstacles present at each.

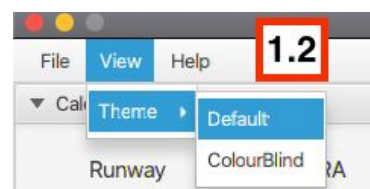
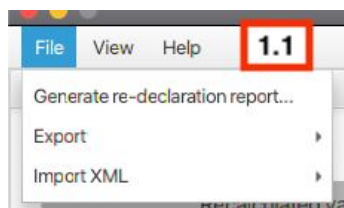
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# Main View



## 1. Menu bar

The menu bar at the top of the window provides access to various other pieces of functionality including the XML input and output services (1.1), an output of the calculation breakdowns and an alternate colour scheme for the visualization (1.2).



## 2. Calculation values

This is a table showing both the original and recalculated values for the currently selected runway (in both directions). The displayed values are those that will be recalculated in a redesignation;

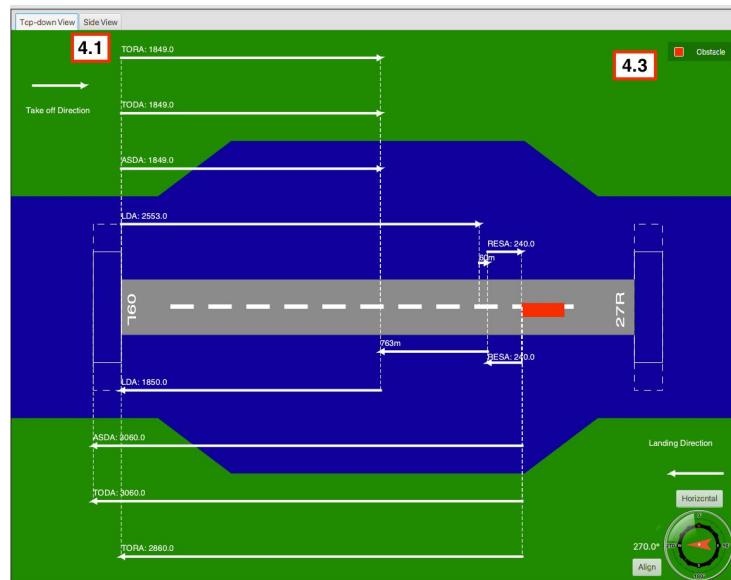
- a. *TORA* - Take Off Run Available
- b. *TODA* - Take Off Distance Available
- c. *LDA* - Landing Distance Available
- d. *ASDA* - Accelerate-Stop Distance Available

▼ Calculation values				
Runway	TORA	TODA	LDA	ASDA
Recalculated values				
27R	2860.0m	3060.0m	1850.0m	3060.0m
09L	1849.0m	1849.0m	2553.0m	1849.0m
Original values				
27R	3660.0m	3660.0m	3660.0m	3660.0m
09L	3660.0m	3660.0m	3394.0m	3660.0m

## 3. Re-declaration breakdown

This is a tabbed pane showing the calculations carried out by the software. At the top of the pane are four tabs relating to the four recalculated values which can be clicked on to view the relevant information. The breakdown includes the formula used and the calculation carried out for each direction of the runway.





Top View - Default colour scheme

## 5. Airport

This pane allows the user to select the working airport and runway through the use of drop down boxes at the top (5.1) and (5.2). Information about the selected runway is presented to the user for both directions: the length, clearway, stopway and displaced threshold.

▼ Airport

Airport: ✓ (LHR) London Heathrow

Blast Protection: (BHX) Birmingham Airport

Strip End: (LGW) Gatwick Airport

Runway: (LTN) London Luton Airport

Length: 4000.0m

Designator: 27R 09L

Threshold: 0.0m 306.0m

Clearway: 200.0m 200.0m

Stopway: 200.0m 200.0m

5.1

▼ Airport

Airport: (LHR) London Heathrow

Blast Protection: 300m

Strip End: 60.0m

Runway: 27R/09L

Length: 27R/09L

Designator: 27L/09R

Threshold: 0.0m 306.0m

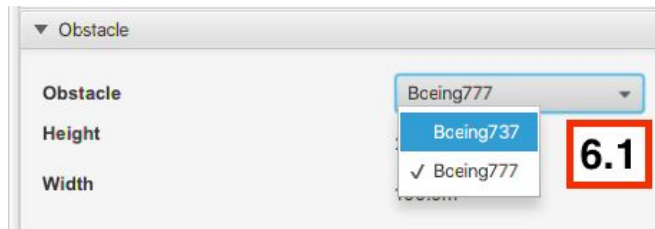
Clearway: 200.0m 200.0m

Stopway: 200.0m 200.0m

5.2

## 6. Obstacle

This pane presents the user with information about the currently placed obstacle including its height, width and placement. The user can use the drop down box at the top (6.1) to select which obstacle is currently obstructing flights, or add a new obstacle using the **add** button. It is also possible to use the **edit** button to change the details of the currently selected obstacle.



## 7. Compass

The compass needle points to reflect the real bearing of the runway. The **align** button can be used to rotate the visualisation of the runway to match this (assuming it is not naturally horizontal), and the **horizontal** button to return it to its original state.

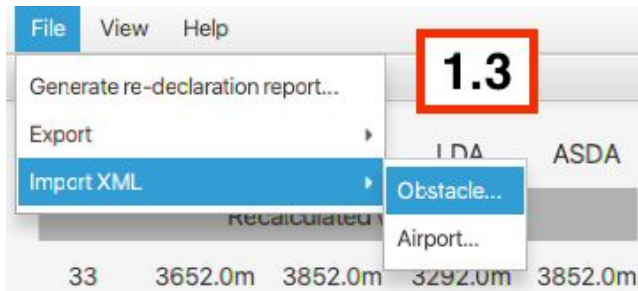


# Configuring Data

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## Via XML

*The XML input parser can be accessed via the menu bar (1.3).*



*The following explanation assumes an already present understanding of XML.*

The program enables the data of an airport or obstacle to be inputted via a document in XML format. To match the required format, the data must be presented as so:

- <airport> - The root tag for the airport.
  - The “**name**” attribute allows for naming of the airport with a string.
  - <city> - The city the airport is situated in.
  - <lat> - The geographical latitude of the airport.
  - <long> - The geographical longitude of the airport.
  - <runways> - The tag for defining the airport’s runways.
    - <runway> - The tag for defining a runway.
      - <left> - The tag for defining the left runway.
      - <right> - The tag for defining the right runway.
        - <designator> - The name of the runway.
        - <length> - The length of the runway.
        - <tora> - The runway’s TORA value.
        - <toda> - The runway’s TODA value.
        - <lda> - The runway’s ASDA value.
        - <asda> - The runway’s LDA value.
        - <threshold> - The runway’s displaced threshold.
        - <clearway> - The runway’s clearway value.
        - <stopway> - The runway’s stopway value.
  - <obstacle> - The tag for defining an obstacle.
    - <name> - The obstacle’s name.
    - <height> - The obstacle’s height.

- <width> - The obstacle's width.
- <distancecentre> - The obstacle's distance from the centre line.
- <distancelthreshold> - The obstacle's distance from the runway' left threshold.
- <distancerthreshold> - The obstacle's distance from the runway's right threshold.

*All distance values entered should be in meters.*

With an XML file matching that format the user can enter the data into the program. Clicking **file** then **import xml** on the menu bar, the user can choose between inputting data for an airport or obstacle (an airport can contain obstacles). This will bring up a file picker where the user will be able to navigate to the location of their XML file. Upon successfully importing the data, the program will display a pop-up window confirming the addition of the new data, which will then be selectable from the drop down menus.

## Configuring data manually

*The following sections refer to the obstacle pane, detailed in point 6 in the "Main View" section.*

Obstacles can also be added within the program. This can be done with the **add** button present in the obstacle pane at the bottom right of the program. This brings up a pop-up window to enter the details of the new obstacle.

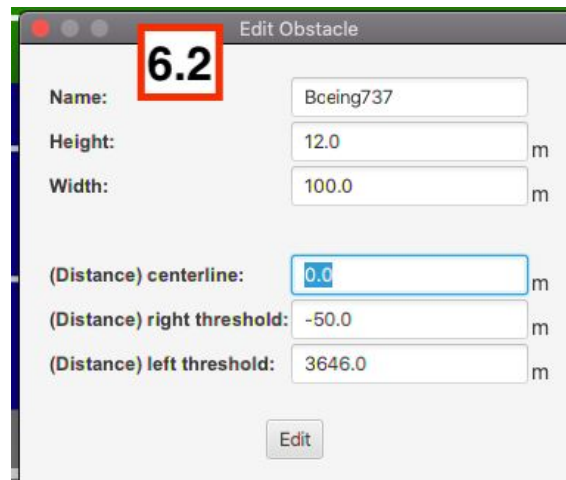
The information required is:

- *Name* - The obstacle's name.
- *Height (m)* - The obstacle's height.
- *Width (m)* - The obstacle's width.
- *(Distance) Centreline (m)* - The distance of the middle of the object to the runway's centre-line.
- *(Distance) left threshold (m)* - The distance between the left edge of the obstacle and the left edge of the runway.
- *(Distance) right threshold (m)*- The distance between the right edge of the obstacle and the right edge of the runway.

When all this information is entered and valid, the user can press the **add** button on the pop-up window to confirm the entry of the new obstacle. After showing a pop-up box confirming the addition, the obstacle will then be present in the drop down box for selection.



Pre-existing obstacles can also be edited. The user can select the desired obstacle from the drop down and hit the **edit** button in the obstacle pane to bring up a pop-up (6.2) containing its details in editable text fields. These values are those detailed in the previous section and can be changed as the user desires before hitting the pop-up's **edit** button to commit the changes.



6.2

**Edit Obstacle**

Name: Bceing737

Height: 12.0 m

Width: 100.0 m

(Distance) centerline: 0.0 m

(Distance) right threshold: -50.0 m

(Distance) left threshold: 3646.0 m

Edit

## General Use

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The purpose of the application is for simulating an obstacle being present on the runway and seeing how this affects 4 values crucial for a safe take off;

- Take-Off Run Available (TORA)
- Take-Off Distance Available (TODA)
- Accelerate-Stop Distance Available (ASDA)
- Landing Distance Available (LDA)

*The following section refers to the Obstacle (6) and Airport (5) areas of the program, detailed in the “Main View” sections.*

To calculate these values, the user needs to select which runway they are carrying out the calculations on and which obstacle is present on it. With the required data added to the program (see the *Configuring Data* section of this document) the user can use the drop down boxes

present in the Airport and Obstacle sections of the program to model the real life scenario they are experiencing.

*The following sections refer to the Calculation values (2), Re-declaration breakdown (3) and Visualization (4) areas of the program, detailed in the “Main View” sections.*

With the values loaded in, the program will automatically calculate the values. This will update multiple areas of the program. The first is the table to the left containing the newly calculated values, displayed for both directions of the runway, in the top two rows. For comparison, the original values are displayed in the two rows below.

Shown in the panel below are the formulas and calculations used by the program in calculating these values. The four recalculated values can be viewed by changing between the tabs at the top of the panel. The breakdown allows for the user to compare their own workings out with that of the computer to check if they match.

In the middle of the program is a graphic representing the runway selected. The chosen obstacle is displayed as a red box, relative to its defined size and location. There are also arrows displaying the recalculated values in both directions of the runway alongside other data values including the RESA and blast protection. Marked out with dashed white lines are the clearway and stopway.

Present on the visualisation is a compass which shows the bearing of the runway. The runway will default to being displayed as horizontal, and pressing the **Align** button above the compass will rotate the graphics to match the runway's bearing. The **Horizontal** button will return it to its original, horizontal state.

Using the tabs at the top the user can switch between the top-down (default) and side on views of the runway. The side view maintains the arrows showing the numerical values but loses the compass (the view is at a fixed angle).

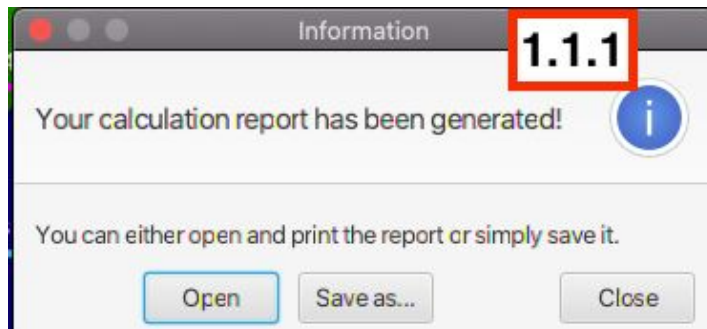
## Exporting Data

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*The following section refers to the menu bar (1) of the program, detailed in the “Main View” sections.*

The user can print out a PDF containing information on the calculations by navigating through the options on the menu bar. By selecting **File > Generate re-declaration report...** the system will generate a pop-up (1.1.1) showing if the generation was successful and allowing the user to open the file or save as - allowing for it to be retrieved later. The output file (1.1.2) will be updated to contain a report of the breakdown of the calculations carried out along with a table

containing the original and new values and a screenshot of the visualisation with the obstacle present .



## Calculation report

13-05-2020

1.1.2

### Airport details

Name: Henrys Test Land  
Runway: 27L/09R  
Runway length: 4000.0m  
Blast protection: 300.0m  
Strip end: 60.0m

### Obstacle details

Name: Boeing777  
Width: 100.0m  
Height: 25.0m  
(Distance) right threshold: 2853.0m  
(Distance) left threshold: 500.0m  
(Distance) center: 20.0m

### Re-declaration breakdown

#### 09R (Taking Off Towards, Landing Towards)

TORA = Distance From Threshold + Runway Threshold - (Slope Calculation) - Strip End  
= 2853.0 + 0.0 - (25.0 \* 50.0) - 60.0  
= 1543.0

ASDA = (R) TORA  
= 1543.0

TODA = (R) TODA  
= 1543.0

LDA = Distance from Threshold - RESA - Strip End  
= 2853.0 - 240.0 - 60.0  
= 2553.0

#### 27L (Taking Off Away, Landing Over)

TORA = Original TORA - Blast Protection - Distance From Threshold - Displaced Threshold  
= 4000.0 - 300.0 - 500.0 - 0.0  
= 3200.0

ASDA = (R) TORA + STOPWAY  
= 3200.0 + 50.0

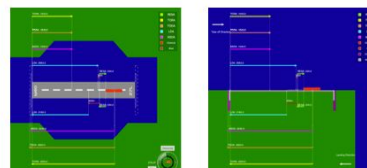
TODA = (R) TORA + Clearway  
= 3200.0 + 100.0

LDA = Original LDA - Distance From Threshold - Slope Calculation - Strip End  
= 4000.0 - 500.0 - (25.0 \* 50.0) - 60.0  
= 2190.0

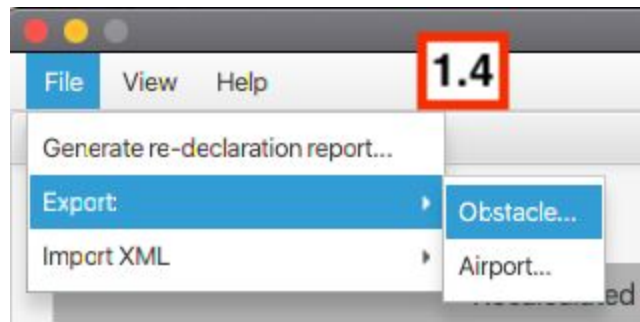
Runway designator	TORA	TODA	ASDA	LDA
Original Values				
27L	4000.0m	4100.0m	4000.0m	4000.0m
09R	4000.0m	4100.0m	4000.0m	4000.0m
Recalculated Values				
27L	3200.0m	3300.0m	3250.0m	2190.0m
09R	1543.0m	1543.0m	1543.0m	2553.0m

1.1.2

### Visualisation of re-declared distances



The user can also export the details of the currently selected airport or obstacle to an XML file - allowing it to be shared with other users of the system. The user presses **File > Export > Airport.../Obstacle...** (1.4) depending on their desires. This will then bring up a file picker to choose where to save the generated XML. Once the target file has been chosen, the program will return a new pop-up confirming the creation. The user can then access and share the file from their chosen location.



## Accessibility

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*The following section refers to the menu bar (1) and visualisation (4) parts of the program, detailed in the “Main View” sections.*

It is possible to change the colours of the arrows on the visualisation between two colour schemes aimed at opening up the use of the program to those affected by colour blindness. By navigating to **View > Theme > Default/ColourBlind** the user can switch between the two. The **Default** theme switches the arrows to white and removes the colour key from the visualisation, whereas the **ColourBlind** option uses specific colours to make it as easy as possible to distinguish the arrows.

## Frequently Asked Questions

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**Q** - When loading up the program it already has a runway and obstacle present?

**A** - This is because there is no way to have no airport/obstacle selected. The program can be used as if this wasn't the case by just ignoring the data filling the tables and carrying on as normal.

**Q** - Why do I need to specify the distance of the obstacle from both ends of the runway instead of its length?

**A** - The calculations require the knowledge of how far from each end the obstacle is as this allows them to figure which direction to land and take off in.

**Q** - The compass in the bottom corner does not point north. What does it mean?

**A** - The needle of the compass does not point north - instead it points to the bearing of the runway. When first shown on the visualisation, the runway will remain horizontal, and the needle will reflect its true bearing. When clicking **align** the needle remains stationary but the runway moves to reflect it. So, it does not act as a “true” compass, instead pointing to the degree of the runway.

**Q** - Why do I need to edit the obstacle when I change the airport?

**A** - This is because different airports have different length runways - meaning the defined parameters for the distances from each end of the obstacle may be incorrect and cause erroneous and invalid values as the recalculations.

## Known Issues

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These are errors that we noticed with the program during use/testing that we were not able to resolve in time. The system still works with these issues present, they are just something that should be present in the back of the user’s mind during use.

- If the user attempts to add an obstacle without entering a value in one of the distance from the threshold fields, the program will return an error message referring to the wrong threshold (i.e. if you leave the distance from right threshold field blank it will say the left threshold box was incorrect, even if it was populated).
- When entering the distance from the thresholds for an obstacle, the user is prevented from having an obstacle positioned at a large distance from the end of the runway - it would not have an affect on the runway and thus redeclaration is unnecessary. This same logic is not applied to obstacles that are a long distance away from the centreline and thus obstacles that don’t affect the runway can still be added.
- When opening the program, the default colour scheme is in fact not the default, it is the colour blind mode. The default must be selected manually to view.